

Beaver Dam Mine Project
Updated 2021
Environmental Impact Statement
May 2021

Atlantic Mining NS Inc.

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June 16, 2021

Kathryn MacCarthy, Project Manager
Impact Assessment Agency of Canada
Suite 200, 1801 Hollis Street
Halifax, NS 63J 3N4

Bridget Tutty, Environmental Assessment Officer
Environmental Assessment Branch
Nova Scotia Environment
Suite 2085, 1903 Barrington Street
PO Box 442, Halifax, NS B3J 2P8

Dear Ms. MacCarthy and Ms. Tutty,

Atlantic Mining NS Inc, a wholly owned subsidiary of St Barbara Limited, is pleased submit the Updated 2021 Environmental Impact Statement (EIS) as per the *Canadian Environmental Assessment Act, 2012* and the Environmental Assessment Registration Document (EARD) as per Nova Scotia *Environmental Assessment Regulations.* The Updated 2021 EIS is being issued to support the Responses to the Information Request, Round 2, for the Beaver Dam Mine Project that was submitted on June 4, 2021.

The Beaver Dam Mine Project Updated 2021 EIS Guidance Concordance table is attached.

The undersigned has signing authority and submits the documents as per the federal and provincial environmental assessment processes.

Any correspondence regarding the Environmental Assessment should be directed to the undersigned.

<Original signed by>

Craig Hudson
Head of Permitting and Projects
Atlantic Mining NS Inc

cc: Mike Atkinson, Impact Assessment Agency of Canada

Beaver Dam Mine Project Updated 2021 Environmental Impact Statement Guidelines (CEAA 2016) Concordance Table

Guidelines Section	Guidelines for the Preparation of an Environmental Impact Statement pursuant to the *Canadian Environmental Assessment Act,* 2012 Beaver Dam Mine Project EIS Guidelines Descriptions	Applicable Corresponding 2017 EIS Section	Applicable Corresponding Revised 2019 EIS Section	Applicable Corresponding Updated 2021 EIS Section
1. INTRODUCTION AND OVERVIEW	-	**1. INTRODUCTION**	**1. INTRODUCTION**	
1.1. The proponent	In the EIS, the proponent will: - provide contact information (e.g. name, address, phone, fax, email); - identify itself and the name of the legal entity that would develop, manage and operate the project; - describe corporate and management structures; - specify the mechanism used to ensure that corporate policies will be implemented and respected for the project; and - identify key personnel, contractors, and/or sub-contractors responsible for preparing the EIS.	1.2 Proponent Information	1.2 Proponent Information	1.4 Proponent Information
1.2. Project overview	The EIS will describe the project, key project components and associated activities, scheduling details, the timing of each phase of the project and other key features. If the project is a part of a larger sequence of projects, the EIS will outline the larger context. The overview is to identify the key components of the project, rather than providing a detailed description, which will follow in Section 3 of this document.	1.1 Project Overview	1.1 Project Overview	1.2 Project Overview
1.3. Project location	The EIS will contain a description of the geographical setting in which the project will take place. This description will focus on those aspects of the project and its setting that are important in order to understand the potential environmental effects of the project. The following information will be included: - the UTM coordinates of the main project site; - land use in the area currently; - distance of the project facilities and components to any federal lands; - Crown lands and other provincially-owned lands; - the environmental significance and value of the geographical setting in which the project will take place and the surrounding area; - environmentally sensitive areas, such as national, provincial and regional parks or wilderness areas, ecological reserves, wetlands, estuaries, designated areas (e.g., important bird habitat), mature or interior forest habitat of migratory birds, and habitats of federally or provincially listed species at risk and other sensitive areas (e.g. habitats of species of conservation concern, colonial nesters, areas of concentration of migratory birds) that are within the project's potential zone of influence including accidents and malfunctions ; - local communities; and - traditional Aboriginal territories and/or consultation areas, treaty lands, Indian reserve lands or other Aboriginal communities	2.1 Project Location	2.1 Project Location	1.2.2 Project Location
1.4 Regulatory framework and the role of government	The EIS will identify: - any federal power, duty or function that may be exercised that would permit the carrying out (in whole or in part) of the project or associated activities; - the environmental and other regulatory approvals and legislation that are applicable to the project at the federal, provincial, regional and municipal levels; - government policies, resource management, planning or study initiatives pertinent to the project and/or EA and their implications; - any treaty or self-government agreements with Aboriginal groups that are pertinent to the project and/or EA; - any relevant land use plans, land zoning, or community plans; and - regional, provincial and/or national objectives, standards or guidelines that have been used by the proponent to assist in the evaluation of any predicted environmental effects.	1.3 Regulatory Framework and Role of Government	1.3 Regulatory Framework and Role of Government	1.5 Regulatory Framework and Role of Government
2. PROJECT JUSTIFICATION AND ALTERNATIVES CONSIDERED	-	1.4 Purpose of the Project 2.6 Alternatives Means of Carrying Out of the Project	1.4 Purpose of the Project 2.6 Alternatives Means of Carrying Out of the Project	1.3 Purpose of the Project 2.10 Alternatives Means of Carrying Out of the Project
2.1. Purpose of the project	The EIS will describe the purpose of the project by providing the rationale for the project, explaining the background, the problems or opportunities that the project is intended to satisfy and the stated objectives from the perspective of the proponent. If the objectives of the project are related to broader private or public sector policies, plans or programs, this information will also be included. The EIS will also describe the predicted environmental, economic and social benefits of the project. This information will be considered in assessing the justifiability of any significant adverse residual environmental effects, if such effects are identified.	2.1 Purpose of the Project	2.1 Purpose of the Project	1.3 Purpose of the Project 2.4 Ecological Setting 2.5 Project History 2.6 Geology and Resources

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2.2. Alternative means of carrying out the project	The EIS will identify and consider the effects of alternative means of carrying out the project that are technically and economically feasible. The proponent will complete the following procedural steps for addressing alternative means: - identify the alternative means to carry out the project; - identify the effects of each technically and economically feasible alternative means; - select the approach for the analysis of alternative means (i.e., identify a preferred means or bring forward alternative means); and - assess the environmental effects of the alternative means. In its alternative means analysis, the proponent will address, at a minimum, the following project components: - mine type (e.g. open pit, underground); - material extraction methods; - processing (process types); - processing location (e.g. Beaver Dam versus Touquoy Mine Site); - transportation of ore (means and routing considered); - energy sources to power the project site (diesel, electricity, renewables); - location of key project components; - water supply and management; and - mine waste disposal (methods and sites considered including dry stack tailings disposal)[1]. For further information regarding the "purpose of" and "alternative means", please consult the Agency's Operational Policy Statement entitled "Addressing "Purpose of" and "Alternative Means" under the Canadian Environmental Assessment Act, 2012". The Agency recognizes that projects may be in the early planning stages when the EIS is being prepared. Where proponents have not made final decisions concerning the placement of project infrastructure, the technologies to be used, or that several options may exist for various project components, they are strongly encouraged to conduct an environmental effects analysis at the same level of detail assessment of the various options available (alternative means) within the EIS.	2.6 Alternative Means of Carrying Out the Project	2.6 Alternative Means of Carrying Out the Project	2.10 Alternative Means of Carrying Out the Project

[1] Should an MMER Schedule 2 amendment be required for the Project, the proponent is strongly encouraged to include MMER requirements for an assessment of alternatives for mine waste disposal in the EIS. The methodology recommended for the conduct of mine waste disposal alternatives is described in Environment Canada's Guidelines for the Assessment of Alternatives for Mine Waste Disposal (2011). A copy of this guide can be found on Environment Canada's website at www.ec.gc.ca. Proponent should also refer to Part 1, section 4.1 of this document.

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3. PROJECT DESCRIPTION	-	2. Project Description	2. Project Description	2. Project Description
3.1. Project components	The EIS will describe the project, by presenting the project components, associated and ancillary works, and other characteristics that will assist in understanding the environmental effects. This will include: - maps, at an appropriate scale, of the project location, the project components (at the Beaver Dam Mine Touquoy Mine, and roads), boundaries of the proposed site with UTM coordinates, the major existing infrastructure, Crown lands and any other designated lands, adjacent land uses and any important environmental features; - waste rock, overburden, topsoil, low grade ore storage and stock piles (footprint, locations, volumes, development plans and design criteria); - open pit mine (footprint, location, development plans including pit phases); - crusher and processing facilities (footprint, technology, location); - water (pit water, mine effluent) management and treatment infrastructure (e.g. settling ponds, sumps, water diversion structures); - permanent and temporary linear infrastructures (e.g. roads, transmission lines), identifying the route of each of these linear infrastructures, the location and types of structures used for stream crossings (e.g. culverts and bridges); - drinking and industrial water requirements (source, quantity required, need for water treatment); - energy supply (source, quantity); - pit and infrastructure lighting; - administrative buildings, garages, petroleum product storage facility, other ancillary facilities; - construction camp (location, capacity, wastewater treatment); - waste disposal (type of waste, method of disposal, quantity); and - all changes to components, activities, scheduling, and lifespan at the Touquoy Mine resulting from the Beaver Dam Project (e.g. potential increase in processing, waste rock, tailings management, water management).	2.2 Project Components	2.2 Project Components	2.7 Project Components
3.2. Project activities	The EIS will include descriptions of the construction, operation, decommissioning and abandonment associated with the proposed project. This will include descriptions of the activities to be carried out during each phase, the location of each activity, expected outputs and an indication of the activity's magnitude and scale. Although a complete list of project activities should be provided, the emphasis will be on activities with the greatest potential to have environmental effects. Sufficient information will be included to predict environmental effects and address public concerns identified. Highlight activities that involve periods of increased environmental disturbance or the release of materials into the environment. The EIS will include a summary of the changes that have been made to the project since originally proposed, including the benefits of these changes to the environment, Aboriginal peoples, and the public. The EIS will include a schedule including time of year, frequency, and duration for all project activities. The information will include a description of:	2.3 Project Activities	2.3 Project Activities	2.9 Project Activities
3.2.1. Site preparation and construction	Site preparation and construction - site clearing, excavation - drilling and blasting (frequency and methods, type of explosive used), including any transport and/or storage - borrow materials requirements (source and quantity) - water diversion required (location, methods, timing) - contribution to atmospheric emissions, including emissions profile (type, rate and source) - quantification of direct greenhouse gas emissions - equipment requirements (type, quantity) - administrative buildings, garages, construction camp, other ancillary facilities - number of employees and transportation of employees - dewatering of man-made pond in northeast section of project area or any other waterbody - haul road upgrades (e.g. grading, widening, rerouting, upgrading) and maintenance, including construction, replacement, installation and/or modification of bridges and culverts as well as consideration of geochemical and physical properties of rock to be used for road upgrades (e.g. waste rock from Touquoy mine).	2.3.1 Subsections titled “Site Preparation and Construction”	2.3.1 Subsections titled “Site Preparation and Construction”	2.9.1 Subsections titled “Site Preparation and Construction”

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3.3.2. Operation	- mining plan, ore production, ore stockpiling, concentrate production - equipment requirements - drilling - explosive uses (storage location [should storage be required], transportation, and management) - blasting (frequency and methods) - water management on the project site, including a detailed water budget - ore crushing and treatment - noise and dust management - reagent requirements (volumes, storage, types) - petroleum products (source, volume, storage) - characterization and management of ore, waste rock, low grade ore, overburden and tailings (volumes generated, mineralogical characterization, potential for metal leaching and acid rock drainage) - effluent management and treatment (quantity, treatment requirement, release point) - contribution to atmospheric emissions, including emissions profile (type, rate and source) - quantification of direct greenhouse gas emissions - water recycling - light management - waste management and recycling (other than mine waste such as tailings and waste rock) - number of employees, transportation of employees, work schedule, lodging requirement on site and off site - maintenance activities - transportation of ore to the Touquoy Mine (e.g. maximum number of trucks per day)	2.3.2 Subsections titled “Operation and Maintenance”	2.3.2 Subsections titled “Operation and Maintenance”	2.9.2 Subsections titled “Operation and Maintenance”
3.2.3. Decommissioning and abandonment	- the outline of a decommissioning and reclamation plan for any components associated with the project - the ownership, transfer and control of the different project components - the responsibility for monitoring and maintaining the integrity of the remaining structures - for permanent facilities, a conceptual discussion on how decommissioning could occur	2.3.3 Subsections titled “Decommissioning and Reclamation”	2.3.3 Subsections titled “Decommissioning and Reclamation”	2.9.3 Subsections titled “Active Reclamation”
4. PUBLIC CONSULTATION AND CONCERNS	The EIS will describe the ongoing and proposed consultations and the information sessions that the proponent will hold or that it has already held on the project. It will provide a description of efforts made to distribute project information and provide a description of information and materials that were distributed during the consultation process. The EIS will indicate the methods used, where the consultation was held, the persons and organizations consulted, the concerns voiced and the extent to which this information was incorporated in the design of the project as well as in the EIS. The EIS will provide a summary of key issues raised related to the environmental assessment as well as describe any outstanding issues and ways to address them.	3. Public Consultation and Engagement Program	3. Public Consultation and Engagement Program	3. Public Engagement Program Appendix A.4a Appendix A.6

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5. ABORIGINAL ENGAGEMENT AND CONCERNS	For the purposes of developing the EIS, the proponent will engage with Aboriginal groups that may be affected by the project, to obtain their views on:
	- effects of changes to the environment on Aboriginal peoples (health and socio-economic conditions; physical and cultural heritage, including any structure, site or thing that is of historical, archaeological, paleontological or architectural significance; and current use of lands and resources for traditional purposes) pursuant to subparagraph 5(1)(c) of CEAA 2012, and
	- potential adverse impacts of the project on potential or established Aboriginal or Treaty rights, title and related interests, in respect of the Crown's duty to consult, and where appropriate, accommodate Aboriginal peoples.
	
	With respect to effects of changes to the environment on Aboriginal peoples, the assessment requirements are outlined in Part 2, Sections 6.1.9 and 6.3.5, of these Guidelines. With respect to potential adverse impacts of the project on potential or established Aboriginal or treaty rights, title and related interests, the EIS will document for each group identified in section 5.1 of these Guidelines (or in subsequent correspondence from the Agency):
	- Potential or established Aboriginal or treaty rights[2], title and related interests, when this information is provided by a group to the proponent or available through public records including:
	  - geographical extent, nature, frequency, timing of the practice or exercise of the right; and,
	  - maps and data sets (e.g. fish catch numbers);
	- potential adverse impacts of each of the project components and physical activities, in all phases, on potential or established Aboriginal or treaty rights, title and related interests. This assessment is to be based on a comparison of the exercise or state of the identified rights, title and related interests between the predicted future conditions with the project and the predicted future conditions without the project. Include the perspectives of Aboriginal groups where these were provided to the proponent by the groups;
	- measures identified to mitigate or accommodate potential adverse impacts of the project on the potential or established Aboriginal or treaty rights, title and related interests. These measures will be written as specific commitments that clearly describe how the proponent intends to implement them and may go beyond mitigation measures that are developed to address potential adverse environmental effects;
	- potential adverse impacts on potential or established Aboriginal or treaty rights, title and related interests that have not been fully mitigated or accommodated as part of the environmental assessment and associated engagement with Aboriginal groups. The proponent will also take into account the potential adverse impacts that may result from the residual and cumulative environmental effects. Include the perspectives of Aboriginal groups where these were provided to the proponent by the groups.
		4. Indigenous Peoples Consultation and Engagement Program	4. Indigenous Peoples Consultation and Engagement Program	4. Indigenous Peoples Engagement Program

[2] The 2011 Updated Guidelines for Federal Officials to Fulfill the Duty to Consult (the Guidelines) defines Aboriginal rights as: practices, traditions and customs integral to the distinctive culture of the Aboriginal group claiming the right that existing prior to contact with the Europeans (Van de Peet). In the context of Métis groups, Aboriginal rights means practices, traditions, and customs integral to the distinctive culture of the Métis group that existed prior to effective European control, that is, prior to the time when Europeans effectively established political and legal control in the claimed area (Powley). Generally, these rights are fact and site specific. For greater certainty, the Guidelines also define Aboriginal title as an Aboriginal right. Visit the Aboriginal Affairs and Northern Development Canada website at: www.aadnc-aandc.gc.ca/eng/1100100014680/1100100014681"

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	The information sources, methodology and findings of the assessment of subparagraph 5(1)(c) effects may be used to inform the assessment of potential adverse impacts of the project on potential or established Aboriginal or treaty rights, title and related interests. However, there may be distinctions between the adverse impacts on potential or established Aboriginal or treaty rights, title and related interests and subparagraph 5(1)(c) effects. The proponent will carefully consider the potential distinction between these two aspects and, where there are differences, will include the relevant information in its assessment. In terms of gathering views from Aboriginal groups with respect to both environmental effects of the project and the potential adverse impacts of the project on potential or established Aboriginal or treaty rights, title and related interests, the EIS will document: - VCs suggested by Aboriginal groups for inclusion in the EIS, whether they were included, and the rationale for any exclusions; - specific suggestions raised by each Aboriginal group for mitigating the effects of changes to the environment on Aboriginal peoples or accommodating potential adverse impacts of the project on potential or established Aboriginal or treaty rights, title and related interests; - views expressed by each Aboriginal group on the effectiveness of the mitigation or accommodation measures; - from the proponent's perspective, any potential cultural, social and/or economic impacts or benefits to each Aboriginal group identified that may arise as a result of the project . Include the perspectives of Aboriginal groups where these were provided to the proponent by the groups ; - any other comments, specific issues and concerns raised by Aboriginal groups and how the key concerns were responded to or addressed; - changes made to the project design and implementation directly as a result of discussions with Aboriginal groups; - where and how Aboriginal traditional knowledge was incorporated into the environmental effects assessment (including methodology, baseline conditions and effects analysis for all VCs) and the consideration of potential adverse impacts on potential or established Aboriginal or treaty rights, title and related interests and related mitigation measures; and - any additional issues and concerns raised by Aboriginal groups in relation to the environmental effects assessment and the potential adverse impacts of the project on potential or established Aboriginal or treaty rights, title and related interests. A suggested format for providing some of the information above is the creation of a tracking table of key issues raised by each Aboriginal group, including the concerns raised related to the Project, proposed mitigation options, and where appropriate, a reference to the proponent's analysis in the EIS. Information provided related to potential adverse impacts on potential or established Aboriginal or treaty rights will be considered by the Crown in meeting its common law duty to consult obligations as set out in the Updated Guidelines for Federal Officials to Fulfill the Duty to Consult (2011)[3].			4. Indigenous Peoples Engagement Program Appendix A.5 Mi'kmaq of Nova Scotia Engagement Log
5.1. Aboriginal groups to engage and engagement activities	With respect to engagement activities, the EIS will document: - the engagement activities undertaken with each Aboriginal group prior to the submission of the EIS, including the date and means of engagement (e.g., meeting, mail, telephone); - any future planned engagement activities; and - how engagement activities by the proponent allowed Aboriginal groups to understand the project and evaluate its effects on their communities, activities, potential or established Aboriginal or treaty rights, title and related interests. In preparing the EIS, the proponent will ensure that Aboriginal groups have access to timely and relevant information on the project and how the project may adversely impact them. The proponent will structure its Aboriginal engagement activities to provide adequate time for Aboriginal groups to review and comment on the relevant information. Engagement activities are to be appropriate to the groups' needs, arranged through discussions with the groups and in keeping with established consultation protocols, where available. The EIS will describe all efforts, successful or not, taken to solicit the information required from Aboriginal groups to support the preparation of the EIS. The proponent will ensure that views of Aboriginal groups are recorded and that each Aboriginal group is provided with opportunities to validate the interpretation of their views. The proponent will keep detailed tracking records of its engagement activities, recording all interactions with Aboriginal groups, the issues raised by each Aboriginal group and how the proponent addressed the concerns raised. The proponent will share these records with the Agency.	4. Indigenous Peoples Consultation and Engagement Program	4. Indigenous Peoples Consultation and Engagement Program	4. Indigenous Peoples Engagement Program Appendix A.5 Mi'kmaq of Nova Scotia Engagement Log

[3] Visit the Aboriginal Affairs and Northern Development Canada website at: www.aadnc-aandc.gc.ca/eng/1100100014680/1100100014681

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	For the Aboriginal groups expected to be most affected by the project, the proponent is expected to strive towards developing a productive and constructive relationship based on on-going dialogue with the groups in order to support information gathering and the effects assessment. These groups include: - Acadia First Nation - Annapolis Valley First Nation - Bear River First Nation - Chapel Island First Nation - Eskasoni First Nation - Glooscap First Nation - Membertou First Nation - Millbrook First Nation - Paq'tnkek (Afton) First Nation - Pictou Landing First Nation - Sipekne'katik First Nation - Wagmatcook First Nation - We'koqma'q First Nation - Assembly of Nova Scotia Mi'kmaq Chiefs and the Kwilmu'kw Maw-klusuaqn Negotiation Office (KMKNO) For the above groups, the proponent will strive to use primary data sources and hold face-to-face meetings to discuss concerns. The proponent will facilitate these meetings by making key EA summary documents (baseline studies, EIS, key findings, plain language summaries) accessible. The proponent will ensure there are sufficient opportunities for individuals and groups to provide oral input in the language of their choice. If possible, the proponent should consider translating information for theseAboriginal groups into the appropriate Aboriginal language(s) in order to facilitate engagement activities during the environmental assessment. The groups referenced above may change as more is understood about the environmental effects of the project and/or if the project or its components change during the EA. The Agency reserves the right to alter the list of Aboriginal groups that the proponent will engage as additional information is gathered during the assessment. In addition, for the purposes of good governance, the proponent should also provide information to and discuss potential environmental effects from the Project, as described under section 5 of CEAA 2012, with the Nova Scotia Native Council. Upon receipt of knowledge or information of potential effects to an Aboriginal group not listed above, the proponent shall provide that information to the Agency at the earliest opportunity.			4. Indigenous Peoples Engagement Program Appendix A.5 Mi'kmaq of Nova Scotia Engagement Log 6.14 Mi'kmaq of Nova Scotia
6. EFFECTS ASSESSMENT	-	6. Environmental Effects Assessment	5. Environmental Effects Assessment Methodology 6. Environmental Effects Assessment	5. Environmental Effects Assessment Methodology 6. Environmental Effects Assessment

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6.1. Project setting and baseline conditions	Based on the scope of project described in section 3 (Part 1), the EIS will present baseline information in sufficient detail to enable the identification of how the project could affect the VCs and an analysis of those effects. Should other VCs be identified during the conduct of the EA, the baseline condition for these components will also be described in the EIS. To determine the appropriate spatial boundaries to describe the baseline information, refer to section 3.3.3 (Part 1). As a minimum, the EIS will include a description of:	6. Subsections for each VC titled "Baseline Conditions"	6.x.x Subsections for each VC titled "Baseline Conditions"	Subsections for each VC titled "Baseline Conditions" 6.1.3 Noise 6.2.4 Air 6.3.4 Light 6.4.4. Greenhouse Gases 6.5.4 Geology, Soil, and Sediment 6.6.4 Groundwater 6.7.4 Water Quantity 6.7.5 Water Quality 6.8.4 Wetlands 6.9.4 Fish and Fish Habitat 6.10.4 Habitat and Flora 6.11.4 Terrestrial Fauna 6.12.5 Avifauna 6.13.4 Species of Conservation Interest and Species at Risk 6.14.4 Mi'kmaq of Nova Scotia 6.15.4 Physical Cultural Heritage 6.16.4 Socio-economic Conditions
6.1.1. Atmospheric environmental	- ambient air quality in the project areas and, for the mine site, the results of a baseline survey of ambient air quality, including but not limited to the following contaminants: total suspended particulates, fine particulates ($PM_{2.5}$), particulate matters up to 10 micrometers in size (PM_{-10}), sulfur oxides (SO_X), volatile organic compounds (VOCs) and nitrogen oxides (NO_X);existing greenhouse gas emissions in the project study areas; - current provincial/federal limits for greenhouse gas emission targets; - current ambient noise levels in the project area and key receptor points (e.g. Aboriginal communities, closest residences, seasonal cottages, cabins), including the results of a baseline ambient noise survey. Information on typical sound sources, geographic extent and temporal variations will be included; - existing ambient night-time light levels at the project site and at any other areas where project activities could have an effect on light levels. The EIS will describe night-time illumination levels during different weather conditions and seasons; and - historical records of relevant meteorological information (e.g. total precipitation: rain and snow); mean, maximum and minimum temperatures; and typical wind speed and direction.	6.1 Atmospheric Environment	6.1 Noise 6.2 Air 6.3 Light 6.4 Greenhouse Gases	6.1 Noise 6.2 Air 6.3 Light 6.4 Greenhouse Gases
6.1.2. Geology and geochemistry	- the surficial geology, bedrock and host rock geology of the deposit, including a table of geologic descriptions, geological maps and cross-sections of appropriate scale; - geomorphology, topography, structural fabric (e.g. fractures, faults, foliation and lineation) and geotechnical characteristics of areas proposed for construction of major project components; - the geochemical characterization of expected mine material such as waste rock, ore, low grade ore, tailings, overburden and potential construction material in order to predict metal leaching and acid rock drainage[4]; and - geological hazards that exist in the areas planned for the project facilities and infrastructure, including: - history of seismic activity in the area; - isostatic rise or subsidence; and - landslides, slope erosion and the potential for ground and rock instability, and subsidence following project activities.	6.2 Geology, Soil and Sediment Quality	6.5 Geology, Soil and Sediment Quality	6.5 Geology, Soil, and Sediment Quality

[4] The manual produced by the Mine Environment Neutral Drainage (MEND) Program, entitled, MEND Report 1.20.1, "Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials", Version 0 - December 2009 is a recommended reference for use in acid rock drainage and metal leaching prediction.

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6.1.3. Topography and soil	- baseline mapping and description of landforms and soils within the local and regional project area; - maps depicting soil depth by horizon and soil order within the mine site area to support soil salvage and reclamation efforts, and to outline potential for soil erosion; and - suitability of topsoil and overburden for use in the rehabilitation of disturbed areas.	6.2 Geology, Soil and Sediment Quality	6.5 Geology, Soil and Sediment Quality	6.5 Geology, Soil, and Sediment Quality
6.1.4. Groundwater and surface water	- the hydrogeology, including: - the hydrogeological context (e.g., hydrostratigraphy with aquifers and aquitards, major faults, extensive fractures, etc.) including the delineation of key stratigraphic and hydrogeologic boundaries; - the physical properties of the hydrogeological units (e.g., hydraulic conductivity, transmissivity, saturated thickness, storativity, porosity, specific yield); - the regional and local groundwater flow patterns and rates; - a discussion of the hydrogeologic, hydrologic, geomorphic, climatic and anthropogenic controls on groundwater flow; - temporal changes in groundwater flow (e.g., seasonal and long term changes in water levels); - baseline groundwater quality; and - a delineation and characterization of groundwater surface water interactions including the locations of groundwater discharge to surface water and surface water recharge to groundwater.	6.3 Groundwater Quality and Quantity 6.4 Surface Water Quality and Quantity	6.6 Groundwater Quality and Quantity 6.7 Surface Water Quality and Quantity	6.6 Groundwater Quality and Quantity 6.7 Surface Water Quantity and Quality
	- hydrogeological maps and cross-sections for the mine area to outline the extent of aquifers and aquitards, including bedrock fracture and fault zones, locations and depths of wells, groundwater types, springs, surface waters, and project facilities. Groundwater levels, potentiometric contours, flow directions, groundwater divides and areas of recharge and discharge should be included; - all groundwater monitoring wells, including their location, in respect to the project area, including geologic, hydrostratigraphic, piezometric and construction data (e.g., depths of surficial and bedrock units, water level, hydraulic conductivity, diameter and screen depth and intercepted aquifer unit); - monitoring protocol for collection of existing groundwater data; - an appropriate hydrogeologic model for the project area including a detailed conceptual model, which discusses the hydrostratigraphy and groundwater flow systems; the rationale for the selected model will be provided; a sensitivity analysis will be performed to test model sensitivity to climatic variations (e.g., recharge) and hydrogeologic parameters (e.g., hydraulic conductivity); - graphs or tables indicating the seasonal variations in groundwater levels, flow regime, and quality; - local and regional potable groundwater supplies and/or surface water, including their current use and potential for future use; - bedrock fracture sizes and orientations in relation to groundwater flow; - the delineation of drainage basins, at appropriate scales (water bodies and watercourses), including intermittent streams, flood risk areas and wetlands, boundaries of the watershed and subwatersheds, overlaid by key project components; - hydrological regimes, including monthly, seasonal and annual water flow (discharge) data; - for each affected water body, the total surface area, bathymetry, maximum and mean depths, water level fluctuations, type of substrate (sediments); - seasonal water quality field and lab analytical results (e.g. water temperature, turbidity, pH, dissolved oxygen profiles) and interpretation at several representative local stream and water body monitoring stations established at the project site; and - sediment quality analysis for key sites likely to receive mine effluents.			Appendix A.2c Appendix E.3 Appendix F.5 Appendix F.6 Appendix P.4

Beaver Dam Mine Project Updated 2021 Environmental Impact Statement Guidelines (CEAA 2016) Concordance Table (continued)

Guidelines Section	Guidelines for the Preparation of an Environmental Impact Statement pursuant to the *Canadian Environmental Assessment Act,* 2012 Beaver Dam Mine Project EIS Guidelines Descriptions	Applicable Corresponding 2017 EIS Section	Applicable Corresponding Revised 2019 EIS Section	Applicable Corresponding Updated 2021 EIS Section
6.1.5. Wetlands	Wetlands that may be affected by project activities will be characterized according to their location, size, type (wetland class and form), species composition and ecological function (Canadian Wetland Classification System, National Wetlands Working Group [NWWG] 1997). Efforts should focus on describing the wetlands with the greatest potential to be affected, including those within the project footprint. An overview of the key plant communities and animals that rely on wetlands will be presented. - The locations and extent of all wetlands in the project area will be mapped. The EIS will provide an estimate (in hectares) of each type of wetland ecosystem in the project area. This will include all wetlands previously mapped by the province, as well as wetlands identified by the study team through desktop analysis and field survey programs. - The desktop study to identify and determine the extent of wetlands within the Project area will be conducted using the provincial mapping and databases, aerial imagery, and 1:50,000 topographic mapping. - Nova Scotia requires wetland class to be based on the Canadian Wetland Classification System (NWWG 1997) and descriptions in the Nova Scotia Wetland Conservation Policy. Ecological function of all identified wetlands should be assessed and an evaluation of the following included: wildlife habitat potential (including rare and endangered species and overall plant community composition), groundwater recharge potential, the role of the wetland in surface flow regulation (stormwater retention and flood control), the potential role of the wetland in water quality improvement, and any other notable site specific functions that the wetland may provide. - For those potentially affected wetlands where the Federal Policy on Wetland Conservation would be applicable, and avoidance is deemed not possible, a detailed description of potential effects, and of the reasons why avoidance and minimization of impacts were determined to not be possible should be provided. The mitigation measures and monitoring plan, as well as a proposed compensation plan, should be consistent with those proposed for other projects in Atlantic Canada.	6.5 Wetlands	6.8 Wetlands	6.8 Wetlands
6.1.6. Fish and fish habitat	For potentially affected surface waters: - a characterization of fish populations on the basis of species and life stage, including information on the surveys carried out and the source of data available (e.g. location of sampling stations, catch methods, date of catches, species); - a list of any fish or invertebrate species at risk that are known to be present; - a description of the habitat by homogeneous section, including the length of the section, width of the channel from the high water mark (bankful width), water depths, type of substrate (sediments), aquatic and riparian vegetation, and photos; - a description of natural obstacles (e.g. falls, beaver dams) or existing structures (e.g. water crossings) that hinder the free passage of fish and the location of the obstacle or structure in relation to the site of the impact; - maps, at a suitable scale, indicating the surface area of potential or confirmed fish habitat for spawning, nursery, feeding, overwintering, migration routes, etc. This information should be linked to water depths (bathymetry) to identify the extent of a water body's littoral zone; and - the description and location of suitable habitats for fish species at risk that appear on federal and provincial lists and that are found or are likely to be found in the study area. Note that certain intermittent streams or wetlands may constitute fish habitat or contribute indirectly to fish habitat. The absence of fish at the time of the survey does not irrefutably indicate an absence of fish habitat.	6.6 Fish and Fish Habitat	6.9 Fish and Fish Habitat	6.9 Fish and Fish Habitat
6.1.7. Migratory birds and their habitat[5]	- the various ecosystems found in the project area likely to be affected based on existing information; - migratory and non-migratory birds (including landbirds, waterfowl, raptors, shorebirds, and other waterbirds); - year-round migratory bird use of the area (e.g., winter, spring migration, breeding season, fall migration), based on preliminary data from existing sources; and - the results of any baseline surveys and a description of the methodology. In addition to information obtained from previous environmental assessments in the area, naturalists and Aboriginal peoples, other relevant datasets should be consulted. Existing data will be supplemented by surveys where necessary. The EIS will give particular consideration to areas of concentration of birds, such as breeding, staging and/or wintering areas, species of conservation concern, as well as breeding areas of species low in number and high in the food chain.	6.9 Birds	6.12 Birds	6.12 Avifauna

[5] Surveys should be designed with reference to the Canadian Wildlife Service's guidance such as Technical Report No. 508, A Framework for the Scientific Assessment of Potential Project Impacts on Birds (Hanson et al. 2009). Appendix 3 of the Framework provides examples of project types and recommended techniques for assessing impacts on migratory birds.

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Guidelines Section	Guidelines for the Preparation of an Environmental Impact Statement pursuant to the *Canadian Environmental Assessment Act,* 2012 Beaver Dam Mine Project EIS Guidelines Descriptions	Applicable Corresponding 2017 EIS Section	Applicable Corresponding Revised 2019 EIS Section	Applicable Corresponding Updated 2021 EIS Section
6.1.8. Species at Risk	- a list of all potential or known species at risk that appear on federal and provincial lists that may be affected by the project (fauna and flora), using existing data and literature as well as surveys to provide current field data; - a list of all federal species designated by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) for listing on Schedule 1 of the Species at Risk Act. This will include those species in the risk categories of extirpated, endangered, threatened and special concern[6]. For the purposes of the provincial EA, any species listed by the Nova Scotia Endangered Species Act and listed as S1, S2 or S3 by the Atlantic Canada Conservation Data Centre; - any published studies that describe the regional importance, abundance and distribution of species at risk; and - residences, seasonal movements, movement corridors, habitat requirements, key habitat areas, identified critical habitat and/or recovery habitat (where applicable) and general life history of species at risk that may occur in the project area, or be affected by the project. Consult recovery strategies for information on the critical habitat of endangered and threatened species, and consult management plans for information on habitat use of species of special status.	6.10 Species at Risk	6.13 Species of Conservation Interest and Species at Risk	6.13 Species of Conservation Interest and Species at Risk
6.1.9. Ecosystems	The EIS will describe the various ecosystems (e.g. grassland, temperate forest) found in the project area which are likely to be affected by the project. For the provincial EA, the description of forest ecosystems within the project footprint should be undertaken using the Nova Scotia Forest Ecosystem Classification (http://novascotia.ca/natr/forestry/veg-types/).	6.7 Habitat and Flora 6.8 Terrestrial Fauna	6.10 Habitat and Flora 6.11 Terrestrial Fauna	6.10 Habitat and Flora 6.11 Terrestrial Fauna
6.1.10. Aboriginal peoples	With respect to potential effects on Aboriginal peoples and the related VCs, baseline information will be provided for each Aboriginal group identified in section 5 (and any groups identified after these guidelines are finalized). Baseline information will describe and characterize the elements in paragraph 5(1)(c) of CEAA 2012 based on the spatial and temporal scope selected for the assessment according to the factors outlined in Part 1, section 3.3.3. Baseline information will also characterize the region al context of each of the paragraph 5(1)(c) elements to support the assessment of project related effects and cumulative effects. Baseline information will be sufficient to provide a comprehensive understanding of the current state of each VC. Baseline information for current use of lands and resources for traditional purposes will focus on the traditional activity (e.g., hunting, fishing, trapping, plant gathering) and include a characterization of all attributes of the activity that can be affected by environmental change. This includes not only identifying species of importance but also assessing the quality and quantity of preferred traditional resources and locations, timing (e.g., seasonality, access restrictions, distance from community), ambient/sensory environment (e.g., noise, air quality, visual landscape, presence of others) and cultural environment (e.g., historical/generational connections, preferred areas). Specific aspects that will be considered include, but are not limited to: - location of traditional territory (including maps where available); - location of reserves and communities; - location of permanent residences, hunting camps and cabins; - traditional uses currently practiced or practiced in recent history; - fish, wildlife, birds, plants or other natural resources of importance for traditional use; - places where fish, wildlife, birds, plants or other natural resources are harvested; - access and travel routes for conducting traditional practices; - frequency, duration or timing of traditional practices; - cultural values associated with the area affected by the project and the traditional uses identified; - areas of concentration of migratory animals, such as breeding, denning and/or wintering areas; - ungulates, furbearers, amphibians, small mammals, and their habitat; - existing or proposed protected areas, special management areas, and conservation areas in the regional study area; - wetlands most likely to be affected by project activities according to their location, size, type (wetland class and form), species composition and ecological function (Canadian Wetland Classification System, National Wetlands Working Group, 1997); - key plant communities and animals that rely on wetlands; and - submerged floating and emergent aquatic vegetation.	6.11 Indigenous Peoples App B Summary of Consultation	6.14 Indigenous Peoples	6.14 Mi'kmaq of Nova Scotia

[6] Proponents are encouraged to consult COSEWIC's annual report for a listing of the designated wildlife species: http://www.cosewic.gc.ca/eng/sct0/index_e.cfm#sar

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	Baseline information for health[7] and socio-economic conditions will include the functioning and health of the socio-economic environment, encompassing a broad range of matters that affect communities in the study area in a way that recognizes interrelationships, system functions and vulnerabilities. Specific aspects that will be considered include, but are not limited to: - drinking water sources (permanent, seasonal, periodic, or temporary); - reliance on country foods (also known as traditional foods) including food that is trapped, fished, hunted, harvested or grown for subsistence or medicinal purposes, outside of the commercial food chain; - which country foods are consumed by which Aboriginal groups, how frequently and where these country foods are harvested; - commercial activities (e.g. fishing, trapping, hunting, forestry, outfitting); - recreational uses; Any other baseline information that supports the analysis of predicted effects on Aboriginal peoples will be included as necessary. The EIS will also indicate how input from Aboriginal groups was used in establishing the baseline conditions related to health and socio -economics, physical and cultural heritage and current use of lands and resources for traditional purposes.			6.14 Mi'kmaq of Nova Scotia 6.16 Socio-economic Conditions Appendix C.2
6.1.11. Other environmental changes arising as a result of a federal decision or due to effects on federal lands, lands in another province or lands outside Canada	Should there be the potential for a change to the environment arising as a result of a federal decision(s), or on federal lands, lands in another province or lands outside Canada, the EIS will include baseline information on the environmental component likely to be affected (if this information is not already covered in other subsections of these guidelines). For example, if an authorization provided under the Fisheries Act was to result in the flooding of key wildlife habitat, baseline information should be provided on the wildlife species likely to be affected.	6.14.5 Environmental Effects Incidental of Decisions Made by a Federal Authority	6.17.5 Environmental Effects Incidental of Decisions Made by a Federal Authority	6.17.6 Environmental Effects Incidental of Decisions Made by a Federal Authority
6.2. Predicted changes to the physical environment	The assessment will include a consideration of the predicted changes to the environment as a result of the project being carried out or as a result of any powers duties or functions that are to be exercised by the federal government in relation to the project. These predicted changes to the environment are to be considered in relation to each phase of the project (construction, operation, decommissioning, and abandonment) and are to be described in terms of the geographic extent of the changes, the duration and frequency of change, and whether the environmental changes are reversible or irreversible.	6.X.6 Subsections for each VC titled "Project Interactions and Effects"	6.X.X Subsections for each VC titled "Project Activities Interactions and Effects"	Subsections for each VC titled "Project Activities/Interactions and Effects" 6.1.7 Noise 6.2.7 Air 6.3.7 Light 6.4.7 Greenhouse Gases 6.5.7 Geology, Soil, and Sediment 6.6.7 Groundwater 6.7.8 Water Quantity and Quality 6.8.7 Wetlands 6.9.7 Fish and Fish Habitat 6.10.7 Habitat and Flora 6.11.7 Terrestrial Fauna 6.12.8 Avifauna 6.13.7 Species of Conservation Interest and Species at Risk 6.14.7 Mi'kmaq of Nova Scotia 6.15.7 Physical Cultural Heritage 6.16.10 Socio-economic Conditions

[7] The proponent should refer to Health Canada's Useful Information for Environmental Assessments document in order to include the appropriate baseline information relevant to human health. This document can be obtained at http://www.hc-sc.gc.ca/ewhsemt/pubs/eval/environ_assess-eval/index-eng.php

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6.2.1. Changes to the atmospheric environment	- changes in air quality - changes in greenhouse gas emissions levels; - changes in ambient noise levels; and - changes in night-time light levels.	6.1.6 Project Activities Interactions and Effects	6.1.6 Project Activities and Noise Interactions and Effects 6.2.5 Project Activities and Air Interactions and Effects 6.3.6 Project Activities and Light Interactions and Effects 6.4.6 Project Activities and GHG Interactions and Effects	6.1.7 Project Activities and Noise Interactions and Effects 6.2.7 Project Activities and Air Interactions and Effects 6.3.7 Project Activities and Light Interactions and Effects 6.4.7 Project Activities and GHG Interactions and Effects
6.2.2. Changes to groundwater and surface water	- changes to turbidity, oxygen level, water temperature, ice regime, water quality; - changes to the hydrological and hydrometric conditions; - changes to groundwater flow regime (directions and rates of flow), groundwater recharge/discharge areas and any changes to groundwater infiltration areas; - changes to water quality attributed to acid rock drainage and metal leaching associated with the storage of waste rock, ore, low grade ore, tailings, overburden and potential construction material, including: - short term metal leaching properties; - longer term rates of acid generation (if any) and metal leaching; - estimates of the potential for mined materials (including waste rock, tailings and low grade ore) to be sources of acid rock drainage or metal leaching; - estimates of potential time to the onset of acid rock drainage or metal leaching; - quantity and quality of leachate from samples of tailings, waste rock, and ore; - quantity and quality of effluent to be released from the site into the receiving waters; - quality of humidity cell or column test liquid from acid rock testing; - sensitivity analysis to assess the effects of imperfect segregation of waste rock; - pit water chemistry during operation and post-closure, and pit closure management measures (e.g. flooding). This will include geochemical modelling of pit water quality in the post-closure period; - surface and seepage water quality and flow rates from the waste rock dumps, tailings/waste rock impoundment facility, stockpiles and other infrastructure during operation and post-closure; - drawings and/or figures showing groundwater contours (piezometric surfaces) to illustrate projected seepage conditions for the applicable project components; and - a discussion of the potential for and timing of off-site migration of impacted groundwater, and an analysis of contaminant attenuation capacities within the hydrogeological units within the project area.	6.3.6 Project Activities and Surface Water Interactions and Effects; 6.4.6 Project Activities and Groundwater Quality and Quantity Interactions and Effects	6.6.6 Project Activities and Groundwater Quality and Quantity Interactions and Effects 6.7.6 Project Activities and Surface Water Interactions and Effects	6.6.7 Project Activities and Groundwater Quality and Quantity Interactions and Effects 6.7.8 Project Activities and Surface Water Interactions and Effects
6.2.3. Changes to wetlands	- changes in wetland size, function, or resident flora or habitat; - changes to hydrological conditions; - identification of all direct and indirect effects on wetlands; and - if warranted, a preliminary wetland compensation plan as detailed in the Nova Scotia Wetland Conservation Policy.	6.5.6 Project Activities and Wetlands Interactions and Effects	6.8.6 Project Activities and Wetlands Interactions and Effects	6.8.7 Project Activities and Wetlands Interactions and Effects
6.2.4. Changes to the terrestrial landscape	- overall description of changes related to landscape disturbance; - changes to migratory bird habitat, including losses, structural changes, fragmentation of habitat and wetlands (cover types, ecological land unit in terms of quality, quantity, diversity, distribution and functions) used by migratory birds; - changes to critical habitat for provincially or federally listed species at risk; and - changes to key habitat for species important to Aboriginal current use of resources.	6.2.6 Project Activities Interactions and Effects; 6.7.6 Project Activities and Habitat and Flora Interactions and Effects; 6.8.6 Project Activities and Terrestrial Fauna Interactions and Effects	6.10.6 Project Activities and Habitat and Flora Interactions and Effects 6.11.6 Project Activities and Terrestrial Fauna Interactions and Effects	6.10.7 Project Activities and Habitat and Flora Interactions and Effects 6.11.7 Project Activities and Terrestrial Fauna Interactions and Effects

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6.3. Predicted effects on valued components	Based on the predicted changes to the environment identified in section 6.2, the proponent is to assess the environmental effects of the project on VCs including those listed below. Additional VCs may be identified through the analysis of environmental effects and based on federal or provincial requirements.	6.X.6 Subsections for each VC titled "Project Interactions and Effects"	6.X.X Subsections for each VC titled "Project Interactions and Effects"	Subsections for each VC titled "Project Interactions and Effects" 6.1.7 Noise 6.2.7 Air 6.3.7 Light 6.4.7 Greenhouse Gases 6.5.7 Geology, Soil, and Sediment 6.6.7 Groundwater 6.7.8 Water Quantity and Quality 6.8.7 Wetlands 6.9.7 Fish and Fish Habitat 6.10.7 Habitat and Flora 6.11.7 Terrestrial Fauna 6.12.8 Avifauna 6.13.7 Species of Conservation Interest and Species at Risk 6.14.7 Mi'kmaq of Nova Scotia 6.15.7 Physical Cultural Heritage 6.16.10 Socio-economic Conditions
6.3.1. Fish and fish habitat	- the identification of any potential harmful alteration, disruption or destruction of fish habitat, including the calculations of any potential habitat loss (temporary or permanent) in terms of surface areas (e.g. spawning grounds, fry-rearing areas, feeding), and in relation to watershed availability and significance. The assessment will include a consideration of: - the geomorphological changes and their effects on hydrodynamic conditions and fish habitats (e.g. modification of substrates, dynamic imbalance, silting of spawning beds); - the modifications of hydrological and hydrometric conditions on fish habitat and on the fish species' life cycle activities (e.g. reproduction, fry-rearing, movements); - potential impacts on riparian areas that could affect aquatic biological resources and productivity taking into account any anticipated modifications to fish habitat; and - any potential imbalances in the food web in relation to baseline. - the effects of changes to the aquatic environment on fish and their habitat, including: - estimates of fish mortality for various species and life stage (e.g. egg, juvenile, adult); - the anticipated changes in the composition and characteristics of the populations of various fish species, included shellfish and forage fish; - any modifications in migration or local movements (upstream and downstream migration, and lateral movements) following the construction and operation of works (physical and hydraulic barrier); - any reduction in fish populations as a result of potential overfishing due to increased access to the project area; and - any modifications and use of habitats by federally or provincially listed fish species. - a discussion of how project construction timing correlates to key fisheries windows for freshwater and anadromous species, and any potential impacts resulting from overlapping periods; and - a discussion of how vibration caused by blasting may affect fish behaviour, such as spawning or migrations.	6.6.6 Project Activities and Fish and Fish Habitat Interactions and Effects	6.9.6 Project Activities and Fish and Fish Habitat Interactions and Effects	6.9.7 Project Activities and Fish and Fish Habitat Interactions and Effects
6.3.2. Migratory birds	- direct migratory bird mortality that could be caused by clearing of sites or birds and nests being in contact with contaminated waters (e.g., tailing impoundment area); - collision risk of migratory birds with any project infrastructures; and - indirect effects caused by increased disturbance (e.g. noise, light, presence of workers), relative abundance movements and changes in migratory bird habitat.	6.9.6 Project Activities and Birds Interactions and Effects	6.12.7 Project Activities and Birds Interactions and Effects	6.12.8 Project Activities and Avifauna Interactions and Effects

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6.3.3. Species at risk	- for each habitat unit, the potential effects of the project on federally listed species at risk and those species listed by the Committee on the Status of Endangered Wildlife in Canada classified as extirpated, endangered, threatened or of special concern (flora and fauna) and their critical habitat. Also the potential effects to any species listed by the Nova Scotia Endangered Species Act and listed as S1, S2 or S3 by the Atlantic Canada Conservation Data Centre.	6.10.6 Project Activities and Species at Risk Interactions and Effects	6.13.6 Project Activities and Species at Risk Interactions and Effects	6.13.7 Project Activities and Species at Risk Interactions and Effects
6.3.4. Aboriginal peoples	With respect to Aboriginal peoples, a description and analysis of how changes to the environment caused by the project will affect each Aboriginal group's: - current use of land and resources for traditional purposes. This assessment will characterize the effect(s) on the use or activity (e.g., hunting, fishing, trapping, plant gathering) as a result of the underlying changes to the environment (i.e., how will the activity change if the project proceeds). The underlying changes to the environment will also be described, including, but not limited to: - any changes to resources (fish, wildlife, birds, plants or other natural resources) used for traditional purposes (e.g. hunting, fishing, trapping, collection of medicinal plants, use of sacred sites); - any changes or alterations to access into the areas used for traditional purposes, including development of new roads, deactivation or reclamation of access roads and changes to waterways that affect navigation; - any changes to the environment that affect cultural value or importance associated with traditional uses or areas affected by the project (e.g. values or attributes of the area that make it important as a place for inter-generational teaching of language or traditional practices, communal gatherings, integrity of preferred practice areas); - how timing of project activities that have the potential to affect Aboriginal peoples (e.g., construction, blasting, discharges) interacts with the timing of traditional practices, and any potential effects resulting from overlapping periods; - any changes to the alienation of lands from Aboriginal traditional use, including consideration of the regional context for traditional use, and the value of the project area in that regional context; - any changes to environmental quality (e.g. air, water, soil) or the sensory environment (e.g. noise, light, visual landscape), or perceived disturbance of the environment (e.g. fear of contamination of water or country foods) that could detract from Aboriginal use of the area or lead to avoidance of the area; and - an assessment of the potential to return affected areas to pre-disturbance conditions to support traditional practices. - human health, focusing on effects on health outcomes or risks in consideration of but not limited to potential changes in air quality, effects of vibration from blasting, quality and availability of country foods, water quality and quantity (drinking and recreational), and noise exposure. When risks to human health due to changes in one or more of these components are predicted, a complete Human Health Risk Assessment (HHRA) examining all exposure pathways for pollutants of concern may be necessary to adequately characterize potential risks to human health. Where adverse health effects are predicted, any incidental effects such as effects on current use of lands and resources for traditional purposes will also be assessed. The proponent must provide a justification if it determines that an assessment of the potential for contamination of country foods is not required or if some contaminants are excluded from the assessment.; - socio-economic conditions, including but not limited to: - the use of navigable waters; - forestry and logging operations; - commercial fishing, hunting, trapping, and gathering activities; - commercial outfitters; and - recreational use. - physical and cultural heritage, and structure, site or thing of historical, archaeological, paleontological or architectural significance to Aboriginal groups, including, but not limited to: - the loss or destruction of physical and cultural heritage; - changes to access to physical and cultural heritage; and - changes to the cultural value or importance associated with physical and cultural heritage. Other effects of changes to the environment on Aboriginal peoples should be reflected as necessary.	6.11.6 Project Activities and Indigenous Peoples Interactions and Effects	6.14.6 Project Activities and Indigenous Peoples Interactions and Effects	6.14.7 Project Activities and Mi'kmaq of Nova Scotia Interactions and Effects 6.15.7 Project Activities and Physical and Cultural Heritage Interactions and Effects Appendix C.2

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6.4. Other valued components that may be affected as a result of a federal decision or due to effects on federal lands, lands in another province or lands outside Canada	If there is the potential for a change to the environment arising as a result of a federal decision(s), for example an authorisation under section 35 of the Fisheries Act, the EIS should include a description of the specific project components for which a federal authorisation/decision is required, and an assessment of any other VCs (not already covered in other subsections of these guidelines) that may be affected by the changes to the environment caused by these specific project components. If there is the potential for the project to result in environmental changes on federal lands, another province, or another country, then VCs of importance not already identified should be included. For example, if the project will result in the generation of greenhouse gas emissions, the EIS should include a description of the project's greenhouse gas emissions in a regional, provincial, national or international context if applicable. Suggested VCs are noted below for this project.	6.X.6 Subsections for each VC titled "Project Interactions and Effects"	6.X.X Subsections for each VC titled "Project Interactions and Effects"	Subsections for each VC titled "Project Interactions and Effects" 6.1.7 Noise 6.2.7 Air 6.3.7 Light 6.4.7 Greenhouse Gases 6.5.7 Geology, Soil, and Sediment 6.6.7 Groundwater 6.7.8 Water Quantity and Quality 6.8.7 Wetlands 6.9.7 Fish and Fish Habitat 6.10.7 Habitat and Flora 6.11.7 Terrestrial Fauna 6.12.8 Avifauna 6.13.7 Species of Conservation Interest and Species at Risk 6.14.7 Mi'kmaq of Nova Scotia 6.15.7 Physical Cultural Heritage 6.16.10 Socio-economic Conditions
6.4.1. Atmospheric environment	- effects on the atmospheric environment (e.g. air emissions, noise, light) that could occur within Beaver Lake Indian Reserve 17 and as a result of project components that could require a federal decision.	6.1.6 Project Activities Interactions and Effects	6.1.6 Project Activities and Noise Interactions and Effects 6.2.5 Project Activities and Air Interactions and Effects 6.3.6 Project Activities and Light Interactions and Effects 6.4.6 Project Activities and GHG Interactions and Effects	6.1.7 Project Activities and Noise Interactions and Effects 6.2.7 Project Activities and Air Interactions and Effects 6.3.7 Project Activities and Light Interactions and Effects 6.4.7 Project Activities and GHG Interactions and Effects
6.4.2. Water quality and quantity	- all direct and indirect effects on water quality and quantity in Beaver Lake Indian Reserve 17 and those affected by project components that could require a federal decision.	6.3.6. Project Activities and Surface Water Interactions and Effects 6.4.6 Project Activities and Groundwater Quality and Quantity Interactions and Effects	6.6.6. Project Activities and Groundwater Quality and Quantity Interactions and Effects 6.7.6 Project Activities and Surface Water Interactions and Effects	6.6.7 Project Activities and Groundwater Quality and Quantity Interactions and Effects 6.7.8 Project Activities and Surface Water Interactions and Effects
6.4.3. Wetlands	- all direct and indirect effects on wetlands in Beaver Lake Indian Reserve 17 and those affected by project components that could require a federal decision.	6.5.6 Project Activities and Wetlands Interactions and Effects	6.8.6 Project Activities and Wetlands Interactions and Effects	6.8.7 Project Activities and Wetlands Interactions and Effects
6.4.4. Plants	- all direct and indirect effects on plants in Beaver Lake Indian Reserve 17 and those affected by project components that could require a federal decision.	6.7.6 Project Activities and Habitat and Flora Interactions and Effects	6.10.6 Project Activities and Habitat and Flora Interactions and Effects	6.10.7 Project Activities and Habitat and Flora Interactions and Effects
6.4.5. Wildlife	- all direct and indirect effects on wildlife (e.g. furbearers) in Beaver Lake Indian Reserve 17 and those affected by components of the Project that could require a federal decision.	6.8.6 Project Activities and Terrestrial Fauna Interactions and Effects	6.11.6 Project Activities and Terrestrial Fauna Interactions and Effects	6.11.7 Project Activities and Terrestrial Fauna Interactions and Effects
6.4.6. Health and socio-economic conditions	- a description and analysis of how changes to the environment caused by project components that could require a federal decision could affect heath and socio-economic conditions of non-Aboriginal peoples (e.g. tourism, hunting and trapping, hiking).	6.13.6 Project Activities Interactions and Effects	6.16.7 Project Activities and Socioeconomic Interactions and Effects	6.16.10 Project Activities and Socioeconomic Interactions and Effects

Beaver Dam Mine Project Updated 2021 Environmental Impact Statement Guidelines (CEAA 2016) Concordance Table (continued)

Guidelines Section	Guidelines for the Preparation of an Environmental Impact Statement pursuant to the *Canadian Environmental Assessment Act,* 2012 Beaver Dam Mine Project EIS Guidelines Descriptions	Applicable Corresponding 2017 EIS Section	Applicable Corresponding Revised 2019 EIS Section	Applicable Corresponding Updated 2021 EIS Section
6.4.7. Physical and cultural heritage and structures, sites or things of historical, archaeological, paleontological or architectural significance	- a description and analysis of how changes to the environment caused by project components that could require a federal decision could affect physical and cultural heritage and structuress, sites or things of historical, archaeological, paleontological or architectural significance of non-Aboriginal People.	6.12.6 Project Activities Interactions and Effect	6.15.6 Project Activities and Physical and Cultural Heritage Interactions and Effects	6.15.7 Project Activities and Physical and Cultural Heritage Interactions and Effects
6.5. Mitigation	Every EA conducted under CEAA 2012 will consider measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the project. Each measure will be specific, achievable, measurable and verifiable, and described in a manner that avoids ambiguity in intent, interpretation and implementation. Mitigation measures may be considered for inclusion as conditions in the EA decision statement and/or in other compliance and enforcement mechanisms provided by other authorities' permitting or licensing processes. As a first step, the proponent is encouraged to use an approach based on the avoidance and reduction of the effects at the source. Such an approach may include the modification of the design of the project or relocation of project components. The EIS will describe the standard mitigation practices, policies and commitments that constitute technically and economically feasible mitigation measures and that will be applied as part of standard practice regardless of location (including the measures directed at promoting beneficial or mitigating adverse socio-economic effects. The EIS will then describe the project's environmental protection plan and its environmental management system, through which the proponent will deliver this plan. The plan will provide an overall perspective on how potentially adverse effects would be minimized and managed over time. The EIS will further discuss the mechanisms the proponent would use to require its contractors and sub-contractors to comply with these commitments and policies and with auditing and enforcement programs. The EIS will then describe mitigation measures that are specific to each environmental effect identified. Measures will be written as specific commitments that clearly describe how the proponent intends to implement them and the environmental outcome the mitigation is designed to address. Where mitigation measures have been identified in relation to species and/or critical habitat listed under the Species at Risk Act, the mitigation measures will be consistent with any applicable recovery strategy and action plans.	6.X.7 Subsections for each VC titled "Mitigation and Monitoring"	6.X.X Subsections for each VC titled "Mitigation"	Subsections for each VC titled "Mitigation" 6.1.8 Noise 6.2.8 Air 6.3.8 Light 6.4.8 Greenhouse Gases 6.5.8 Geology, Soil, and Sediment 6.6.8 Groundwater 6.7.9 Water Quantity and Quality 6.8.8 Wetlands 6.9.8 Fish and Fish Habitat 6.10.8 Habitat and Flora 6.11.8 Terrestrial Fauna 6.12.9 Avifauna 6.13.8 Species of Conservation Interest and Species at Risk 6.14.8 Mi'kmaq of Nova Scotia 6.15.8 Physical Cultural Heritage 6.16.11 Socio-economic Conditions
	The EIS will specify the actions, works, minimal disturbance footprint techniques, best available technology, corrective measures or additions planned during the project's various phases to eliminate or reduce the significance of adverse effects. The impact statement will also present an assessment of the effectiveness of the proposed technically and economically feasible mitigation measures. The reasons for determining if the mitigation measure reduces the significance of an adverse effect will be made explicit. The EIS will indicate what other technically and economically feasible mitigation measures were considered, and explain why they were rejected. Trade-offs between cost savings and effectiveness of the various forms of mitigation will be justified. The EIS will identify who is responsible for the implementation of these measures and the system of accountability. Where mitigation measures are proposed to be implemented for which there is little experience or for which there is some question as to their effectiveness, the potential risks and effects to the environment should those measures not be effective will be clearly and concisely described. In addition, the EIS will identify the extent to which technology innovations will help mitigate environmental effects. Where possible, it will provide detailed information on the nature of these measures, their implementation, management and the requirements of the follow-up program. Adaptive management is not considered as a mitigation measure, but if the follow-up program (refer to section 8) indicates that corrective action is required, the proposed approach for managing the action should be identified.			2.10 Alternative Means of Carrying out the Project 9 Summary of the Environment al Impact Statement, Table 9.1-1 Summary of Key Mitigation Measures by Valued Component

Beaver Dam Mine Project Updated 2021 Environmental Impact Statement Guidelines (CEAA 2016) Concordance Table (continued)

Guidelines Section	Guidelines for the Preparation of an Environmental Impact Statement pursuant to the *Canadian Environmental Assessment Act,* 2012 Beaver Dam Mine Project EIS Guidelines Descriptions	Applicable Corresponding 2017 EIS Section	Applicable Corresponding Revised 2019 EIS Section	Applicable Corresponding Updated 2021 EIS Section
6.6. Significance of residual effects	After having established the technically and economically feasible mitigation measures, the EIS will present any residual environmental effects of the project on the VCs identified in section 6.3. The residual effects will be described, even if very small or deemed insignificant. The EIS will then provide an analysis of the significance of the residual environmental effects that are considered adverse, using guidance described in section 4 of the Agency's reference guide Determining Whether a Project is Likely to Cause Significant Adverse Environmental Effects12 . The EIS will identify the criteria used to assign significance ratings to any predicted adverse effects. It will contain clear and sufficient information to enable the Agency, technical and regulatory agencies, Aboriginal groups and the public to review the proponent's analysis of the significance of effects. The EIS will document the terms used to describe the level of significance. The following criteria should be used in determining the significance of residual effects: - magnitude; - geographic extent; - duration; - frequency; - reversibility; - ecological and social context; and - existence of environmental standards, guidelines or objectives for assessing the impact. In assessing significance against these criteria the proponent will, where possible, use relevant existing regulatory documents, environmental standards, guidelines, or objectives such as prescribed maximum levels of emissions or discharges of specific hazardous agents into the environment. The EIS will contain a section which explains the assumptions, definitions and limits to the criteria mentioned above in order to maintain consistency between the effects on each VC. Where significant adverse effects are identified, the EIS will set out the probability (likelihood) that they will occur, and describe the degree of scientific uncertainty related to the data and methods used within the framework of its environmental analysis.	6.X.8 Subsections for each VC titled "Residual effects and Significance"	6.X.X Subsections for each VC titled "Residual Effects and Significance"	Subsections for each VC titled "Residual Effects and Significance" 6.1.9 Noise 6.2.9 Air 6.3.9 Light 6.4.9 Greenhouse Gases 6.5.9 Geology, Soil, and Sediment 6.6.9 Groundwater 6.7.10 Water Quantity and Quality 6.8.9 Wetlands 6.9.9 Fish and Fish Habitat 6.10.9 Habitat and Flora 6.11.9 Terrestrial Fauna 6.12.10 Avifauna 6.13.9 Species of Conservation Interest and Species at Risk 6.14.9 Mi'kmaq of Nova Scotia 6.15.9 Physical Cultural Heritage 6.16.11 Socio-economic Conditions
6.7. Other effects to consider	-	6.15 Accidents and Malfunctions 7 Effects of the Environment on the Project 8 Cumulative Effects Assessment	6.18 Accidents and Malfunctions 7 Effects of the Environment on the Project 8 Cumulative Effects Assessment	6.18 Accidents and Malfunctions 7 Effects of the Environment on the Project 8 Cumulative Effects Assessment

Beaver Dam Mine Project Updated 2021 Environmental Impact Statement Guidelines (CEAA 2016) Concordance Table (continued)

Guidelines Section	Guidelines for the Preparation of an Environmental Impact Statement pursuant to the *Canadian Environmental Assessment Act,* 2012 Beaver Dam Mine Project EIS Guidelines Descriptions	Applicable Corresponding 2017 EIS Section	Applicable Corresponding Revised 2019 EIS Section	Applicable Corresponding Updated 2021 EIS Section
6.7.1. Effects of potential accidents or malfunctions	The failure of certain works caused by human error or exceptional natural events (e.g. flooding, earthquake) could cause major effects. The proponent will therefore conduct an analysis of the risks of accidents and malfunctions, determine their effects and present a preliminary emergency measures. Taking into account the lifespan of different project components, the proponent will identify the probability of potential accidents and malfunctions related to the project, including an explanation of how those events were identified, potential consequences (including the environmental effects as defined in section 5 of CEAA 2012), the plausible worst case scenarios and the effects of these scenarios. This assessment will include an identification of the magnitude of an accident and/or malfunction, including the quantity, mechanism, rate, form and characteristics of the contaminants and other materials likely to be released into the environment during the accident and malfunction events and would potentially result in an adverse environmental effect as defined in section 5 of CEAA 2012. The EIS will describe the safeguards that have been established to protect against such occurrences and the contingency and emergency response procedures in place if such events do occur.	6.15 Accidents and Malfunctions	6.18 Accidents and Malfunctions	6.18 Accidents and Malfunctions
6.7.2. Effects of the environment on the project	The EIS will take into account how local conditions and natural hazards, such as severe and/or extreme weather conditions and external events (e.g. flooding, drought, ice jams, landslides, erosion, subsidence, fire, outflow conditions and seismic events) could adversely affect the project and how this in turn could result in impacts to the environment (e.g., extreme environmental conditions result in malfunctions and accidental events). These events will be considered in different probability patterns (i.e., 5-year flood vs. 100-year flood). Longer-term effects of climate change will also be discussed up to the projected post-closure phase of the project. This discussion will include a description of climate data used. For the provincial assessment the proponent will consider the Guide to Considering Climate Change in Environmental Assessments in Nova Scotia. The EIS will provide details of planning, design and construction strategies intended to minimize the potential environmental effects of the environment on the project.	7 Effects of the Environment on the Project	7 Effects of the Environment on the Project	7 Effects of the Environment on the Project
6.7.3. Cumulative effects assessment	The proponent will identify and assess the project's cumulative effects using the approach described in the Agency's Operational Policy Statement entitled Addressing Cumulative Environmental Effects under the Canadian Environmental Assessment Act, 2012 and the guide entitled Cumulative Effects Assessment Practitioners' Guide, 1999[8]. Cumulative effects are defined as changes to the environment due to the project combined with the existence of other past, present and reasonably foreseeable physical activities. Cumulative effects may result if: - implementation of the project being studied may cause direct residual adverse effects on the valued components, taking into account the application of technically and economically feasible mitigation measures; and - the same valued components may be affected by other past, present or reasonably foreseeable physical activities. Valued components that would not be affected by the project or would be affected positively by the project can, therefore, be omitted from the cumulative effects assessment. A cumulative effect on an environmental component may, however, be important even if the assessment of the project's effects on this component reveals that the effects of the project are minor. In its EIS, the proponent will: - identify and provide a rationale for the valued components that will constitute the focus of the cumulative effects assessment, emphasizing this assessment on the VCs most likely to be affected by the project and other project and activities. To this end, the proponent must consider, without limiting itself thereto, the following components likely to be affected by the project: - fish and fish habitat; - migratory birds; - species at risk; and - Aboriginal peoples.	8 Cumulative Effects Assessment	8 Cumulative Effects Assessment	8 Cumulative Effects Assessment

[8] Visit the Canadian Environmental Assessment Agency's website at: www.ceaa-acee.gc.ca/

Beaver Dam Mine Project Updated 2021 Environmental Impact Statement Guidelines (CEAA 2016) Concordance Table (continued)

Guidelines Section	Guidelines for the Preparation of an Environmental Impact Statement pursuant to the *Canadian Environmental Assessment Act,* 2012 Beaver Dam Mine Project EIS Guidelines Descriptions	Applicable Corresponding 2017 EIS Section	Applicable Corresponding Revised 2019 EIS Section	Applicable Corresponding Updated 2021 EIS Section
	- identify and justify the spatial and temporal boundaries for the cumulative effects assessment for each VC selected. The boundaries for the cumulative effects assessments will generally be different for each VC considered. These cumulative effects boundaries will also generally be larger than the boundaries for the corresponding project effects;			8 Cumulative Effects Assessment
	- identify the sources of potential cumulative effects. Specify other projects or activities that have been or that are likely to be carried out that could cause effects on each selected VC within the boundaries defined, and whose effects would act in combination with the residual effects of the project. This assessment may consider the results of any relevant study conducted by a committee established under section 73 or 74 of CEAA 2012; - assess the cumulative effects on each VC selected by comparing the future scenario with the project and without the project. Effects of past activities (activities that have been carried out) will be used to contextualize the current state of the VC. In assessing the cumulative effects on current use of lands and resources for traditional purposes by Aboriginal peoples, the assessment will focus on the cumulative effects on the activity (e.g., hunting, fishing, trapping, plant harvesting). - describe the mitigation measures that are technically and economically feasible. The proponent shall assess the effectiveness of the measures applied to mitigate the cumulative effects. In cases where measures exist that are beyond the scope of the proponent's responsibility that could be effectively applied to mitigate these effects, the proponent will identify these effects and the parties that have the authority to act. In such cases, the EIS will summarize the discussions that took place with the other parties in order to implement the necessary measures over the long term; - determine the significance of the cumulative effects; and - develop a follow-up program to verify the accuracy of the assessment or to dispel the uncertainty concerning the effectiveness of mitigation measures for certain cumulative effects. The proponent is encouraged to consult with key stakeholders and Aboriginal groups prior to finalizing the choice of VCs and the appropriate boundaries to assess cumulative effects.			8 Cumulative Effects Assessment
7. SUMMARY OF ENVIRONMENT EFFECTS ASSESSMENT	The EIS will contain a table summarising the following key information: - potential environmental effects; - proposed mitigation measures to address the effects identified above; and - potential residual effects and the significance of the residual environmental effects. The summary table will be used in the EA Report prepared by the Agency. An example of a format for the key summary table is provided in Appendix 1 of this document. In a second table, the EIS will summarize all key mitigation measures and commitments made by the proponent which will more specifically mitigate any significant adverse effects of the project on valued components (i.e., those measures that are essential to ensure that the project will not result in significant adverse environmental effects).	10 Summary of the Environmental Impact Statement	10 Environmental Impact Statement Summary and Conclusions	9 Summary of Environmental Effects Assessment Beaver Dam Mine Project Environmental Impact Statement Summary – May 2021
8. FOLLOW-UP AND MONITORING PROGRAMS	A follow-up program is designed to verify the accuracy of the effects assessment and to determine the effectiveness of the measures implemented to mitigate the adverse effects of the project. The goal of a monitoring program is to ensure that proper measures and controls are in place in order to decrease the potential for environmental degradation during all phases of project development, and to provide clearly defined action plans and emergency response procedures to account for human and environmental health and safety.	9 Compliance and Effects Monitoring Program	9 Compliance and Effects Monitoring Program	10 Follow-up and Monitoring Programs Proposed

Beaver Dam Mine Project Updated 2021 Environmental Impact Statement Guidelines (CEAA 2016) Concordance Table (continued)

Guidelines Section	Guidelines for the Preparation of an Environmental Impact Statement pursuant to the *Canadian Environmental Assessment Act,* 2012 Beaver Dam Mine Project EIS Guidelines Descriptions	Applicable Corresponding 2017 EIS Section	Applicable Corresponding Revised 2019 EIS Section	Applicable Corresponding Updated 2021 EIS Section
8.1. Follow-up program	The duration of the follow-up program shall be as long as required for the environment to regain its equilibrium and to evaluate the effectiveness of the mitigation measures. The EIS shall present a preliminary follow-up program in particular for areas where scientific uncertainty exists in the prediction of effects. This program shall include: - objectives of the follow-up program and the VCs targeted by the program; - list of elements requiring follow-up; - number of follow-up studies planned as well as their main characteristics (list of the parameters to be measured, planned implementation timetable, etc.); - intervention mechanism used in the event that an unexpected deterioration of the environment is observed; - mechanism to disseminate follow-up results among the concerned populations; - accessibility and sharing of data for the general population; - opportunity for the proponent to include the participation of Aboriginal groups and stakeholders on the affected territory, during the development and implementation of the program; and - involvement of local and regional organizations in the design, implementation and evaluation of the follow-up results as well as any updates, including a communication mechanism between these organizations and the proponent.	9.1 Environmental Management Plans	9.1 Environmental Management Plans	10.1 Environmental Follow-up Programs
8.2. Monitoring	The proponent will prepare an environmental monitoring program for all phases of the project. This program will help ensure that the project is implemented as proposed, that the mitigation or compensation measures proposed to minimize the project's environmental effects are effectively implemented, and that the conditions set at the time of the project's authorization and the requirements pertaining to the relevant laws and regulations are met. The monitoring program will also make it possible to check the proper operation of works, equipment and facilities. If necessary, the program will help reorient the work and possibly make improvements at the time of construction and implementation of the various elements of the project. Specifically, the environmental impact statement shall present an outline of the preliminary environmental monitoring program, including the: - identification of the interventions that pose risks to one or more of the components and the measures and means planned to protect the environment; - description of the characteristics of the monitoring program where foreseeable (e.g., location of interventions, planned protocols, list of measured parameters, analytical methods employed, schedule, human and financial resources required); - description of the proponent's intervention mechanisms in the event of the observation of noncompliance with the legal and environmental requirements or with the obligations imposed on contractors by the environmental provisions of their contracts; and - guidelines for preparing monitoring reports (number, content, frequency, format) that will be sent to the authorities concerned.	9.2 Environmental Monitoring Plans	9.2 Environmental Monitoring Plans	10.2 Environmental Monitoring Plans
9. NOVA SCOTIA ENVIRONMENT REQUIREMENTS	The Government of Nova Scotia requires a Class I Registration under the Nova Scotia Environmental Assessment Regulations made under the Environment Act. Pursuant to Schedule A of the Environmental Assessment Regulations a facility that extracts or processes a metallic or non-metallic mineral is a Class I Undertaking.	-	-	Beaver Dam Mine Project Updated 2021 Environmental Impact Statement
	The undertaking will not be officially registered until the proponent submits all applicable fees prescribed under the Nova Scotia Environment Act and all the required information. When preparing a registration document for a Class 1 undertaking, the proponent must ensure that certain information is included in the document. Under Section 9 (1A) of the Environmental Assessment Regulations, a registration document must include, as a minimum, the following information:	-	-	Beaver Dam Mine Project Updated 2021 Environmental Impact Statement
	- the name of the undertaking;	1.2 Proponent Information	1.2 Proponent Information	1.4 Proponent Information
	- the location of the undertaking;	2.1 Project Location	2.1 Project Location	1.2.2 Project Location 2.3 Project Location
	- the name, address, signature, and identification of the proponent including the name of the Chief Executive Officer and contact persons;	1.2 Proponent Information and signed letter	1.2 Proponent Information and signed letter	1.4 Proponent Information and signed letter
	- the nature of the undertaking;	1.1 Project Overview	1.1 Project Overview	1.2 Project Overview
	- the purpose and need of the undertaking;	1.4 Purpose of the Project	1.4 Purpose of the Project	1.3 Purpose of the Project
	- the proposed construction and operation schedules;	2.5 Project Schedule	2.5 Project Schedule	2.8 Project Schedule
	- a description of the undertaking;	2 Project Description	2 Project Description	2 Project Description

Beaver Dam Mine Project Updated 2021 Environmental Impact Statement Guidelines (CEAA 2016) Concordance Table (continued)

Guidelines Section	Guidelines for the Preparation of an Environmental Impact Statement pursuant to the *Canadian Environmental Assessment Act,* 2012 Beaver Dam Mine Project EIS Guidelines Descriptions	Applicable Corresponding 2017 EIS Section	Applicable Corresponding Revised 2019 EIS Section	Applicable Corresponding Updated 2021 EIS Section
	- environmental baseline information;	6 Environmental Effects Assessment	6.X.X Subsections for each VC titled "Baseline Conditions"	Subsections for each VC titled "Baseline Conditions" 6.1.3 Noise 6.2.4 Air 6.3.4 Light 6.4.4. Greenhouse Gases 6.5.4 Geology, Soil, and Sediment 6.6.4 Groundwater 6.7.4 Water Quantity 6.7.5 Water Quality 6.8.4 Wetlands 6.9.4 Fish and Fish Habitat 6.10.4 Habitat and Flora 6.11.4 Terrestrial Fauna 6.12.5 Avifauna 6.13.4 Species of Conservation Interest and Species at Risk 6.14.4 Mi'kmaq of Nova Scotia 6.15.4 Physical Cultural Heritage 6.16.4 Socio-economic Conditions
	- all steps taken or proposed by the proponent to identify and address the concerns of the public and Aboriginal people; - a list of all concerns regarding the undertaking expressed by the public and Aboriginal people;	3 Public Consultation and Engagement Program 4 Indigenous Peoples Consultation and Engagement Program 6.11 Indigenous Peoples	3 Public Consultation and Engagement Program 4 Indigenous Peoples Consultation and Engagement Program 6.14 Indigenous Peoples	3 Public Engagement Program 4 Indigenous Peoples Engagement Program 6.14 Mi'kmaq of Nova Scotia
	- a list of approvals which will be required and other forms of authorization; and	1.3 Regulatory Framework and Role of Government	1.3 Regulatory Framework and Role of Government	1.5 Regulatory Framework and Role of Government
	- the sources of any public funding.	1.1 Project Overview	1.1 Project Overview	1.2 Project Overview

Beaver Dam Mine Project Updated 2021 Environmental Impact Statement Guidelines (CEAA 2016) Concordance Table (continued)

Guidelines Section	Guidelines for the Preparation of an Environmental Impact Statement pursuant to the *Canadian Environmental Assessment Act,* 2012 Beaver Dam Mine Project EIS Guidelines Descriptions	Applicable Corresponding 2017 EIS Section	Applicable Corresponding Revised 2019 EIS Section	Applicable Corresponding Updated 2021 EIS Section
	The proponent also needs to address factors relevant to the Minister's decision. Under Section 12 of the Environmental Assessment Regulations, the Minister must consider the following information when making a decision: - the location of the proposed undertaking and the nature and sensitivity of the surrounding area; - the size, scope and complexity of the proposed undertaking; - concerns expressed by the public and Aboriginal people about the adverse effects or the environmental effects of the proposed undertaking; - steps taken by the proponent to address environmental concerns expressed by the public and Aboriginal people; - whether environmental baseline information submitted under subclause 9(1A)(b)(x) for the undertaking is sufficient for predicting adverse effects or environmental effects related to the undertaking; - potential and known adverse effects or environmental effects of the proposed undertaking, including identifying any effects on species at risk, species of conservation concern and their habitats; - project schedules where applicable; - planned or existing land use in the area of the undertaking; - other undertakings in the area; - whether compliance with licenses, certificates, permits, approvals or other documents of authorization required by law will mitigate the environmental effects; and - such other information as the Minister may require. For more information the proponent may refer to the Guide to Preparing an EA Registration Document for Mining Developments in Nova Scotia.	-	-	Beaver Dam Mine Project Updated 2021 Environmental Impact Statement

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Appendix A.2c Geotechnical Investigation: Data Report - Beaver Dam Mine, January 15, 2021

Appendix A.3 Terms of Reference for the Community Liaison Committee (CLC)

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Appendix A.4b NSSA letter March 21, 2021, notes from Sept 9 meeting and presentation

Appendix A.4c Community Bulletins

Appendix A.5 Summary of Mi'kmaq and Indigenous Peoples Engagement as Completed for the Project as of 2021

Appendix A,6 draft Public Engagement Plan – May 2021

Appendix B.1 Beaver Dam Mine Construction Noise Assessment Atlantic Mining NS Inc., Beaver Dam Mine Project, Nova Scotia - January 25, 2021

Appendix B.2 Noise Impact Assessment Technical Report - January 13, 2021

Appendix C.1 Air Emissions Assessment Technical report, February 16, 2021

Appendix C.2 Evaluation of Potential Human Exposures and Risks related to Emissions from the Beaver Dam Mine Project (Dust deposition; Recreational water usage; and country foods) - April 22, 2020

Appendix C.3 Draft Fugitive Dust Control Plan – May 2021

Appendix D.1 Light Impact Assessment Beaver Dam Mine Project, January 28, 2021

Appendix E.1 Sediment Baseline Analytical Results

Appendix E.2 Beaver Dam Project - ML/ARD Assessment Report - December 20, 2018

Appendix E.3 Beaver Dam Project - Geochemical Source Term Update – January 20, 2021

Appendix E.4 DRAFT Beaver Dam Project: 2020 Kinetic Test Update (IR NSE 2-74) – June 11, 2020

Appendix E.5 DRAFT Beaver Dam Mine ML/ARD Management Plan – August 8, 2019

Appendix E.6 Phase I - Environmental Site Assessment (Beaver Dam), - August 6, 2019

Appendix E.7 Limited Phase II - Environmental Site Assessment (Beaver Dam Property) - August 23, 2019

Appendix E.8 Final (Revised) – Extended Phase II Environmental Site Assessment Beaver Dam Project Property - March 8, 2021

Appendix E.9 Draft Historic Tailings and Waste Rock Management Plan - May 2021

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Appendix F.1 Assessment of Potential Open Pit Groundwater Inflows Beaver Dam Gold Project Nova Scotia - April 2015

Appendix F.2 Hydrogeologic Investigation - Beaver Dam Mine - July 30, 1986

Appendix F.3	**Field Activities Report Beaver Dam Mine Project - November 8, 2018**
Appendix F.4	**Baseline Groundwater Program, Beaver Dam - March 20, 2021**
Appendix F.5	**Hydrogeologic Modelling Report - April 2021**
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Appendix F.7	**Touquoy Integrated Water and Tailings Management Plan - Beaver Dam Gold Project - April 15, 2021**
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Appendix F. 9	**Response to Information Request Nos. CEAA 2-36, CEAA 2-37, and NSE 2-130 Evaluation of Potential Impacts from Metals COCs to Groundwater and Surface Water from Dust Deposition along the Haul Road Beaver Dam Mine Project Marinette, Nova Scotia - April 14, 2021**
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Appendix J.1	**Photographic Log of Watercourses and Fish Habitat – December 14, 2018**
Appendix J.2	**Fish and Fish Habitat Baseline Report – January 2021**
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Appendix N.3 **Beaver Dam Gold - WRSP West Archaeological Screening & Reconnaissance 2018 Beaver Dam, Nova Scotia -January 2019**

Appendix N.4 **Beaver Dam Gold Project - Haul Road Archaeological Reconnaissance Halifax Regional Municipality, Nova Scotia -March 2016**

Appendix N.5 **Beaver Dam Gold Project - Haul Road Option 2 Archaeological Reconnaissance Halifax Regional Municipality, Nova Scotia -March 2017**

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- **Appendix A draft Spill Contingency Plan**

Apppendix P.2 **draft Reclamation and Closure Plan**

Apppendix P.3 **draft Nitrogen Management Plan**

Apppendix P.4 **Mine Water Management Plan:**

- **Appendix A Water Balance Analysis**
- **Appendix B Stormwater Management Assessment – Hydrologic Modelling**
- **Appendix C Erosion and Sediment Control Plan**
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- **Appendix F Water Treatment Assessments**
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- **Appendix F.2 Operation Phase**
- **Appendix F.3 Post-closure Phase**
- **Appendix G Proposed Groundwater Monitoring Plan**
- **Appendix H Baseflow Mitigation Assessment**

Apppendix P.5 AEMP – not included will be developed as part of the Industrial Approval

Apppendix P.6 Preliminary Lichen Mitigation and Monitoring Plan

Apppendix P.7 draft Wildlife Mitigation and Monitoring Plan

- **Appendix A Landbird SAR Mitigation and Monitoring Plan**

1 INTRODUCTION

1.1 Purpose of the Environmental Impact Statement 2021 Update

The Environmental Impact Statement (EIS) was submitted in 2017 (AGC 2017) and resubmitted as the Revised 2019 EIS (AMNS 2019) to address Information Requests (Round 1) from the Impact Assessment Agency of Canada (IAAC; formerly the Canadian Environmental Assessment Agency [formal change of name August 2019]) and Nova Scotia Environment (NSE) (CEAA 2017 and NSE 2017). This Updated 2021 EIS has been developed to support Information Requests (Round 2; CEAA 2019 and NSE 2019). The Updated 2021 EIS also addresses advances in the Project Descriptions as well as additional Regulatory, Public and Indigenous Peoples engagement that has been undertaken since the Revised 2019 EIS. The Project Description updates coupled with engagement has resulted in changes to Valued Component (VC) Sections (Section 6). Each section of the EIS includes a summary of changes before and after the 2021 updates. **Changes to Updated 2021 EIS from the Revised 2019 EIS are HIGHLIGHTED.** Sections that have been completely replaced from the Revised 2019 EIS version **do not** include highlighting. The completely replaced sections are:

- Section 2 Project Description;
- Section 6.7 Surface Water Quantity and Quality;
- Section 6.9 Fish and Fish Habitat;
- Section 6.14 Mi'kmaq of Nova Scotia;
- Section 6.16 Socio-economic Conditions;
- Section 8 Cumulative Effects;
- Sections 9 Summary of Environmental Effects Assessment Mitigations and Environmental Residual Effects; and
- Section 10 Follow-up and Monitoring Programs Proposed.

The ownership of the company has also changed since the Revised 2019 EIS, which is presented in the Introduction (Section 1.4) as well as the Project Description (Section 2).

1.1.1 Summary of Updates to Introduction

Atlantic Mining NS Inc. (AMNS; the Proponent), a wholly owned subsidiary of St Barbara Limited (St Barbara), is a well-financed, growth-oriented gold development group with a long-term strategy to create a mid-tier gold production group focused on manageable, executable projects in mining-friendly jurisdictions. Its board and management team, with extensive experience in geology, mining and mine development, process and metallurgy and project financing, has been updated to reflect new company ownership and organizational structure. The Beaver Dam Mine Project (the Project) is proposing to construct (1 year), operate (5 years) and reclamation (active closure 2 years and post-closure monitoring 10+ years). The operation period has been extended from 3.5 years to 5 years, which is reflected in the ore production schedule and number of trucks needed to transport ore to Touquoy for processing. The Project layout has been altered to reflects more advanced engineering while ensuring that infrastructure avoids critical habitat (e.g., blue felt lichen). Additional engagement undertaken in 2020 to 2021 resulted in the need to allow for continued access along the haul road and around the Beaver Dam Mine site, which is addressed through the construction of bypass roads. Additional baseline data collection improved the overall assessment by reducing uncertainty and providing for improved clarity to address Round 2, Information Requests (IR2). Table 1.1-1 provides a summary of the Introduction subsections that have been updated from the Revised 2019 EIS.

Table 1.1-1: Updated Subsections from the 2019 Revised Environmental Impact Statement – Introduction

2019 Revised EIS Submission (February 28, 2019)	Updated in 2021	Corresponding 2021 EIS Update Section Number	Reason for Update
-	-	1.1 Purpose of the Environmental Impact Statement 2021 Update	• New
1.1 Project Overview	Yes	1.2 Project Overview	• Updates to reflect changes in the Project Description, Project Schedule, and Project Layout
1.2 Proponent Information	Yes	1.4 Proponent Information	• Section moved for section layout organization • Updates to reflect changes in ownership and organizational structure
1.3 Regulatory Framework and Role of Government	Yes	1.5 Regulatory Framework and Role of Government	• Section moved for section layout organization • Updates to reflect current regulatory regime
1.4 Purpose of the Project	Yes	1.3 Purpose of the Project	• Section moved for section layout organization • Minor updates
1.5 Guiding Principals	Yes	1.6 Guiding Principals	• Minor updates to include recent engagement with pubic and the Mi'kmaq of Nova Scotia
1.6 Benefits of the Project	Yes	1.7 Benefits of the Project	• Updated to include bypass roads
-	-	1.8 Report Organization	• New • includes high-level tables summarizing changes of EIS sections and Appendices from 2017 to 2019 and to 2021

1.2 Project Overview

1.2.1 Name of Designated Project

The designated Project will be known as the "Beaver Dam Mine Project" (the Project).

1.2.2 Project Location

1.2.2.1 Beaver Dam Mine Site

The Beaver Dam Mine property is in Marinette, Regional Municipality of Halifax Area, Nova Scotia, which is approximately 85 km northeast of Halifax. The approximate centre point of the Beaver Dam Mine Site is 521319 E 4990700 N (UTM Zone 20 NAD83 CSRS).

1.2.2.2 Haul Road

The Haul Road extends from the Beaver Dam Mine Site to the Touquoy Mine site (Figure 1.2-1). By-pass roads to allow light truck traffic and recreational vehicles (e.g., ATV and snowmobiles) to maintain access during operations will be constructed adjacent and parallel to portions of the Haul Road. The total disturbance of Haul Roads is 25 ha and by-pass roads are expected to disturb approximately 10 ha with 25 ha on crown land.

1.2.2.3 Touquoy Mine

The Touquoy property is located 60 km northeast of t Halifax, Nova Scotia, which is centered on the former mining village of Moose River Gold Mines. The closest population centres are Middle Musquodoboit located 20 km to the northwest and approximately 12

km from the community of Mooseland which is located to the southeast. The approximate centre point of the Touquoy property is 505280.58E 505280.58N UTM Zone20 NAD83 CSRS.

1.2.3 Overview

The Beaver Dam Mine Project (the Project) proposed by Atlantic Mining NS Inc. (AMNS), a wholly owned subsidiary of St Barbara or the Proponent, will operate as a satellite open pit mine with total ore extracted over five years will range from 0.7 to 2.1 million tonnes per year (Mt/year). Crushed ore from the Beaver Dam Mine Site will be transported by an average of 190 trucks (i.e., round trip) approximately 31 kilometers (km) to the existing and fully permitted Touquoy Mine. Processing of ore from the Beaver Dam gold deposit at the existing Touquoy plant will begin upon completion of mining activities from the Touquoy open pit. The Project is anticipated to begin construction in 2022, come into production in 2023, cease operations in 2027 and then be reclaimed. The Project timelines, however, is subject to environmental assessment and associated permitting approvals.

The Project is subject to both federal and provincial environmental assessment (EA) processes. This document forms both the Environmental Impact Statement (EIS) and EA Registration Document (EARD) under the federal and provincial processes.

This EIS/EARD for the Project has been prepared to facilitate the approval of the Project in accordance with the *Canadian Environmental Assessment Act,* 2012 (CEAA 2012) and Environmental Assessment Regulations made under the *Nova Scotia Environment Act*. The EIS Guidelines (CEA Agency 2016) prepared by Canadian Environmental Assessment Agency (CEA Agency) have provided a framework for the organization of this EIS. No public money is being sought to undertake the Project.

The Project consists the **Beaver Dam Mine Property** (i.e., mining and storing of waste rock), an approximately 31-kilometre (km) **Haul Road** that connects to the two sites and the **Touquoy Property** (i.e., processing, and depositing tailings) (Figure 1.2-1). The Project is bound within a Project Area (PA). The PA will result in approximately 243 hectares (ha) of disturbance with 34 ha or 14% occurring on crown land. The Beaver Dam Mine site is shown on Figure 1.2-2 and Touquoy Mine site is shown on Figure 1.2-3.

1.2.4 Beaver Dam Mine

The Beaver Dam Mine is in Marinette, Regional Municipality of Halifax Area, Nova Scotia, which is approximately 85 km northeast of Halifax. The Beaver Lake IR 17 is located approximately 6 km of the Beaver Dam deposit and 5 km from the intersection of the Beaver Dam Mine Road and Highway 224. The community of Mooseland is approximate 1 km from the intersection of the Beaver Dam Haul Road and the Mooseland Road. The Beaver Dam mine footprint approximately 208 ha with 26 ha or 14% on Crown land. Physical activities specific to the operation of the Beaver Dam Mine will include mining of ore, crushing of ore, operation of till and waste rock storage facilities, and treatment of surface water runoff and mine discharge water through collection and settling ponds. No ore processing or tailings management will occur at the Beaver Dam Mine Site. Operational infrastructure will be minimal as those Project activities will use infrastructure at the Touquoy Mine in Moose River. Electrical power demand required for the Beaver Dam Mine Site is not anticipated to be substantial and will be supplied by on site generators. Petroleum products will be stored on-site for use in generators, operational equipment, and haul trucks.

Beaver Dam Mine site will be reclaimed following operations, which will include two years of active closure (i.e., decommissioning and earthworks) and 10+ years of monitoring. The length of time of reclamation monitoring will be informed by successive reclamation plans as well as ongoing monitoring.



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Atlantic Gold

FIGURE 1.2-1

Beaver Dam Mine Project
Project Location

Project Area



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 1.25 2.5 5 km

1:130,000

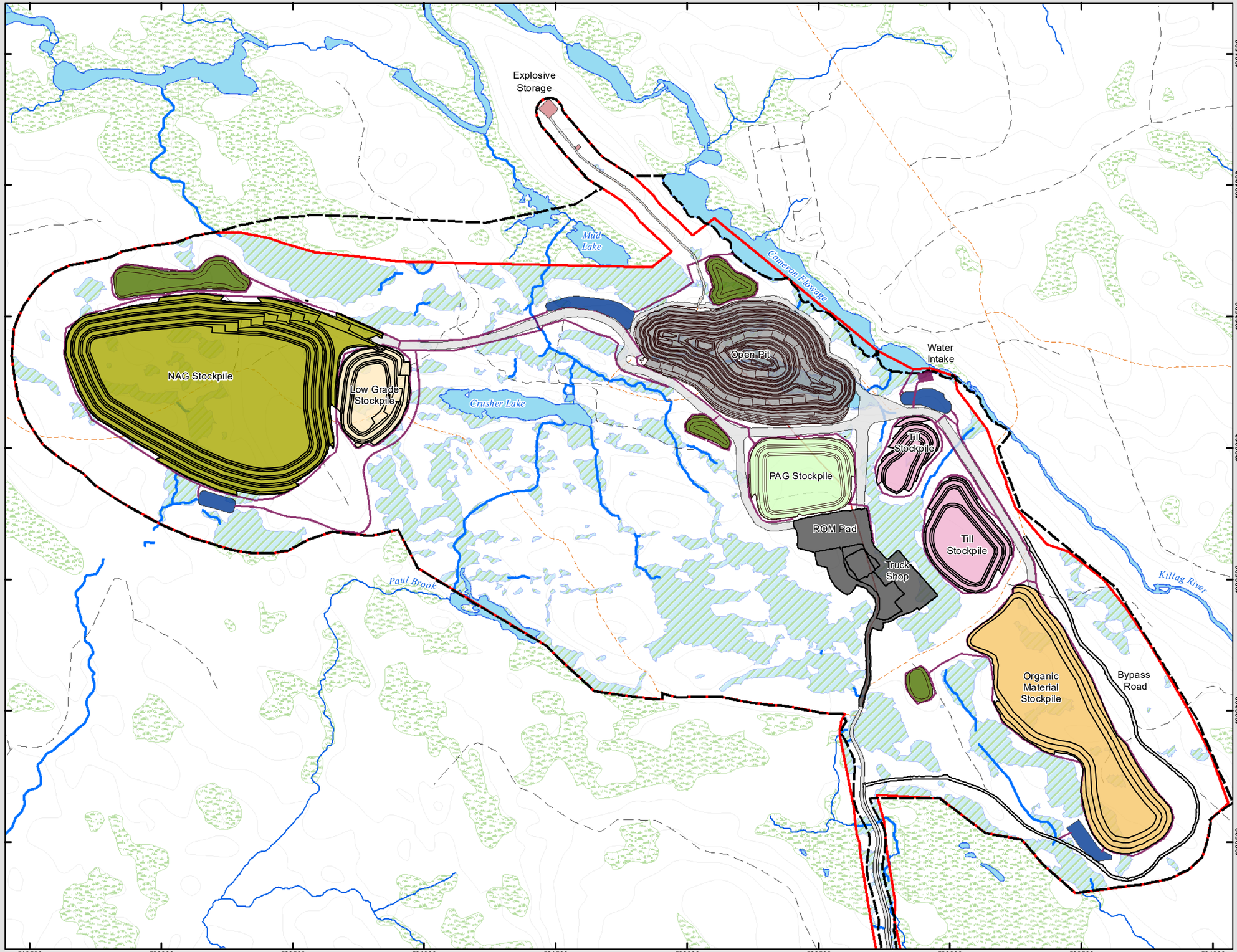
Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed by: XX

Date: 2021-03-01

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

McCallum Environmental Ltd.



Prepared For:

Atlantic Gold

FIGURE 1.2-2

Beaver Dam Mine Site

General Mine Layout

Proposed Infrastructure

- Crusher Pad
- Open Pit
- Low Grade Stockpile
- NAG Stockpile
- PAG Stockpile
- Organic Material Stockpile
- Topsoil Stockpile
- Till Stockpile
- Explosive Storage
- Road
- Settling Pond
- Water Management

- Topo Line - 5m contour
- Local Road
- Dry Weather / Seasonal Road
- Track
- NSTDB Mapped Watercourses outside PA
- Field Delineated Watercourses within PA
- Open Water / Lake
- Field Delineated Wetlands within PA
- NSE Mapped Wetlands outside PA
- Preliminary Property Boundary
- Project Area Boundary



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 125 250 500 m

1:13,500 Scale when printed @ 11" x 17"

Drawn By: LP
Reviewed By: XX

Date: 2021-04-12

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

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Document Name: BD_EIS_Fig2.1-X General Mine Arrangement

Prepared For:

Atlantic Gold

FIGURE 1.2-3

Touquoy Mine Site

General Arrangement for Beaver Dam Ore Processing

Square Lake
New Dam Flowage
Moose River Road
Plant
Till Stockpile
Till Stockpile
Till Stockpile
Touquoy Mine Waste Rock Storage
By-Pass Road
Realigned Road
Mooseland Road
Till Stockpile
Till Stockpile
Bevear Dam Mine Tailings Management
Moose River
Till Stockpile
By-Pass Road
Till Stockpile
Touquoy Mine Tailings Management
Fish River
Indian Gil...

4982500
4982000
4981500
4981000
4980500
4980000

503500 504000 504500 505000 505500 506000 506500 507000

- Project Area

Touquoy Mine Infrastructure

- Site Roads
- Tailings Management
- Waste Rock Storage
- Pit
- Plant
- Till Stockpile
- Pit Berm
- Realigned Road
- By-Pass Road
- NSE Wetlands
- Lake
- Local Roads
- Dry Weather / Seasonal Roads
- Diveways (>300 m)
- Track
- NSTDB Mapped Watercourses



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 100 200 400 m

1:12,000 Scale when printed @ 11" x 17"

Drawn By: XX
Reviewed By: XX

Date: 2021-03-01

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

McCallum Environmental Ltd.

Document Name: BD_EIS_Fig2.1-X General Touquoy Arrangement

1.2.5 Haul Road

The Haul Road extends from the Beaver Dam Mine Site to the Touquoy Mine site (Figure 1.2-1). Transporting ore from the Beaver Dam Mine Site to the existing Touquoy Mine facilities is required for processing the ore and managing tailings in the exhausted Touquoy pit. Portions of the Haul Road route (approximately 16 km) will be upgraded to a dual lane road to facilitate the safe passage of two-way truck traffic at a maximum speed of 70 kilometres per hour (km/h). By-pass roads to allow light truck traffic and recreational vehicles (e.g., ATV and snowmobiles) to maintain continued access during operations will be constructed adjacent and parallel to portions of the Haul Road. The total disturbance of Haul Roads is 25 ha and by-pass roads are expected to disturb approximately 10 ha with 25 ha on crown land. Where possible, the upgrades will follow the course of the existing roadway; however, some adjustments to existing road alignment will be required to fulfill safe design standards.

The Haul Road consists of the following four main segments:

- 7.2 km existing Beaver Dam Mines road, that extends east from the proposed mine site to highway 224, which will be upgraded to support ore transport and will include bypass road.
- 4 km of new constructed road west of Highway 224 to connect the Haul road to an existing forestry road, this section will not include bypass road.
- 8.2 km existing forestry road that extends east to the Mooseland Road, referred to locally as the Dump Road, will be upgraded to support ore transport truck and will include bypass road.
- 10.7 km Mooseland Road that will be upgraded by Department of Transportation and Infrastructure Renewal (TIR) extends north along the Mooseland Road to the existing Touquoy Mine. Bypass roads crossing and parking area is currently being considered in the design to address safety concerns by local residents.

1.2.6 Touquoy Gold Mine

The Touquoy Mine, is centered in former mining village of Moose River Gold Mines, will process ore and manage tailings in the exhausted or mined-out pit at the Touquoy facilities currently operating as part of the fully permitted Touquoy Mine.

The Touquoy Gold Project underwent a review in 2007 to determine if an EA was required under the existing provincial and federal legislation. It was determined by Nova Scotia Environment (NSE) and the CEA Agency that only a provincial EA was required in accordance with the Nova Scotia Environmental Assessment Regulations. Under the *Canadian Environmental Assessment Act* (1992) and its pursuant regulations, there were no triggers for a federal EA when the Touquoy Gold Project was reviewed in 2007. The CEA Agency file number for the review is 10700-40. The Touquoy Gold Project obtained EA approval in 2008 and has since obtained additional approvals through the applicable provincial regulatory processes, including the Industrial Approval (IA); the Touquoy Gold Mine has been in in operation as per the associated approvals since 2018.

Changes to the Touquoy Gold Mine as a result of the Project will be assessed through this EIS. They include: an increase in the duration of ore processing (approximately four additional years); minor adjustments to the ore processing facility; and disposal of Beaver Dam Mine tailings in the exhausted Touquoy Mine open pit. There is not anticipated disturbance to the exiting Touquoy Mine site that will result from processing Beaver Dam ore.

Due to the timing of the Beaver Dam Mine ore being processed at the Touquoy Mine site, the Beaver Dam tailings will not be stored in the Touquoy tailings management facility, but instead would be permanently stored in the pit after the Touquoy gold deposit has been mined. This allows the Touquoy Mine Site footprint to be maintained as permitted and no tailings management facility will need to be constructed at the Beaver Dam Mine Site (Section 2). Other aspects of the Touquoy Gold Mine will remain

as assessed and approved through the Nova Scotia EA process in 2008 (NSE 2008) and/or currently being assessed as part of the Touquoy Mine Expansion that is currently planned to be submitted in June 2021.

Updates to the current reclamation plan for the Touquoy Gold Mine, as a result of the Project, would require approval by the Province of Nova Scotia as a condition of Mineral Lease (MLE11-1) and Industrial Approval (#2012-084244-08).

1.3 Purpose of the Project

The implementation of the Project will provide additional ore to the existing Touquoy Mine processing plant. This will extend the life of the Touquoy Mine Site to continue to provide economic and social benefits with minimal additional infrastructure. Completing the Project with safe production, environmental stewardship and community engagement is key for the Proponent to ensure that the Province, the community, and the Mi'kmaq of Nova Scotia receive optimum benefit.

Worldwide annual gold production is about 3,200 tonnes (NRCan 2019). Gold is used primarily for jewelry and as a storage form of wealth with China and India forming the majority of the demand. Canada produced about 5% of the world total in past years. With the Proponent's four gold development projects in Nova Scotia, there is much opportunity to supply gold with existing and expected future demand.

The Proponent has recognized that the quantity and unusual style of gold mineralization at the Beaver Dam Mine Site will support a commercially viable surface mining operation with on-site crushing and off- site processing of ore. The amount of gold expected to be recovered will represent more than one-third of the gold produced from the historic goldfields of Nova Scotia since the 1860s.

The Proponent is proposing to develop this resource in line with all applicable regulatory requirements and recognizes the significant potential benefits to the local economy, the Province of Nova Scotia, the Mi'kmaq of Nova Scotia and the AMNS in completing this Project. The Proponent has designed a project that is in line with the intent of NSL&F for efficient use of mineral resources and to "*promote the concepts of environmental responsibility and sustainable development, stewardship of the mineral resource sector, and integrated resource planning*."

All phases of the Project will provide employment opportunities for local residents and Indigenous Peoples, as well as provide tax revenue for the municipal, provincial, and federal levels of government. It is anticipated that additional labour force will be required during construction and a smaller, but still significant, labour force will be required during operation. Indirect employment will be generated by the Project through the use of external contractors and suppliers. Tax revenue in the millions of dollars per year will be generated through corporate income taxes paid by the Proponent, as well as its contractors and suppliers. Socio-economic benefits that will occur as a result of the Project are discussed further in Section 1.7.2.

1.4 Proponent Information

1.4.1 Proponent Profile

Atlantic Mining NS Inc. (the Proponent), a wholly owned subsidiary of St Barbara, is a well-financed, growth-oriented gold development group with a long-term strategy to create a mid-tier gold production group focused on manageable, executable projects in mining-friendly jurisdictions. Its board and management team, with extensive experience in geology, mining and mine development, process and metallurgy and project financing, are currently focused on the development of its project portfolio of advanced gold development properties located in Nova Scotia, Canada.

Currently, the Proponent holds four gold development projects in Nova Scotia: the Touquoy Gold Project, the Beaver Dam gold deposit, the Fifteen Mile Stream gold deposit and, the Cochrane Hill gold deposit. The Touquoy Gold Project has been in operation since October 2017. The Beaver Dam Mine Project Environmental Impact Statement has been submitted to IAAC and is in the information request phase.

Environmental data collection for the Project commenced in November 2016 when exploration drilling began to clearly define the gold resource. In January 2018, Ausenco Engineering Canada Inc. (Ausenco) was commissioned by the Proponent to complete a Project Pre-Feasibility Study and the NI 43-101 Technical Report for the development of the Moose River Consolidated Project Phase I (Touquoy and Beaver Dam deposits), and Phase II expansion (Fifteen Mile Stream and Cochrane Hill deposits) (Ausenco 2019). A Feasibility Report is currently being updated for the Beaver Dam Mine by Ausenco that included updates to the Project Description including the Project Layout (Figure 1.2-2 and 1.2-3).

Regulatory consultation on the Beaver Dam Mine Project began in October 2014 with a Provincial "One Window Process: Mineral Development in Nova Scotia" meeting to present the planned Project and to receive feedback on the regulatory regime and regional expertise. The EIS was submitted to CEA Agency in June 2017 and a Revised EIS was submitted in February 2019 to address Round 1 of Information Requests. This Updated 2021 Beaver Dam Mine EIS along with responses to Round 2 IRs forms the next step in the permitting process. The Fifteen Mile Stream Project EIS was submitted in February 2021 and is currently awaiting Round 1 of Information Requests. The Cochrane Hill projects is in the pre-submission phase of the EIS/EARD review process.

Mineral exploration and mining licences are issued by the Nova Scotia Department of Energy and Mines (NSDEM) under the Mineral Resources Act of 2016 (amended in 2018). Exploration licences are granted for two-year terms, and are renewable indefinitely, provided certain annual conditions are met. Exploration licences can contain a maximum of 80 bordering mineral claims. Mining licences are granted for 20-year terms and can be renewed an indefinite number of times at the discretion of the Minister for Natural Resources.

The Beaver Dam property is held under two exploration license EL50421 and EL51852. The EL EL50421 comprises 76 contiguous claims that cover an area of approximately 1,230 ha and EL51852 comprises 7 claims and covers 113 ha. Exploration Licence 50421 is an amalgamation of EL 05920 and EL 06175 which was reissued as EL 50421 in August 2014. Exploration Licence 05920 represented the amalgamation of three pre-existing Exploration Licences 00047, 04790 and 04516. The Exploration Licences were regrouped in 2003 as EL 05920 and reissued by the NSDEM in 2005 .

Mineral rights to the Touquoy Property are wholly owned by AMNS and consist of one mineral lease (MLE11-1) comprising 49 claims and covering 793 ha, and one adjoining Exploration License (EL10377) comprising 64 claims and covering 1,036 ha.

1.4.2 Corporate Governance and Management Structure

The Proponent is committed to the highest practical standards of corporate governance and to being a responsible corporate citizen. Safe production and environmental stewardship are keys to the Proponent's organization. The guiding principles, including the purpose, commitments and core values of St Barbara, are detailed on their company website: https://stbarbara.com.au/about-us/our-vision-and-values/.

The company relies upon its senior management team and Board of Directors who have extensive experience with past mining developments worldwide.

The current senior management team of St Barbara:

- Craig Jetson – Managing Director and Chief Executive Officer (CEO);
- Garth Campbell-Cowan– Chief Financial Officer (CFO);
- Rowan Cole – Corporate Secretary;
- Laird Brownlie – Head of External Affairs and Business Continuity;
- Craig Hudson – Head of Permitting and Projects;
- Andrew Taylor General Manager, Atlantic Operations; and
- Neil Schofield – Consulting Resource Geologist.

The CEO reports to the six-member Board of Directors:

- Craig Jetson – Managing Director and CEO;
- Tim Netscher – Independent Non-Executive Chairman;
- Kerry Gleenson – Independent Non-Executive Director;
- David Moroney - Independent Non-Executive Director;
- Stef Loader – Independent Non-Executive Director; and
- Steven Dean – Independent Non-Executive Director.

Traded on the Australian Securities Exchange (ASX) as SBM, St Barbara committed to maintaining high standards of ethics, integrity and statutory compliance in all Company dealings and conformance with the ASX Corporate Governance Principles and Recommendations (3rd Edition). The Proponent has a Nominating and Corporate Governance Committee, an Audit Committee and a Compensation Committee, as well as policies and codes, such as Code of Conduct which includes obligations regarding environmental standards, health and safety, contributions to local communities, and respect and tolerance. Any breaches of this Code must be immediately reported to the Chair of the Nominating and Corporate Governance Committee.

As part of its commitment to corporate responsibility and incorporation of best practices, the proponent has established a Geotechnical and Tailings Dam Review Board (Review Board) for design, construction and operation phases of the AMNS projects. This includes tailings management, waste rock storage and open pit mining activities. Reporting to AMNS's General Manager Atlantic Operations, the Review Board is established to provide ongoing, independent confirmation to the proponent by internationally-recognized experts that the design, construction, operation and closure of the AMNS projects conform with international best practice and to minimize impact in compliance with its permits and licenses. The Review Board is independent, and its scope includes reviewing, commenting, questioning, critiquing and advising on all aspects of including, but not limited to:

- Engineering design;
- Construction practices;
- Operation and maintenance practices;
- Closure and post-closure requirements;
- Stability;
- Water management and treatment, including both surface and ground water;

- Geochemical considerations;
- Management systems;
- Budget and staffing;
- Emergency preparedness and response planning; and
- Community interaction.

AMNS intends to maintain suitable insurance and bonding to ensure its commitments are met. This includes maintaining financial bonding to ensure that adequate reclamation security is in place at all times during the construction, development and operational phases of the Company's mining projects, as well as appropriate environmental impairment liability insurance. As part of the existing Touquoy Gold Project, both reclamation security and environmental liability insurance are maintained as per requirements of the Province of Nova Scotia.

Further AMSN commits to completing its operations in adherence with best available practices (BAPs) and industry standards as per guides developed by Mining Association of Canada, such as the Towards Sustainable Mining initiative, and the Canadian Dam Association.

1.4.3 Proponent Personnel Details

A corporate office in Melbourne, Victoria, Australia and a local office in Moose River Gold Mines, Nova Scotia are maintained in support of the AMNS projects. Key management and technical staff will be located in both locations for the duration of the Beaver Dam Mine Project. The addresses for both office locations are provided in Table 1.4-1.

Table 1.4-1: Office Locations

Corporate Office	Local Office
Level 10, 432 St Kilda Road, Melbourne, VIC 3004 Locked Bag 9, Collins Street East, VIC 8003 Tel: +61 (3) 8660 1900 Fax: +61 (3) 8660 1999	6749 Moose River Road Moose River Gold Mines RR2 Middle Musquodoboit, Nova Scotia Canada B0N 1X0 Phone: (902) 384-2772

All communications regarding the EA for the Project should be sent to the Head of Permitting and Projects as directed by the CEO. The contact information for these two roles is outlined in Table 1.4-2.

Table 1.4-2: Proponent Contacts

Position	Proponent
Environment Permitting Project Manager	Barb Bryden Middle Musquodoboit, Nova Scotia Phone: (902) 384-2772 Email: Barb.Bryden@Atlanticgold.ca
Head of Permitting and Projects	Craig Hudson Middle Musquodoboit, Nova Scotia Phone: (902) 384-3641 Email: Craig.Hudson@atlanticgold.ca
General Manager Atlantic Operations	Andrew Taylor Middle Musquodoboit, Nova Scotia Phone: (902) 384-3603 Email: Andrew.Taylor@atlanticgold.ca

1.4.4 Environmental Assessment Consulting Team

The EIS was prepared by a consulting team that is provided in Table 1.4-3

Table 1.4-3: Environmental Assessment Consultant Team Contributions

Consultant	Contributing Role
Allnorth Engineering, Consulting, Project Management, and Surveying	• Reviewed the engineering feasibility of the new construction portion of the Haul Road, 2019 Moose River Consolidated NI 43-101 (Ausenco 2019)
Ausenco Engineering Canada Incorporated	• Preparation of the 2021 feasibility study for the Project (In Progress)
Brighter Community Planning & Consulting	• Public Engagement and Socio-Economic (Section 3, Section 6.16 and Appendix A.6 [draft Public Engagement Plan])
Confederacy of Mainland Mi'kmaq – Mainland Mi'kmaq Development inc.	• Prepared a Mi'kmaq Ecological Knowledge Study report for the Project (Appendix M.1)
Cultural Resource Management Group Limited	• Prepared archaeological screening and reconnaissance reports for the Project (Appendices N.1 to N.7)
GHD	• Noise environmental effects assessment and Noise Impact Assessment Technical Report (operations) and Memorandum (construction) (Section 6.1 and Appendices B.1 and B.2) • Air environmental effects assessment and Air Emissions Technical Report (Section 6.2 and Appendix C.1) • Light environmental effects assessment and Light Impact Assessment (Section 6.3 and Appendix D.1) • Surface Water Quantity and Quality environmental effects assessment, additional water quality modelling, water balance analysis, stormwater management, erosion and sediment control plan, predictive water quality, water treatment assessments, and baseflow mitigation assessment (Section 6.7 and Appendices G.1, G.3, G.4 and P.4) • Groundwater Quality and Quantity environmental effects assessment, field activities, baseline groundwater program, hydrogeological modelling report, and potential impacts from metals COCs to groundwater and surface water from dust deposition along the Haul Road (Section 6.6 and Appendices F.3, F.4, F.5 and F.9)
Golder Associates Ltd.	• Mine Waste Stockpile Geotechnical Design and Geotechnical Investigation: Data Report (Appendices A.2a and A.2c) • Preparation of a Geotechnical Assessment of the Beaver Dam Mine Open Pit (In Progress)
Intrinsik	• Prepared an evaluation of exposure and risks related to emissions from the Project onto recreational water usage and country foods and an aquatic effects assessment (reassessment) for the Killag and Moose rivers (Appendices C.2 and G.2)
KPMG	• Economic Impact Assessment Reports for the Project and the Moose River Consolidated Project (Appendices O.1 and O.2)
Lorax Environmental	• Prepared geochemical source term predictions and an ML/ARD assessment report, geochemical source terms update, kinetic test update and a draft ML/ARD management plan and nitrogen source control monitoring plan for Touquoy Mine (Appendices E.2 to E.5 and E.10)

Table 1.4-3: Environmental Assessment Consultants (continued)

Consultant	Contributing Role
McCallum Environmental Ltd.	• Wetlands environmental effects assessment, wetlands functional assessment, characterization and preliminary Wetlands Compensation Plan (Section 6.8 and Appendices H.1 to H.3) • Fish and Fish Habitat environmental effects assessment, photographic log, and Fish and Fish Habitat baseline (2015 to 2017 and 2019 to 2020) (Section 6.9 and Appendices J.1, J.2, and J.4) • Habitat and Flora environmental effects assessment, master species list, preliminary Lichen Mitigation and Management Plan, (Section 6.10 and Appendices K.1 and P.6) • Terrestrial Fauna environmental effects assessment, draft Wildlife Mitigation and Monitoring Plan and Landbird SAR Mitigation and Monitoring Plan (Section 6.11 and Appendix P.7) • Avifauna environmental effects assessment, relative abundance of avian species and Landbird SAR Mitigation and Monitoring Plan (Section 6.12 and Appendices L.2 and Appendix A of Appendix P.7 [draft Wildlife Mitigation and Monitoring Plan]) • Species of Conservation Interest and Species at Risk environmental effects assessment (Section 6.13) • Mi'kmaq of Nova Scotia engagement and environmental effects assessment (Section 4 and Appendix A.5 [Mi'kmaq of Nova Scotia engagement log], and Section 6.14) • Review and update of physical and cultural heritage environmental effects assessment and assessment of valued components within Federal jurisdiction (Sections 6.15 and 6.17) • Cumulative effects assessment (Section 8)
Moose Mountain Technical Services	• Preparation of Beaver Dam Mine Planning component of the Feasibility for the Project 2019 Moose River Consolidated NI 43-101 (Ausenco 2019) and 2021 Feasibility Study NI 43-101 2021 (In Progress)
Nortek Resource Solutions Inc.	• Prepared the visual simulations (zone of influence) for the Project (Appendix M.2)
Wood Environment & Infrastructure Solutions	• Senior review of Fish and Fish Habitat environmental effects assessments (Section 6.9), review of Air (Section 6.2), Geology, Soils and Sediment Quality (Section 6.5) and Surface Water Quantity and Quality (Section 6.7) environmental effects assessments and development of the draft Fish Habitat Offset Plan (Appendix J.3)
Stantec	• Prepared Phase I and Phase II's (limited and extended) environmental site assessments for the Project (Appendices E.6 to E.8) • Review of Geology, Soil, and Sediment Quality environmental effects assessment (Section 6.5) • Prepared the following studies at the Touquoy Mine Site; a water and tailings management plan, groundwater flow and solute transport model, an assimilative capacity study of Moose River, and a simulation of cumulative effects of deposition of tailings (Appendices F.6 to F.8, and F.10) • Prepared assessment of water quality downstream of tailings facility and water balance report (Rev. 2) for tailing management – Touquoy Mine (Appendices G.5a and G.5b)
WSP	• Preliminary Design of Haul Road including By-pass Roads (2021 Feasibility Study NI 43-101 2021[In Progress])

1.5 Regulatory Framework and Role of Government

The federal, provincial, and municipal regulatory framework outlines requirements for the EA process, the permits required for construction, operation and reclamation, and the conditions under which the Project will be operated. General legislation that may be applicable to the Project is outlined in Table 1.5-1, while key legislation which directly drives the development of the EIS is explained in more detail in the coming sections.

Table 1.5-1: Legislation Potential Applicable to the Beaver Dam Mine Project

Legislation	Physical Activity and/or Trigger	Regulatory Authority
Federal		
CEAA 2012	Assessment due to the construction, operation, decommissioning of a gold mine with an ore production capacity greater than 600 tonnes per day.	IAAC
Fisheries Act	Authorization and compensation due to physical activities in wetlands, watercourses, and water bodies.	DFO
Fisheries Act – Metal and Diamond Mining Effluent Regulations	Environmental Effects Monitoring program due to mining effluent discharge to aquatic habitat.	ECCC
Migratory Birds Convention Act – Migratory Bird Regulations	Potential authorization due to physical activities potentially relocating birds and altering their habitat.	ECCC
Species at Risk Act	Potential authorization due to physical activities destroying SARA listed species and/or their habitat.	DFO/ECCC
Canadian Navigable Waters Act	Potential authorization due to physical activities diverting water or activities that may interfere with navigation of non-scheduled waterways. Requirements to be ascertained following submission of a Notice of Work.	TC
Canadian Environmental Protection Act	Promotes sustainable development through pollution prevention and the protection of the environment and human health from risks associated with toxic substances.	ECCC
Transportation of Dangerous Goods Act	The movement of dangerous foods to, from, and within the site must comply with applicable regulations.	TC
Provincial		
Environment Act – EA Regulations – Schedule A	Assessment due to the construction, operation, decommissioning of a facility that extracts of processes metallic or non-metallic minerals.	NSE
Environment Act – Activities Designation Regulations	Industrial Approval for the construction, operation, or reclamation of a surface mine using explosives and procuring mineral bearing ore.	NSE
Environment Act – Activities Designation Regulations	Water approval and/or notification for water withdrawal, alteration of water bodies, watercourses, and/or wetlands.	NSE
Environment Act – Air Quality Regulations	Ambient air quality standards for baseline environmental conditions discussion.	NSE
Special Places Protection Act and Regulations	Authorization required prior to conducting intrusive archaeological work.	NSCCH
Wildlife Act	Prohibits taking, hunting, killing, or possessing eagles, osprey, falcons, hawks, owls, and any other protected wildlife.	NSL&F
Endangered Species Act	Prohibits killing, injuring, disturbing, taking or interfering with endangered or threatened species and/or their habitat.	NSL&F
Crown Lands Act	Crown Lands Lease due to exploration and/or construction occurring on Crown Lands.	NSL&F
Municipal Government Act	Authorizes municipalities to develop Municipal Planning Strategies and Land Use By-laws.	NSDMA
Municipal		
National Building Code of Canada	Approval for construction and occupation of buildings.	HRM

Source: Atlantic Gold 2017 and 2019.

Note: SARA = *Species at Risk Act*; NPA = *Navigation Protection Act*; NWPA = *Navigable Waters Protection Act*; CEA Agency = Canadian Environmental Assessment Agency; DFO = Fisheries and Oceans Canada; ECCC = Environment and Climate Change Canada; TC = Transport Canada; NSE = Nova Scotia Environment; NSCCH = Nova Scotia Communities, Culture and Heritage; NSDNR = Nova Scotia Department of Natural Resources; NSL&F = Nova Scotia Department of Lands and Forestry; NSDMA = Nova Scotia Department of Municipal Affairs and Housing; HRM = Halifax Regional Municipality.

The Project is also driven by guidelines, policies, and standards that may be applicable during design, construction, operation, and reclamation. Those that may potentially be applicable to the Project are listed below, while key guidance documents which are directly applicable to the development of the EIS are listed in the coming sections.

- Federal
  - Canadian Council of Ministers of the Environment (CCME) Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (FWAL) (CCME 1999a);
  - CCME Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health (CCME 1999b);
  - CCME Canadian Sediment Quality Guidelines for the Protection of Aquatic Life (CCME 2001);
  - CCME Canada Wide Standards for Particulate Matter (PM) and Ozone (CCME 2010);
  - Environmental Codes of Practice for Metal Mines (EC 2012c);
  - Guidelines for the Assessment of Alternatives for Mine Waste Disposal (EC 2011);
  - Streamlining the Approvals Process for Metal Mines with Tailings Impoundment Areas (EC 2012a);
  - Guidance Document for Flow Measurement of Metal Mining Effluents (EC 2001);
  - Guidance Document for Sampling and Analysis of Metal Mining Effluents (EC 2002);
  - Federal Environmental Quality Guideline (FEQG): Cobalt. May 2017. (ECCC 2017a);
  - Fisheries Protection Policy Statement (DFO 2013a);
  - Fisheries Productivity Investment Policy: A Proponent's Guide to Offsetting (DFO 2013b);
  - Assessing Cumulative Environmental Effects under the Canadian Environmental Assessment Act, 2012: Interim Technical Guidance (CEAA 2018);
  - Guide for Reporting to the National Pollutant Release Inventory (NPRI) 2016 and 2017 (ECCC 2016a); and
  - Federal Policy on Wetland Conservation (EC 1991).
- Provincial
  - Guidelines for Environmental Noise Measurement and Assessment (NSE 1990);
  - Toward a Greener Future: Nova Scotia's Climate Change Action Plan (NSE 2009a);
  - Guide to Consider Climate Change in Project Development in Nova Scotia (NSE 2011a);
  - Nova Scotia Wetland Conservation Policy (NSE 2019);
  - The Path We Share: A Natural Resource Strategy for Nova Scotia 2011-2020 (NSDNR 2011);
  - Water for Life: Nova Scotia's Water Resource Management Strategy (NSE 2010a);
  - Environmental Quality Standards (NSEQS) for Contaminated Sites (Tier 1) for Groundwater, Surface Water (fresh water), Soils and Sediment (NSE 2013b);
  - Remediation Levels Protocol. Table 3, Pathway Specific Standards for Groundwater (NSE 2013a);
  - Nova Scotia Standard Specifications: Highway Construction and Maintenance (NSTIR 1997);

- Erosion and Sediment Control Handbook for Construction Sites (NSE 1988);
- Guide to Altering Watercourses (NSE 2015a);
- Nova Scotia Watercourse Alterations Standard (NSE 2015b);
- Generic Environmental Protection Plan for Construction of 100 Series Highways (NSTIR 2007);
- Storm Drainage Works Approval Policy (NSE 2002a);
- Pit and Quarry Guidelines (NSDEL 1999);
- Blasting Safety Regulations made under Section 82 of the *Occupational Health and Safety Act* S.N.S. 1996, c. 7 O.I.C. 2008-65 (February 26, 2008, effective April 1, 2008), N.S. Reg. 89/2008 as amended by O.I.C. 2013-65 (March 12, 2013, effective June 12, 2013), N.S. Reg. 54/2013;
- Air Quality Regulations (NSE 2007); and
- Greenhouse Gas Emissions Regulations (NSE 2018).

- Municipal
  - Musquodoboit Valley/Dutch Settlement Municipal Planning Strategy (HRM 1996a);
  - Musquodoboit Valley/Dutch Settlement Land Use By-law (HRM 1996b);
  - Eastern Shore (East) Municipal Planning Strategy (HRM 1996c); and
  - Eastern Shore (East) Land Use By-law (HRM 1996d).

1.5.1 Federal Regulatory Framework

1.5.1.1 Canadian Environmental Assessment Act, 2012

The *Impact Assessment Act* 2019 (IAA) and its regulations establish the current legislative basis for the federal impact assessment process. CEAA 2012 regulates the Government of Canada's EA process and the Regulations Designating Physical Activities (amended December 31, 2014) specify the physical activities to which CEAA 2012 applies. The Project is a designated project in accordance with Section 16(c) of these Regulations, as it is a project which states:

> *The construction, operation, decommissioning, and abandonment of a new rare earth element mine or gold mine, other than a placer mine, with an ore production capacity of 600 t/day or more.*

Key regulatory events in accordance with CEAA 2012 which have given rise to the completion of this EIS are provided in Table 1.5-2. Additional details for all of these events can be found on the Canadian Environmental Assessment Registry (CEAR).

Table 1.5-2: Timeline of Events in Accordance with Canadian Environmental Assessment Agency 2012

Date	Event
October 16, 2015	AMNS and GHD submit a Project Description document to CEAA in order to initiate the EA determination process (GHD 2015)
October 19, 2015	CEAA releases a public notice inviting comments on the Project Description document in order to acquire assistance in the EA determination process. The public has 20 days to comment
December 3, 2015	CEAA releases the Notice of EA Determination indicating that a federal EA is required for the Beaver Dam Mine Project
December 7, 2015	CEAA releases the Notice of Commencement of an EA.
December 7, 2015	CEAA releases the draft EIS Guidelines and a public notice inviting comments on the guidelines in order to ensure they reflect which aspects of the environment may be affected and should be examined during the EA. The public has 37 days to comment
January 19, 2016	CEAA releases the final EIS Guidelines specific to the Beaver Dam Mine Project.
January 25, 2016	CEAA releases a public notice inviting eligible individuals and groups to apply for federal funding in order to enable their participation in the upcoming steps of the environmental assessment
April 29, 2016	CEAA releases the results of funding allocation for participation in the upcoming steps of the environmental assessment.
Project Initiation to March 2017	Baseline data collection, engagement with regulators, stakeholders, and Mi'kmaq, and drafting of the EIS
March 27, 2017	AMNS submits the Beaver Dam Mine Project EIS for conformity review
April 27, 2017	CEAA issues a letter providing the outcome of the Beaver Dam Mine Project EIS conformity review
June 2, 2017	AMNS re-submits the Beaver Dam Mine Project EIS for conformity review
June 28, 2017	Beaver Dam Mine Project meets conformity and commences formal review process under CEAA
August 9 and 21, 2017	CEAA provided Round 1, Information Requests to AMNS (CEAA 2017 and NSE 2017)
February 28, 2019	AMNS submits the Beaver Dam Mine Project Revised 2019 EIS
March 31, 2019	Beaver Dam Mine Project meets conformity and commences formal review process under CEAA
May 8 and June 12, 2019	CEAA provided Round 2, Information Requests to AMNS (CEAA 2019 and NSE 2019)
June 4, 2021	AMNS submits Responses to Round 2, Information Requests
June 11, 2021	AMNS submits Updated 2021 EIS to support Responses to Round 2, Information Requests

Following submission of this EIS to IAAC, another public notice will be released inviting public comment. The provincial and federal government reviews will be completed in conjunction with this public review period. The IAAC will then prepare and publish a draft EA report which considers all public and government comments, and detail conclusions regarding the potential for environmental effects from the Project. The Project is contingent upon receipt of an approved EA decision statement.

1.5.1.2 Fisheries Act, 1985

The *Fisheries Act* is administered by Fisheries and Oceans Canada (DFO) and generally protects the sustainability and productivity of recreational, commercial, and indigenous fisheries in Canada.

Under Section 35(1) The Minister may designate, as a work, undertaking, or activity that is associated with a designated project, any work, undertaking or activity, that the Minister considers likely to result in the death of fish or the harmful alteration, disruption or destruction [HADD] of fish habitat unless authorized by or carried on in accordance with regulations issued in accordance with the Fisheries Act. In addition, Section 36(3) prohibits the discharge or deposition of a deleterious substance of any type in water frequented by fish or in any place under any conditions where the deleterious substance or any other deleterious substance that

results from the deposit of the deleterious substance may enter such water unless authorized or carried on in accordance with those same regulations.

As a result of anticipated physical activities potentially occurring in wetlands, watercourses, and water bodies, authorization in accordance with Section 35(2) of the *Fisheries Act* may be required.

1.5.1.2.1 Metal and Diamond Mining Effluent Regulations

The Metal and Diamond Mining Effluent Regulations (MDMER) are made under the *Fisheries Act* and apply to mines that exceed an effluent flow rate of 50 m^3 per day, based on effluent deposited from all final discharge points of the mine and deposit a deleterious substance in any water or place referred to in subsection 36(3) of the *Fisheries Act*.

As a result of anticipated collection and discharge of surface water runoff and mine discharge water through water management ponds, effluent monitoring in accordance with the Section 2(1) of the MDMER may be required.

In addition to likely residual impacts that constitute a HADD, any fish and fish habitat that may be subject to a MDMER Schedule 2 designation and accordingly a fish habitat compensation process for these residual impacts has also been included in the draft Fish Habitat Offset Plan (Appendix J.3).

1.5.1.3 Migratory Birds Convention Act, 1994

Section 5 of the Migratory Birds Convention Act (MBCA) protects migratory birds, their nests, and their eggs from hunting, trafficking, and commercialization. A permit is required to disturb, destroy, or take a nest, egg, nest shelter, eider duck shelter, or duck box of a migratory bird.

In addition, Section 5.3 of the MCBA prohibits the discharge or deposition of a substance harmful to migratory birds in waters or an area frequented by migratory birds or in a place from which the substance may enter such waters or such an area. The discharge or deposition of a substance that may combine with a substance already present to create a harmful substance is also prohibited in Section 5.3.

1.5.1.3.1 Migratory Birds Regulations

The Migratory Birds Regulations (MBR) is made under the *MBCA* and may apply to the Project as a result of anticipated physical activities potentially relocating birds and destroying their habitat. An authorization in accordance with Section 4(1) of the MBR may be required.

1.5.1.3.2 Species at Risk Act, 2002

The *Species at Risk Act* (SARA) protects wildlife species from becoming extinct through prohibitions against killing, harming, harassing, capturing or taking species at risk (SAR), and against destroying their critical habitats. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) identifies species of special concern that may then qualify for legal protection and recovery in accordance with SARA. SARA's mandate is to provide for the recovery of SAR and to ensure through sound management that species of concern do not require SARA listing. DFO is responsible for aquatic SAR, while ECCC is responsible for terrestrial SAR.

As a result of anticipated physical activities potentially occurring in wetlands, watercourses, and water bodies, as well as the potential destruction of sensitive terrestrial habitat, authorization in accordance with SARA may be required.

1.5.1.4 Navigation Protection Act, 1985

The *Navigation Protection Act* (NPA), formerly the *Navigable Waters Protection Act* (NWPA), was amended in April 2014 and effectively changed the definition of navigable waters under this legislation. Prior to the last amendment of the NPA, navigable waters included all bodies or courses of water that were capable of being navigated by any type of floating vessel for transportation, recreation, or commerce. This definition created the need for works in, on, under, or over any water body or watercourse to obtain a Navigable Waters Protection Approval.

The last amendment added a schedule to the NPA that listed scheduled waters for which regulatory approval is required for works that risk a substantial interference with navigation. The schedule listed three oceans, 62 rivers, and 97 lakes, none of which are located in the area of the Project.

The federal government recently made changes to these regulations and the *Canadian Navigable Waters Act (CNWA)* that replaced the *Navigation Protection Act* came into effect August 28, 2019. There is potential that, under this new regulation, waterways within the Project Area could require permitting. Further consultation with Transport Canada (TC) will be required as permitting proceeds. The Proponent has consulted with TC and confirmed that no pre-existing permits are in place within the PA under the repealed NWPA or the schedule of waterways that has been retained from the NPA in the new CNWA. Based upon the absence of any designations of local waterways, the requirement of permits for navigable waters is not anticipated for the Project under the CNWA. However, the Project involves diverting water and upgrades or construction of new works that may restrict navigation of a non-scheduled waterway (e.g., installation or upgrades of bridges, culverts, etc.). This requirement can only be ascertained once the Proponent submits a Notice of Work to TC.

AMNS will identify to TC the existing crossings on which alterations/work are being proposed and will opt out of the NPA regime as required. A full list of watercourses and waterbodies located within the Beaver Dam Mine Site and Haul Road are discussed in Section 6.7 (Surface Water Quantity and Quality) and Appendix G.4 (Physical Characterization of Watercourses and Waterbodies).

1.5.1.5 Federal Guidance Applicable to the Project

In addition to the EIS Guidelines developed for the Project (CEAA 2016), other guidance documents from CEAA that have been consulted include but are not limited to:

- Operational Policy Statement Assessing Cumulative Environmental Effects under the *Canadian Environmental Assessment Act*, 2012 (CEAA 2013a);
- Operational Policy Statement Addressing "Purpose of" and "Alternative Means" under the *Canadian Environmental Assessment Act*, 2012 (CEAA 2013b);
- Operational Policy Statement Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the *Canadian Environmental Assessment Act*, 2012 (CEAA 2015a);
- Draft Technical Guidance for Assessing Cumulative Environmental Effects Under the *Canadian Environmental Assessment Act*, 2012 (CEAA 2014a); and

- Technical Guidance for Assessing Physical and Cultural Heritage or any Structure, Site, or Thing that is of Historical, Archaeological, Paleontological, or Architectural Significance under the *Canadian Environmental Assessment Act*, 2012 (CEAA 2014b).

1.5.2 Provincial Regulatory Framework

1.5.2.1 Nova Scotia Environment Act, 1995

1.5.2.1.1 Environmental Assessment Regulations

The Environmental Assessment Regulations made under Section 49 of the *Nova Scotia Environment Act* regulates the Government of Nova Scotia's EA process. Projects that trigger the EA process are sub-divided into two classes - Class I and Class II. The Project triggers a Class I EA in accordance with Schedule A, Section B(1a) of these regulations, as it is a project which involves:

- A facility that extracts or processes metallic or non-metallic minerals.

This EIS will substitute and fulfill all the requirements of a provincial EARD.

1.5.2.1.2 Activities Designation Regulations

Many of the provincial permits anticipated to be required for the Project are regulated in accordance with the Activities Designation Regulations made under Section 66 of the *Nova Scotia Environment Act*. An Industrial Approval (IA) will be required in accordance with Section 16(2d) of these regulations, as it is a project that involves:

- A surface mine where an opening or excavation is made in the ground from the surface which may require the use of explosives for the purpose of procuring any mineral bearing ore, including coal, and any associated infrastructure.

The IA process, known as Part V of the *Nova Scotia Environment Act* seeks to guide the proponent in determining the way in which a project, after EA Approval, is to be monitored for compliance targets, objectives set through the EA process, and commitments made by proponents through various means such as public and Indigenous Peoples engagement. It is a well understood process by the Proponent, having been part of the process for the existing Touquoy operation that has an IA.

Activities required to facilitate the Project, including wetland and watercourse alteration and groundwater and surface water withdrawals, may require approvals in accordance with these regulations as well. These permitting requirements will be initiated once EA approval has been received from the province.

1.5.2.2 Nova Scotia Endangered Species Act, 1999

The Nova Scotia Endangered Species Act (NSESA) prohibits the killing or disturbing species at risk, destroying or disturbing its residence, and destroying or disturbing of core habitat.

As a result of anticipated physical activities potentially occurring in wetlands, watercourses, and water bodies, as well as the potential destruction of sensitive terrestrial habitat, authorization in accordance with NSESA may be required.

1.5.2.3 Provincial Guidance Applicable to the Project

Provincial guidance documents that have been consulted in preparation of this EIS include:

- A Proponents Guide to Environmental Assessment (NSE 2001);
- Guide to Preparing an EA Registration Document for Mining Developments in Nova Scotia (NSE 2002b);
- Guide to Considering Climate Change in Environmental Assessment in Nova Scotia (NSE 2011c); and
- Guide to Addressing Wildlife Species and Habitat in an EA Registration Document (NSE 2005).

1.5.3 Municipal Regulatory Framework

The Halifax Regional Municipality is divided into 21 community plan areas that have their own set of land use strategies and by-laws. The Project straddles the boundary of the Musquodoboit Valley/Dutch Settlement Plan Area and the Eastern Shore (East) Plan Area.

The Beaver Dam Mine Site and Touquoy Mine Site are located in the Musquodoboit Valley and Dutch Settlement Plan Area. The Land Use By-law and Municipal Planning Strategy for this area were last amended in October 2014. The area is zoned mixed use, and extractive facilities, of which mining related infrastructure is one, are permitted within this zoning designation. The by-law for mixed use land use prescribes minimum separation distances from features such as lot lines, dwellings, watercourses, domestic wells, and residential zones. The physical activity of mining or extraction is not specified in the by-law as it is governed in the provincial and federal regulatory regime. The Municipal Planning Strategy (HRM MPS 2014) describes mining as an important land use within the Plan Area from an economic perspective; however, extractive operations can potentially create harmful environmental effects. The Municipal Planning Strategy also states these concerns are addressed by the provincial Department of Environment through their permitting process (HRM MPS 2014).

The majority of the Haul Road is located in the Eastern Shore (East) Plan Area, while a minor portion is located in the Musquodoboit Valley and Dutch Settlement Plan Area. The Municipal Planning Strategies describe extraction as an important land use within the Plan Area from an economic perspective; but also acknowledge that extractive operations can potentially create harmful environmental effects.

1.5.4 Indigenous Peoples

In 2004 and 2005, the Supreme Court of Canada decided the Crown (provincial and federal) has a duty to consult with Indigenous Peoples when contemplating decisions or actions that may adversely affect their established or potential Indigenous rights and treaty rights. The provincial government typically delegates certain procedural aspects of this consultation to the Proponent of a project. The federal government always acts as the consultation coordinator to integrate the Government of Canada's indigenous consultation activities into the EA process. This duty cannot be delegated to proponents.

The Made-in-Nova Scotia Process is the forum for the Mi'kmaq, Nova Scotia and Canada to resolve issues related to Mi'kmaq treaty rights, Aboriginal rights, including Aboriginal title, and Mi'kmaq governance. The process involves the Mi'kmaq of Nova Scotia as represented by the Assembly of Nova Scotia Mi'kmaq Chiefs and the provincial and federal governments.

Through the provincial Indigenous Peoples engagement process, AMNS and the consulting team undertook engagement. This engagement with the Mi'kmaq of Nova Scotia by AMNS referenced two key guidance documents which have influenced the EA process for the Project:

- Proponents' Guide: The Role of Proponents in Crown Consultation with the Mi'kmaq of Nova Scotia (Province of Nova Scotia 2012); and
- Mi'kmaq Ecological Knowledge Study Protocol, 2nd Edition (KMKNO 2007).

Other pertinent guidance in the federal regulatory framework which has influenced the EA process for the Project includes:

- Aboriginal Consultation and Accommodation – Updated Guidelines for Federal Officials to Fulfill the Duty to Consult (AANDC 2011);
- Technical Guidance for Assessing the Current Use of Lands and Resources for Traditional Purposes under the *Canadian Environmental Assessment Act*, 2012 (CEAA 2015b);
- Reference Guide Considering Aboriginal Traditional Knowledge in Environmental Assessments Conducted Under the *Canadian Environmental Assessment Act*, 2012 (CEAA 2014c); and
- In Nova Scotia, treaty rights following the 1999 decision in the Donald Marshall Jr. case confirms the right of the Mi'kmaq to hunt, fish, and gather to earn a moderate livelihood. These are protected under Section 35 of the *Constitution Act*, 1982.

1.6 Guiding Principles

1.6.1 Planning Tool

At its foundation, EA is a planning tool used to ensure that projects are carefully planned to avoid or mitigate possible negative environmental effects and to maximize potential benefits. Use of the EA process early in a project's planning phase can be used to encourage proponents to develop their projects in the most sustainable manner. The use of the EIS Guidelines (CEAA 2016) required the Proponent to carefully review and consider the Project, including its alternatives, and the potential effects on valued components

1.6.2 Public Participation

The EIS Guidelines require that the Proponent provide current information about the Project to the general public and especially the communities likely to be most affected by Project activities (CEAA 2016). Within the provincial and federal EA processes, there are distinct public comment periods, including the opportunity to comment on the EIS. To maximize public participation, proponents are required engage the public directly and early on in the EA process.

The Proponent has been engaging stakeholders, including the local community, non-governmental organizations, governmental departments, and the local community since planning and permitting began on the Touquoy Mine over a decade ago. More specific to the Project, specific engagement activities occurred in past year to facilitate public participation. This included open houses in May 2016, presentations and meeting with community organizations and expansion of the existing Community Liaison Committee (CLC). Additional engagement was undertaken in 2020 to 2021 with residents, key stakeholders, and members of the public, which is described in Section 3. It should be noted that concerns related to access are addressed through the construction of bypass roads that will allow for continued access during operations.

Comments from the public were considered in the development of the EIS in terms of planning the Project and its assessment for each Valued Component (VC); responses from the Proponent are documented in this EIS. Additional public engagement details are discussed in Section 3 and Appendix A.4a.

1.6.3 Mi'kmaq of Nova Scotia Engagement

The EIS Guidelines require that the Proponent engage with Indigenous Groups, Mi'kmaq of Nova Scotia, that may be affected by the Project (CEAA 2016).

Within the provincial and federal EA processes and as part of the Made-in-Nova Scotia Process, there are distinct consultation processes completed by the Crown. To maximize engagement of Indigenous Peoples in the EA process, proponents are required to engage Indigenous Peoples directly and early on in the EA process (CEAA 2016).

The Proponent engaged with the Mi'kmaq of Nova Scotia to obtain views on:

- Effects of changes to the environment on the Mi'kmaq of Nova Scotia, specifically: health and socio- economic conditions; physical and cultural heritage, including any structure, site or thing that is of historical, archaeological, paleontological or architectural significance, and current use of lands and resources for traditional purposes; and
- Potential adverse impacts of the Project on potential or established Indigenous Peoples rights or Treaty rights, title and related interests, in respect of the Crown's duty to consult, and where appropriate, accommodate the Mi'kmaq of Nova Scotia.

The information gathered by the proponent during its engagement with Indigenous Peoples helps to contribute to the Crown's understanding of any potential adverse impacts of the Project on potential or established Aboriginal or treaty rights, title and related interests, and the effectiveness of measures proposed to avoid or minimize those impacts.

AMNS has been engaging the Mi'kmaq of Nova Scotia since planning and permitting began on the Touquoy Gold Mine over a decade ago. More specific to the Project, specific engagement activities occurred in past year to engage the Mi'kmaq of Nova Scotia. This included open houses in May 2016, many presentations and meetings with different Mi'kmaq groups, and expansion of the existing CLC to include representatives of the two nearest Mi'kmaq communities, Millbrook First Nation and Sipekne'katik First Nation. Recent engagement efforts through 2018 and 2019 have taken place with Millbrook, Sipekne'katik and KMKNO relating to project technical updates, mitigation and monitoring plans, changes to Project infrastructure including waste rock stockpiles and the Preferred Alternative Haul Road, and discussions relating to thresholds of significance with Millbrook First Nation.

Additional engagement has been undertaken since the 2019 Revised EIS, which are documented in Section 4. Comments from the Mi'kmaq of Nova Scotia were considered in the development of the EIS in terms of planning the Project and the assessment for each VC; responses from the Proponent are documented in this EIS (Section 4 and Appendix A.5).

1.6.4 Precautionary Approach Application

The EIS Guidelines require that the Proponent demonstrate how all aspects of the Project have been examined and planned in a precautionary manner to avoid serious or irreversible environmental effects (CEAA 2016). This EIS applies the precautionary approach through the following assessment methodologies:

- provide extensive detail about the existing environment and develop mitigation measures to eliminate, reduce, or control the effect Project activities have on the environment;
- consider project designs that will minimize disturbance to the existing environment;
- outline contingency plans that address worst-case accidents and malfunctions;
- outline follow-up and monitoring programs to verify project activity related impact predictions; and
- anticipate other projects in the area in an effort to assess cumulative effects.

The application of a precautionary approach in developing this EIS will allow the EA to act as a planning tool which will be used to ensure the Project avoids or mitigates potential environment effects and promotes sustainable development.

1.7 Benefits of the Project

1.7.1 Environmental Benefits

The environmental benefits of the Project to Nova Scotia are numerous to correct past practices with respect to the environment. Given the area has been subjected to extensive exploration, mining, and logging activity over several decades, baseline conditions show obvious effects from these historic activities (Section 6.5 Geology, Soil, and Sediment Qualtiy). The current condition at the Beaver Dam Mine Site is disturbed, and fragmented habitat based on significant timber harvesting, associated road building and yarding areas and historic exploration/mining activity. The PA contains a diversity of habitat types and landscape features but has experienced a considerable amount of disturbance and habitat fragmentation as a result of these activities. The level of disturbance within the Beaver Dam mine site disproportionately affects uplands, over wetlands. The level of new fragmentation associated with the Project is anticipated to be moderate, given the existing disturbance. Historic tailings and waste rock will be removed from the site and encapsulated in the Touquoy exhausted pit. Water will be treated during construction to remove metals associated with historic tailings.

The poor condition of the majority of existing Haul Road culvert crossings directly contributes to poor surface water quality and fish passage in watercourses and wetlands along the Beaver Dam Mines Road and the Moose River Cross Road (Figure 1.2-1) Upgrades to this existing Haul Road will include culvert replacements at over 20 locations and 3 new bridges, where determined to be necessary (Section 2 and Section 6.9). It is expected that correctly installed culverts will increase fish passage and positively affect fish habitat through improved surface water quality.

All environmental baseline investigations for the Project have added to the scientific understanding of the area and improved background data held by the province. Background data helps increase the knowledge base of its users and increases public ecological awareness and promotes conservation of natural ecosystems.

At closure, reclamation will occur at the Project Site and Touquoy Mine Site. The reclamation plan will be secured with a bond held by the Province of Nova Scotia to ensure there are sufficient funds to reclaim the site at any point during the Project. The plan for reclamation requires approval of the Nova Scotia Department of Lands and Forests.

1.7.2 Socio-economic Benefits

KPMG International completed an Economic Impact Assessment of the Moose River Consolidated (MRC) Project to evaluate the economic benefits stemming from the Proponent's mining projects in Nova Scotia (KPMG 2015). This assessment considered the Touquoy and Beaver Dam Mine Projects together and found that socio-economic benefits will stem primarily from the construction and operation phases of the Project.

Construction activities will involve preparing the Project Site, setting up infrastructure and facilities, and purchasing mining processing equipment to enable the MRC Project to reach full production. Much of the spending associated with these activities will be incurred in Nova Scotia and Canada. As per the KPMG report, it was projected that construction costs will be approximately $146 million, with approximately $97.6 million, or 67%, being spent in Nova Scotia, and approximately $111.9 million, or 77%, being spent in Canada. As a result of this spending, it is anticipated that 391 full time equivalent jobs will be created in Nova Scotia per year during construction. For Canada as a whole, the construction phase will create 437 full time equivalent jobs per year. Tax revenues stemming from the construction phase are expected to be $4.1 million for the Government of Nova Scotia and $5.5 million for the Government of Canada. This is a conservative estimate as corporate income taxes paid by contractors and suppliers cannot be estimated.

Operational mining and processing activities will involve the deployment and operation of new mining production capacity. Similar to the construction phase, much of the spending associated with operation of the MRC Project will be incurred in Nova Scotia and Canada. As per the KPMG report, it was projected that annual operating costs will be approximately $52.3 million, with approximately $38.1 million, or 73%, being spent in Nova Scotia, and approximately $39.4 million, or 75%, being spent in Canada. The costs include several spending components, the most important being:

- salaries and benefits for 27% of total annual operating costs;
- cyanide, lime, and reagents for 24% of total annual operating costs;
- diesel for 22% of total annual operating costs;
- wear parts and spare parts for 15% of total annual operating costs; and
- electricity (Touquoy only) for 7% of total annual operating costs.

As a result of this spending, it was anticipated in the KPMG report that 228 yearly and recurrent full-time equivalent jobs will be created in Nova Scotia during operation. For Canada as a whole, the operation phase will create 278 yearly and recurrent full-time equivalent jobs during operation. Tax revenues stemming from the operation phase are expected to be $10.2 million annually for the Government of Nova Scotia and $8.1 million annually for the Government of Canada. These represent conservative estimates as corporate income taxes paid by suppliers cannot be estimated.

The Province of Nova Scotia's unemployment rate is higher than the national average (8.8%>6.9%) and its gross domestic product (GDP) growth was the slowest of all Canadian provinces the last few years. In addition, the GDP per capita is the second lowest in Canada. The MRC Project would greatly benefit the Province of Nova Scotia due to substantial upfront investments and significant annual operation costs contributing to job creation and government tax revenue.

AMNS is committed to working with local communities and the Mi'kmaq of Nova Scotia to maximize socio-economic benefits as the Company developments its projects in the Province, including the Beaver Dam Mine Project.

1.8 Environmental Impact Statement Organization

The Updated 2021 EIS for the Project has retained most of the primary structure of the Revised 2019 EIS (AMNS 2019) (i.e., most major headings match between the two documents). An overview of the contents of each section of the Updated 2021 EIS are provided in the following text:

- Section 1 Introduction introduces the Project and the 2021 EIS Update. It provides summary information and updates, where relevant, to details provided in Section 1 of the 2017 EIS (AGC 2017) and the Revised 2019 EIS (AMNS 2019) relating to the Proponent, Project Overview, and Regulatory Process.
- Section 2 Project Description has been updated to include changes to the Project Layout, Mine Infrastructure Layout, Project Production Schedule, inclusion of bypass roads due to advances in project engineering and resulting from recent engagement regarding land use access. The effects of Project Description Updates are documented in Sections 6 through 10 of the EIS.
- Section 3 Public Engagement has been updated to include engagement activities post the Revised 2019 EIS submission. A public engagement log and supporting documentation are included in Appendices A.4a to A.4c.
- Section 4 Indigenous Peoples Engagement Program has been expanded to include Mi'kmaq of Nova Scotia engagement activities post the Revised 2019 EIS submission. The engagement log is presented in Appendix A.5.
- Section 5 Environmental Effects Assessment Methodology provides a summary of the environmental assessment methodology used for the EIS. The methodology has been updated for clarification on significance thresholds (i.e., magnitude and significance).
- Section 6 Environmental Effects Assessment – Updates to each of the Valued Component sections are based on changes to infrastructure and Project Description for the Beaver Dam Mine Site and in response to IR2s.
- Section 7 Effects of the Environment on the Project has been updated with relevant climate data sets.
- Section 8 Cumulative Effects Assessment has been updated to reflect existing developments/projects, current future developments/projects, changes to infrastructure and Project Description for the Beaver Dam Mine Site and in response to IR2s.
- Section 9 Summary of Environmental Effects and Conclusions has been updated to reflect changes to infrastructure and Project Description for the Beaver Dam Mine Site and in response to IR2s.
- Section 10 Summary of Proposed Follow-up Monitoring Programs has been updated to reflect changes to infrastructure and Project Description for the Beaver Dam Mine Site and in response to IR2s.
- Section 11 References has been updated to reflect any additional cited information.
- Section 12 Acronyms, Abbreviations, Units and Glossary has been updated to reflect additional terms.

Table 1.8-1 identifies the sections of the 2017 EIS (AGC 2017) and specifies whether they are unchanged or updated within the 2019 Revised EIS (AMNS 2019) and/or this 2020 EIS Update. If they are unchanged, the text will reflect what was presented in the 2019 Revised EIS (AMNS 2019). If the text in the subsection required updates, the changes will be highlighted in yellow.

Table 1.8-1: Summary of Updates to Sections from the 2017 Environmental Impact Statement through to the Updated 2021 Environmental Impact Statement

Section from the 2017 EIS		Updated in 2019	Updated in 2021	Nature of Update in 2021
1	Introduction	Yes	Yes	Updated to reflect changes in the Project Description and Regulatory changes since previous submission
2	Project Description	Yes	Yes	Updated to reflect changes in the Project Description (i.e., infrastructure and layout)
3	Public Engagement Program	No	Yes	Updated to reflect engagement undertaken since 2019
4	Indigenous Peoples Engagement Program	Yes	Yes	Updated to reflect engagement undertaken since 2019
5	Environmental Effects Assessment Methodology	No	Yes	Updated based on clarification on significance thresholds and related indices
6	Environmental Effects Assessment	Yes	Yes	Updated based on changes in Project Description, Beaver Dam Mine Layout, additional baseline information, and in response to Information Requests
6.1	Noise	Yes	Yes	Updated modelling based on changes to Project Description and in response to Information Requests
6.2	Air	Yes	Yes	Updated modelling based on changes to Project Description and in response to Information Requests
6.3	Light	Yes	Yes	Updated modelling based on changes to Project Description and in response to Information Requests
6.4	Greenhouse Gases	Yes	Yes	Updated modelling based on changes to Project Description and in response to Information Requests
6.5	Geology, Soil, and Sediment Quality	Yes	Yes	Updated modelling based on changes to Project Description/project layout. Additional baseline information collected on source terms, and historic mining activities including additional information on sediments.
6.6	Ground Water Quality and Quantity	Yes	Yes	Updated modelling based on changes in Project Descriptions/project layout including details additional details on water management structures. Updated modelling was undertaken to document as inputs to surface water quantity and wetlands. Mitigation and Monitoring updates.
6.7	Surface Water Quality	Yes	Yes	Updated modelling based on changes in Project Descriptions/project layout including details additional details on water management structures. Additional water modelling was undertaken to document changes in baseflow and water quality. Mitigation and Monitoring updates.
6.8	Wetlands	Yes	Yes	Updates based on changes in Project Descriptions/project layout. Updates to Air, Surface Water and Groundwater Section resulted in changes to indirect impacts. Mitigation and Monitoring updates.
6.9	Fish and Fish Habitat	Yes	Yes	Updates based on changes in Project Descriptions/project layout. Updated baseline data. Updates to Air, Surface Water and Groundwater Section resulted in changes to indirect impacts. Mitigation and Monitoring updates
6.10	Habitat and Flora	Yes	Yes	Updates based on changes in Project Descriptions/project layout. Updates to Air, Surface Water and Groundwater Section resulted in changes to indirect impacts. Mitigation and Monitoring updates

Table 1.8-1: Summary of Updates to Sections from the 2017 Environmental Impact Statement through to the Updated 2021 Environmental Impact Statement (continued)

Section from the 2017 EIS		Updated in 2019	Updated in 2021	Nature of Update in 2021
6.11	Terrestrial Fauna	Yes	Yes	Updates based on changes in Project Descriptions/project layout. Updates to Air, Surface Water and Groundwater Section resulted in changes to indirect impacts. Mitigation and Monitoring updates
6.12	Birds	Yes	Yes	Section title change to Avifauna Updates based on changes in Project Descriptions/project layout. Updates to Air, Surface Water and Groundwater Section resulted in changes to indirect impacts. Mitigation and Monitoring updates
6.13	Species of Conservation Interest and Species at Risk	Yes	Yes	Updates based on changes in Project Descriptions/project layout. Updates to Air, Surface Water and Groundwater Section resulted in changes to indirect impacts. Mitigation and Monitoring updates
6.14	Indigenous Peoples	Yes	Yes	Section title change to Mi'kmaq of Nova Scotia Updates based on additional engagement and feedback received since the Revised 2019 EIS.
6.15	Physical and Cultural Heritage	Yes	Yes	Updates based on Project Descriptions additional baseline reporting
6.16	Socio-economic Conditions	Yes	Yes	Updates based on Project Descriptions, additional linkages key Provincial Socio-Economic Policies and Documents as well as AMNS policies
6.17	Assessment of Valued Components within Federal Jurisdiction	Yes	Yes	Minor Updates to reflect changes in legislation and regulations
6.18	Accidents and Malfunctions	Yes	Yes	Updates to address Information Requests (Round 2 Part 1 and Part 2)
7	Effects of the Environment on the Project	Yes	Yes	Updated to reflect current data sets and additional available information
8	Cumulative Effects Assessment	Yes	Yes	Updated based changes to Project Description/project layout as well as additional corresponding changes to VCs
9	Summary of Compliance and Effects Monitoring Programs	Yes	Yes	Updated based on changes to VC
10	Environmental Impact Statement Summary and Conclusions	Yes	Yes	Updates based on outcomes from VC sections
11	References	No	Yes	Expanded
12	Acronyms, Abbreviations, Units and Glossary	No	Yes	Expanded acronym, abbreviation and unit lists and included Glossary

Appendices associated with the 2017 EIS (AGC 2017) are summarized in Table 1.8-2, together with cross-references to those appendices revised and presented within the 2019 Revised EIS (AMNS 2019) and this submission (Updated 2021 EIS). Appendices that are new in the 2021 EIS Update have also been identified (e.g., Appendix P.4 Mine Water Management Plan) in Table 1.8-2.

Table 1.8-2: Revisions to Appendices

Appendices from the 2017 EIS		Updated in 2019	Appendices from 2019 Revised EIS		Updated in 2021	Appendix Number within the 2021 EIS Update	
Appendix A	Community Liaison Committee draft Terms of Reference	yes	Appendix A.1	Terms of Reference for the Community Liaison Committee (CLC)	Yes	A.1	Plain Language Summary Beaver Dam Mine Project
Appendix B	Summary of Stakeholder and Mi'kmaq Engagement	Yes	Appendix A.2	Summary of Stakeholder and Mi'kmaq Engagement as Completed for the Project as of January 2018	New	A.2a	Mine Waste Stockpile Geotechnical Design - April 1, 2021
Appendix C	Sediment Baseline Analytical Results	New	Appendix B.1	Noise Impact Study Beaver Dam Mine Project	New	A.2b	Beaver DAM Project – Conceptual PAG Closure Options - December 1, 2021
Appendix D	Surface Water Balance Analytical Results	New	Appendix C.1	Air Dispersion Modelling and Air Emission Estimate Technical Memorandum	New	A.2c	Geotechnical Investigation: Data Report - Beaver Dam Mine, January 15, 2021
Appendix E	Hydrogeological Reports	New	Appendix C.2	Evaluation of Exposure Potential Related to Dust Deposition from Haul Road Traffic onto Soils, Berries, and Vegetation	No	A.3	Terms of Reference for the Community Liaison Committee (CLC)
Appendix F	Wetland Functional Assessment Summary Table	New	Appendix C.3	Dust Control Plan	New	A.4a	Summary of Public and Stakeholder Engagement as Completed for the Project as of 2021
Appendix G	Wetland Characterization Table	New	Appendix D.1	Light Impact Assessment	New	A.4b	NSSA letter March 21, 2021, notes from Sept 9 meeting and presentation
Appendix H	Photographic Log of Watercourses and Fish Habitat	Yes	Appendix E.1	Sediment Baseline Analytical Results	New	A.4c	Community Bulletins
Appendix I	Priority Species List	New	Appendix E.2	Beaver Dam Project - ML/ARD Assessment Report	New	A.5	Summary of Mi'kmaq and Indigenous Peoples Engagement as Completed for the Project as of 2021
Appendix J	Documented Priority Species (ACCDC and NS Communities, Culture, and Heritage)	New	Appendix E.3	Beaver Dam Project - Geochemical Source Term Predictions for Waste Rock, Low-Grade Ore, Tailings and Overburden	New	A,6	draft Public Engagement Plan – May 2021
Appendix K	Master Plant List	New	Appendix F.1	Assessment of Potential Open Pit Groundwater Inflows - Beaver Dam Gold Project	New	B.1	Beaver Dam Mine Construction Noise Assessment Atlantic Mining NS Inc., Beaver Dam Mine Project, Nova Scotia - January 25, 2021
Appendix L	Maritime Breeding Bird Atlas Data Summaries	New	Appendix F.2	Hydrogeologic Investigation - Beaver Dam Mine	Yes	B.2	Noise Impact Assessment Technical Report - January 13, 2021
Appendix M	Relative Abundance of Avian Species	New	Appendix F.3	Field Activities Report Beaver Dam Mine Project	Yes	C.1	Air Emissions Assessment Technical report, February 16, 2021
Appendix N	Mi'kmaq Ecological Knowledge Study	New	Appendix F.4	Groundwater Quality Data	Yes – Updated/New	C.2	Evaluation of Potential Human Exposures and Risks related to Emissions from the Beaver Dam Mine Project (Dust deposition; Recreational water usage; and country foods) - April 22, 2020
Appendix O	Archaeological Reconnaissance Reports and Nova Scotia Communities, Culture, and Heritage Communications	New	Appendix F.5	Hydrogeologic Model Development and Application	Yes	C.3	Draft Fugitive Dust Control Plan – May 2021
-	-	New	Appendix F.6	Groundwater Flow and Solute Transport Modelling to Evaluate Disposal of Beaver Dam Tailings in Touquoy Open Pit - Beaver Dam Gold Project	Yes	D.1	Light Impact Assessment Beaver Dam Mine Project, January 28, 2021
-	-	Yes	Appendix G.1	Surface Water Baseline Analytical Results	No	E.1	Sediment Baseline Analytical Results
-	-	New	Appendix G.2	Touquoy Integrated Water and Tailings Management Plan	Yes	E.2	Beaver Dam Project - ML/ARD Assessment Report - December 20, 2018
-	-	New	Appendix G.3	Predictive Water Quality Assessment - Beaver Dam Gold Mine	Yes	E.3	Beaver Dam Project - Geochemical Source Term Update – January 20, 2021
-	-	New	Appendix G.4	Evaluation of Potential for Aquatic Effects as a Result of Effluent Releases Related to Beaver Dam Mine	New	E.4	DRAFT Beaver Dam Project: 2020 Kinetic Test Update (IR NSE 2-74) – June 11, 2020
-	-	New	Appendix G.5	Water Balance Analysis - Beaver Dam Mine Site	New	E.5	DRAFT Beaver Dam Mine ML/ARD Management Plan – August 8, 2019
-	-	New	Appendix G.6	Assimilative Capacity Study of Moose River. Touquoy Open Pit Discharge	New	E.6	Phase I - Environmental Site Assessment (Beaver Dam), - August 6, 2019
-	-	New	Appendix G.7	Beaver Dam Conceptual Treatment Approach	New	E.7	Limited Phase II - Environmental Site Assessment (Beaver Dam Property) - August 23, 2019
-	-	yes	Appendix H.1	Wetland Functional Assessment Summary Table	New	E.8	Final (Revised) – Extended Phase II Environmental Site Assessment Beaver Dam Project Property - March 8, 2021
-	-	No	Appendix H.2	Wetland Characterization Table	New	E.9	Draft Historic Tailings and Waste Rock Management Plan - May 2021
-	-	New	Appendix H.3	Preliminary Wetland Compensation Plan	New	E.10	Nitrogen Source Control Monitoring Plan for Touquoy Mine - March 14, 2021

Table 1.8-2: Revisions to Appendices (continued)

Appendices from the 2017 EIS		Updated in 2019	Appendices from 2019 Revised EIS		Updated in 2021	Appendix Number within the 2021 EIS Update	
-	-	New	Appendix I.1	ACCDC Report Beaver Dam Mine Site (Data Report 5262: Marinette, NS)	No	F.1	Assessment of Potential Open Pit Groundwater Inflows Beaver Dam Gold Project Nova Scotia - April 2015
-	-	New	Appendix I.2	ACCDC Report Haul Road (Data Report 5559: Mooseland, NS)	No	F.2	Hydrogeologic Investigation - Beaver Dam Mine - July 30, 1986
-	-	New	Appendix I.3	ACCDC Report Touquoy Mine Site (Data Report 5433: Moose River Mines, NS)	No	F.3	Field Activities Report Beaver Dam Mine Project - November 8, 2018
-	-	New	Appendix I.4	Environmental Screening Beaver Dam Mine Site - Nova ScotiaCommunities, Culture, & Heritage	New	F.4	Baseline Groundwater Program, Beaver Dam - March 20, 2021
-	-	no	Appendix I.5	Priority Species List	Yes	F.5	Hydrogeologic Modelling Report - April 2021
-	-	Yes	Appendix J.1	Photographic Log of Watercourses and Fish Habitat	Yes	F.6	Groundwater Flow and Solute Transport Modelling to Evaluate Disposal of Beaver Dam Tailings in Touquoy Open Pit - Beaver Dam Gold Project - April 12,.2021
-	-	No	Appendix K.1	Master Plant List	Yes	F.7	Touquoy Integrated Water and Tailings Management Plan - Beaver Dam Gold Project - April 15, 2021
-	-	No	Appendix L.1	Maritime Breeding Bird (MBBA) Atlas Data Summaries	Yes	F.8	Beaver Dam Gold Project Assimilative Capacity Study of Moose River – Touquoy Pit Discharge - April 12, 2021
-	-	No	Appendix L.2	Relative Abundance of Avian Species	New	F. 9	Response to Information Request Nos. CEAA 2-36, CEAA 2-37, and NSE 2-130 Evaluation of Potential Impacts from Metals COCs to Groundwater and Surface Water from Dust Deposition along the Haul Road Beaver Dam Mine Project Marinette, Nova Scotia - April 14, 2021
-	-	no	Appendix M.1	Mi'kmaq Ecological Knowledge Study (MEKS)	New	F.10	Simulating the Cumulative Effects of Deposition of Tailings to the Touquoy Pit – April 8, 2021
-	-	New	Appendix N.1	Archaeological Assessment - Beaver Dam Mine Site	Yes	G.1	Surface Water Baseline Analytical Results
-	-	New	Appendix N.2	Archaeological Assessment - Beaver Dam Mine Site (WRSP West)	Yes	G.2	Beaver Dam Mine: Killag River and Moose River Water Quality Predictions and Aquatic Effects Assessment – Reassessment of Killag River based on February 2021 Update (GHD modelling Provided February 12, 2021); Reassessment of Moose River based on March 2021 Update (Stantec modelling of March 11, 2021) – April 30, 2021
-	-	New	Appendix N.3	Archaeological Assessment - Haul Road	New	G.3	Additional Water Quality Modelling Mine Water Management Plan, Beaver Dam Gold Mine - February 12, 2021
-	-	New	Appendix N.4	Archaeological Assessment - Haul Road Option 2	New	G.4	Physical Characterization of Watercourses – May 2021
-	-	New	Appendix N.5	Archaeological Assessment - Preferred Alternative Haul Road (Haul Road West)	New	G.5a	Assessment of Water Quality Downstream of Tailings Management Facility, Touquoy Gold Project –November 25, 2015
-	-	New	Appendix O.1	Preliminary Environmental Effects Monitoring Plan	New	G.5b	Water Balance Report Revision 2.0, Atlantic Gold Tailings Management Facility - November 25, 2016
-	-	-	-	-	Yes	H.1	Wetland Functional Assessment Summary Table
-	-	-	-	-	Yes	H.2	Wetland Characterization Table
-	-	-	-	-	Yes	H.3	Preliminary Wetland Compensation Plan – April 2021
-	-	-	-	-	Yes	I.1	ACCDC Report Beaver Dam Mine Site and Haul Road (DATA REPORT 6749: Marinette, NS)- January 4, 2021
-	-	-	-	-	No	I.2	ACCDC Report Touquoy Mine Site (Data Report 5433: Moose River Mines, NS), September 10, 2015
-	-	-	-	-	No	I.3	Environmental Screening Beaver Dam Mine Site - Nova Scotia Communities, Culture, & Heritage - April 21, 2015
-	-	-	-	-	New	I.4	Maritimes Butterfly Atlas Results – Beaver Dam Mine Project
-	-	-	-	-	No	J.1	Photographic Log of Watercourses and Fish Habitat – December 14, 2018
-	-	-	-	-	New	J.2	Fish and Fish Habitat Baseline Report – January 2021

Table 1.8-2: Revisions to Appendices (continued)

Appendices from the 2017 EIS		Updated in 2019	Appendices from 2019 Revised EIS		Updated in 2021	Appendix Number within the 2021 EIS Update	
-	-	-	-	-	New	J.3	draft Fish Habitat Offset Plan – May 2021
-	-	-	-	-	New	J.4	Detailed Figures (as referenced in Fish and Fish Habitat EA [Section 6.9]) – May 2021
-	-	-	-	-	Yes	K.1	Master Species List - March 22, 2021
-	-	-	-	-	Yes	L.1	Maritime Breeding Bird (MBBA) Atlas Data Summaries - November 20, 2020
-	-	-	-	-	Yes	L.2	Relative Abundance of Avian Species – March 2021
-	-	-	-	-	No	M.1	Mi'kmaq Ecological Knowledge Study (MEKS) - 2016
-	-	-	-	-	Yes	M.2	Visual Simulations – November 2020 and May 2021
-	-	-	-	-	No	N.1	Beaver Dam Development Archaeological Screening & Reconnaissance Halifax Regional Municipality, Nova Scotia - March 2009
-	-	-	-	-	No	N.2	Beaver Dam Gold Project Archaeological Assessment Halifax Regional Municipality, Nova Scotia - March 2015
-	-	-	-	-	No	N.3	Beaver Dam Gold - WRSP West Archaeological Screening & Reconnaissance 2018 Beaver Dam, Nova Scotia -January 2019
-	-	-	-	-	No	N.4	Beaver Dam Gold Project - Haul Road Archaeological Reconnaissance Halifax Regional Municipality, Nova Scotia -March 2016
-	-	-	-	-	No	N.5	Beaver Dam Gold Project - Haul Road Option 2 Archaeological Reconnaissance Halifax Regional Municipality, Nova Scotia -March 2017
-	-	-	-	-	New	N.6	Beaver Dam Gold - Archaeological Screening & Reconnaissance 2019 Beaver Dam, Nova Scotia - August 2020
-	-	-	-	-	New	N.7	Beaver Dam Archaeological Shovel Testing 2020 Halifax County, Nova Scotia - February 2021
-	-	-	-	-	New	O.1	KPMG Atlantic Gold Corporation Economic Impact Assessment of the Beaver Dam Mining Project – November 2020
-	-	-	-	-	New	O.2	KPMG MRC Economic Impact Assessment – February 2020
-	-	-	-	-	New	P	Management Plans and Monitoring Programs – May 2021
-	-	-	-	-	New	P.1	draft Emergency Response Plan
-	-	-	-	-	New		Appendix A draft Spill Contingency Plan
-	-	-	-	-	New	P.2	draft Reclamation and Closure Plan
-	-	-	-	-	New	P.3	draft Nitrogen Management Plan
-	-	-	-	-	New	P.4	Mine Water Management Plan:
-	-	-	-	-	New		Appendix A Water Balance Analysis
-	-	-	-	-	New		Appendix B Stormwater Management Assessment – Hydrologic Modelling
-	-	-	-	-	New		Appendix C Erosion and Sediment Control Plan
-	-	-	-	-	New		Appendix D Predictive Water Quality Assessment
-	-	-	-	-	New		Appendix E Hydrogeological Modelling Report
-	-	-	-	-	New		Appendix F Water Treatment Assessments
-	-	-	-	-	New		Appendix F.1 Construction Phases
-	-	-	-	-	New		Appendix F.2 Operation Phase
-	-	-	-	-	New		Appendix F.3 Post-closure Phase

Table 1.8-2: Revisions to Appendices (continued)

Appendices from the 2017 EIS		Updated in 2019	Appendices from 2019 Revised EIS		Updated in 2021	Appendix Number within the 2021 EIS Update	
-	-	-	-	-	New		Appendix G Proposed Groundwater Monitoring Plan
-	-	-	-	-	New		Appendix H Baseflow Mitigation Assessment
-	-	-	-	-	New	P.5	AEMP – not included will be developed as part of the Industrial Approval
-	-	-	-	-	New	P.6	Preliminary Lichen Mitigation and Monitoring Plan
-	-	-	-	-	New	P.7	draft Wildlife Mitigation and Monitoring Plan
-	-	-	-	-	New		Appendix A Landbird SAR Mitigation and Monitoring Plan

2 PROJECT DESCRIPTION

2.1 Introduction

2.1.1 Summary of the Project Description Before the Updates

The **proposed Beaver Dam Mine Project** includes construction, operation, decommissioning, and reclamation of an open pit gold mine in Marinette, Nova Scotia. As proposed, the Beaver Dam Mine Project would have an ore production rate of 2.1 million tonnes per year, over a four-year period. Ore from the project would be crushed and transported approximately 31 kilometres by road to the Moose River (Touquoy) mine for processing. Beaver Dam mine tailings will be deposited sub aqueously in the mined-out Touquoy pit. The Beaver Dam mine site includes an open pit, mine site haul roads, waste material storage areas, primary crusher and administrative.

The Project Area (PA), therefore, includes:

- Beaver Dam Mine Site –mining, waste rock and water management;
- Haul Road – transport of ore to Touquoy Mine Site; and
- Touquoy Mine Site – processing ore and tailings disposal in the mined-out pit.

2.1.2 Summary of Updates to Project Description

AMNS has updated the project description to include five years of operations. The maximum ore production rate is 2.1 million tonnes per year (Mt/y) that will range from 0.75 to 2.1 Mt/y over the five years. Components of the project still include an open pit, mine site haul roads, waste material storage piles, ore stockpiles, optional primary crusher and operational facilities, and water management. Addition geochemical work indicated that there is potential for potential acid generative (PAG) material that requires segregation into a separate stockpile that will require an engineered cover at closure. Advances in detailed engineering include an option to undertake the operations without a primary crusher, using mine equipment within the pit (e.g., jawbreaker) to crush ore for transport. This assessment considers options with and without a primary crusher is described. Water management structures have been updated to include ponds that are sized to consider extreme weather events (i.e., Hurricane Beth) and climate change. Overall updates to the project footprint have been undertaken to avoid and/or minimize direct impacts to lichens, wetlands, and water bodies courses.

Additional studies on haul trucks have been undertaken to reduce to overall number of truck trips to an average of 200 return truck trips a day over the life of mine. The Preferred Alternative Road, which would require additional disturbance, is no longer considered in the updated as part of the Haul Road design. It may be necessary to use the Public Roads during start-up (i.e., 6 to 8 months) depending on approval and permitting timelines and construction restrictions.

Engagement undertaken in 2020 and 2021 indicated there was considerable concern regarding limitation of access along the Haul Road. A by-pass road will be constructed parallel and adjacent to proposed Haul Road to mitigate concerns raised by both the Mi'Kmaq of Nova Scotia and members of the public. The bypass road will be constructed to allow light truck and recreational vehicles access while the haul road is in operation.

The Project Area (PA), therefore, includes:

- Beaver Dam Mine Site – mining ore, managing waste rock storage, and water management;
- Haul Road – transport of ore to Touquoy Mine Site and will include; and
- Touquoy Mine Site – processing ore and tailings disposal in the mined-out pit.

St. Barbara Limited is committed to carbon neutrality across its mining operations by 2050. AMNS is continually looking for opportunities target carbon neutrally by 2025. Although advances in technologies including hydrogen cells in mine fleets are being developing, they are currently not technically and commercially viable option at the Beaver Dam Mine Site. Other assessments are being undertaken is evaluating if wind energy can be used to supply energy to Touquoy mill.

2.1.3 Overview of Updates

An overview of updates to the Project Description and corresponding sections is provided in Table 2-1.1.

Table 2.1-1: Updated and Unchanged Subsections from the 2019 Revised Environmental Impact Statement – Project Description

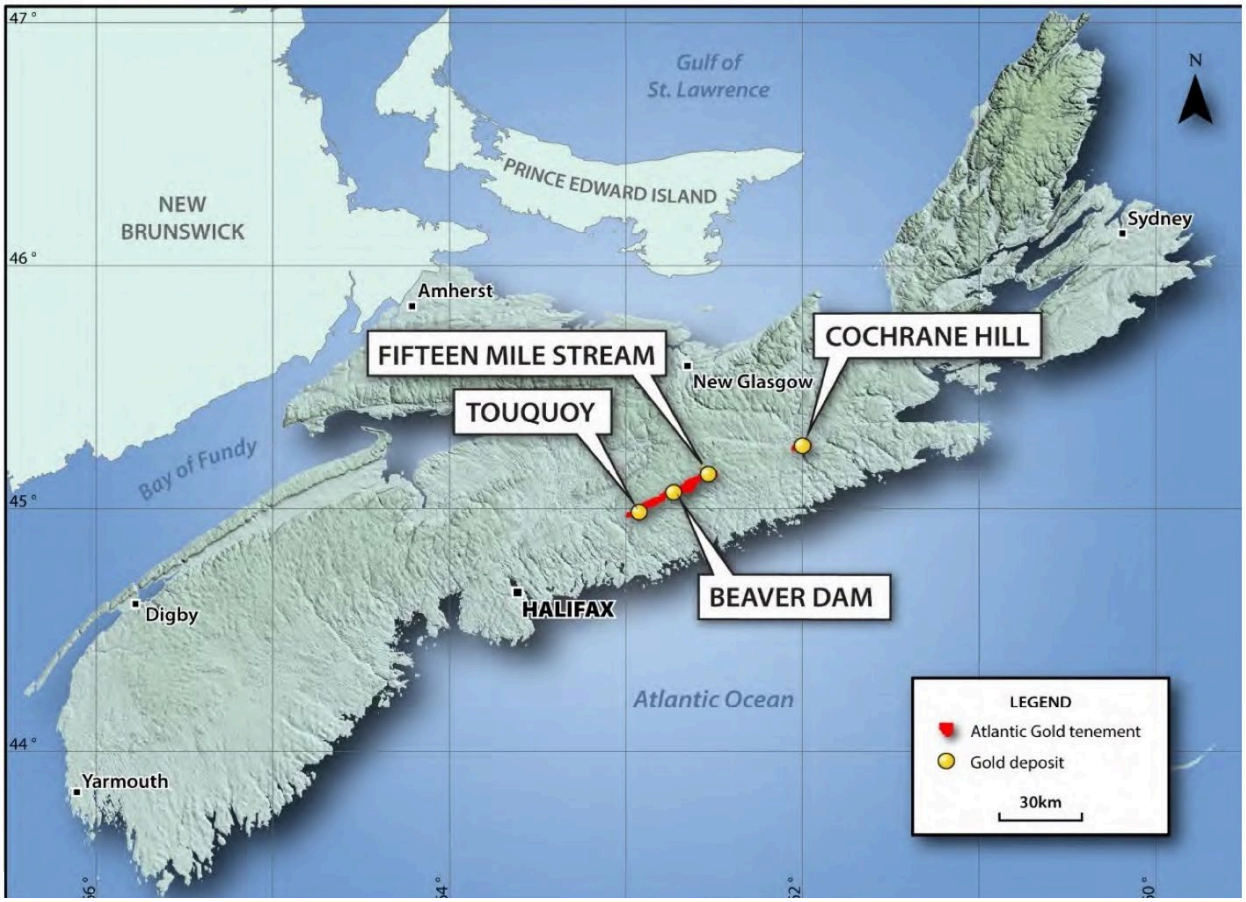
Project Description from the 2019 Revised EIS Submission	Updated in 2021	Reason for Update
2.1 Introduction	New	Project Summary based on 2019 Revised EIS and Summary based on Updated 2021 EIS
2.2 Ownership and Tenements	Update	New ownership; lease boundary updates due in changes in Project layout
2.3 Project Location	Limited Update	Updates Description of Project and included new figures
2.4 Ecological Setting	Limited Update	Updated description
2.5 Project History	Limited Update	Updated based on new Phase I and II information on historic mining activities
2.6 Geology and Resources	New	Additional information on geology and resources
2.7 Project Components	Updated	Updates to reflect updates to mining components at Beaver Dam Mine; Removal of the Preferred Alternative Haul Road Route and updates to Touquoy processing and tailings disposal
2.8 Project Schedule	Updated	Increase in Project Operations from 3.5 Years to 5 Years and updates to Active and Post-Closure
2.9 Active and Post Closure	Updated	Updated to reflect draft Reclamation and Closure Plan
2.10 Preferred Means of Carrying Out Project	No Change	
2.11 Conclusion	Limited Updates	Updates based on Socio-Economic Information

2.2 Ownership and Tenements

2.2.1 Ownership

Atlantic Mining NS Inc. (AMNS), formerly Atlantic Gold, is wholly owned by St Barbara Limited (St Barbara) that completed the acquisition of Atlantic Corporation on July 19, 2019. The proposed Beaver Dam Mine and existing Touquoy Mine are 100% owned by AMNS. The company is focused on growing gold production in Nova Scotia beginning with its Moose River Consolidated phase one open pit gold mine at Touquoy, which declared commercial production in March 2018. The life of mine expansion involves satellite deposits at Beaver Dam, Fifteen Mile Stream and Cochrane Hill (Figure 2.2-1).

Figure 2.2-1: Atlantic Mining NS Inc. Projects



2.2.2 Mineral Tenures

2.2.2.1 Beaver Dam Property

Mineral exploration and mining licences are issued by the Nova Scotia Department of Energy and Mines (NSDEM) under the *Mineral Resources Act* of 2016 (amended in 2018). Exploration licences are granted for two-year terms, and are renewable indefinitely, provided certain annual conditions are met. Exploration licences can contain a maximum of 80 bordering mineral claims. Mining licences are granted for 20-year terms and can be renewed an indefinite number of times at the discretion of the Minister for Natural Resources.

The Beaver Dam property is held under two exploration license EL50421 and EL51852. The EL EL50421 comprises 76 contiguous claims that cover an area of approximately 1, 230 ha and EL51852 comprises 7 claims and covers 113 ha. Exploration Licence 50421 is an amalgamation of EL 05920 and EL 06175, which was reissued as EL 50421 in August 2014. Exploration Licence 05920 represented the amalgamation of three pre-existing Exploration Licences 00047, 04790 and 04516. The Exploration Licences were regrouped in 2003 as EL 05920 and reissued by the NSDEM in 2005. The Mineral Tenure details are provided in Table 2.2-1 and Figure 2.2-2.

EL: 51412
Atlantic
Mining NS Inc.

EL: 50421
Atlantic
Mining NS Inc.

EL: 05927
SCHENKELS,
HENRY F.

EL: 51731 1156219
B.C. Limited

EL: 51852
Atlantic
Mining NS Inc.

EL: 53494
1156219
B.C. Limited

EL: 52054
1156219 B.C.
Limited

EL: 51939
Atlantic
Mining NS Inc.

519500 520000 520500 521000 521500 522000 522500 523000 523500 524000

4991500 4991000 4990500 4990000 4989500 4989000 4988500 4988000

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Atlantic Gold

FIGURE 2.2-2

Beaver Dam Mine Project

Exploration License Boundaries

Proposed Infrastructure
- Crusher Pad
- Open Pit
- Low Grade Stockpile
- NAG Stockpile
- PAG Stockpile
- Organic Material Stockpile
- Topsoil Stockpile
- Till Stockpile
- Explosive Storage
- Road
- Settling Pond
- Water Management

- Historical Mine Workings
- Topo Line - 5m contour
- Local Road
- Dry Weather / Seasonal Road
- Track
- NSTDB Watercourse
- Lake
- Crown Lands (Not surveyed)
- Northern Timber (Not surveyed)
- Exploration Licence
- Project Area



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 125 250 500 m

1:15,000 Scale when printed @ 11" x 17"

Drawn By: LP
Reviewed By: XX

Date: 2021-04-12

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

McCallum Environmental Ltd.

Document Name: BD_EIS_Fig2.1-X Exploration License Boundaries

Table 2.2-1: Mineral Tenures

EI	Holder	Granted	Location	NTS	Tract	Claims	No.	Regional Municipality
Beaver Dam								
50421	AMNS	13-May-76	Beaver Dam	11 E 02 A	58	EFKLOPQ	7	Halifax
50421	AMNS	13-May-76	Beaver Dam	11 E 02 A	59	EFGHJKLMNOPQ	12	Halifax
50421	AMNS	13-May-76	Beaver Dam	11 E 02 A	60	EFGHJKLMNOPQ	12	Halifax
50421	AMNS	13-May-76	Beaver Dam	11 E 02 A	61	ABCDEFGH	8	Halifax
50421	AMNS	13-May-76	Beaver Dam	11 E 02 A	62	ABCDEFGHJKLM	12	Halifax
50421	AMNS	13-May-76	Beaver Dam	11 E 02 A	63	ABCDEFGHJKLMPQ	14	Halifax
50421	AMNS	13-May-76	Beaver Dam	11 E 02 A	64	DEFKLMNOPQ	10	Halifax
50421	AMNS	13-May-76	Beaver Dam	11 E 02 A	65	N	1	Halifax
51852	AMNS	07-Dec-15	Beaver Dam	11 E 02 A	58	CD	2	Halifax
51852	AMNS	07-Dec-15	Beaver Dam	11 E 02 A	59	ABCD	4	Halifax
51852	AMNS	07-Dec-15	Beaver Dam	11 E 02 A	60	A	1	Halifax

Haul Road does not require mineral leases because not extracting materials.

2.2.2.2 Touquoy Property

Mineral rights to the Touquoy Property are wholly owned by AMNS and consist of one mineral lease (MLE11-1) comprising 49 claims and covering 793 hectares (ha), and one adjoining Exploration License (EL10377) comprising 64 claims and covering 1,036 ha.

2.2.3 Surface Rights

2.2.3.1 Beaver Dam Property

Under the current *Mineral Resources Act*, prospectors and exploration companies must obtain permission from the landowner (whether private or Crown) prior to accessing licences.

At the Beaver Dam Mine Site, AMNS is in process of negotiation surface titles with Northern Timber Nova Scotia Corporation (Northern Timber) as well as applying for crown land lease parcels. Surface leases have been negotiated on portion of the haul road (i.e., near the intersection of the Mooseland Road). The remaining surface rights are currently under negotiations with Northern Timber and applications crown lease parcels.

2.2.3.2 Haul Road

The Haul Road will be under lease from Forestry companies and/or part of a purchasing arrangement, which is currently being negotiated.

2.2.3.3 Touquoy Property

At Touquoy, AMNS Atlantic holds (i.e., holds fee simple title to and possesses) of the private land required for the operation of the Touquoy mining operation. A Crown land lease to seven parcels of Crown land was granted in June 2014. The lease is for a 10-year term, renewable for a further 10 years.

2.3 Project Location

The Project consists the Beaver Dam Mine Property (i.e., mining and storing of waste rock), a 31-kilometre (km) haul road that connects to the two sites and the Touquoy Property (i.e., processing, and depositing tailings) (Figure 2.3-1). The Project is bound within a Project Area (PA). The PA will result in approximately 244 hectares (ha) of disturbance with 34 ha or 14% occurring on crown land.

2.3.1 Beaver Dam Mine

The Beaver Dam Mine property is in Marinette, Regional Municipality of Halifax Area, Nova Scotia, which is approximately 85 km northeast of Halifax. The Beaver Lake IR is located approximately 6 km of the Beaver Dam deposit and 5 km from the intersection of the Beaver Dam Mine Road and Highway 224. The community of Mooseland is approximate 1 km from the intersection of the Beaver Dam Haul Road and the Mooseland Road. Goods and services needed are generally sourced from Halifax/Dartmouth. The Beaver Dam Mine Project layout is provided in Figure 2.3-2. The Beaver Dam mine footprint approximately 208 ha with 26 ha or 14% on Crown land. The approximate centre point of the Beaver Dam Mine Site is 521319 E 4990700 N (UTM Zone 20 NAD83 CSRS).

2.3.2 Haul Road

The Haul Road extends from the Beaver Dam Mine Site to the Touquoy Mine site (Figure 2.3-3). Bypass roads to allow light truck traffic and recreational vehicles (e.g., ATV and snowmobiles) to maintain access during operations will be constructed adjacent and parallel to portions of the Haul Road. The total disturbance of Haul Roads is 25 ha and by-pass roads are expected to disturb approximately 10 ha with 25 ha on crown land. The Haul Road consists of the following four main segments:

- 7.2 km existing Beaver Dam Mines road, that extends east from the proposed mine site to highway 224, which will be upgraded to support ore transport and will include bypass road.
- 4 km of new constructed road west of Highway 224 to connect the Haul road to an existing forestry road, this section will not include bypass road.
- 8.2 km existing forestry road that extends east to the Mooseland Road, referred to locally as the Dump Road, will be upgraded to support ore transport truck and will include bypass road.
- 10.7 km Mooseland Road that will be upgraded by Department of Transportation and Infrastructure Renewal (TIR) extends north along the Mooseland Road to the existing Touquoy Mine. By-pass roads crossing and parking area is currently being considered in the design to address safety concerns by local residents.

It may be necessary to use the Public Roads during start-up (i.e., 6 to 8 months) depending on approval and permitting timelines and construction restrictions.

2.3.3 Touquoy Mine

The Touquoy property is located 60 km northeast of t Halifax, Nova Scotia, which is centered on the former mining village of Moose River Gold Mines. Halifax provides the majority of goods and services required by the Project The closest population centres are Middle Musquodoboit located 20 km to the northwest and approximately 12 km from the community of Mooseland which is located to the southeast. The Touquoy Mine Site is shown in Figure 2.3-4. There is no anticipated disturbance to the exiting Touquoy Mine site that will result from processing Beaver Dam ore. The approximate centre point of the Touquoy property is 505280.58E 505280.58N UTM Zone20 NAD83 CSRS.

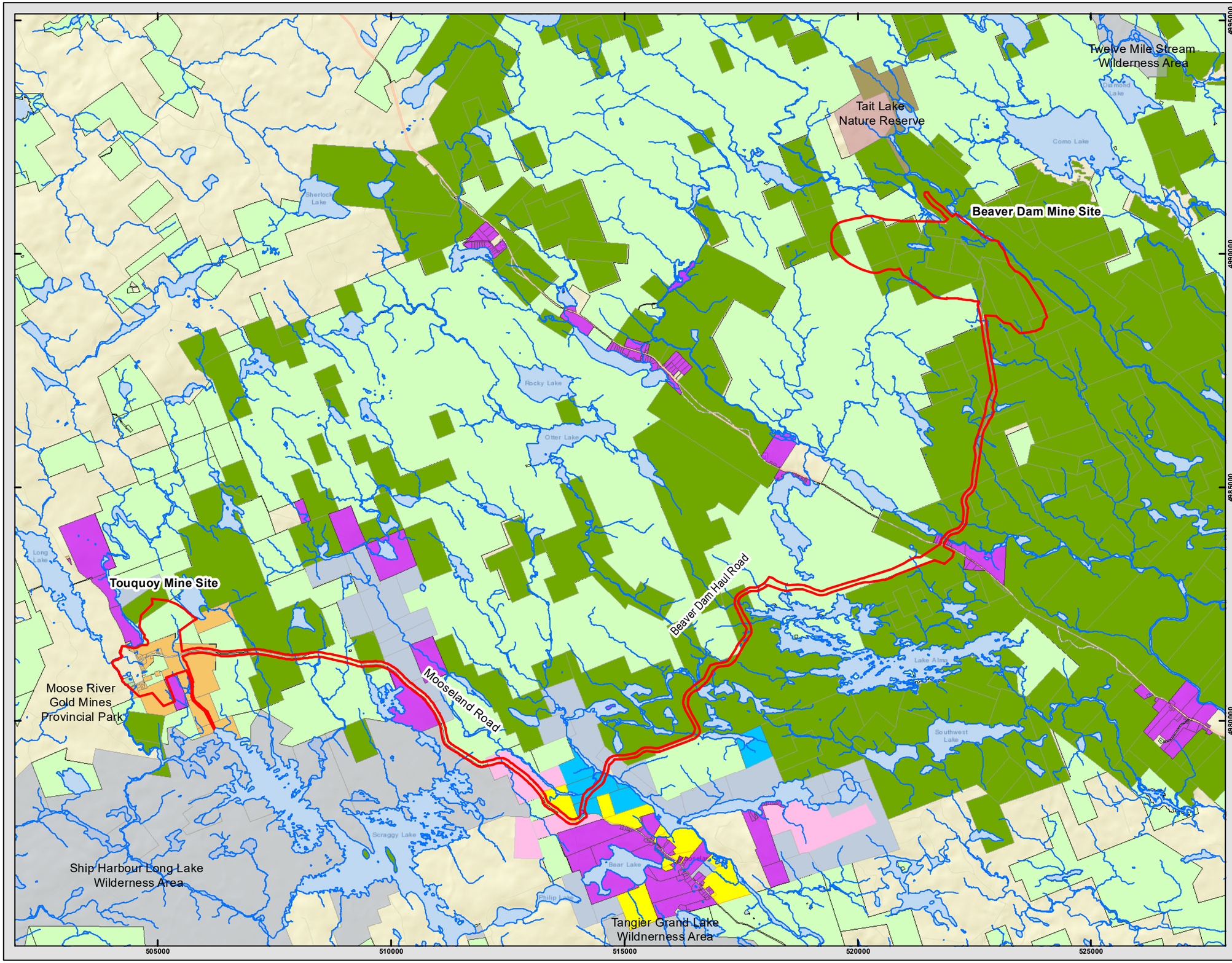

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FIGURE 2.3-1

Beaver Dam Mine

Project Area

NSTDB Mapped Watercourse

Project

Nova Scotia Protected Lands

- Nature Reserve
- Provincial Park
- Wilderness

Other Land

- Private
- Crown Lands (Not surveyed)

Corporate Property

- D.D.V. Gold Limited
- Deepwood Estates Limited
- Forestex Limited
- Musquodoboit Lumber Co. Ltd.
- Northern Timber (Not surveyed)
- Prest Bros Limited
- Prest Enterprises Limited



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 1 2 4 km

1:75,000 Scale when printed @ 11" x 17"

Drawn By: EP Date: 2021-03-01
Reviewed by: XX

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

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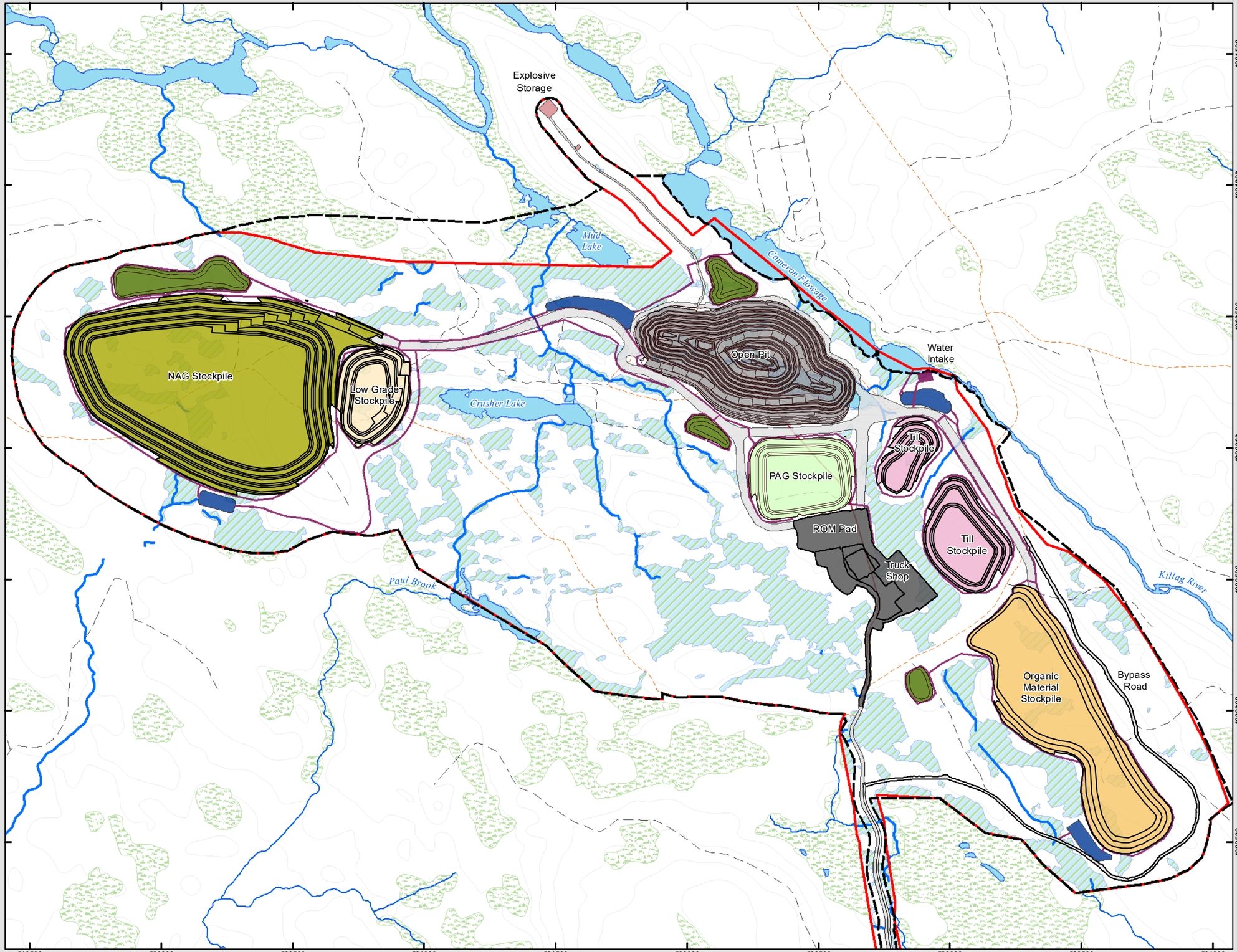
Atlantic Gold

FIGURE 2.3-2

Beaver Dam Mine Project

General Mine Layout



Proposed Infrastructure

- Crusher Pad
- Open Pit
- Low Grade Stockpile
- NAG Stockpile
- PAG Stockpile
- Organic Material Stockpile
- Topsoil Stockpile
- Till Stockpile
- Explosive Storage
- Road
- Settling Pond
- Water Management

- Topo Line - 5m contour
- Local Road
- Dry Weather / Seasonal Road
- Track
- NSTDB Mapped Watercourses outside PA
- Field Delineated Watercourses within PA
- Open Water / Lake
- Field Delineated Wetlands within PA
- NSE Mapped Wetlands outside PA
- Preliminary Property Boundary
- Project Area Boundary



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

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1:13,500 Scale when printed @ 11" x 17"

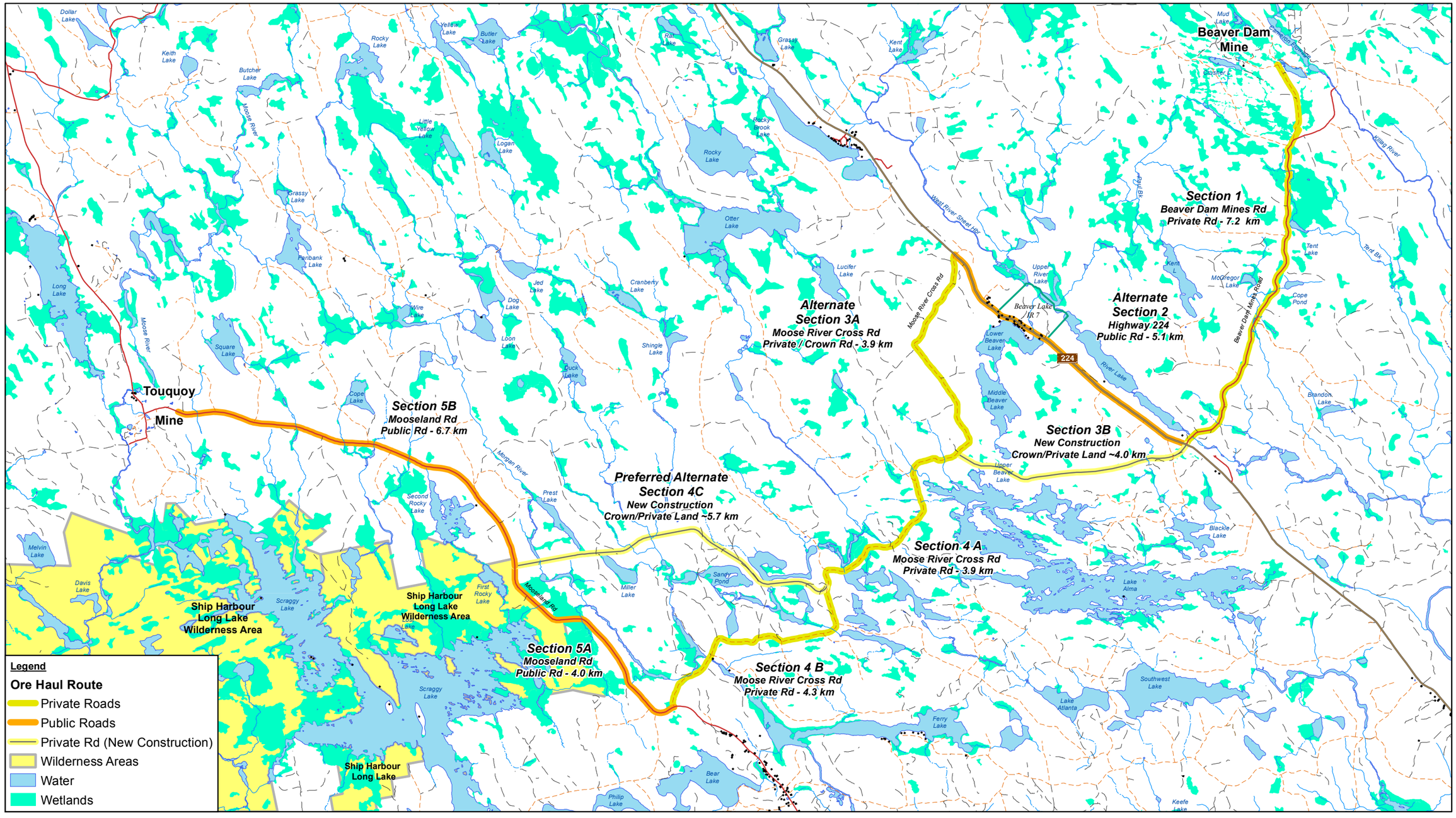
Drawn By: LP
Reviewed By: XX

Date: 2021-04-12

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

McCallum Environmental Ltd.

Document Name: BD_EIS_Fig2.1-X General Mine Arrangement



Source: Service Nova Scotia (Water, Wetlands, Roads), NS Environment (Protected Areas), Atlantic Gold (Route)

0 600 1,200 1,800
Metres

Coordinate System:
NAD 1983 CSRS UTM Zone 20N

ATLANTIC GOLD CORPORATION
MARINETTE, HALIFAX CO., NOVA SCOTIA
ENVIRONMENTAL IMPACT STATEMENT - BEAVER DAM MINE

088664
Feb 14, 2019

HAUL ROAD ROUTE WITH ALTERNATES

FIGURE 2.3-3

GIS File: I:\GIS_DATA\Projects\6-chars\08----\088---\088664 Atlantic BD\088664(004)\Revised2018\088664(004)GIS-DA008.mxd

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FIGURE 2.3-4

Touquoy Mine Site

Square Lake

New Dam Flowage

Moose River Road

By-Pass Road

Realigned Road

Mooseland Road

Plant

Till Stockpile

Touquoy Mine Waste Rock Storage

Bevear Dam Mine Tailings Management

Touquoy Mine Tailings Management

Moose River

Fish River

Indian Gill

4982500
4982000
4981500
4981000
4980500
4980000

503500
504000
504500
505000
505500
506000
506500
507000

- Project Area

Touquoy Mine Infrastructure

- Site Roads
- Tailings Management
- Waste Rock Storage
- Pit
- Plant
- Till Stockpile
- Pit Berm
- Realigned Road
- By-Pass Road
- NSE Wetlands
- Lake
- Local Roads
- Dry Weather / Seasonal Roads
- Diveways (>300 m)
- Track
- NSTDB Mapped Watercourses



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 100 200 400 m

1:12,000 Scale when printed @ 11" x 17"

Drawn By: XX
Reviewed By: XX

Date: 2021-03-01

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Document Name: BD_EIS_Fig2.1-X General Touquoy Arrangement

2.4 Ecological Setting

2.4.1 Physiography and Drainage

The proposed Beaver Dam Mine and Touquoy Mine is located within the Eastern Drumlins ecodistrict, a further subdivision of the Eastern ecoregion of NS. The ecodistrict is characterized by drumlin fields with generally north-south oriented drumlins. Beaver Dam is an area of low topographic relief with most of the area being around 140 metres above sea level (masl) with scattered drumlins reaching 160 masl.

At the Beaver Dam Mine drainage is to the southeast along a number of poorly drained streams and shallow lakes. Drainage in the area generally flows to the southeast along poorly drained streams, shallow lakes, and wetlands that eventually drain into Cameron Flowage and the Killag River. A drainage divide is present within the proposed Beaver Dam Mine Site, with drainage towards the south through Paul Brook (AMNS 2021). Locally, water in the eastern portion of the Site is directed toward an artificial historical settling pond with the remains of a dam that is maintaining the water level in the pond. Overflow from the historical settling pond is directed into Cameron Flowage and the Killag River. There are a number of boggy areas within the property. The Cameron Flowage/Killag River, Crusher Lake, Mud Lake, Tent Brook and Cope Brook (Beaver Dam Mine Site area) and associated drainage are the watercourses that will receive direct discharge and/or their catchment area. The vegetation consists of spruce, fir, and some hardwood. Logging has been widely carried out more recently including clear cutting in the immediate area of the deposit. Historic mining has occurred within the proposed Beaver Dam Mine property, which is detailed in Section 2.5 and Section 6.5 (Geology, Soils and Sediment Quality).

The Haul road is located in generally low-lying area with a mosaic of upland forests and wetlands. Forestry is the main land use that continues in the area and the existing road was constructed to allow access for logging. There is evidence of historic mining along the haul road.

At Touquoy Mine catchment areas drain mainly to the Moose River and its tributaries with the southern area of the property draining to Scraggy Lake. The runoff from the site infrastructure areas has been altered and is managed and controlled by means of collection ditches and ponds with collected water being discharged to Scraggy Lake. Fish River drains Square Lake to Scraggy Lake and both lakes are part of the Fish River Watershed that flows west and then south into Lake Charlotte, eventually draining to Ship Harbour.

2.4.2 Climate

The Project is located inland and somewhat removed from the immediate climatic influence of the Atlantic Ocean. It is characterized by warmer summers and cooler winters. Daily rainfall, snowfall and mean temperature data were obtained from the Environment Canada Middle Musquodoboit Climate Station (Climate ID 8203535) for a 41-year period between 1968 to 2016. Monthly lake evaporation normals were obtained from the Environment Canada Truro Climate Station (Climate ID 8205990), which is the closest climate station to the Project that collects lake evaporation data.

The average monthly temperature at the Site ranges from a low of -6.2°C in January to a high of 18.5°C in July. The lowest average total monthly precipitation occurs in June (94.8 millimetres [mm]), while the highest occurs in November (137.1 mm). Hurricanes are also possible in this region. The largest hurricane on record, recorded at Halifax International Airport (approximately 80 km west of the Site), was Hurricane Beth in 1971 with 296.4 mm of rainfall over 48 hours. This has been considered in the development of water management structures (i.e., settling ponds and diversion ditches) at the Beaver Dam Mine Site (Section 2.7.2.9).

Nova Scotia Environment and Climate Change (NSECC) provides climate change projections across the province (NSE 2020). The two climate regions nearest the Project (i.e., Halifax Regional Municipality and Truro, NS) project a 5% increase in short period rainfall intensity for the 2020s according to NSE (2020). As such, a 5% increase to the historic Intensity, Duration and Frequency (IDF) curve was incorporated into the design of water management structures at Beaver Dam Mine site and are therefore sized to consider climate change Appendix P.4 Mine Water Management Plan).

2.4.3 Current Land Use

The Project occurs within an area used for forestry with existing road used to access logging areas. The area is used by recreational hunters and fishers. The existing roads are used by light vehicles and recreational vehicles to access areas lakes and rivers as well as access east of the Killag River where there are camps and gathering sites. AMNS has and continues to undertake geological and geotechnical drilling to support the EIS and mine plans. Environmental monitoring is ongoing to support the Project.

The Nova Scotia Salmon Association (NSSA) leads the West River Sheet Harbour Acid Mitigation Project, which involves the operation and maintenance of automated lime dosers on both the Killag River and the West River (NSSA 2020). The lime doser on the Killag River is situated downstream from the proposed Project. The lime dosers are intended to buffer the naturally low pH of river water downstream to a more suitable pH to support Atlantic salmon and brook trout (NSSA 2020). In addition to these liming efforts, the NSSA conducts monitoring of Atlantic salmon (e.g., annual smolt monitoring, adult monitoring, electrofishing surveys) as well as other ecosystem components, such as invertebrates and water chemistry (NSSA 2020).

Touquoy Mine is currently an operating mine and land use in the area includes recreation, hunting and fishing as well as traditional land pursuits.

2.4.4 Traditional Land Use

The Confederacy of Mainland Mi'kmaq (CMM) was retained in 2009 by GHD Limited on behalf of the AMNS to complete a Mi'kmaq Ecological Knowledge Study (MEKS) for the proposed Project at the Beaver Dam Mine Site. In 2015, CMM was retained to update the MEKS, due to changes in the Haul Road to include approximately 4 km of new construction. CMM was then retained again in 2016 to finalize the MEKS to include the revised Project Area (PA) and any additional information.

In addition to the MEKS cited above, in 2018, a Traditional Land and Resource Use Study (TLRUS; MFC 2019) was undertaken by Millbrook First Nation to document historical and current use of the Project Area and surrounding areas by the Millbrook First Nation. This document was shared with AMNS under a confidentiality agreement. AMNS has integrated information obtained from the TLRUS, with permission from Millbrook First Nation, in appropriate sections of the EIS.

There are a number of activities associated with the harvest and use of plants, animals and fish within the PA and in the Local Assessment Area (LAA) that relate to historical traditions and customs of the Mi'kmaq that are still practiced today. As described, the TLRUS (MFC 2019), the MEKS and residents of the Beaver Lake IR 17 identify trapping and hunting activities, plant and berry gathering, and fishing in, near and surrounding the PA for purposes of sustenance, spiritual and cultural practice. The TLRUS (MFC 2019) described the frequency of use within the LAA which can be summarized as regular: weekly to annually across all seasons. This means the area was, and still is, an important resource area for the Millbrook First Nation community members and by extension, all Mi'kmaq of Nova Scotia, and any Project activities may have potential impacts on the ability of the Mi'kmaq of Nova Scotia to access certain areas to practice their rights where species with important cultural relevance may be found. Wild meat was traditionally a staple of the Millbrook First Nation diet, and a few of the harvesters interviewed for the TLRUS (MFC 2019) indicated they rely mainly on this food source and they share their food with other community members, rather than purchase their meat at a local supermarket.

2.4.5 Significant Areas

Some Mi'kmaq community members have camps on Crown land where they go to enjoy peaceful recreational and traditional activities with family and community members. There camps are documented within 1 km of the Haul Road and multiple other camp locations throughout the LAA (MFC 2019) The approximate distances of these areas from the PA (i.e., Beaver Dam Mine Site, Haul Road, and Touquoy Mine Site) is summarized in Table 2.4-1.

Table 2.4-1: Protected Areas with Provincial Designation

Provincially Designated Areas	Approximate Distance (From Beaver Dam Mine Project Area)	Direction	Type of Designation
Tait Lake Nature Reserve	1 km from Beaver Dam Mine Site	North	Nature Reserve
Cowan Brook Nature Reserve	9.5 km from Touquoy Mine Site	South	Nature Reserve
Twelve Mile Stream Wilderness Area	4.5 km from Beaver Dam Mine Site	Northeast	Wilderness Area
Liscomb Game Sanctuary	7.3 km from Beaver Dam Mine Site	East	Game Sanctuary
Tangier Grand Lake Wilderness Area	2.2 km from intersection of Moose River Cross Road and Mooseland Road	South	Nature Reserve
Ship Harbour Long Lake Wilderness Area	Adjacent to Mooseland Road	West	Nature Reserve

2.5 Project History

2.5.1 Beaver Dam Mine

The proposed Beaver Dam mine site has been subject to exploration and mining activity since gold was first discovered in 1868. Between 1871 and 1949, there were intermittent attempts to develop and mine the area, initially focused on the Austen Shaft area and later the Mill Shaft area located approximately 1.2 km west of the Austen Shaft. The small Papke Pit located approximately 400 m west of the Austen Shaft was excavated in 1926; however, the majority of development was focused on a belt of quartz veins in greywacke and slates that was approximately 23 m wide where intersected from the Austen Shaft. Approximately 967 ounces (oz) of gold production is recorded for Beaver Dam between 1889 and 1941. From 1978 until 1988, several companies drilled a combined 251 diamond drill holes for 47,935 metres (m). Some of these drill holes were completed underground via an exploration decline installed in the mid-1980s that reached a maximum depth of 100 m below surface. In 1987, a small open pit was also excavated in the Austen Shaft zone. Approximately 2,445 oz of gold production was also recorded for Beaver Dam between 1986 and 1989. Between 2005 and 2009 two companies drilled a combined 153 diamond drill holes for 22,010 m and completed several other exploration programs including an aeromagnetic survey, a till survey, and a follow-up reverse circulation drilling program for geochemical purposes. Additional details on historic mining at the Beaver Dam Mine Site is provided in Section 6.5 (Geology, Soil, and Sediment Quality).

AMNS secured rights to the property in 2014 and executed an exploration program whereby 38 diamond drill holes for 7,810 m were completed over the proposed surface mine area with the goal of increasing subsurface knowledge of the site and converting inferred gold resources to measured or indicated resources

There is evidence of historical mining at the site, including access roads/laydown areas, abandoned cabins, hunting blinds, old mine workings, dam structures, apparent building foundations, waste rock piles, and an old mining excavation. There are currently no permanent buildings in use and the site is not serviced. AMNS is committed to removing the historic tailings and waste rock from the site and disposing in the mined-out pit at Touquoy.

AMNS has undertaken exploration activities with the proposed Beaver Dam Mine Site. A project description was submitted to IAAC in 2015 (Atlantic Corporation 2015) with an Environmental Impact Statement (EIS) submitted in 2017 (AGC 2017). A revised EIS was submitted in February 2019 to address the first-round information requests (IR1). This updated Project Description and EIS is submitted to address changes in the Project Description and advances in detailed engineering as well as to address IR2 (AMNS 2021a).

2.5.2 Touquoy Mine

In 2012, an application for Industrial Approval (IA) and supporting documentation was prepared by Conestoga-Rovers & Associates (CRA) (CRA 2012) and submitted to NSE on behalf of AMNS. The application was based on the feasibility level design completed by Golder Associates Ltd. (Golder) in 2007 and revised in 2010. The 2011 Preliminary Reclamation plan (CRA 2011) was submitted as part of the IA Application. The IA application was approved on March 24, 2014, under Approval No. 2012- 084244.

Following receipt of the initial IA in March 2014, an update to the project feasibility level design was completed in July 2015 by Stantec (Stantec, July 7, 2015) to include updates to the mine development plan primarily relating to design changes for the TMF. The design was finalized, and drawings issued for construction in 2016 by Stantec.

The Project has and is currently in the process of applying for amendments with the NSE for modifications of infrastructure. A Class 1 Provincial Environmental Assessment for the site will be submitted later in June 2021. This will be followed by IA amendment applications.

2.6 Geology and Resources

2.6.1 Regional Geology

In Nova Scotia, two distinct geological terranes, the Avalon Terrane to the north and the Meguma Terrane to the south, are juxtaposed along the Cobequid–Chedabucto Fault Zone (CCFZ).

The Avalon Terrane comprises multiple successions of sedimentation and volcanism, together with felsic to mafic igneous intrusion. A number of metalliferous deposits have been recognized in the Avalon Terrane, mostly within Pre-Cambrian rocks, including carbonate hosted zinc skarn deposits, stratabound massive sulphide deposits, quartz-vein hosted high-grade gold mineralization in gneiss and diorite, polymetallic volcanic-hosted massive sulphide deposits in volcanic rocks and porphyry-style mineralization (Donohoe, 1996).

The Meguma Terrane consists of marine sedimentary and volcaniclastic rocks together with bimodal volcanic rocks. The terrane has hosted most of the gold mineralization exploited historically (from 1860 onward) in Nova Scotia with approximately 1.2 Moz Au produced (Bierlein and Smith, 2003).

Post juxtaposition, a series of shallow basins developed on both sides of the CCFZ. These are infilled by slate, quartzite and volcanic rocks of the Rockville Notch Group, and range in age from Early Silurian to Early Devonian (White and Barr, 2012).

Numerous, late syntectonic to post-tectonic, mainly Middle to Late Devonian, peraluminous, granitic plutons have intruded the earlier sequences (White and Barr, 2012).

The oldest known rocks of the Meguma Terrane are the greywackes and argillites of the Cambrian to Ordovician-aged Meguma Supergroup. The Meguma Supergroup is divided into two stratigraphic units, the basal greywacke dominated Goldenville Group and the overlying, finer-grained, argillite-dominated Halifax Group (Figure 2.6-1).

The basal contact of the Goldenville Group is not known, but the Goldenville Group is at least 5,600 m thick while the overlying Halifax Group averages approximately 4,400 m. These sediments were uplifted and deformed into a series of tightly-folded, subparallel, northeast-trending anticlines and synclines during the Acadian Orogeny (ca. 410–380 Ma). The sediments have been metamorphosed to greenschist to amphibolite (staurolite) facies and have been intruded by granites and minor mafic intrusions.

The Goldenville Group comprises, from oldest to youngest:

- Moose River Formation;
- Tangier Formation; and
- Taylors Head Formation.

2.6.2 Beaver Dam Deposit (Resource)

The Beaver Dam deposit is hosted in the southern limb of a north-dipping overturned anticlinal fold. The Moose River Formation is relatively thick in the vicinity of the Beaver Dam deposit (Figure 2.6-1 and Figure 2.6-2). The host stratigraphy is offset into segments by two northwest trending faults; the sinistral Mud Lake Fault and the dextral Cameron Flowage Fault. The Mud Lake Fault truncates, and forms the eastern boundary to, the Main Zone mineralization.

Lithologies at Beaver Dam have been metamorphosed to amphibolite facies (biotite grade) increasing to higher (staurolite) grade with proximity to the River Lake Pluton, the contact of which is about 2 km west of the Beaver Dam deposit.

Gold mineralization at Beaver Dam has been recognised over a strike length of approximately 1.4 km, extending from the Main Zone northwest to the Mill Shaft Zone. Historic drilling has shown that mineralization weakens between the Main Zone and Mill Shaft Zone. The eastern end of the main zone is controlled by the Mud Lake Fault and possible offsets to the mineralization have been identified between the Mud Lake and Cameron Flowage faults and in the Northeast Zone, immediately east of the Cameron Flowage Fault.

The mineralised zone can reach as much as 100 m in width with better gold grade (e.g., >0.5 gpt) material typically confined to 5 m to 40 m widths within that zone. Mineralization has been identified in historical drill holes at vertical depths of >600 m below surface and remains open below that depth.

Gold mineralization is hosted within quartz veins and within the argillite and greywacke host rocks. Mineralized quartz veins are typically 0.5–20 cm in thickness, are commonly bedding parallel, but can also include cross-cutting veins. Sulphide assemblages include pyrrhotite, pyrite and/or arsenopyrite with lesser chalcopyrite, galena or sphalerite. Gold commonly occurs within quartz veins as coarse (>1 mm) grains and clusters of finer, but still visible (<1 mm), grains. Coarse gold grains are more likely to be found at vein-wall rock contacts and are often spatially associated with sulphides.

In the immediate vicinity of the deposit the host stratigraphy has been subdivided into several mappable units, from oldest to youngest: the Crouse Mudstone, Hangingwall Greywacke, Papke Mudstone, Millet Seed Sandstone and Austen Mudstone. The mineralized zone appears to gently cross-cut this macro-stratigraphy. Gold mineralization is often associated with sulphides including pyrrhotite, pyrite, arsenopyrite, and chalcopyrite.

Figure 2.6-1: Beaver Dam Deposit

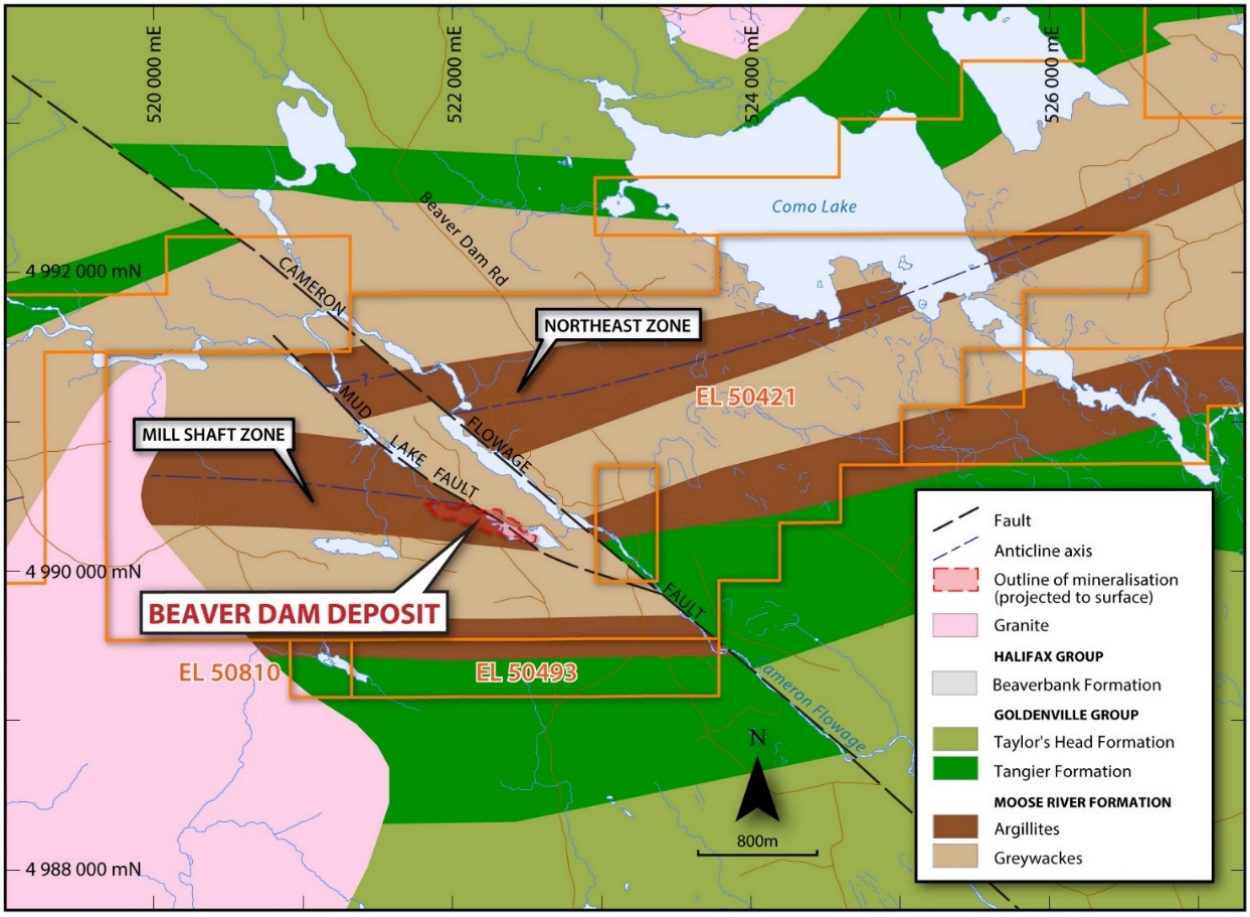
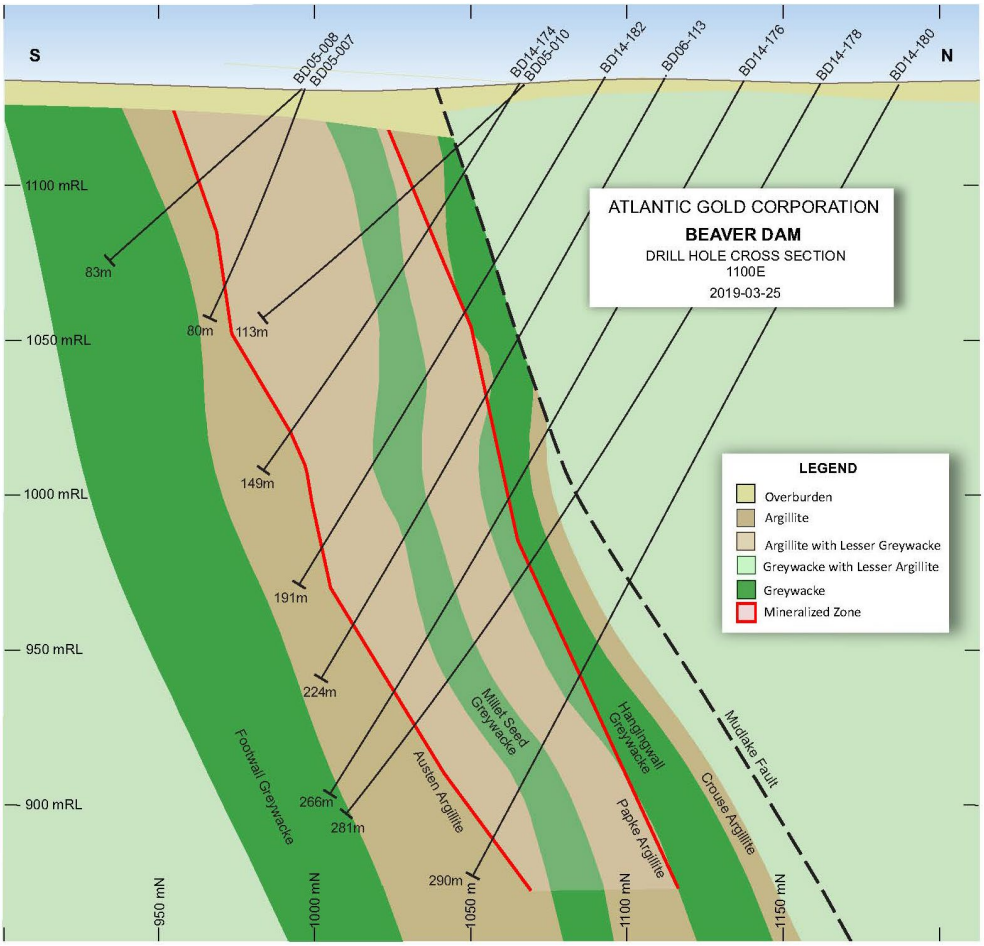


Figure 2.6-2: Cross Section of Beaver Dam Deposit



2.7 Project Components

The Beaver Dam Mine Project will operate as a satellite surface mine that will transport crushed ore along an approximately 31 km Haul Road to the Touquoy Mine in Moose River. Tailings will be disposed of in the exhausted Touquoy open pit.

The primary components associated with the Beaver Dam Mine Project include the following:

- Beaver Dam Mine Site:
  - Open pit for extracting ore and waste rock;
  - Mine site Haul Roads;
  - Waste material storage piles for waste rock (non-acid generating (NAG) and potential acid generating (PAG), one topsoil, three till and one organics stockpiles;
  - Run of mine (ROM), and low-grade ore (LGO) stockpiles;
  - Optional primary crusher;

  - Operational facilities; and
  - Water management.
- Haul Road any bypass roads for transporting ore; and,
- Existing Touquoy Mine Site.

The location of components at the Beaver Dam Mine Site, the Haul Road, and the location of the relevant components of the Touquoy Mine Site related to the Beaver Dam Mine Project are shown in Figures 2.3-1 to 2.3-4.

2.7.1 Summary of 2021 Updates

Geographical restrictions have been applied to the Beaver Dam Mine infrastructure layout to minimize disturbance to environment. The open pit, for example is at least 50 m away from the Cameron Flowage/Killag River to the north. Waste and till storage facilities, as described in Section 2.7.2 are distant from lakes and property boundaries, 500 m from all surveyed Boreal Felt Lichen, 50 m from all surveyed Boreal Felt Lichen habitats, and 100 m from all surveyed Frosted Glass Lichen (Section 6.13 Species of Conservation Interest and Species at Risk). Wetland disturbance at Beaver Dam by waste storage piles is minimized, wherever possible (Section 6.8 Wetlands).

Project components of the Beaver Dam Mine Project have been altered since the February Revised 2019 EIS (AMNS 2019) and in consideration of the geographical restrictions defined above are shown on Figure 2.7-1 that include the following:

- Adjustment in the location of the Waste Rock Storage and Low -Grade storage area to the west and away from critical habitat including blue felt lichen and frosted glass lichen.
- High Grade Stockpile will form part of the ROM Stockpile.
- Inclusion of a PAG stockpile south of the pit.
- Adjustment in the location of temporary stockpiles (i.e., topsoil, till and organic) to avoid critical habitat and minimize impacts to wetlands. The organic stockpile was not included in the 2019 revised EIS Project Description.
- Adjustments in the location of mine site haul roads to avoid critical habitat and minimize impacts to wetlands.
- Adjustments and more detailed engineering on administrative and ancillary areas that include the following:
  - Administration/Security Building;
  - Truck Shop/Truck Wash;
  - Crusher Structure and Conveyor (optional);
  - Stormwater/Evaporation Retention Pond;
  - Various Trailers;
  - Septic and Propane Tanks;
  - Petroleum and Hazardous Material Storage; and
  - Explosive Storage Area.
- Detailed water management structures including water management settling ponds, diversion ditches and water treatment.

Prepared For:

Atlantic Gold

FIGURE 2.7-1

Beaver Dam Mine Project

2019 vs 2021 Updated Infrastructure Layout

- 2019 Infrastructure Layout
- 2021 Updated Infrastructure
- Local Road
- Dry Weather / Seasonal Road
- Track
- Field Delineated Watercourses
- NSTDB Mapped Watercourses
- Field Delineated Wetlands
- NSE Wetlands
- Lakes
- Project Area



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 200 400 800 m

1:15,000 Scale when printed @ 11" x 17"

Drawn By: XX
Reviewed By: XX

Date: 5/10/2021

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

McCallum Environmental Ltd.

Document Name: BD_EIS_Fig2.1-X 2019vs2021

2.7.2 Beaver Dam Mine Site

2.7.2.1 Open Pit

Mining is based on conventional open pit methods suited for the project location and local site requirements. The mining fleet will include diesel powered down the hole (DTH) drills with 144 mm bit size for production drilling, diesel-powered RC drills for bench-scale grade control drilling, 5.0 cubic metres (m^3) bucket size diesel hydraulic excavators and 9.0 m^3 bucket sized wheel loaders for production loading, and 64 tonne (t) payload rigid-frame haul trucks and 41 t articulated trucks for production hauling, plus ancillary and service equipment to support the mining operations. In-pit dewatering systems will be established for the pit. All surface water and precipitation in the pits will be handled by submersible pumps.

Holes will be drilled into the host rock to receive explosives used for blasting. Previous exploration drilling has mapped the host rock for ore-bearing potential. Further grade control drilling will be undertaken to confirm any local variation in ore distribution allowing blast patterns to be executed to maximize production of ore and minimize production of non-ore bearing waste rock. All blasting activities will be conducted by a licensed contractor.

The open pit will remove approximately 56.6 million tonnes (Mt) of material (i.e., ore, non-ore bearing waste rock, till, and organic material) over the life of mine. The production schedule for the Beaver Dam Mine is shown in Table 2.7-1 and Figure 2.7-2. The pit will be mined in a west/east phases. Ultimate pit limits are split into phases or pushbacks to target higher economic margin material earlier in the mine life. The ultimate pit is subdivided into two phases, west and east, but for considerations of vertical advance the pit is mined as one phase from top to bottom. A small starter pit phase is also planned for the northwest corner of the pit to provide construction materials early in the mine life. The ore mined from the pit will range from 0.75 Mt to 2.1 Mt per year over the life of mine with approximately 0.5 Mt to a maximum of 14.9 Mt of waste being generated over life of mine. The open pit will be advanced from the surface at 130 to 155 masl down to 45 masl. At completion, the open pit will measure approximately 900 m along its east-west axis, approximately 500 m along its north-south axis, with a depth of ranging approximately 175 to 200 m based on the current ore delineation. The total area comprising the open pit will be approximately 31 ha.

Table 2.7-1: Summary of Mine Production Schedule

Materials	Unit	LOM	2022	2023	2024	2025	2026	2027
Total ore Mined from pit	Mt	7.84	0	1.32	2.10	1.76	1.90	0.75
Total waste mined	Mt	44.03	2.85	14.96	11.98	9.35	4.33	0.55
Strip ratio		5.6	0.0	11.4	5.7	5.3	2.3	0.7
Total material mined	Mt	51.86	2.85	16.28	14.08	11.12	6.23	1.30
Cumulative Material Mined	Mt		2.85	19.13	33.22	44.33	50.56	51.86
Total Material Moved	**Mt**	**56.66**	**2.85**	**16.36**	**14.08**	**11.45**	**6.43**	**3.00**
Total Ore Milled	Mt	12.47	0	1.23	2.10	2.10	2.10	2.40
Gold Grade	g/t	1.03	0.00	1.59	1.38	1.27	1.19	0.65

Source: Aucenco 2021

Note: LOM – Life of Mine; Differences in (LOM) totals are attributed to rounding between Kilotonnes to Milltion tonnes

Note: Milled includes ore includes from other operations

At Beaver Dam, ore will be hauled to a ROM pad that will be located 600 m south of the pit, and then ROM ore will be hauled by on-highway haulers from Beaver Dam to the process plant at Touquoy operations. Waste rock from Beaver Dam will be deposited into PAG and NAG Waste Rock Storage Facilities (WRSFs) to be situated 200 m south and 1,500 m west of the pit, respectively. The high grade ore will be stored on ROM stockpile.

Mining operations will be based on 365 operating days per year with two 12 hour shifts per day. An allowance of 12 days of no mine production has been built into the mine schedule to allow for adverse weather conditions.

Maintenance on mine equipment will be performed in the field with major repairs to mobile equipment in the shops located near the ROM pad.

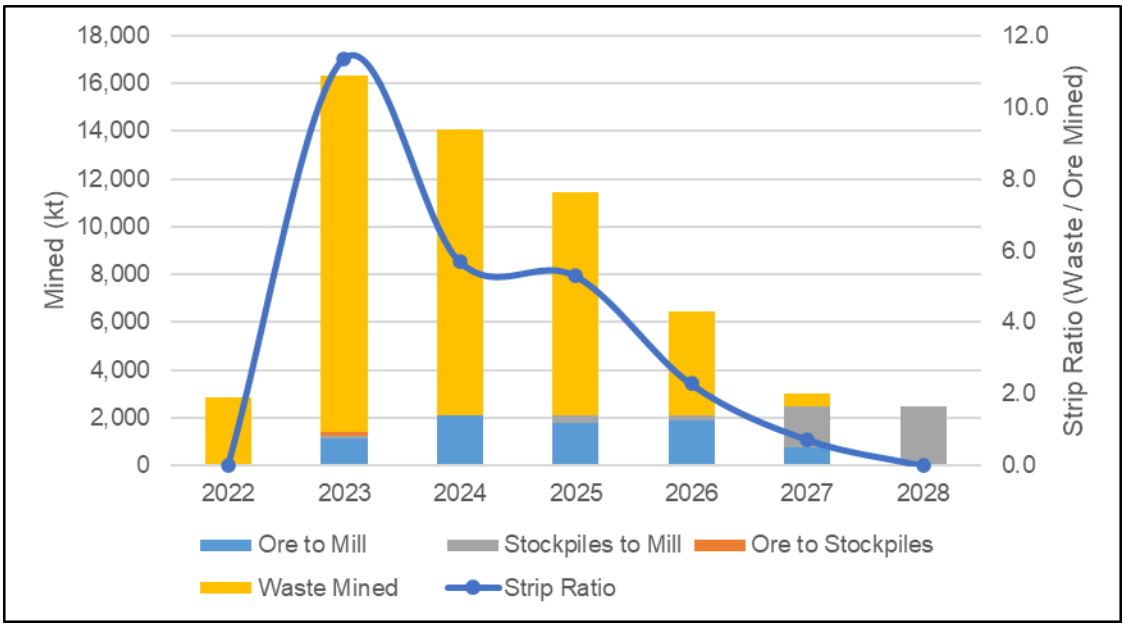
Clearing, grubbing, grading, and stockpiling of vegetation, topsoil, and till in the pit area will be conducted progressively prior to accessing bedrock for mining purposes, to avoid erosion. All topsoil and till will be stored in stockpiles for use in reclamation and construction of berms, impoundments, mine site roads, and/or general site grading. Stockpile locations are shown on Figure 2.3-2 and detailed in Section 2.7.2.3. Once vegetation, topsoil, and till have been removed, drilling and blasting will be used to mine ore and non-ore bearing waste rock, as well as establish benches along rock walls.

2.7.2.2 Waste Material Stockpiles

The stockpiles on the Beaver Dam Mine site consist of the following:

- Waste Rock Storage Area (NAG and LGO stockpiles);
- Potential Acid Generating (PAG) Stockpile;
- Topsoil Stockpiles (TSS);
- Till Stockpiles (TLS); and
- Organic Material Stockpile (OMS).

Figure 2.7-2: Mine Production Schedule



The proposed stockpile locations including the waste rock storage area, potential acid generating stockpile and reclamation material stockpiles is summarized in Table 2.7-2. Stockpiles are located to minimize impacts to wetlands, water courses, surveyed lichen and lichen habitat buffer zones and the Crusher Lake buffer zone.

Table 2.7-2: Waste Material Stockpile Location and Design Criteria

Stockpile	General Description	Design Criteria				Bulk Density (t/m^3)	Swell Factor	Placed Density
		Area (ha)	Maximum Crest Height (m)	Weight (Mt)	Volume (Mm^3)			
Waste Rock Storage Area								
Non-Acid Generating Stockpile (NAG)	One NAG Stockpile located in the most Western extent of site, accessed by existing public roadways off Beaver Dam Road.	60	190	34.28	16.32	2.73	30%	2.10
Low Grade Ore Stockpile (LGO)	One LGO located in the Western portion of site directly East in near proximity to the NAG stockpile, accessed by existing public roadways off Beaver Dam Road.	12	170	2.45	1.17	2.73	30%	2.10
Potential Acid Generating Stockpile Area								
Potential Acid Generating Stockpile (PAG)	One Pag Located in the North-Central section of site, directly North of the originally proposed crusher pad, accessed by Beaver Dam Road.	10	180	2.50	1.19	2.73	30%	2.10
Temporary Stockpiles								
Topsoil Stockpiles (TSS)	Four small topsoil stockpiles are planned for the site. They are spaced across the site near areas requiring topsoil stripping.	15	165	1.10	0.55	2.00	-7%	2.00
Till Stockpiles (TLS)	Two till stockpiles are planned. They are both located East of the in the Central-East end of site.	15	165	2.66	1.73	2.00	30%	1.54
Organic Material Stockpile (OMS)	Located on the South-East section of site, accessed by public roads off Beaver Dam Road.	31	165	2.29	1.49	N/A	N/A	N/A

Source: Golder 2021 included in Appendix A.2a (Mine Wasted Stockpiles Geotechnical Design) .

ha = hectares; m =meters Mt = million tonnes; Mm^3 = million cubic metres; t/m^3 = tonnes per cubic metre; % = percent; N/A = not applicable.

2.7.2.3 Waste Rock Storage Area

Waste rock is generated during open pit development and used during operations for grading and construction of embankments and other infrastructure. The waste rock (NAG and PAG) stockpiles locations are within areas to avoid water courses, surveyed lichen and lichen habitat buffer zones and the crusher lake buffer zone (AMNS 2021). Stockpiles are also sited to minimize disturbance of surveyed wetland area. Waste rock not used for site development is stored permanently in the Waste Rock Storage Area (WRSA) to be reclaimed at closure. The WRSA (i.e., NAG rock stockpile, and the LGO stockpile), is located to the northwest of the Beaver Dam Mine Site as shown on Figure 2.3-2. A PAG stockpile, situated immediately south of the pit (Figure 2.3-2), described below, to allow for closure drainage to be directed towards the pit. Preliminary waste rock characterization has been completed, with pit excavated materials tagged as PAG vs. NAG based on block model codes defined by 3D solids delineating PAG materials (AMNS 2021).

2.7.2.3.1 Non-Acid Generating Stockpiles

The NAG rock stockpile will consist of benches 10 m in height with approximate with 15 m horizontal benches between each lift during construction (Table 2.7-3). During placement, waste rock is end-dumped at angle of repose of the waste rock. As construction proceeds to a higher lift, the preceding lift will be progressively recontoured during operations to a closure slope of 2.7H:1V, with benches left between each lift to allow a final overall slope from toe to crest of 3.0H:1V. The bench widths in some areas may vary between 3 to 4 m. The waste rock areas will have a 21 m dual lane haul road wrapping around the sides of facility for progressive access to all lifts, suitable for 64 t payload haulers. A 10% maximum grades on access haul ramps is included in the design. Table 2.7-3 provides the lift capacities.

Table 2.7-3: Waste Rock (NAG LGO and PAG) Lift Capacities

Lift top Elevation (m)	NAG Volume (MLCM)	NAG Capacity (Mt)	NAG Cumulative Capacity (Mt)	Low Grade Ore Volume (MLCM)	Low Grade Ore Capacity (Mt)	Low Grade Cumulative Capacity (Mt)	PAG Volume (MLCM)	PAG Capacity (Mt)	PAG Cumulative Capacity (Mt)
150	0.38	0.80	0.80	0.26	0.54	0.54			
160	3.53	7.41	8.21	0.58	1.23	1.77	0.2	0.43	0.43
170	4.84	10.17	18.38	0.32	0.68	2.45	0.59	1.24	1.67
180	4.16	8.73	27.11				0.25	0.52	2.19
190	3.41	7.17	34.28						

Source AMNS 2021.

m = metre; Mt = million tonnes; NAG = non-acid generating; PAG = potential acid generating.

Slope stability analysis of the WRSA was completed by Golder Associates Ltd. (Golder 2021, Appendix A.2a). The slope stability report recommended that the stockpile could be constructed to elevation 190 m using the geometry above and satisfy the stability requirements. In accordance with the Golder recommendations (Golder 2021, Appendix A.2a), further construction to the final design elevation is based on monitoring and surveillance results during construction. Stability analysis will be completed by a professional engineer and provided to NSECC/DEM prior to exceeding elevation 190 m (Table 2.7-3).

2.7.2.3.2 Potential Acid Generating Stockpile

The PAG stockpile is located in the north-central section of site south of the open pit (Figure 2.3-2). As noted above, preliminary waste rock characterization has been completed, with pit excavated materials tagged as PAG vs. NAG based on block model codes defined by 3D solids delineating PAG materials. The PAG stockpile has been designed to store 2.5 Mt of PAG within 10 ha footprint (Table 2.7-3). The design includes a 180 m maximum height crest (Table 2.7-3). The lift capacities for PAG are provided in Table 2.7-3.

During construction, historic tailings and waste rock designated as PAG will be either temporarily or permanently stored in the PAG area depending on final quantities. It is anticipated that the majority of historic tailings will be removed from the Beaver Dam Mine site and stored sub-aqueously in mined-out Touquoy Pit. Appendix A.2b (Conceptual PAG Closure Options) additional details on historic tailings assessment of disposal options and is discussed in Section 6.5 (Geology, Soils and Sediment Quality) as well as the draft Reclamation and Closure Plan (Appendix P.2).

2.7.2.3.3 Ore Stockpiles

The LGO stockpile is located adjacent to the NAG Stockpiles with a footprint of 12 ha and is designed to achieve a maximum height of 170 m (Table 2.7-3) and Figure 2.3-2. The ROM stockpile is located near the pit. When ore is mined from the pit it will either be delivered to the ROM pad or the "low grade waste" stockpile in accordance with the following sequence:

- The ROM stockpile is for storing ore for delivery to Touquoy within the coming weeks. There is up to a 4-week capacity that can be stored during short-term periods of ore mining from the pit that exceed capacity to haul off site.
- During the construction period of the mine, any ore encountered in planned pit excavation will be stockpiled within the "low grade waste" NAG waste rock stockpile footprint. This material, less than 200 kilo tonnes (kt) estimated, is planned to be directed to the ROM pad before this area gets covered over by waste rock mined later in the mine life.
- The "low grade waste" stockpile is also planned to store all inferred resource and any mineralized materials that the short to medium term mine planning may want segregated from the bulk NAG waste rock. While this material is not considered ore for the purposes of the Feasibility Study (AMNS Internal, *In Progress*), experience at the Touquoy Mine operations would suggest that a dedicated area should be planned for segregating additional mineralization identified during operations.

2.7.2.3.4 Topsoil Stockpiles

Four topsoil stockpiles are planned for the site and are spaced across the site near areas requiring topsoil stripping (Figure 2.3-2). Topsoil will be salvaged as required from all disturbed areas and stockpiled in designated areas. An average topsoil thickness of 0.3 m has been assumed for all disturbed areas. The total disturbance for topsoil stockpiles is 15 ha with a design crest height maximum of 165 m and total storage capacity of 1.10 Mt and 0.55 Mm^3 (Table 2.7-4). The topsoil lifts will be 5 m and 3:1 slope. A 17 to 20 m berm allowance is included in the design. An overall slope range of 3:1 will be established once berms and ramps are completed. A summary of the amount of topsoil lift capacities for each stockpile during construction is provided in Table 2.7-4.

Additional topsoil piles with the following capacities are designed to store materials salvaged from the waste and ore stockpile footprints, as well as from the haul road footprints. Where possible, the topsoil materials will be windrowed directly outside the design footprints, rather than hauled to these stockpiles. An annual or light seeding will be applied to limit erosion and potential suspended solids. Drainage ditches will be established around the stockpile and water collect will be directed to settling ponds, which are described in Water Management (Section 2.7.2.9).

Table 2.7-4: Topsoil Storage Capacities

Source	Area (m^2)	Topsoil Volume (BCM)	Placed Volume (MLCM)	Planned Pile
Open Pit	314,000	94,200	0.11	North Pit Pile
Non-acid generating stockpile Haul Roads	829,000	248,700	0.34	North SP Pile
PAG SP	98,000	29,400	0.07	South Pit Pile
Crusher Area	120,300	36,100	0.03	South Site Pile

m^2 = square metres; BCM = bank cubic metres; MLCM = million loose cubic metres; SP = stockpile; PAG = potential acid generating.

2.7.2.3.5 Till Stockpiles

Two till stockpiles are planned (i.e., west and east) and they are both located east of the in the Central-East end of site (Table 2.7-5 and Figure 2.3-2). Till is defined as all materials between the topography surface and the bedrock contact surface, minus estimates for topsoil. Updates to bedrock contact surface have recently been made that will be included in design. The altered surface will be incorporated into an updated till quantity estimate during the detailed mine planning stage of the Project. The planned lifts for till stockpiles will be 10 m and a 20 m berm allowances for access around each lift. An overall slope range of 3:1 will be established once berms and ramps are completed. The lift top elevation, volume, and capacity is provided in Table 2.7-5. A portion of the till materials, related to the historic tailings and contamination from historic workings, is planned to be stored in the PAG stockpile location, however, the majority of historic tailings, as discussed below and in Section 6.5 (Geology, Soil and Sediment Quality), will disposed sub-aqueously in the mined-out pit at the Touquoy Mine.

An annual or light seeding will be applied to limit erosion and potential suspended solids. Drainage ditches will be established around the stockpile and water collect will be directed to settling ponds, which are described in Water Management (Section 2.7.2.9 and Appendix P.4 Mine Water Management Plan).

Table 2.7-5: Till Storage Capacities

Lift top Elevation (m)	West Till Capacity (Mt)	West Till Cumulative Capacity (Mt)	East Till Capacity (Mt)	East Till Cumulative Capacity (Mt)
150	0.15	0.15		
160	0.30	0.45	0.27	0.27
170	0.24	0.69	0.96	1.24
180			0.73	1.97

m = metre; Mt = million tonne.

2.7.2.3.6 Organic Stockpile

One organic stockpile is planned for the site, which is located on the south-east section of site. Organics will be salvaged as required from all disturbed areas and stockpiled in designated areas. The total disturbance for topsoil stockpiles is 31 ha with a design crest height maximum of 165 m (Table 2.7-6). The organic lifts will be 5 m and 7:1 slope. A 17 to 20 m berm allowance is included in the design. A summary of the organic lift capacities is provided in Table 2.7-6.

An annual or light seeding will be applied to limit erosion and potential suspended solids. Drainage ditches will be established around the stockpile and water collected will be directed to settling ponds, which are described in Water Management (Section 2.7.2.9).

Table 2.7-6: Organic Storage Capacities

Lift top Elevation (m)	Organic Till Capacity (Mt)	Organic Till Cumulative Capacity (Mt)
160	0.85	0.85
165	1.45	2.30

m = metre; Mt = million tonne.

2.7.2.4 Historic Tailings and Waste Rock

Historic tailings have been deposited within the footprint of the open pit and will be excavated early in the mine life. Estimated quantities of 50,000 t of historic tailings are described in Historic Tailings Quantities Estimate (Appendix A.2b) . This quantity occurs above the bedrock contact surface and therefore has been measured as part of the overall till quantities coming out of the open pit. A further 350,000 t of till materials is estimated to be affected by the historic tailings and historic mine operations.

These materials will not be sent to the till stockpiles, but rather to the PAG storage area. The historic tailings are planned to be directed off site from Beaver Dam to Touquoy for final deposition. An Historic Tailings Management Plan and a Potential Acid Generating Management Plan have been prepared for the Project to monitor and update estimates when construction and operations commence.

2.7.2.5 Mine Site Roads

Mine site roads will be constructed to enable the mining fleet (loaders, dozers, off-highway haul trucks) to access the stockpile locations and site facilities. The primary use of mine site roads will be the transportation of ore and non-ore bearing waste rock from the open pit to stockpile locations. Mine site Haul Roads will be dual lane and connect the pit exit with the topsoil, till, non-ore bearing waste rock stockpiles and ROM stockpiles.

The roads will be constructed out of non-ore bearing waste rock from the open pit and be approximately 27 m wide, including berms and drainage, with a maximum speed limit of 40 km/h. The density for cut and fill is provided in Table 2.7-7. Specifically, the mine haul road designs include the following inputs:

- 27 m wide haul roads that incorporate dual lane running width and berms on both edges of the haul road;
- 10% maximum grade;
- primarily constructed using pit run waste rock, hauled from pit, then dumped out, with final contouring done by dozers;
- running surface capped by 0.5 m crushed rock layer;
- balanced cut and fill areas built by dozers; and
- areas with excess cut handled by excavators and construction haulers.

Table 2.7-7: Density for cut and fill

Material	Bank Cut Density (t/m^3)	Swell Factor	Placed Density (t/m^3)
Haul Road Rock	2.78	30%	2.10

Additional roads surround the west, north and east limits of the open pit, as well as out to the explosives and magazine storage pads. A pit perimeter road on top of the berm surrounding the pit will be a gravel base and be 12 m wide. The general location of the mine site roads is displayed on Figure 2.3-2. Mine site Haul Roads will be dual lane and connect the pit exit with the topsoil, till, organic and non-ore bearing waste rock stockpiles and ROM stockpiles.

The following design criteria is used for these additional roads.

Pit perimeter road:

- 2 m in height;
- 12 m wide top surface to fit berms on both sides, and sized for travel by highway class vehicles as well as one way travel for articulated hauler;
- 10% maximum grade; and
- primarily fill constructed using pit run waste rock, hauled from pit, then dumped out, with final contouring done by dozers.

Explosive access road and pads:

- 6 m wide for on-highway class vehicle traffic;
- following existing on-site road paths;
- magazine pad dimensions of 20 m x 15 m as per supplier recommendations;
- explosive storage pad dimensions of 50 m x 50 m as per supplier recommendations; and
- balanced cut/fill construction by dozers.

The haul roads run from the open pit entrances on the west side of the pit:

- west of the NAG and low-grade WRSA;
- switchbacking southeast at the exit towards the ROM pad and PAG; and
- till will come out of the east side of the pit onto the haul road to the east and south towards the till stockpiles. The depth of the pit during till excavation will not require exiting to the west.

The pit haul roads at the Beaver Dam Mine Site will be built during the construction phase of the Project. The following table lists the cut and fill quantities estimated to construct the designed Beaver Dam mine haul roads, as well as the pit perimeter berm and the explosives access roads. Fill volumes for the haul road and pit perimeter berms are sourced as NAG rock from the open pit and quantities are provided in Table 2.7-8. The explosives storage road and pad are balanced cut to fill.

Table 2.7-8: Haul Road Construction Quantities

Road	Cut Volume (kBCM)	Fill Volume (kLCM)
Ex-Pit Haul Roads	42	140
Pit Perimeter Berm	0	43
Explosives Roads and Pads	1	2

Source: AMNS (2021).

kBCM = kilo bank cubic metre; kLCM = kilo loose cubic metre.

A pit perimeter road on top of the berm surrounding the pit will be a gravel base and be 12 m wide. The general location of the mine site roads is displayed on Figure 2.3-2.

Mine site Haul Roads will be dual lane and connect the pit exit with the topsoil, till, organic and non-ore bearing waste rock stockpiles and ROM stockpiles.

2.7.2.5.1 In-Plant Roads

One In-Plant Road is identified:

- Mining Infrastructure Area (MIA) In-Plant Access Road.

The road will be designed to a 30 km/hr design and posted speed limit and use the following design criteria: maximum longitudinal grade 12%, two lanes per road with lane width of 3.0 m per lane, 3% road cross-slope. Batter slopes shall be 1 vertical (V) to 3 horizontal (H) fill slopes and 1 V:2H back slopes and 1 vertical to 3 horizontal side slopes with a trapezoidal ditch shape.

2.7.2.5.2 Low-Volume Haul Road

One Low-Volume Haul Roads is identified:

- ROM to MIA Haul Road.

The road will be consistent with a 30 km/hr design and posted speed limit and use the following design criteria: maximum longitudinal grade 8%, two lanes per road with lane width of 15.0 m per lane, 2% road cross-slope. Batter slopes shall be 1 vertical to 3 horizontal fill slopes and 1 vertical to 2 horizontal back slopes and 1 vertical to 3 horizontal side slopes with a v-ditch shape.

At the entrance of the site, the road design modifications will allow for separation of the lanes, so that a gatehouse will be situated between the two lanes.

2.7.2.5.3 Dosing Station Bypass Road

The Dosing Station Bypass Road will be constructed to allow external traffic to access the Nova Scotia Salmon Association (NSSA) Lime Dosing station located along the Cameron Flowage to the east of the project site.

The road will be designed to a 30 km/hr design and posted speed limit and use the following design criteria: maximum longitudinal grade 12%, single lane per road with a lane width of 5.0 m per lane, 3% road cross-slope. Batter slopes shall be 1 vertical to 3 horizontal fill slopes and 1 vertical to 2 horizontal back slopes and 1 vertical to 3 horizontal side slopes with a trapezoidal ditch shape.

2.7.2.6 Infrastructure and Facilities

2.7.2.6.1 Earthworks Platforms

The following earthworks platforms will be constructed for the Beaver Dam Mine Site:

All new facility areas and surrounding areas are graded to ensure stormwater drains away from the facilities during rainfall. Drainage ditches, where necessary, along roadways are 0.6 m bottom channels with a minimum longitudinal grade of 0.5%. At the intersection of drainage paths and access roads or site roads, water will be conveyed across the road via a culvert crossing. Culverts will be installed with rip-rap erosion protection at inlets and outlets and will require regular maintenance to keep them sediment free and free-flowing during rainfall.

2.7.2.6.2 Buildings Administration, Mine Dry and Security

The principal buildings at the Project Site will include a truck shop, a combined building consisting of mine dry, offices and security administration, a gatehouse, and lunch/breakout room building. Where practical, buildings will be modular type construction to reduce construction costs. The truck shop building will be a fabric type construction with 3 haul truck bays and two maintenance bays for lube handling and a warehouse and workshop.

Figure 2.3-2 illustrates the overall site layout and Figure 2.7-3 illustrates the general layout of the plant and ancillary facilities.

The building list including WBS Area, name, building type and size is show in Table 2.7-9.

Table 2.7-9: Beaver Dam Mine Building List

Item	WBS Area	Building Description	Building Type	Building Area (m^2)
1	1311	Truck Shop	Fabric Building	882
2	1330	Mine Dry and Offices	Modular Complex	407
3	1330	Security Administration	Modular Complex	60
4	1330	Lunch / Breakout Room	Modular Complex	21
5	4230	Gate House	Security Trailer	20

2.7.2.6.3 Truck Shop Building

The maintenance shop facility will be a pre-engineered fabric structure with a roof and low walls and limited interior support steel structures. The building will be supported on pre-cast concrete footings.

The facility will house a lube handling bay, warehouse/workshop bay and 3 haul truck bays with 7 m wide door openings. The facility is designed to service and maintain both the mining fleet and the process plant/site services fleet.

2.7.2.6.4 Mine Dry, Office & Security Administration Building

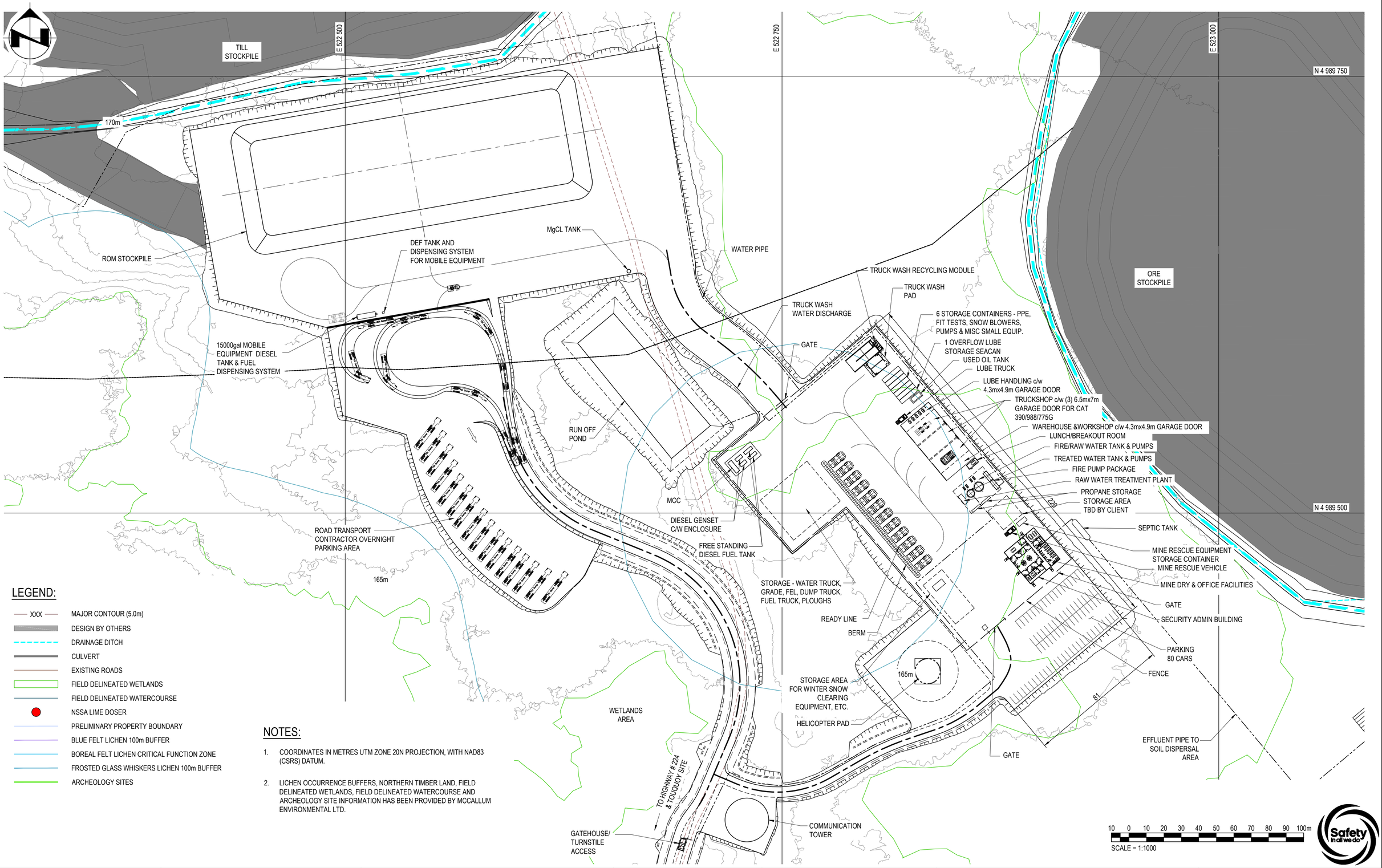
The mine dry, offices and security administration building will be a single-story, modular complex. The building will be supported on timber sleepers sitting above the finished grade level. This security administration building will have separate entry from the mine dry and office building, though it will share common walls.

2.7.2.6.5 Lunch / Breakout Building

The lunch / breakout room building will be a standalone modular building situated south-west of the truck shop. The building will be supported on timber sleepers sitting above the finished grade level.

2.7.2.6.6 Gate House

The gatehouse will be a security trailer situated at the entrance to the Project Site between the two road lanes. The building will be supported on timber sleepers sitting above the finished grade level.



LEGEND:

- XXX — MAJOR CONTOUR (5.0m)
- DESIGN BY OTHERS
- DRAINAGE DITCH
- CULVERT
- EXISTING ROADS
- FIELD DELINEATED WETLANDS
- FIELD DELINEATED WATERCOURSE
- NSSA LIME DOSER
- PRELIMINARY PROPERTY BOUNDARY
- BLUE FELT LICHEN 100m BUFFER
- BOREAL FELT LICHEN CRITICAL FUNCTION ZONE
- FROSTED GLASS WHISKERS LICHEN 100m BUFFER
- ARCHEOLOGY SITES

NOTES:

1. COORDINATES IN METRES UTM ZONE 20N PROJECTION, WITH NAD83 (CSRS) DATUM.
2. LICHEN OCCURRENCE BUFFERS, NORTHERN TIMBER LAND, FIELD DELINEATED WETLANDS, FIELD DELINEATED WATERCOURSE AND ARCHEOLOGY SITE INFORMATION HAS BEEN PROVIDED BY MCCALLUM ENVIRONMENTAL LTD.

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REF	DRAWING No.	REFERENCE DRAWING	No	BY	DATE	REVISION DETAILS	CHKD	ENG	APPR
			K	NH	08APR2021	ISSUED FOR STUDY	KS	KS	AW
			J	SC	07DEC2020	ISSUED FOR CLIENT REVIEW	KS	KS	BH
			C	PM	28SEP2020	PRELIMINARY ISSUE	KS	KS	BH
			B	PM	18SEP2020	PRELIMINARY ISSUE	KS	KS	BH
			A	PM	18SEP2020	PRELIMINARY ISSUE	KS	KS	BH

DRAWN	S. CUI	16SEP2020
DRG CHECKED	K. SHARIATI	07DEC2020
DESIGNED	K. SHARIATI	16SEP2020
DES. APPR	A. WEISZBECK	16MAR2021
PROJ APPR		

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CLIENT: ATLANTIC GOLD CORPORATION

TITLE: MOOSE RIVER CONSOLIDATED PROJECT
BEAVER DAM MINE
SITE LAYOUT
GENERAL ARRANGEMENT

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PROJECT No	SCALE	SIZE
105227	1:1000	A1

DRAWING No	REV
105227-0000-G-102	K

2.7.2.7 Fuel Storage and Distribution

The site will be serviced by both propane and diesel. Diesel will be stored primarily at the mobile equipment fuelling station meant to serve both the mining fleet and the transport fleet. The fueling station consists of a 3,000 heated and insulated tank with a hybrid pump. The fueling system will supplied and owned by a third party vendor who will rent to the site as part of the fuel contract.

The generators will also be supplied with fuel tanks at 13,200 litres each and will be filled by the 3rd party vendor. Propane will be stored at site in two 7,500 L tanks which will be owned by the same vendor as the diesel fuel supplier. Propane will then be plumbed to the various buildings for heating.

2.7.2.8 Power Generation and Distribution

There is no external power supply being considered for the beaver dam site. All power will be generated on site via a diesel fueled generating plant. The generating plant will consist of two low voltage generators rated for 250 kW at 600 V. The plant design includes load shedding in the event of a failure of either generator.

Distribution is accomplished via cabling as there are no significant loads at a distance sufficient to warrant an overhead power line.

2.7.2.9 Water Management

2.7.2.9.1 Mining Infrastructure Area Collection Pond

The Mining Infrastructure Collection Pond is located adjacent to the Mining Infrastructure Area (MIA) and south of the ROM Pad. Contact water run-off from the plant pads will be collected and diverted to the collection pond. Stormwater run-off that does not come in contact with the plant pads, is considered clean, and is directed away from the plant site.

The MIA Collection Pond is sized to contain the run-off from the MIA Pad, Loading Pad and Trucking Contractor's Laydown. The pond will comprise of a Geosynthetic Clay Liner (GCL), HDPE geomembrane along with rock ballast.

The MIA Collection Pond for the plant site follows a wet pond design concept and delays the peak flow into the project's overall water management network. The MIA Collection Pond is sized to contain and convey the 100-year, 24-hour event storm.

2.7.2.9.2 Contact Water Treatment/Disposal System

The Mine Water Management Plan (Appendix P.4) and associated design measures have been developed based on the proposed feasibility level mine site arrangement with inputs from AMNS, Moose Mountain Technical Services (MMTS) and Ausenco. The Mine Water Management Plan will be implemented during the initial mine development phase and will be adjusted as necessary throughout the mine operations and closure phase.

Site contact water will be managed to meet the following regulatory discharge requirements prior to discharge to the natural environment:

- Metal and Diamond Mining Environmental Regulations (MDMER) Objectives.
- Canadian Council of Ministers of the Environment (CCME) Guidelines for the Protection of Aquatic Life.
- Tier 1 Nova Scotia Environment Quality Standards (EQS) for Surface Water.
- Site specific criteria (based on background).

Based on predictive water quality modelling, it is understood that the water quality at some locations may be acceptable for discharge to the environment with TSS removal as the only form of treatment. Where this is not the case, contingency measures (shutoff valves and pumps etc.) will be put in place to redirect water towards the north water treatment system (WTS) in case of exceedances. The primary objectives of the Mine Water Management Plan are as follows:

- Provide mechanism to dewater and treat ponded water within the project area (including the historic tailings area) to allow for development and excavation of mine infrastructure (e.g., pit, waste piles, haul road etc.).
- Capture, treat and provide controlled discharge for all site contact water during construction and operations.
- Divert all off-site clean water away from the mine site infrastructure to maintain existing drainage features (e.g., Mud Lake) and reduce the total volume of water entering the settling ponds for treatment.

2.7.2.9.3 Design Basis Criteria

The criteria used for the design of the water management infrastructure are based on the feasibility level design site arrangement, regulatory discharge water quality requirements, operational requirements, and environmental site conditions. The design basis criteria for storm events utilized for the Mine Water Management Plan (Appendix P.4) design are summarized in Table 2.7-10.

Table 2.7-10: Water Management Design Basis Criteria

Item	Design Basis
Contact Water. Non-contact Water Ditches and Culverts	Designed to convey stormwater runoff resulting from the 1 in 100 year, 24-hour, climate change adjusted storm event (113 mm).
Collection Ponds	Designed to contain runoff resulting from the 2 5 mm 4-hour storm event, 1 in 10-year 24-hour climate change adjusted storm event (87 mm) and 1 in 100-year 24-hour climate change adjusted storm event (113 mm) for a minimum of 24 hours to allow for TSS removal due to settling. Designed to convey runoff resulting from the 1 in 100-year 24-hour climate change adjusted storm event (113 mm) to Cameron Flowage via a concrete outlet structure. Designed to convey runoff from Hurricane Beth, modelled as a 48-hour storm event, through an emergency spillway. All discharge water from collection ponds must meet MDMER water quality requirements. All discharge water must meet CCME, Tier 1 NSE WQS or site-specific requirements within the 100 m mixing zone of the natural watercourse receiver (Killag River).
Pump Systems and Pipelines	Designed to convey stormwater runoff water from low-lying areas to settling ponds for up to the 1 in 2 year 24-hour, climate adjusted storm event (66 mm). Multiple back up pumps for larger storm events are to be located across the Site to be moved to different areas across the Site as needed.

mm = millimetres; TSS = Topsoil Stockpiles; MDMER = Metal and Diamond Mining Environmental Regulations; CCME = Canadian Council of Ministers of the Environment; m = metres.

The Site was modelled using PCSWMM (Version 7.3.3095) which is a hydrologic and hydraulic modelling software that uses the EPA SWMM (Version 5.1.015) engine. PCSWMM was used to develop the design storm hydrographs, estimate peak flow rates and runoff volumes for the design storm events.

To add contingency to the design, the impacts due to climate change were considered when developing the design storm hydrographs. To account for the project duration (operation life of less than 15 years) and nearest climate regions (Halifax Regional Municipality and Truro), a 3.3% increase in the total rainfall depth was applied to each design storm based on the requirements outlined in Climate Data Nova Scotia as the projected increase in annual precipitation for 2050 (https://climatechange.novascotia.ca/climate-data?tid=8#climate-data-map).

The estimated runoff volumes resulting from the 24-hour, 1 in 100-year climate change adjusted storm event were used to determine the storage capacity of the settling ponds. The 25 mm 4-hour, 10-year and 100-year climate change adjusted storm events were used to design the settling pond outlet structures such that a minimum 24-hour detention time was achieved in each settling pond to allow for settling of TSS. Hurricane Beth (as recorded by Halifax International Airport Climate Station (Climate ID: 8202251)) was used to size the emergency spillway of the settling ponds. The 100-year climate change adjusted storm event was used to size the swale, culverts and other conveyance pathways leading to the settling ponds. Additional design details for the various water management design elements are provided in the following sections.

2.7.2.9.4 Collection Ditches and Culverts

The Mine Water Management Plan (Appendix P.4) consists of a series of surface water ditches and culverts collecting all Site stormwater runoff. The surface water ditches include contact water ditches, which collect runoff from all mine infrastructure, and clean water ditches. The surface water ditches all include clean water diversion ditches, which collect water from adjacent undisturbed lands and direct it away from the Site. Culverts are dispersed throughout the Site to convey stormwater below mine infrastructure (i.e., haul roads). The contact water ditches drain to one of three settling ponds located across the Site.

Each ditch will be trapezoidal in section with 3H:1V side slopes and bottom widths and depths ranging from approximately 0.5 m to 2 m. Ditch slopes range between 0.3% and 7.5% depending on the location across the Site. Ditches will be excavated into the existing overburden and/or bedrock or formed by grading existing surface material to form the required channel cross-section. All excess material used to grade the channel to the required cross-section will be sloped to existing ground at a 3H:1V slope. The exposed slopes will be covered with a bio-degradable erosion control matting and seeded upon reaching finished grade to prevent erosion of these previously disturbed areas.

Contact water ditches will be lined with an HDPE liner followed by a layer of sand and a layer of riprap to prevent infiltration of stormwater into the surficial groundwater and protect the ditch from erosion. The riprap layer in the liner system will be sized appropriately to prevent erosion during the 1 in 100-year 24-hour climate change adjusted storm event. Detailed riprap requirements will be determined during later design stages. Rock check dams will be put in place on ditches that have a slope of greater than 3% in addition to the riprap layer to prevent erosion. Rock check dams reduce the overall slope of the water surface, reducing the potential for erosion. Rock check dams also allow time for suspended sediment to settle out prior to reaching the settling pond. The ditches leaving the settling ponds will contain clean water following TSS removal and any additional required water treatment via the WTS in the case of the north settling pond. The outlet of the effluent ditch into the receiving watercourse will be lined with riprap to prevent erosion. Detailed outlet design will be determined during later design stages.

Culverts are to be circular corrugated steel pipe (CSP) culverts with diameters ranging from 600 mm to 1600 mm and lengths between 30 m and 50 m. Culvert slopes range between 0.5% and 7% across the Site. Each culvert will include a riprap apron on the upstream and downstream sides of the culvert to prevent erosion around the inlet and outlet. The outlet riprap aprons are designed to include an energy dissipation basin. The energy dissipation reduces velocities in the downstream ditch, reducing the potential for erosion. The energy dissipation basin is to be lined with riprap specifically sized to withstand culvert exit velocities and reduce flow velocity downstream of the culvert.

The Site haul road crosses over top of WC-5, the watercourse leading from Crusher Lake to Mud Lake. In order to prevent disruption of the natural flow path, clean water ditches will collect surface water runoff on the south side of the haul road and drain this runoff back towards WC-5. WC-5 will be channelized in a culvert below the haul road for 50 m. The outlet of the WC-5 culvert will have an energy dissipation basin to reduce channel velocities and promote fish passage through the culvert. The contact water ditches

will pass overtop of the WC-5 culvert. As with all other sections of the ditch, the contact water ditch in this area will be lined with an HDPE liner to prevent infiltration of contact water into the adjacent watercourse.

2.7.2.9.5 Settling Ponds

Settling ponds will be constructed to collect and treat contact water prior to discharging to Cameron Flowage. Collection ponds are included for runoff from the NAG Waste Rock Stockpile, PAG Waste Rock Stockpile, Till Stockpile, Low Grade Ore Stockpile, Organics Stockpile and Crusher Pad/administrative building area. The ponds were designed to maintain a 0.3 m freeboard during the 1 in 100-year 24-hour climate change adjusted design storm event. All ponds were also designed with an emergency overflow spillway sized to convey Hurricane Beth sized storm event.

It is anticipated that the settling ponds will be excavated into the existing overburden. Due to the depth to bedrock in the areas of the settling ponds (approximately 4 m to 7 m deep depending on location) it is not anticipated that drilling or blasting into the bedrock will be required. The settling ponds will be lined with a similar liner to the contact water ditches including an HDPE liner and a sand and riprap layer. Due to the high groundwater elevation near the settling ponds (slightly above the bottom of pond invert in the east settling pond) the riprap layer will also act as a ballast to prevent the liner from being impact by buoyancy forces of the nearby groundwater. The ponds will be trapezoidal in cross-section with 3H:1V side slopes. The maximum depth in the ponds varies between 3.5 m and 5.5 m, depending on the location. Settling pond dimensions vary from 45 m to 60 m in width and between 200 m and 325 m in length. Two of the settling ponds (north settling pond and east settling pond) will be classified as dams due to the north embankment berm exceeding the 2.5 m threshold.

To assist with the removal of TSS from the stormwater runoff, each settling pond is to contain a gravel filter berm. The filter berm will consist of a gravel core with an outer riprap layer to provide erosion protection. Geotextile will be placed between the riprap layer and the gravel core to assist with TSS removal and separate the two material layers. In addition, the settling ponds have been designed to contain the 25 mm 4-hour storm event, 1 in 10 year 24-hour climate change adjusted design storm and 1 in 100-year 24-hour climate change adjusted design storm events for a minimum of 24 hours. A detention time of 24 hours allows for suspended particles to settle prior to discharge from the settling pond into the natural environment.

The settling ponds each consist of a concrete outlet structure and emergency overflow spillway. The concrete outlet structure will control storm events up to and including the 1 in 100-year, 24-hour climate change adjusted design storm event through a series of orifices and an overflow weir. The concrete outlet structures will be surrounded with a layer of riprap in order to recue exit velocities and further assist with TSS settling. The emergency overflow channel will convey flows resulting from storm events greater than the 1 in 100 year, 24-hour climate change adjusted design storm event, up to and including Hurricane Beth. The north settling pond will direct the emergency overflow spillway towards the open pit. Directing the overflow spillway towards the open pit will ensure no uncontrolled discharges occur from the Site. Effluent from the north settling pond will pass through the WTS prior to discharge into Cameron Flowage. All settling ponds will discharge effluent at concentrations below the federal MDMER regulations as per the *Fisheries Act*.

2.7.2.9.6 Pump Systems and Pipelines

A collection pond will be situated on the northeast side of the PAG stockpile. A pump and pipeline system will convey stormwater from the collection pond to the north settling pond. In addition to the PAG stockpile pump and pipeline system there will be portable back up pumps located across the site to deal with any potential pooling of water. The pumps will be moved around the Site as needed to dewater ponded water. The PAG stockpile pump system will consist of a single permanent pump, sized to convey the runoff generated from up to a 1 in 2-year 24-hour climate change adjusted storm event. In the event that a storm event greater than the 1 in 2-year climate change adjusted storm event occurs then back up pumps will be brought to the PAG stockpile collection pond to assist with pumping.

2.7.2.9.7 Erosion and Sediment Control Measures

Erosion control measures in the contact water ditches and settling ponds are to be maintained during operations including replacement of riprap, restoration of check dams if damaged and general visual inspection of the ditches and settling ponds. Experience at the Touquoy Mine indicates that significant sediment build up could occur in the collection ditches. The contact water ditches should be inspected regularly and cleaned out as needed to ensure sediment does not build up within the ditches or travel directly into the settling pond, reducing the available storage volume of the settling pond itself.

Contact Water Treatment

During operations stormwater runoff will be directed towards three settling ponds prior to discharge to the natural environment. All potentially impacted water will be directed towards the north settling pond and the associated WTS. The east and south settling ponds are not anticipated to experience water quality concerns, however, regular monitoring will take place in these ponds as a part of federal MDMER regulations. If water quality exceedances occur in the east or south settling pond, a shut off valve on the pond outlet will be closed and the water will be pumped to the north settling pond and WTS for treatment.

During operations, the only constituent predicted to exceed CCME, Tier 1 EQS and Site-Specific guidelines is nitrite. In order to reduce the nitrite concentrations in effluent from the north settling pond, effluent will be routed through a nitrite oxidation unit (aeration treatment pond) to reduce the concentration of nitrite in the effluent. The effluent will pass through a final settling pond, to remove any further suspended solids which were re-suspended during aeration, prior to discharge.

The WTS which was present during construction will remain on Site in case of exceedances of constituents other than nitrite, consisting of aeration (oxidation), lime softening, coagulation/flocculation and multimedia and granular activated carbon (GAC) filtration.

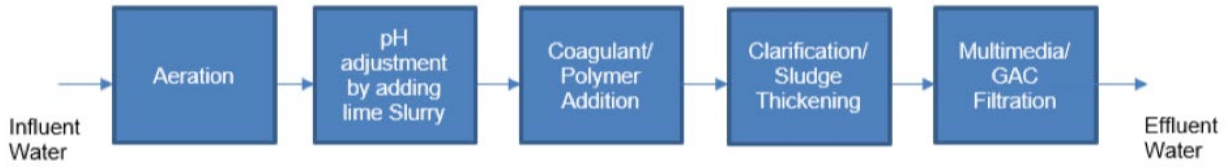
2.7.2.9.8 Construction Water Treatment System Alternative

It is expected that metals such as aluminum, arsenic, cadmium, cobalt, copper, iron, manganese, mercury, lead, and zinc may be among the elements that potentially need treatment during the construction stage. Also, most of the COCs are likely attached to suspended solids, suggesting that a significant fraction of the COCs could be removed by physical filtration.

Aeration, lime softening, followed by coagulation, media and GAC filtration is proposed as the alternative WTS for the construction phase. This system includes an aeration phase at the beginning of the treatment train, which will help to oxidize metals and will reduce chemical demand in the downstream units.

A simplified block flow diagram of this alternative is shown in Figure 2.7-4.

Figure 2.7-4: Simplified Block Flow Diagram for Water Treatment



In the first step, collected contaminated water will be stored in a Frac tank sized to provide an approximate one-hour retention time for aeration purposes. The effluent will be monitored for pH, turbidity, and its flow recorded prior to discharge. There will be a sample port at the final effluent discharge line for sampling and monitoring purposes.

This proposed water treatment alternative will address higher concentration of COCs. The selected alternative technology will be tested in a bench-scale study before implementing the full-scale treatment system to identify optimum chemical conditioning parameters such as aeration rate and chemical dosing rates. This will inform the Standard Operating Procedures that will be developed before implementation.

2.7.2.9.9 Operation Water Treatment System Assessment

The water quality assessment also indicated that nitrite level will be the only exceeded CCME guideline parameter for the EOM scenario, and zinc and cobalt are the exceedances for the PC scenario at Killag River which will require treatment during the post closure stage of the Mine.

Reviewing the feasible alternatives, it was found that a nitrite oxidation unit such as aeration treatment pond could potentially reduce nitrite concentration and obtain the nitrite removal requirement of this project while also having the lowest capital and operation cost.

The proposed aeration treatment pond would consist of three ponds. The first Settling Pond will act as an equalization pond and capture the high influent water volumes during storm events. Furthermore, this pond will help to reduce total suspended particles by allowing settling. A coagulant injection point will be considered at the influent stream to the first pond to be used in case of high suspended solids concentrations or during large storm events to help accelerating precipitation of suspended solids. Water will then flow by gravity to an aeration pond, the air will be introduced by surface agitators to oxidize nitrite, as well as metals. Next, the water will flow by gravity to the third pond for resettling of suspended particles that are generated as the results of oxidation in the second pond.

It is expected that the concentration of nitrite and metals will be below discharge limits during large storm events. For that reason, a bypass ditch will be designed to directly discharge the water from the first pond after removal of suspended particles.

In addition, to address elevated arsenic concentration during operation phase, the water treatment system of construction phase will be used as contingency in case of higher metals concentrations during operation phase. If the aeration treatment pond's final effluent does not meet the discharge objectives, the water could be pumped into the water treatment train to address high metal concentrations.

The general chemistry of impacted water will determine if any nutrient or chemical addition would be required. These parameters could potentially drive the operation cost of the treatment system. It is highly recommended that the selected nitrite removal technology be tested in a bench-scale or even in a pilot-scale before designing the full-scale treatment system.

2.7.2.9.10 Post-Closure Water Treatment System

GHD has completed a predictive water quality assessment and developed a mass balance model which shows that zinc and cobalt are the only likely exceeded parameters during the PC phase. However, the exceedances are not significantly higher than the discharge limit and a passive water treatment system could reduce the concentration of these elements below discharge criteria. In mine-related settings, passive treatment systems are often designed to neutralize acidity and remove metals in drainage waters. Such systems do not require continuous chemical inputs because they are sustained by naturally occurring chemical and biological processes. Anoxic limestone drains (ALDs) have been selected as the passive alternatives for addressing high concentrations of metals in impacted water during the PC phase.

In this treatment approach, impacted water will initially pass through a settling pond for the removal of suspended solids. Then, water will pass through a trench ALDs. ALDs generate alkalinity and increase the pH of the impacted water. By increasing the pH, metals such as zinc and cobalt will precipitate in their hydroxide forms. The ALDs will be followed by an aeration cascade, pond, or aerobic wetland that oxidizes and removes the precipitated metals. A settling pond will then provide adequate hydraulic retention time to let those formed metal hydroxides precipitate. This treatment system is proposed due to its passive nature and the fact that utilities are not required for implementation. The success of an ALD depends on site-specific conditions, primarily on low dissolved oxygen, and minimal ferric iron and aluminum concentrations in the drainage.

The operation and maintenance of this alternative is minimal as no labour or power is required. The primary maintenance would be replacing depleted limestone which is dependent on-site condition and water chemistry. In suitable conditions, limestone could work efficiently for several years.

2.7.2.9.11 Surface Water Monitoring

Surface water quality assessment sites were selected to monitor baseline/construction, operation and post-closure water quality and water quantity at the Beaver Dam Mine. These include both surveillance locations and compliance locations.

During the construction phase, 16 water quality surveillance locations are proposed to be sampled monthly, along with two water quality surveillance locations to be sampled quarterly. At each surveillance monitoring stations, water quality grab samples are collected. Grab will be analyzed for the following list of parameters, in line with the baseline analysis:

- Total metals – (RCAp-MS);
- Total dissolved metals – (Dissolved RCAp-MS);
- Mercury (total, dissolved, methyl);
- Total Phosphorus;
- Cyanide (total, free);
- Tungsten (total, dissolved);
- Zirconium (total, dissolved);
- Dissolved Organic Carbon;
- Dissolved Fluoride;
- Total Chemical Oxygen Demand;
- Chlorophyll A;

- Salinity;
- Acidity;
- Total Suspended Solids;
- Total Dissolved solids; and
- Radium-226.

Three compliance locations are discharge monitoring locations required by the MDMER and are analyzed to this standard.

During the operation phase, the proposed surveillance and compliance locations do not change from the construction phase, although the proposed frequency changes for certain sample locations from monthly to quarterly.

During the two years of active closure, the surveillance locations are proposed to be reduced to the ditches, three settling pond locations, and upstream and downstream of the Killag River. It is proposed that the sample frequency also be reduced, with samples collected quarterly during the first year and semi-annually for the second year. The three compliance locations discharging to the Killag River will continue to be monitored to MDMER standards.

After the completion of active closure, the proposed surveillance locations will further be reduced to three locations the Pit lake and upstream and downstream of the Killag River with a proposed sample frequency of semi-annually. The compliance locations discharging to the Killag River is proposed to be reduced to one location.

Continuous water levels (automated transducers) and manual flow data have been collected at seven water quantity surveillance locations historically by McCallum Environmental Limited (MEL) in 2019 and 2020. The collection of continuous water level and manual flow data at these seven surveillance locations is proposed to continue on a monthly frequency to support and improve the existing stage-discharge relationship/rating curves established by MEL and further help validate modelling completed for the Mine. This monitoring will continue until the completion of active closure.

2.7.3 Haul Roads

As Beaver Dam Mine Site will operate as a satellite surface mine, ore produced will require transport by road to the Touquoy Mine Site (Figures 2.3-3). Portions of the existing logging roads (Section 1 and Section 4A/B) between Beaver Dam Mine Site and the Touquoy Mine Site will require upgrading to a dual lane road to facilitate the safe passage of two-way truck traffic at 70 km/h. The total length of the Haul Road is approximately 31 km. It may be necessary to use the Public Roads during start-up (i.e., 6-8 months) depending on approval and permitting timelines and construction restrictions.

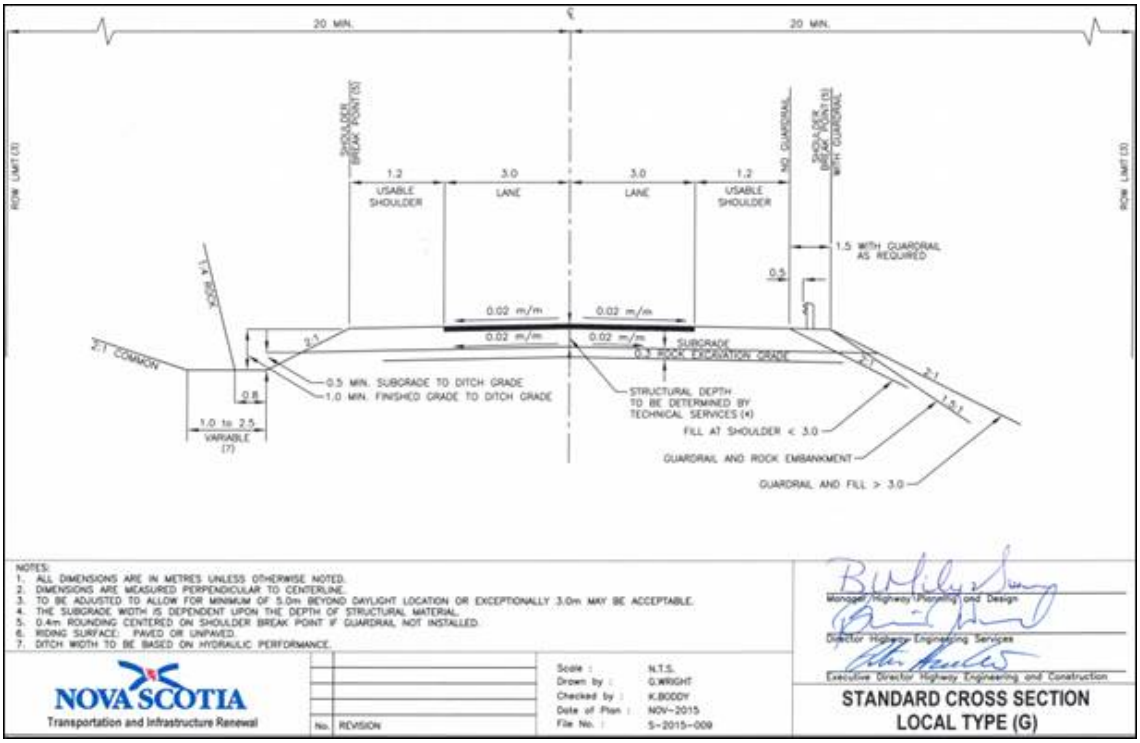
A new section of road (Section 3B; approximately 4.0 km in length) constructed to the same design standards connecting the Beaver Dam Mines Road/Highway 224 intersection with an existing woods road. The alignment displayed in Figure 2.3-2 is based on a preliminary engineering design. Final design will consider safety, social and environmental constraints to ensure the best-case scenario that will optimize worker safety and minimize potential environmental effects. The new 4.0 km section of road is being construction to avoid travel on Hwy 224, through the community at Beaver Lake IR 17.

The upgraded and newly constructed Haul Road will be designed to accommodate up to a 68t gross vehicle weights in either a B-Train or C-Train configuration year-round. Where upgrades will follow the course of the existing woods roads, the width will be increased from approximately 4 m to 10 m, with an additional width of 6 m, on average, to account for sloping and ditching on both sides of the road. Where new road construction is required, including deviations from the existing roads to ensure safe design

standards, the daylighted corridor for the Haul Road will be approximately 16 m wide (on average). Wider areas of disturbance will exist along the route where the natural topography exceeds design grades. In these areas, increased cut and fill will be required to reduce grade and maintain safe design standards. Where possible existing roads will be used in an effort to minimize disturbance of undeveloped areas.

Figure 2.7-5 below, Transportation and Active Transit standard cross-section for Type G gravel roads, represents the intended dimensional road cross section for the full length of Segments 1 through Segment 4. Thicknesses of Type 1 and Type 2 gravels for Segments 2-4 will be determined by road design contractor based on expected loadings. The road design contractor will recommend a road structure for the Mooseland Road upgrade, although NSTAT will perform the final detailed design in-house.

Figure 2.7-5: Transportation and Active Transit Standard Cross-section for Type G Gravel Road



Construction material will be sourced from either Touquoy Mine, Beaver Dam Mine, local quarries (< 4ha) or from a commercial operation. Before material is used it will be physically and chemically tested to ensure suitability for road construction. The lessons learned from Touquoy is select road construction material that is of a hardness that will not erode overtime, which will minimize siltation, which is discussed in Fish and Fish Habitat (Section 6.9).

Over 20 culverts are identified as fish bearing and these culverts will be constructed from concrete with specific details developed for each. The balance of simple drainage applications will be constructed of CSP culverts.

The Haul Road will be upgraded where required to enable the safe and economic transportation of ore. Relict portions of the Haul Road may be properly reclaimed at the end of the Project lifespan or returned to the original owner as per the lease arrangement. Re-vegetation may be undertaken on portions of the Haul Road to minimize stabilize slopes and minimize erosion.

For the purposes of this description, the Haul Road has been sectioned off as follows (Figure 2.3-3).

2.7.3.1 Beaver Dam Mines Road (Section 1)

- 7.2 km of unsealed two-lane private road historically used for logging known as Beaver Dam Mines Road and currently owned by Northern Timber with varying quality from the Beaver Dam Mine Site to Hwy 224.
- The intersection between the Beaver Dam Mines Road, Hwy 224, and the new construction will be designed to meet Nova Scotia Transportation and Infrastructure Renewal (NSTIR) standards.
- The extent of required Haul Road upgrades and new construction will encroach on land owned by Northern Timber and NSDL&F.
- Upgrades to this section of the Haul Road will also require replacement or new installation of up to 9 culverts, and upgrades to, or replacement of, single lane bridges with dual lane bridges across 2 watercourses. All upgrades will be made to government standards and permit requirements.

2.7.3.2 New Construction East of Hwy 224 Section 3B

- Approximately 4.0 km of new construction from the Beaver Dam Mines Road and Hwy 224 intersection to the Moose River Cross Road through a greenfield environment.
- The land required for new construction is currently owned by Northern Timber and NSDLF.
- Construction of the Haul Road will also require installation of one stream culvert. Others may be required to maintain flow in some wetlands. All installations will be made to NSE standards and permit requirements.

2.7.3.3 Haul Road to Mooseland Road Section 4A/B

- 8.2 km portion of the Moose River Cross Road that ends at the intersection with the Mooseland Road. This section is an unsealed single lane private road historically used for logging and currently owned by Northern Timber and others with varying road quality along its length.
- The intersection between the Moose River Cross Road and Mooseland Road will be designed to meet NSTIR standards.
- The extent of required Haul Road upgrades and new construction will encroach on land currently owned by Northern Timber, NSDL&F, Musquodoboit Lumber Limited, Deepwood Estates Limited, Prest Bros Limited, and private residences.
- Upgrades to this section of the Haul Road will also require replacement or new installation of up to 10 culverts and upgrades to, or replacement of, a single lane bridge with a dual lane bridge across one watercourse (WC-AD, Morgan River). All upgrades will be made to NSE standards and permit requirements.

2.7.3.4 Haul Road Mooseland Road to Touquoy Section 5A/B

- 10.7 km of sealed and unsealed dual lane provincial local road known as Mooseland Road and owned by NSTIR suitable for heavy traffic from the Moose River Cross Road to the Touquoy Mine processing facility.

Haul Road upgrades will utilize existing road centre lines where possible to minimize encroachment on adjacent lands. Where encroachment on Crown land is unavoidable, lease agreements through NSDL&F will be pursued. Similarly, where encroachment on private land is unavoidable, lease or purchase agreements will be pursued with the individual landowners. Leases will be in place prior to the beginning of any site work.

Mooseland Road is currently a Class G road with maximum Gross Vehicle Weight (GVW) of 41,500 kg. Most of the route is gravel surface although there is a short section of asphalt close to Touquoy mill. Based on a desktop study currently underway, cross

section is fairly consistent at 10 m (+/- 0.2 m) and indications are that this could be designed to a Type G road (8.4 m cross section) with a built-up gravel cap on the existing road without increasing the existing cross section width, dependent on the extent of additional Type 1/Type 2 gravels required to build up the road surface.

The intent is to upgrade the segment of Mooseland Road to a Schedule B all-season road with GVW capacity of 62,500 kg (C-train), which will maximize payload and eliminate spring weight restrictions. Classification will remain as a Type G road. It is anticipated that the upgrade to Mooseland Road will be designed and executed by Nova Scotia Transportation and Active Transit during 2022, under a cost sharing agreement with AMNS.

2.7.3.5 Bypass Roads

The bypass roads are intended to provide an alternate route for recreational users such as ATVs and pick-up trucks as well as Indigenous rightsholders. The existing logging road represents an integral part of the current ATV Association of Nova Scotia's trail network. It is anticipated that without a bypass road, recreational users will continue to use the haul road to access the trail network. Due to the high traffic volumes and large hauling trucks, it is not desirable to have uncontrolled vehicle conflicts between hauling trucks and ATV's. As a result, a adjacent and parallel bypass road is planned to be constructed adjacent to the haul road. The bypass road routing will improve the safety of the recreational users and haul truck operators by separating the traffic and reducing the number of crossings.

The preliminary haul road routing has been established as part of the 30% design submission. This alignment is not finalized and can be adapted to facilitate an optimized design for both roads simultaneously. As a starting point, the 30% haul road alignment was reviewed against the trail network to establish which side of the haul road the bypass road alignment should follow. To minimize trail crossings, the bypass road will be kept on one side of the haul road with connecting trails crossing the haul road as required.

Large sections of the existing logging road remain after the establishment of the 30% alignment. When possible, WSP has routed the bypass road along the existing logging road. This will reduce the amount of clearing and grubbing and overall construction to establish a bypass road.

There is one existing bridge structure along this portion of the alignment and is currently on the west side of the proposed haul road. The connections of the bypass road to the trail network at the start and end of the alignment are also along the west of the haul road. For this reason, the alignment through Segment 2 has been placed on the west side of the haul road. This will result in one primary intersection location at the mid point of the alignment for the ATVANS trail network. Additional intersections may be required during construction or during operation to facilitate local users.

There are also options under review for connecting the existing trail south of Mooseland Rd to the start of the bypass. The existing trail south of Mooseland, locally known as Scott Road, is approximately 300 m west of the start of the bypass road. The bypass road is currently planned to run on the north side of Mooseland Rd and cross perpendicular at Scott Rd. Consideration is being given to a gravel parking area be considered at the start of entrance from the Mooseland Road to the Haul Road to allow for recreational users to park and offload their ATVs – this parking area is intended for discussion with Nova Scotia Department of Transportation and Active Transit within the broader scope of Mooseland Road upgrades for summer 2022. The parking area is intended to keep the shoulders of Mooseland Road clear and minimize potential for interaction with vehicles and trailers at Mooseland/haul road intersection. This has been identified as part of Public Engagement (Section 3).

2.7.3.6 Haul Road Bridges

There are three bridges along the existing logging roads. These bridges are not sufficient to support the increased loading of the haul traffic. Rather than remove and replace these with new bridges, they will remain in place for use in establishing the bypass road network. The existing capacity of these bridges is under review to establish if any upgrades are required to support mine construction activities.

2.7.3.6.1 Bridge 1 (north of Highway 224)

The intended project use of Beaver Dam Mine Road Bridge 1 is for mobilization of construction and mine development activities, as well as continued use in the bypass road network. This bridge is located just north of Hwy 224 on Beaver Dam Mines Road. The structure is a single span timber superstructure supported on timber crib abutments. The timber girders were treated with creosote and generally appeared to be in fair to good condition. The girders are supported on timber cap beams that are spaced 11.2 m apart (clear span). The cap beams are supported on localized timber cribwork founded on loose rock.

The bridge was inspected by Harbourside Engineering Consultants (HEC) in October 2019 and HEC noted that the foundations are not considered to be adequate. The foundations are not considered to be adequate for the loadings proposed on the haul route. An upgrade to the east and west foundations will be necessary before commencing with construction mobilization to Beaver Dam mine site.

A structural assessment of the bridge superstructure itself is being assessed to determine whether it is suitable for the anticipated loads exerted during the construction period before the new bridge is constructed – the largest load anticipated is expected to be the 58T chassis of a Caterpillar 390 excavator (with 11 tonne boom removed).

2.7.3.6.2 Bridge 2 (Beaver Dam Mine Road)

The intended project use of Beaver Dam Mine Road Bridge 2 is for mobilization of construction and mine development activities, as well as continued use in the bypass road network.

This bridge is a single span timber superstructure supported on timber crib abutments. The runners are in poor condition with visible rot and deterioration. The deck members appeared to be pressure treated and in fair to good condition. The deck is attached to nine 8”x12” timber girders which appear to be pressure treated and are generally in good condition. The girders are supported on timber crib abutments that are spaced 3.4 to 3.5 m apart (clear span).

2.7.3.6.3 Bridge 3 (Moose River Cross Road)

The intended project use of Moose River Cross Road Bridge is for use in Segment 2 road construction activities, as well as continued use in the bypass road network. The bridge at the entrance to Moose River Cross Road is located just off Mooseland Road. The Moose River Cross Road Bridge is a single span timber superstructure supported on concrete abutments in overall good condition. The wearing surface included two timber runners in fair to good condition. The deck members appeared to be in fair condition with some visible wearing on the top of the deck between the runners. The deck is attached to nine 9”x18” timber girders which are treated with creosote and in fair condition. The girders are supported on concrete abutments that are spaced 8.6m apart (clear span). The width of the bridge deck is approximately 4.9 m. The wingwalls are concrete from the footings to the level of the bearing seat and are timber cribs above the bearing seat. The foundations appear in good condition with some cracking noted.

The prefabricated steel girder bridges from Algonquin Bridge (a subsidiary of AIL) is being considered. This bridge has a CL625 loading and offers a rapid construction schedule with minimal cranage requirements.

2.7.4 Touquoy Mine Site

The Beaver Dam Mine Project will utilize the existing permitted processing facility at the Touquoy Mine Site to process Beaver Dam ore. Processing of ore from the Beaver Dam gold deposit at the existing Touquoy processing plant will begin upon completion of mining ore from the Touquoy deposit. Beaver Dam tailings will not be stored in the Touquoy tailings management facility, but instead will be permanently stored in the exhausted Touquoy pit after that deposit has been mined. This allows the Touquoy Mine Site footprint to be maintained as originally permitted and no tailings management will be needed at the Beaver Dam mine site. All other aspects of the Touquoy Gold Project will remain as assessed and approved through the Nova Scotia EA process in 2008 and as approved and regulated under the Touquoy Industrial Approval (IA).

Changes to the Touquoy Mine Site as a result of the Beaver Dam Mine Project will include the following:

- an increase in the duration of ore processing (five years additional years);
- weigh scales, a pair of weigh scales will be installed within the existing footprint to quantify the tonnage haul (i.e., one for incoming load and one to weigh the empty trucks;
- minor alterations to the Touquoy processing facility to accommodate Beaver Dam ore; and
- disposal of tailings Beaver Dam ore processing in the exhausted Touquoy mine. Historic tailings collected during construction will be disposed in the pit as well.

The Touquoy Mine Site will be operational for an additional five years beyond the current lifespan anticipated for the Touquoy Project. There will be no increase in the Touquoy processing rate to accommodate Beaver Dam ore. This will result in four additional years of ore processing, water management, and tailings management (exhausted pit).

The Touquoy processing facility main building houses ball mill, gravity recovery, reagent make-up, elution, and refinery sections. The crushing, carbon in leach (CIL), and cyanide destruction sections are located outdoors. Tailings produced from processing Beaver Dam ore will be stored in the exhausted Touquoy open pit. Water from the deposited tailings will be recirculated through the processing facility in a closed loop. Make up water requirements will be sourced from Scraggy Lake or other sources as per existing approvals. Water withdrawal from Scraggy Lake for the processing of Beaver Dam Mine ore is only expected during start-up. A technical report that presents the technical water and tailings management plan (Appendix F.7) , including tailings deposition and the overall mine site water balance including the direction of flow between components, effluent discharge locations, mine component drainage areas, and locations of MDMER final discharge. The existing Effluent Treatment Plant will be used will be utilized during closure until such time regulatory discharge requirements are met and excess water from the pit discharges to the Moose River along a constructed discharge outline.

The additional operational life of the Touquoy Mine Site involves no new footprint disturbance to the existing Touquoy facility or property. The Beaver Dam tailings will be managed in the exhausted Touquoy open pit. As originally planned in the approved Touquoy Gold Project Reclamation Plan, the inflow of groundwater, surface flow and precipitation into the pit will naturally create a lake upon closure of the site. Air emissions generated from the Touquoy Mine Site associated with the processing of Beaver Dam ore will be limited to emissions from the existing permitted plant operation during processing. The primary potential effect of the continued use of the Touquoy Mine Site is on surface water and groundwater quality associated with processing the Beaver Dam ore through the use of the exhausted open pit for tailings storage. It should be noted that geochemical and water quantity/quality data collected during the operational phase of the current permitted Touquoy Mine Site has been utilized to model surface and

groundwater and to make predictions of future water quantity and quality. As the Touquoy operation progresses, these predictive models will continue to be refined and revised as warranted.

An amendment to the Touquoy IA will be sought as necessary to accommodate these changes. As well, the currently approved Reclamation Plan will be updated to reflect the above changes and re-submitted.

2.7.4.1 Currently Approved Operations at the Touquoy Mine Site

The Touquoy Gold Project was described in a Provincial EARD and planned as a surface operation using drilling and blasting, with processing on site. As described in Section 2.7.2.1, ore production from the pit will vary with a maximum of approximately 5,480 tonnes of ore per day with a total ore production estimate over the life of the mine of at least 9.2 million tonnes for recovery of 0.4 million ounces (oz.) of gold. The Touquoy Gold Project is currently in its fourth year of commercial production, the mine life is estimated to be five to seven years for processing of Touquoy ore, three to four years for processing of Beaver Dam ore based on favorable permitting, and two years for closure and decommissioning.

The open pit and associated infrastructure are centered on areas of previous (bulk sample in 1980's) and historic mining activity at Moose River Gold Mines. The Touquoy facilities include an open pit, processing plant, tailings storage facility, waste rock piles, power and water supply systems, offices, and a service support complex. The total area of the development at the Touquoy Mine Site is approximately 265 ha. The open pit and mine site roads will occupy approximately 40 ha, processing plant and service complex will occupy approximately 60 ha, the tailings management facilities will occupy approximately 130 ha, and the waste rock stockpile will occupy approximately 35 ha.

Ore is mined from the nearby Touquoy pit and delivered to the mill for processing. Processing involves size reduction of the ore by crushing and grinding and recovery of the contained gold by mechanical and chemical processes. Recovery entails gravity concentration, carbon-in-leach (CIL), elution and carbon regeneration, electro-winning and smelting, and cyanide destruction. Tailings from processing of the Touquoy ore are deposited in the permitted TMF. Water associated with the Touquoy tailings is recycled for use in processing. At closure, all facilities will be removed, disturbed lands rehabilitated, and the property returned to otherwise functional use.

As part of the conceptual reclamation plan for the Touquoy Mine Site identified in the Provincial EARD, all site facilities will be removed, and the pit will be allowed to fill with water forming a lake. The flooding of the pit will create a lake approximately 15 ha in size with edge habitat.

2.7.4.2 Touquoy Gold Mine Environmental Assessment

An Environmental Assessment Registration Document (EARD) was submitted for the Touquoy Gold Mine on March 15, 2007 As a result of the subsequent review, a Focus Report was requested by the Minister of Environment and Labour to provide additional details on certain specific aspects of the project. The nature of the Focus Report was detailed in the Terms of Reference (TOR) in a public letter to DDV Gold dated April 15, 2007. The Focus Report was submitted on November 19, 2007.

The EARD assessed the potential environmental effects of the Touquoy Project on biophysical and socio- economic Valued Environmental Components (VECs). This assessment was based on inputs from members of the public, the Mi'kmaq community, government regulators and the professional judgement of the study team. The VECs identified and evaluated for the Touquoy Gold Mine included:

- Air Quality;
- Noise;
- Surface Water Resources;
- Geology and Hydrogeology;
- Terrestrial Resources;
- Wetlands;
- Archaeological and Cultural Resources; and
- Population and Economy.

Species of special concern were also considered within each applicable VEC.

A review of the EARD and Focus Report identified that the following VECs were evaluated in terms of effects of the processing of ore during the Touquoy project: air quality, noise, surface water resources, and terrestrial resources. The remaining VECs were evaluated in terms of the effects of construction, mining operations, and use of the tailings management facility, and no additional effects were anticipated in the EARD or the Focus Report beyond the scope of these operations.

2.7.4.3 Existing Industrial Approval at the Touquoy Mine Site

An Industrial Approval (IA) was developed by NSE to add specific conditions for environmental management and monitoring associated with the construction, operation and reclamation phases of the Touquoy Project. The IA contains over one hundred specific requirements in 25 sections which include but are not limited to the following:

- Particulate emissions (dust) and sound levels;
- Blasting management and monitoring;
- Air emissions from plant operations;
- Groundwater and surface water management and monitoring;
- Liquid effluent discharge management and monitoring;
- Tailings management and requirement for an engineer of record for the tailings management facility;
- Management and containment of historic tailings;
- Management of waste rock and sampling procedures;
- Handling, storage and management of reagents;
- Contingency / emergency response plan;
- Environmental impairment liability insurance requirements;
- Complaint response procedures;

- Community liaison committee (CLC) facilitation;
- Reporting requirements; and
- Reclamation planning and posting of bond to ensure completed.

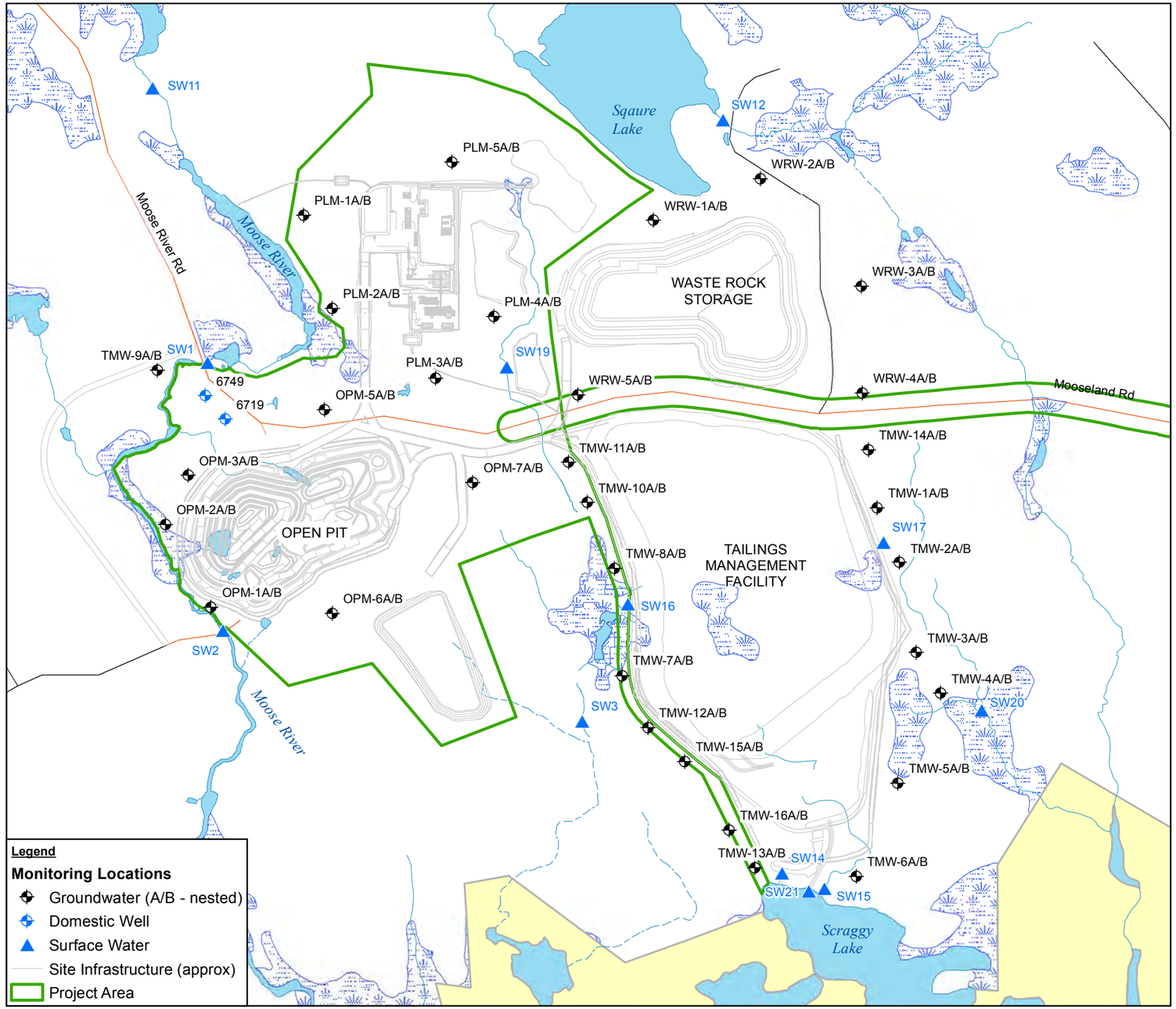
The IA has specific requirements at various project stages of the Touquoy Project. This included installation of 32 nested pairs of groundwater monitoring wells prior to construction and completion of four quarterly monitoring events prior to operation. Subsequent to the start of operations, an additional 10 groundwater wells have been installed monitored: 8 shallow wells, and 1 nested pair. These groundwater monitoring data as well as surface water monitoring data are now being collected at the Touquoy Mine Site and are being used to periodically update the surface and groundwater modelling predictions for operations and post closure. The current compliance monitoring locations at the Touquoy Mine Site for groundwater and surface water are shown in Figure 2.7-6.

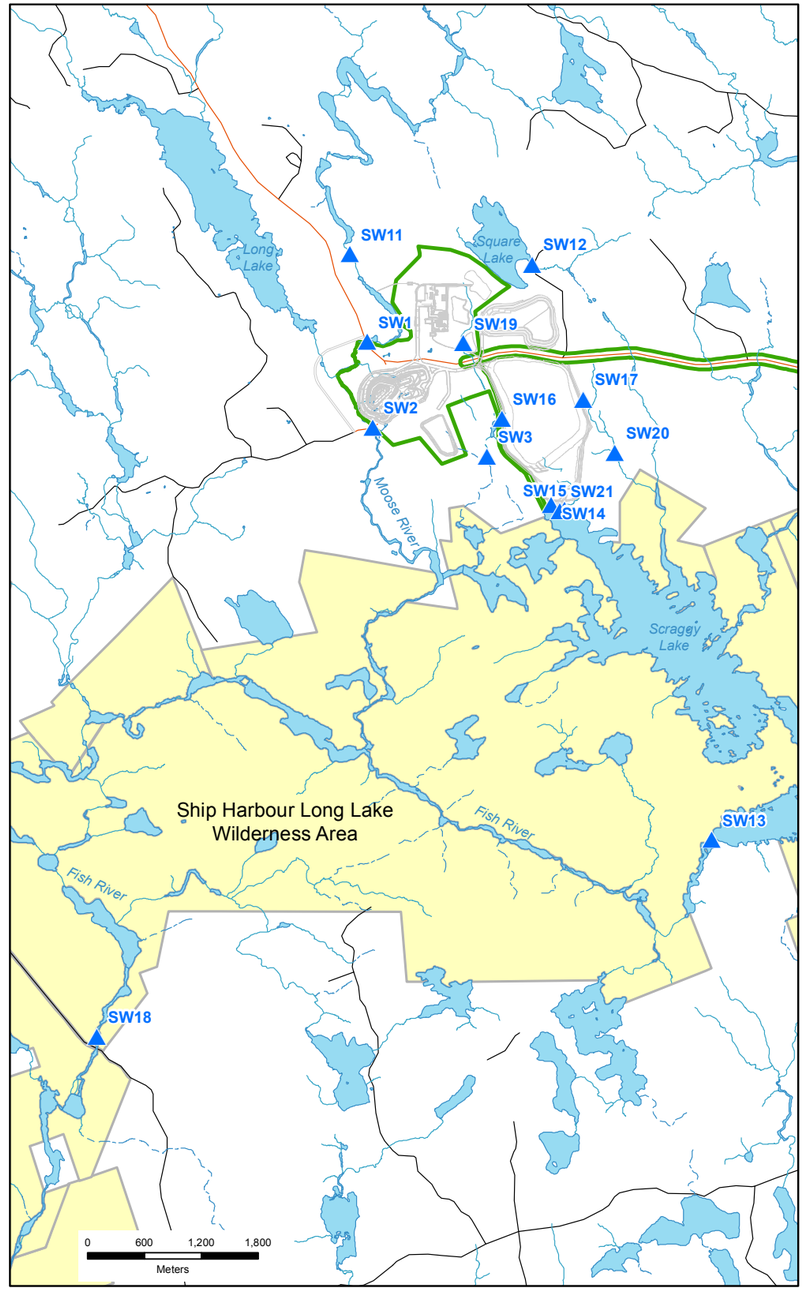
It is anticipated that many of the components of the Touquoy Project IA will be included in a future Beaver Dam Mine Project IA application reviewed by NSE prior to the Beaver Dam Mine Project commencing. As with other federal and provincial permits and approvals, these will be issued after the EA process is completed; typically, the conditions and framing of follow up programs as part of EA approval are reflected as appropriate at the permitting level.

2.7.4.4 Touquoy Mine Site and Benefits to the Beaver Dam Mine Project

Prior to the use of the Touquoy facility for the processing of Beaver Dam ore and storage of tailings in the exhausted Touquoy pit, approximately five years of operational data from the Touquoy operations will have been collected and modelling studies will be updated based on a review of these data. Monitoring of the current Touquoy Project includes air and noise monitoring, surface water monitoring of nearby water bodies, and groundwater monitoring of an extensive network of near and far groundwater monitoring wells. This ability to have actual data from an operational setting that is very similar to that proposed at Beaver Dam Mine Site is unique and important. The two sites have similar geology, ore, mining methods, wetlands and surface water bodies in close proximity to the extraction areas. AMNS will utilize the operational data to update models and provide greater refinement in the potential effect prediction for the Beaver Dam tailings deposition in the exhausted Touquoy pit.

Mining is complex and necessitates the proper use of personnel and equipment in creating an operation that is safe, benefits communities, and is executed in a manner that minimizes potential harm to the current and future natural settings. This operational expertise gained through the development and operation of the Touquoy Mine will be applied at the Beaver Dam Mine Site as proposed. The primarily local workforce will be able to be used at the Beaver Dam facility as it is in the same general area (within 30 km) and they will have over 5 years of additional operational experience beyond what they had prior to the Touquoy Project being opened.





Source: Service Nova Scotia, AGC, Stantec, GHD

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Metres

Coordinate System:
NAD 1983 CSRS UTM Zone 20N

N

GHD

ATLANTIC GOLD CORPORATION
MARINETTE, HALIFAX CO., NOVA SCOTIA
ENVIRONMENTAL IMPACT STATEMENT - BEAVER DAM MINE

TOUQUOY MINE
COMPLIANCE MONITORING LOCATIONS

088664
Feb 22, 2019

FIGURE 2.7-6

GIS File: I:\GIS_DATA\Projects\6-chars\08----\088---\088664 Atlantic BD\088664(004)\Revised2018\088664(004)GIS-DA011.mxd

2.8 Project Schedule

Site preparation and construction for the Beaver Dam Mine Project will begin in 2022 prior to exhaustion of the Touquoy pit so that the ore supply from the Beaver Dam Mine Site to the Touquoy Mine Site will follow shortly after the mining operations at Touquoy have ceased. Table 2.8-1 shows the Project Schedule.

Table 2.8-1: Beaver Dam Construction, Operation, and Reclamation Schedule

Event	Timeline
Beaver Dam Construction	Q4 2022
Beaver Dam Operation	Q1 2023 to Q2 2027
Touquoy Partial Reclamation (waste rock stockpile and tailings management facility) and Environmental Monitoring	2023-2026+
Beaver Dam Reclamation and Environmental Monitoring	2027-2029+
Touquoy Complete Reclamation (processing facility, surface mine/beaver dam tailings management facility) and Environmental Monitoring	2027-2029+

2.9 Project Activities

The Project consists four phases:

- one-year construction phase;
- five-years operations phase;
- two-year active closure and reclamation; and
- 10+ years post-closure monitoring and adaptive management.

2.9.1 Site Preparation and Construction (Year 1)

2.9.1.1 Beaver Dam Mine Site

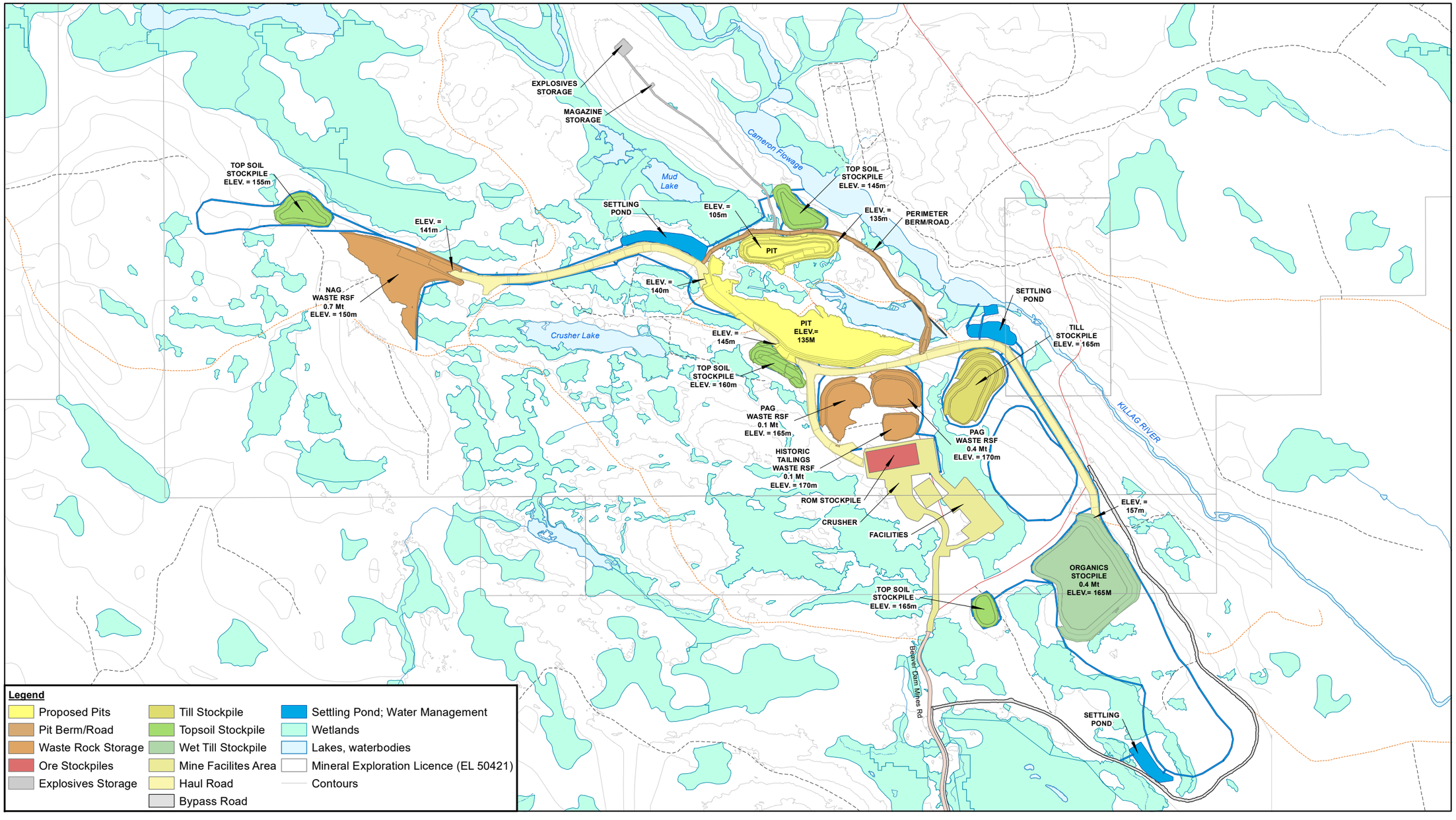
Pre-production mine operations at Beaver Dam include the following tasks. These tasks are planned to take roughly eleven months of calendar time, from July 2022 to May 2023 so will be achievable within the year prior to opening the ore haul road to Touquoy.

Clearing and grubbing of planned disturbance footprints, including ex-pit haul roads, explosives storage access road and pads, topsoil stockpiles, till stockpiles, PAG rock stockpile, NAG rock stockpile, low grade waste stockpile, and open pit areas.

- Ditching around pit and stockpiles and development of north settling pond.
- Fish Out of the open pit area.
- Pump out of open pit area.
- Excavation and stockpiling of historic tailings along with potentially contaminated till materials.
- Removal and windrow/stockpiling of topsoil from haul road, till storage, PAG storage, NAG storage and open pit areas. Topsoil thickness of 30 centimetre (cm) is assumed in all areas.

- Removal and stockpiling of till from the open pits, starting with the construction pit areas in the northwest, then the upper elevations along the south side of the pit, and moving on to the remaining pit once the historic tailings are excavated.
- Grade control drilling on 10 m x 5 m pattern, 40 m depth, through estimated mineralized areas of the pit.
- Mining entire starter construction pit, P610.
- 1.7 Mt mined from 135 elevation down to the bottom on the 105 m bench.
- 0.6 Mt of topsoil/till material mined out and stockpiled.
- 0.7 Mt of rock used for haul road and pit perimeter berm construction.
- 0.3 Mt rock mined and stockpiled in the NAG pile.
- Mt rock mined and stockpiled in the PAG pile.
- Mining of benches 135 to 120 of the remaining pit.
- 8.0 Mt mined.
  - 4.7 Mt of topsoil/till material mined out and stockpiled.
  - 2.7 Mt of rock mined and stockpiled in the NAG pile.
  - 0.4 Mt rock mined and stockpiled in the PAG pile.
  - 0.2 Mt ore mined and stockpiled in the low-grade waste pile.
- Construction of haul roads as described in Section 2.7.3 above.
  - 0.7 Mt of waste rock from the pit used for construction, a portion of which will be crushed on site.

Mine construction to full operations is illustrated in Figures 2.9-1 to 2.9-3. Site access, truck shop, ROM pad area, site facilities, water diversions, and water management infrastructure will be constructed during the same time period.



Source: Atlantic Gold, Service Nova Scotia, NS Natural Resources, NS Environment

0 140 280 420
Metres

Coordinate System:
NAD 1983 CSRS UTM Zone 20N

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MARINETTE, HALIFAX CO., NOVA SCOTIA
ENVIRONMENTAL IMPACT STATEMENT - BEAVER DAM MINE

088664
May 11, 2021

END OF PERIOD - Q4 2022

FIGURE 2.9-1

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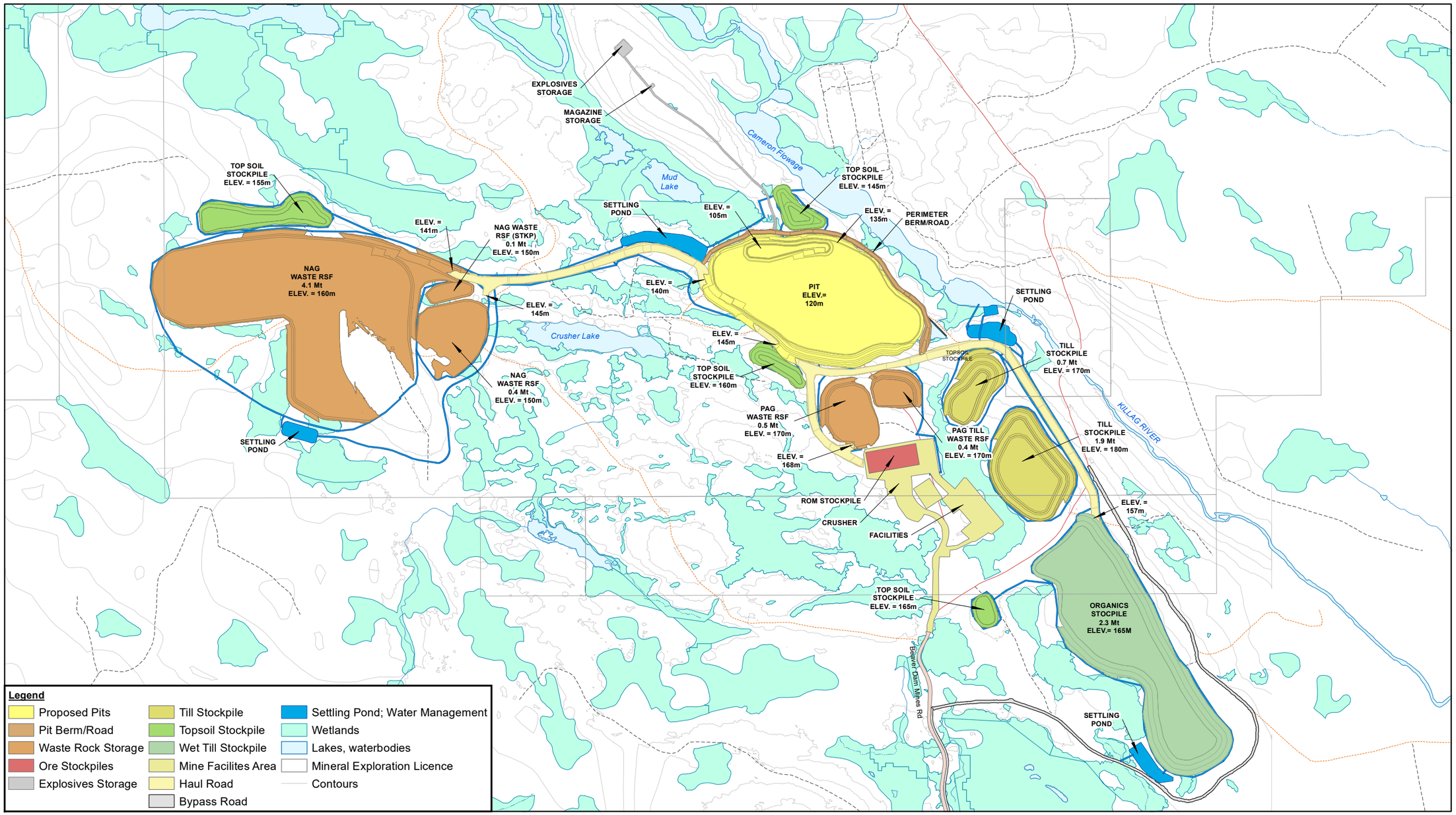

Source: Atlantic Gold, Service Nova Scotia, NS Natural Resources, NS Environment

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Coordinate System:
NAD 1983 CSRS UTM Zone 20N

ATLANTIC MINING NS INC
MARINETTE, HALIFAX CO., NOVA SCOTIA
ENVIRONMENTAL IMPACT STATEMENT - BEAVER DAM MINE

MINE DEVELOPMENT
END OF PERIOD - Q2 2023

088664
May 11, 2021

FIGURE 2.9-2

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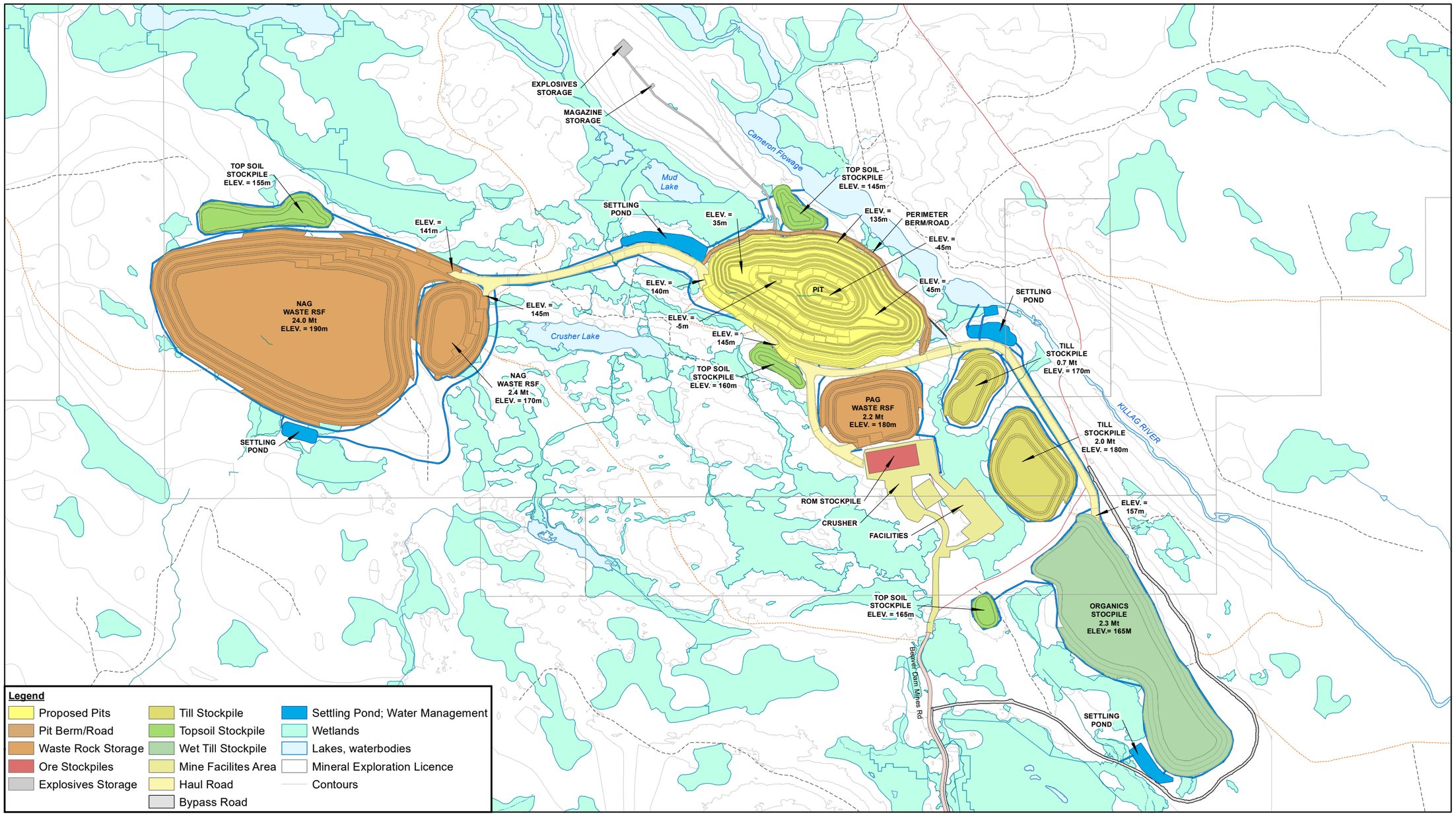

Source: Atlantic Gold, Service Nova Scotia, NS Natural Resources, NS Environment

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Coordinate System:
NAD 1983 CSRS UTM Zone 20N

ATLANTIC MINING NS INC
MARINETTE, HALIFAX CO., NOVA SCOTIA
ENVIRONMENTAL IMPACT STATEMENT - BEAVER DAM MINE

MINE DEVELOPMENT
END OF PERIOD - 2027

088664
May 11, 2021

FIGURE 2.9-3

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2.9.1.1.1 Site Preparation

Clearing, grubbing, grading, and stockpiling of vegetation, topsoil, organics and till in the pit area will be conducted progressively prior to accessing host rock for mining purposes, to avoid erosion. All topsoil, organics, and till will be stored in stockpiles for use in reclamation and construction of berms, impoundments, mine site roads and/or general site grading. Vegetation clearing will be conducted in compliance with nesting bird directives from NSDL&F and Environment and Climate Change Canada. Once vegetation, topsoil, organics and till have been removed, drilling and blasting will be used to mine ore and non-ore bearing waste rock, as well as to establish benches along rock walls. Holes will be drilled into the host rock to receive explosives used for blasting. The open pit will be advanced from the surface at 130 to 155 masl down to 45 masl (i.e., pit depth will range from 175 to 200 m). A berm surrounding the pit will be constructed to act as an access road, noise attenuation and a flood berm.

Areas of waste material storage at the Beaver Dam Mine Site will include six topsoil stockpiles, four till stockpiles, and two non-ore bearing waste rock stockpiles (NAG and PAG). All these locations will be cleared and grubbed concurrently with the pit. The till and waste rock stockpile areas will also have topsoil removed and stored at the topsoil stockpile locations. The existing settling pond at the Beaver Dam Mine Site has been identified as a wetland during the baseline studies (Wetland 59). Inflow into the wetland will be removed and the wetland will be dewatered in preparation for the open pit development. As discussed in Section 6.9 (Fish and Fish Habitat), brook trout have been confirmed within this wetland and a fish rescue and relocation program is anticipated as an approval requirement prior to the pit development.

2.9.1.1.2 Site Construction

Mine site Haul Roads will be constructed to enable the mining fleet (loaders, dozers, haul trucks) to access various site locations including the open pit, waste rock areas, stockpiles and ROM pad area. A waste haulage road will be constructed connecting the pit exit with the topsoil, till, and non-ore bearing waste rock stockpiles. An ore haulage road will also be constructed connecting the pit exit and ROM stockpile. The roads will be dual lane and approximately 27 m wide, including berms and drainage, with a maximum speed limit of 40 kilometres per hour (km/h).

Where practical, mobile equipment and some support facilities will be transported from the Touquoy Mine Site to the Beaver Dam Mine Site for re-use. The mine plan currently is looking to using small blasts within the open pit to break up rock during construction and small crusher will be used for construction material that will be placed adjacent to the pit. Where practical, equipment will be relocated from Touquoy. In the event this is not possible new or used equipment will be sourced from contractors during construction. Fuel storage and distribution will be installed and managed by contractor similar to Touquoy.

Outdoor lighting for at the Beaver Dam Mine Site will be provided by 3 m pole-mounted high- pressure sodium weatherproof lights, while 8 m pole-mounted floodlights will be utilized for the ROM as well as operational facilities pad.

A temporary prefabricated facility equipped with office space, washroom facilities, a mine dry room, and a first aid facility will be provided. In addition, workshop facilities for general maintenance of the mining fleet and ore haulage fleet will be constructed.

A vehicle wash facility likely consisting of manually directed water jets and a high-pressure hot water and steam generator cleaner will be provided for the Beaver Dam Mine Site. The bulk of the mud will be washed off equipment within the pit area with surface water run-off captured within a sump. Final cleaning will occur in the truck wash where water will be circulated through an oil water separator before being directed to an evaporation pond located north of the facilities. Water from the pond will be ditched such that overflow will be directed towards the north settling pond. Water from the evaporation pond will be recycled for truck washing.

The north settling pond will be the first piece of site infrastructure early in construction to prevent discharge of sediment laden water from the Mine Site during construction. All site water will be directed towards the north settling pond (via an expanding network of surface water ditches or pumping) prior to discharge until the east settling pond and south settling pond have been constructed. The north settling pond is to be constructed prior to any clearing or grubbing in preparation for construction of other components of the Mine Site.

Historic tailings will be initially placed within the pit to allow dewatering and later to potentially the ROM pad for storage before being shipped to Touquoy Pit.

Runoff from the till stockpiles will be captured and directed into a collection pond located on the eastern side of the open pit. Water from both these ponds will be gradually decanted to Cameron Flowage by gravity via separate water discharge structures and engineered channels.

The discharge structures on all the settling ponds will be equipped with flow-control devices. The final design of the collection and settling ponds will be submitted as part of the IA application and process.

A berm will be constructed surrounding the pit to prevent shallow groundwater flow and/or surface water originating in Cameron Flowage from entering the pit. A water diversion ditch will be established around the perimeter of the open pit to intercept any surface water that infiltrates the berm and flows into the mine. This ditch will direct water to in-pit sumps where it will be directed to collection ponds located to the east and west of the open pit.

Development of the Beaver Dam Mine Site will cause direct and in-direct impacts to wetlands mostly within the construction phase of the Project. Direct impacts will be associated with clearing, grubbing, infilling and development of the mine and its associated infrastructure. Wetlands located within the Beaver Dam Mine Site are discussed further in Section 6.8 (Wetlands).

2.9.1.2 Haul Road

Site preparation for the Haul Road will begin one year prior to operations commencing, with construction of key infrastructure following shortly thereafter. Based on permitting timelines and environmental restrictions it may be necessary to transport ore along existing Public Roads until such time as Haul Road construction is complete.

The following activities will be undertaken to prepare the Haul Road for construction activities:

- clearing, grubbing, and grading; and
- topsoil, till, and waste rock management.

Once site preparation activities have been completed, construction will commence and involve the following activities:

- watercourse and wetland alteration;
- culvert and bridge upgrades and construction; and
- Haul Road construction and upgrades.

Clearing and grubbing will be conducted prior to upgrading or construction of the Haul Road. Saleable timber will be cut and stockpiled along the road length and the remaining vegetation mulched. Topsoil will be removed and stockpiled along the road length or used in berm construction, water diversion or reclamation of relict portions woods roads not required as part of the realignment.

Where upgrades follow existing woods roads, the width will be increased from approximately 4 m to 10 m, with an additional 3 m on either side to account for sloping and ditching on average. The portions of the Haul Road that require upgrading are anticipated to include approximately 17.8 ha of disturbance.

New road construction totaling approximately 4.0 km, built through a "greenfield" environment, will also be required to avoid travel on Hwy 224 and through Beaver Lake IR 17. The new road construction through the "greenfield" environment is anticipated to result in 6.4 ha of disturbance. The new construction will have a daylighted corridor of approximately 16 m width (on average) with wider areas of disturbance associated with cut and fill sections required to minimize grade and maintain safe design standards. Where possible existing roads will be used to minimize newly disturbed areas.

The upgraded and newly constructed Haul Road will be designed to accommodate up to a 68t gross vehicle weight in either a B-Train or C-Train configuration year-round. It is estimated for construction at total of approximately 275,000 m^3 of material will be excavated during the bulk earthworks phase of construction. The majority of this material will be utilized as fill to establish rough grading of the road. An additional 400,000 T of rock will be required for final grading comprising approximately 225,000 T rock fill for the road base and 175,000 T of gravel for the road surface. Construction material will be sourced from three quarries located along the length of the road with additional requirements for construction material, if required, sourced from either the Touquoy or Beaver Dam Mine Sites or local approved facilities. Road construction will allow for a clear porous subgrade or cross drainage culverts in order for wetland hydrology to be maintained post-construction. Sources of suitably tested clear stone may include the Haul Road corridor and/or the Beaver Dam Mine Site and Touquoy Mine Site or local approved facilities.

Three watercourses between 6 and 13 m wide are currently crossed via single lane timber bridges; these will be replaced by dual lane clear-span pre-engineered single arch modular bridges with an approximate lifespan of 30 years. Smaller watercourse crossings currently utilize culverts of varying sizes, makes, and conditions. Where the upgraded Haul Road follows the course of the existing Haul Road, culverts will be replaced by 600 mm corrugated steel culverts, each designed to extend 2 m beyond the edge of the Haul Road. Where deviations from the existing course are required, culverts of the same design will be installed beneath the new span and culverts beneath the old span will be removed where appropriate to facilitate the restoration of corresponding watercourses and to improve fish passage. Haul Road grades will be designed to maintain a minimum cover of 1 m over all culverts. Culverts will be installed in accordance with DFO and NSE guidance to reduce potential impacts to fish and fish habitat. Where appropriate, AMNS will work to install open bottom box culverts to reduce potential impact on the watercourses and associated fish habitat during road construction. Wetlands that are expected or confirmed to support fish habitat will be partially altered within the Haul Road to support road upgrades, widening and re-alignment as required.

The Haul Road will be upgraded where required to enable the safe and economic transportation of ore. Along the existing Haul Road at locations where the proposed road upgrade alignment will fall, it is anticipated that there could be up to 13 locations where there will be opportunity to improve fish habitat with new culvert installation and old culvert removed, up to 13 net zero scenarios where a new culvert could be installed, and 8 watercourses that will not be affected. Relict portions of the existing portions of the Haul Road that are not reclaimed during Haul Road construction will be properly reclaimed at the end of the Project lifespan or returned to the original owner as per any future lease arrangements.

Speed limit and right-of-way signage will be installed, and all haul truck operators will receive operator training to minimize the risk of collisions. All intersections will be designed to NSTIR Standards. Final design will consider safety and environmental constraints to ensure the best-case scenario for worker safety and environmental effects is developed.

Increased environmental disturbance is anticipated during initial site preparation, construction of new portions of the Haul Road, and during the replacement/upgrades that will be completed to over 20 culverts and 3 bridges.

Prior to construction it is anticipated that the following authorizations will be required:

- Nova Scotia Department of Transportation and Infrastructure Renewal (NSTIR)
  - Highway 224 crossing (preliminary discussions have occurred)
  - Haulage along Mooseland Road (preliminary discussions have occurred)
- Nova Scotia Department of Lands and Forestry (NSL&F)
  - Crown land access/lease (preliminary discussions have occurred)
- Nova Scotia Department of Environment (NSE)
  - Watercourse/Wetland alteration
- Department of Fisheries and Oceans
  - Fisheries Authorization

Authorizations will be sought during the Beaver Dam IA process.

2.9.1.3 Touquoy Mine Site

2.9.1.3.1 General

The Touquoy process plant is located east of Moose River, north east of the Touquoy open pit and north-west of the tailings storage facility. The approach by road to the plant will be from the east via the Mooseland Road.

The Touquoy plant, in particular the crushing circuit, has been designed for simple modification to handle the Beaver Dam feed ore once Touquoy pit is exhausted. The Ball Mill has been sized to accommodate the harder ore from Beaver Dam. Consequently, the Touquoy process flowsheets will remain fundamentally unchanged with the processing of Beaver Dam ore.

The main plant building houses the grinding, gravity recovery, reagent, elution, and refinery sections. The crushing, preleach thickener and CIL sections are located outdoors. The fine ore stockpile is covered for snow protection and dust control. The existing three stage crushing circuit is based on modular mobile crushing equipment to allow the modifications necessary to allow the introduction of Beaver Dam ore to Touquoy.

As noted in Section 2.7.4 weigh stations will be added.

No changes will be made to the remainder of the processing facility are anticipated.

2.9.1.3.2 Crushing Circuit

Ore from the Beaver Dam Mine Site will be transported to the Touquoy Mine Site and fed into the Touquoy ROM hopper by front end loader where it will be transferred by conveyor to the secondary crushing module. Both the secondary and tertiary crushers are similarly sized cone crushers and are designed to produce a fine ore product of P80 of 10 mm. This material is conveyed by a stockpile feed conveyor to the 12,000 t fine ore stockpile (FOS).

The FOS is protected with a cover to reduce moisture, prevent freezing, and minimize dust from the fine ore.

2.9.1.3.3 Grinding

The fine ore is transferred from the FOS via conveyor into the grinding circuit to be processed through one single pinion ball mill in closed circuit with hydrocyclones producing a final product of P80 150 micro metres (µm). The mill has a nominal solids throughput of 5,479 tonnes per day (t/d) and can process 250 tonnes per hour (t/h) at 91.3% availability. The overall ball mill circulating load is 250%. The mill has been sized to handle both the Touquoy and Beaver Dam ores without any mechanical adjustment required during the transition between mines. The Beaver Dam ore is expected to operate at a higher ball volume and steel ball consumption than Touquoy ore to compensate for the difference in hardness and abrasion characteristics.

Mill slurry discharge overflows onto a rubber lined trommel screen with trommel oversize discharging to a bunker for regular collection and disposal by a skid steer loader. The trommel undersize gravitates to the cyclone feed hopper where the slurry is diluted with process water and pumped with a duty/standby cyclone feed pump to the cyclone cluster. A density meter monitors and controls the amount of process water required to produce a target density to the cyclones. The cyclone underflow is split, with up to 30% feeding the gravity circuit and the remaining underflow stream gravitating back to the ball mill.

The cyclone produces a fine ground overflow product of P80 150 µm which is sampled and then gravitates to the vibrating trash screen. Oversize debris is removed and falls to a trash bin at ground level. The trash screen underflow flows by gravity to the pre-leach thickener.

2.9.1.3.4 Gravity and Intensive Cyanidation

A portion of the cyclone underflow (up to 30%) is split and fed into two 50% duty parallel gravity concentrator trains. The gold concentrate recovered is treated in an intensive batch leach system designed to handle 2.4 t/d of concentrate. The resulting concentrated gold solution is pumped to a dedicated eluate tank at the gold room.

The equipment is arranged to provide a gravity cascade under the cyclones. The gravity circuit splitter box provides the feed slurry to the two gravity concentrator trains. Each train consists of a scalping screen, gravity concentrator and gravity area electric chain hoist. The two gravity concentrators in parallel are sized for 188 t/h solids feed rate.

A controlled split of the cyclone underflow to each train is provided with orifice plates located in the underflow launder. The oversize from the scalping screen gravitates to the ball mill feed chute, while the undersize feeds the concentrator. The concentrate gravitates to the intensive cyanidation circuit at ground level.

The intensive cyanidation circuit receives the periodic gold concentrate for treatment in an intensive leach reactor. The gold containing pregnant solution pumps periodically to a dedicated eluate tank in the gold room.

The tailings from the concentrators are transferred back to the ball mill circuit for further processing.

2.9.1.3.5 Carbon-in-Leach (CIL)

The trash screen underflow is increased from 35 to 50% solids in the pre-leach thickener in preparation for the CIL step. The trash screen underflow enters the preleach feedwell after mixing with metered

flocculant. Thickener overflow gravitates to the process water standpipe and is recycled for plant use while the underflow slurry is pumped to the leach feed box for slurry conditioning prior to leaching.

The leach feed from the thickener underflow is pumped to a linear primary CIL feed sampler. The leach feed slurry is mixed with lime slurry in the leach feed box to raise the slurry pH for cyanide gold extraction. The feed box gravitates to the leach tank and optionally can feed directly to CIL Tank 1.

The circuit is a hybrid CIL type and consists of one leach tank and six adsorption tanks in series, each having a live volume of 1,169 m3. The design allows for a 250 t/h solids feed rate at 50% solids for an average 24-hour residence time. Each tank is interconnected with launders to allow slurry to flow sequentially by gravity to each tank in the train.

Barren carbon enters the adsorption circuit at CIL Tank 6. The carbon advances countercurrent to the main slurry flow during periodic transfers of slurry and carbon using air lift movement from a downstream to upstream tank. Carbon concentrations of 10 to 15 g/L are required in all tanks. Carbon will be retained in the upstream tank by an inter-tank screen. The countercurrent process is repeated until the carbon becomes loaded and reaches CIL Tank 1. Then a recessed impeller pump is used to transfer slurry and carbon to a loaded carbon recovery screen. The loaded carbon is washed with water and released to the acid wash column located inside the main plant, in the desorption area. The slurry will be returned to CIL Tank 1.

Following elution of the loaded carbon and thermal regeneration, the barren carbon is screened and reports to CIL Tank 6. Fine carbon is discarded to the CIL tailings hopper.

Tailings slurry from CIL Tank 6 flows by gravity to the vibrating carbon safety screen to recover any carbon in the event of damage, wear or other issues with the CIL Tank 6 inter-stage screen. Recovered carbon is collected in a bin that can be manually transferred for re-use or disposal. Tailings discharging from the safety screen gravitates to the cyanide detox Tank 1 in the cyanide detoxification circuit.

2.9.1.3.6 Desorption and Regeneration

The following operations are carried out in the desorption and regeneration areas:

- Acid washing of carbon.
- Stripping of gold from loaded carbon.
- Regeneration of carbon.

This circuit comprises a fibre reinforced plastic column located within the process building. A separate acid-proofed concrete bund is provided under the acid wash column area to ensure that all spillage is captured and kept separate from other process streams. Transfer and fill operations of the acid wash column are controlled manually. All other aspects of the acid wash and the pumping sequence are automated.

A pressure Zadra elution comprising an elution column, strip solution tank, strip solution pump and a strip solution heater package operates in a closed loop with the electro-winning cells located inside the Gold room.

The elution column is a pressure vessel with a live volume equivalent to 6 t of carbon. The elution column is constructed from carbon steel and includes insulation of all hot surfaces. The column is located next to the acid wash column and shares a bund and a sump pump with the strip solution and transfer water tanks.

The strip solution heater package is located inside the process building, near the elution column, but separately bunded. Within this package there is a recovery heat exchanger, trim heat exchanger, direct- fired heater, control panel, all interconnecting electrics and pipework. The heater is a direct-fired type with a propane fuel modulating burner. The heater is designed for a heat output to maintain the strip solution at 145°C during the stripping cycle. Both heat exchangers are plate and frame type and ensure that the nominal temperature of solution entering the electro-winning cells is less than 100°C.

After completion of the elution process barren carbon is transferred from the elution column to the kiln dewatering screen and into the carbon regeneration kiln feed hopper. In the kiln feed hopper, any residual and interstitial water is drained from the carbon before it enters the kiln. The kiln is a horizontal rotary unit sized for a feed rate of 330 kg/h at 75% utilization and is propane-fired.

The kiln operates at 650 to 750°C and has a nominal retention time of 15 minutes to allow reactivation to occur. Regenerated carbon discharges from the kiln to a quench tank and is then pumped using a recessed impeller pump to the carbon sizing screen. The screen oversize returns to CIL Tank 6, while the quench water and fine carbon report to the tailing's hopper via the carbon safety screen for disposal in the TMF. Fumes from the kiln pass through a wet scrubber to remove entrained minute carbon particles and then to atmosphere via an exhaust stack.

2.9.1.3.7 Gold Room

Three electrowinning sludging cells are used; one cell will be dedicated to the intensive cyanidation circuit and the other two to the elution circuit.

The electrowinning cell dedicated to the intensive cyanidation circuit is fed leach solution via a fixed speed centrifugal pump from the gravity leach liquor storage tank. Solution is pumped to the electrowinning cell and then gravitates back into the gravity leach solution storage tank in a closed loop until suitable gold recovery is achieved. The duration of this cycle varies with the quantity of gold recovered by gravity but is typically less than 24 hours.

The two electrowinning cells dedicated to the elution circuit operate in a closed loop with the elution column and associated equipment. Eluate flows directly from the top of the elution column to the electrowinning cells after cooling through heat exchangers. The eluate flows through the electrowinning cells and then gravitates back to the strip solution tank and then to the elution column in a continuous closed loop. The duration of this cycle is about 16 hours.

2.9.1.3.8 Cyanide Handling and Detoxification

Cyanide

Sodium cyanide (NaCN) is a key reagent used to leach gold from a sold matrix to form a gold cyanide complex that can be extracted from the slurry by adsorption onto activated carbon.

NaCN is delivered in the form of in dry briquettes from an approved supplier as per the International Cyanide Management Code (ICMC) standards. NaCN deliveries are made by truck in one tonne secured (strapped)wooden crates. Within the crates the NaCN is double and sealed close. At site the sodium cyanide is stored in a locked fenced area within the secure reagent building and kept under camera surveillance.

Prior to use, NaCN is mixed with water and sodium hydroxide (NaOH) for dilution and pH control within a mixing tank. Prior to mixing, operators will suit up in full personal protective equipment (PPE) including Tyvek suits and powdered air purifying respirators (PAPR). Water and NaOH are added to the cyanide mix tank. The wooden crates are opened, and a gantry crane lifts the bags out and transports them to the mix tank. The bags are lifted by crane into the bag cutter on top of the mix tank and the door is shut to enclose the bag. The bag is slowly lowered onto the bag cutter and the dry solids are emptied into the mix tank. The bag cutter has water sprays to clean the cyanide bags prior to removing from the enclosure. This process is repeated for 4 cyanide (NaCN) bags to achieve a mix concentration of -22%. Once the NaCN storage tank level is below 20% the mix tank is then transferred to the storage tank for distribution throughout the plant.

Cyanide is added into three areas; Leach tank #1, Intensive Leach Reactor (ILR) and Barren Eluate tank #12. Leach tank #1 is a continuous addition whenever the leach circuit is being fed with ore. It is controlled based on constant cyanide titrations throughout the leach/CIL circuit. The ILR and Barren Eluate tank are dosed based on a batch process. When a batch is ready, the dosage is controlled based on a flowmeter to a targeted concentration. All these addition points have pH control reagents (NaOH or Lime) with automated interlocks that will not permit NaCN addition until a suitable pH is achieved to avoid the formation of hydrogen cyanide (HCN) gas.

Cyanide target concentrations are as follows:

- Leach tank # 1 = 50 ppm (0.005%). By the end of the CIL circuit (CIL tank #6), the remaining cyanide is about 30 ppm (0.003%)
- ILR= 14,000 ppm (1.4%). Once the process is complete, this small volume (5.2 m^3) is transferred and diluted in the much larger Leach/CIL circuit (9,100 m^3) for consumption.
- Barren Eluate Tank #12= 1000 ppm (0.1%). Once the process is complete, the remaining cyanide stays in the tank to be re-used during the next batch. Each new batch, the cyanide is just topped up to the target concentration.

2.9.1.3.9 Cyanide Destruction

Cyanide destruction occurs within the cyanide destruction circuit. Slurry passing through the carbon safety screen gravitates to two 300 m^3 cyanide detoxification tanks which are designed on the conventional air- SO_2 process and can operate in series or parallel for operational flexibility. The average slurry residence time at 250 t/h is 1.5 hours.

The tanks utilize high shear agitators and air injection to enhance high oxygen dissolution in the slurry to meet the high oxygen demand of the cyanide destruction process. Sodium metabisulphite and copper sulphate solutions are dosed into either tank providing the oxidizing agent and catalyst respectively for the cyanide destruction. Acid generation is neutralized by the addition of lime slurry to the detox tanks via a ring main.

The detoxified slurry stream gravitates to the tailings hopper from where it is pumped through a single pipeline to the TMF by variable speed tailings pumps (1 duty/1 standby). The tailings slurry is then discharged at selected outlet points around the periphery of the facility. Pipe runs are designed to be self- draining to avoid dead legs.

Contingency measures for cyanide detoxification include primary linear and secondary rotary vezin tailings samplers taking representative tailings samples after the slurry has been detoxified and prior to entering the tailings hopper. The cyanide destruction and tailings hopper area has a dedicated bunded concrete area for collecting spillage. A local sump pump returns any spillage to the carbon safety screen. The area is enclosed for cold weather protection. A CNWAD analyzer automatically monitors slurry levels and an HCN detector provides monitoring for airborne gas.

Shutdown procedures are in place in the event of process upsets including cyanide detoxification.

2.9.1.3.10 Tailings Disposal

Prior to the completion of mining operations at Touquoy, a tailings line will be routed to the exhausted Touquoy pit in preparation to receive Beaver Dam tailings. Tailings will flow by gravity to the open pit. Initially, reclaim water will be withdrawn from the supernatant pond in the existing TMF to supply processing water needs for Beaver Dam ore. A reclaim water pump and barge, with a new pipeline to the process water tank, will be installed when process water accumulation from the tailings slurry deposited in the pit is adequate. The transition from the TMF to the open pit reclaim water system is expected to be smooth requiring minimal downtime and no extra fresh water requirements beyond what is currently permitted from Scraggy Lake under Touquoy water withdrawal approvals. It may be necessary to withdrawal water from Scraggy Lake at start-up but it is expected that water will be recycled from the pit for processing Beaver Dam mine ore.

Supernatant water collected in the open pit will be pumped to the process water tank located next to the pre-leach thickener. The sections of the tailings and reclaim pipelines between the plant site and open pit will be double-walled and run in HDPE lined trenches to an adequately sized lined collection ponds capable of containing the volume of the pipeline. Monitoring systems will be installed on the pipelines for leak detection and shutdown procedures.

The Touquoy Project currently employs an Operation, Maintenance and Surveillance (OMS) Manual for the existing TMF. This manual will be updated in advance of using the open pit for storage of Beaver Dam tailings in order to reflect changes in operating conditions and environmental factors. As well, Touquoy also currently employs an Emergency and Spill Response Plan which will also be updated, Environmental monitoring will continue as prescribed under the Touquoy IA which will be amended as necessary to reflect the changes in processing of Beaver Dam ore and storage of Beaver Dam tailings.

The minor works necessary to modify the Touquoy Mine Site for Beaver Dam ore, as described above, will begin before initiation of operation of the Beaver Dam Mine Site. This transition phase will likely not exceed two months.

No other changes will be made to the remainder of the processing facility and no additional land disturbances are anticipated to prepare the Touquoy Mine Site to receive Beaver Dam ore.

2.9.1.4 Construction Environmental Mitigations and Monitoring

The construction activities at Touquoy Mine Site required for the Beaver Dam Mine Project are minimal and within the existing Touquoy project footprint. The existing Touquoy IA well addresses construction activities, such as sediment and erosion control and spill protection and containment associated with construction equipment (e.g., fueling).

The existing environmental monitoring requirements at Touquoy include surface and groundwater monitoring as part of the IA. This will have occurred for about five years before construction activities associated with the Beaver Dam Mine Project commences. Also, existing approvals for wetland alteration include requirements for monitoring and compensation; these will be completed during the life of the Touquoy Gold Mine and no additional disturbance of wetlands is required as part of the Beaver Dam Mine Project activities at Touquoy.

2.9.1.4.1 Project Schedule

During the one-year construction phase, flexibility in the schedule may be employed to take advantage of seasonality. The upgrades to the Touquoy processing facility are not anticipated to exceed two months. This will likely be completed near the end of Year 1, after exhaustion of the Touquoy pit. Details regarding, he time of year when activities will begin will be determined at a later date and addressed during the IA process.

2.9.2 Operation and Maintenance (Years 2 to 6)

2.9.2.1 Beaver Dam Mine Site

During operation and maintenance of the Beaver Dam Mine Site the following activities will be undertaken:

- surface mine operation and maintenance:
  - drilling and rock blasting;
  - surface mine dewatering;
- ore management;
- waste rock management;
- surface water management;
- dust and noise management;
- petroleum products management; and,
- site maintenance and repairs.

2.9.2.1.1 Surface Mine Operation and Maintenance

Once accessible, in-situ rock will be drilled and blasted on 5 m bench heights. Diesel powered rotary drills will be used for production drilling and horizontal high wall depressurization drilling on the ultimate pit walls if required. Dedicated reverse circulation grade control drilling and sampling will be used to define ore and waste rock limits, while a fleet management system will track each load transported from the surface mine.

The open pit will remove approximately 56.6 million tonnes (Mt) of material (i.e., ore, non-ore bearing waste rock, till, and organic material) over the life of mine. The production schedule for the Beaver Dam Mine is shown in Table 2.7-1 and Figure 2.7-2. The pit will be mined in a west/east phases. Ultimate pit limits are split into phases or pushbacks to target higher economic margin material earlier in the mine life. The ultimate pit is subdivided into two phases, west and east, but for considerations of vertical advance the pit is mined as one phase from top to bottom. A small starter pit phase is also planned for the northwest corner of the pit to provide construction materials early in the mine life. The ore mined from the pit will range from 0.7 Mt to 2.1 Mt over the life of mine with approximately 0.5 Mt to a maximum of 14.9 Mt of waste being generated over life of mine. The open pit will be advanced from the surface at 130 to 155 masl down to 45 masl. At completion, the open pit will measure approximately 900 m along its east-west axis, approximately 500 m along its north-south axis, with a depth of ranging approximately 175 to 200 m based on the current ore delineation. The total area comprising the open pit will be approximately 31 ha.

A contract explosives supplier will provide the blasting materials for the mine. Emulsion will be the primary blasting agent as the majority of holes will be wet. It is anticipated that explosives and all accessories will be supplied on an as needed basis from the

contractor's base location off-site and delivered to the site explosive storage facilities or directly to the blast holes using the contractor's equipment. If required, magazines will be suitably located to conform with quantity and distance requirements as regulated by Natural Resources Canada (NRCAN). All on and off-site permitting requirements will be the responsibility of the contractor through NRCAN.

Diesel powered hydraulic excavators and a wheel loader will load both ore and waste rock into separate haul trucks. These loading units will also function to re-handle mine material, and load overburden and topsoil, as well as conduct mine clean up, road construction, and snow removal. The off-highway rigid frame haul trucks will have a 64-tonne capacity and haul ore to the ROM pad and ore stockpiles as required, while waste rock will be hauled to the waste rock stockpiles. If dust is generated from hauling during warmer months, it will be controlled by applying water to the Haul Roads utilizing a specialized water truck. At the ROM pad, off-highway haul trucks will dump ore material directly into the primary crusher or place it in an active stockpile on the pad to be re-handled as crusher feed later on. Active stockpiles will be constructed in lifts. Loading of stockpiled ore into the primary crusher will be accomplished via a diesel-powered wheel loader. At the waste rock stockpiles, haul trucks will dump waste rock and diesel-powered track dozers will spread it into lifts.

As all ore processing will be carried out at the existing Touquoy processing facility, no mill reagents, including cyanide, will be utilized at the Beaver Dam Mine Site. No changes will be made to the mill reagents used in the Touquoy gravity/CIL process as described in Section 2.7.4 due to the processing of Beaver Dam ore. All mill reagents used at the Touquoy will continue to be transported, stored, used, and disposed of, where necessary, in accordance with existing Touquoy standard operating procedures, permits, approvals and relevant regulations.

The only chemicals expected to be used at the Beaver Dam Mine Site, not including fuels, oils, lubricants, coolants, etc., are:

- flocculants, which will likely be used to meet suspended solids discharge limits at the discharge point; and,
- chemical dust suppressants, such as magnesium chloride, to supplement the use of water in controlling fugitive dust generation on roads and other trafficable areas. Chemical dust suppressants will be considered for use when conditions render water use alone inefficient in controlling fugitive dust from traffic.

In the event water treatment is required during the operational or post closure phases of mine development, reagents could include ferric sulphate (for arsenic and other metals removal), oxidizers such as hydrogen peroxide and potassium permanganate, lime for pH adjustment, and flocculants for final sludge removal.

The anticipated 246-person workforce at the Beaver Dam Mine Site will include approximately 105 mine personnel (working two or three shifts per day of 12 or 8 hours respectively, or approximately 26 persons per shift (includes 26 on leave at any time). The workforce also includes 60 haul truck drivers, 57 plant staff (at the Touquoy Mine Site), and 24 general and administrative staff (between the Beaver Dam mine site and the Touquoy Mine Site). An allowance of 12 days per year of no mine production has been assumed to allow for adverse weather conditions. No group transportation to the mine site or on-site lodging are anticipated at this time so long as the local labour pool can supply the necessary labour requirements.

A summary of the major mining equipment fleet requirements is provided in Table 2.9-1.

Table 2.9-1: Beaver Dam Primary Mining and Hauling Equipment Requirements

Activity and Equipment	Requirement				
	2022 (Partial year)	2023	2024	2025	2026 (Partial year)
Drilling					
Diesel DTH Tracked Drill, 110 mm holes	4	5	4	2	1
Diesel RC Tracked Drill, 135 mm holes	2	2	2	2	2
Loading					
Hydraulic Excavator - 4.55 m3 bucket	4	4	3	2	2
Wheel Loader - 7.0 m^3 bucket	2	2	2	1	1
Hauling					
Haul Truck - 64 tonne payload	13	13	11	5	4

To facilitate successful mining operations, the following in situ support services will be available:

- mine site road maintenance;
- mine floor and ramp maintenance;
- ditching;
- reclamation and environmental controls;
- surface mine dewatering;
- surface mine lighting;
- mine safety and rescue;
- transportation of personnel and operating supplies; and
- snow removal.

A summary of the equipment chosen to conduct these support services and their specific role is provided in Table 2.9-2.

Table 2.9-2: Beaver Dam Operational Equipment Requirements

Equipment	Function	Requirement
Motor Grader (4.3 m blade)	Mine site road maintenance	1
Water/Gravel Truck	Mine site road maintenance	1
Track Dozer (325 kW)	Waste rock stockpile maintenance	3
Water Pumps (150 m^3/h)	Mine sump dewatering	2
Track Dozer (237 kW)	Mine support and construction	1
Wheel Loader (5.5 m^3)	Mine support and construction	1
Hydraulic Excavator (2 m^3)	Utility excavator and rock breaker	2
On-highway Dump Truck	Utility material movement	2
Fuel and Lube Truck	Mobile fuel/lube service	2
Shuttle Bus (16 passenger)	Employee transportation	1

Table 2.9-2: Beaver Dam Operational Equipment Requirements (continued)

Equipment	Function	Requirement
Backhoe Loader (69 kW)	Utility loader and stemming loader	1
Pickup Trucks (1/4 tonne)	Staff transportation	7
Light Plants (20 kW)	Surface mine lighting	6
Skid Steer (54 kW)	Utility material movement	1
Track Dozer (149 kW)	Utility material movement	1
Maintenance Trucks	Mobile maintenance crew and tool transport	2
Mobile Crane (36 tonne capacity)	Mobile maintenance material handling	1
Float Trailer (55 tonne capacity)	Equipment transport	1
Forklift (3 tonne capacity)	Shop material and tire handling	1
Mobile steam cleaner	Mobile maintenance equipment cleaning	1

The majority of this equipment will be utilized during the site preparation and construction phase as well. Maintenance activities for the mobile mining, hauling, and operation equipment will be performed in the field and at the mine maintenance workshop facility located near the primary crusher. All field maintenance will be performed with dedicated maintenance equipment operated by qualified staff. A grader will be used to maintain the mine site roads. Snow clearing will be conducted regularly during the winter months. No salting of mine Haul Roads is anticipated during winter conditions for traction.

The maximum anticipated daily volume on the Highway #224 and Beaver Dam Mines Road associated with the Beaver Dam Mine Project is estimated to be 175 (passenger and service vehicles). In reality, based on use of the Haul Road, intermittent service vehicle schedules and car-pooling, the number on #224 could be reduced by 50% to around 85 to 90 per day over a 24-hour period or roughly 4 per hour on the #224. Traffic on Highway #224 is expected to remain within the traffic count ranges as provided by NSTIR (refer to Section 6.16 Socio-economic Conditions).

The Beaver Dam Mine Site will require a water source for fire protection and dust control. Raw water will be pumped either directly from Cameron Flowage or recycled from the site water collection ponds or ditches assuming the water quality meets regulatory requirements. Water will be distributed from the storage tank to various users including, but not limited to, the site facilities facility and primary crusher location if required. Dust control will occur as required and will consist primarily of wet suppression controls using only water on unpaved surfaces. However, in some high traffic areas including site facilities and internal access roads, a chemical suppressant (e.g., Magnesium Chloride) may be used to more effectively control dust. This will be applied during the summer/fall months (May to October) in liquid form using the mine water truck and in granular form during the colder months (November to April). There is no requirement for decant water and potable water will be delivered via specialized truck.

Daily domestic water usage is based on approximately 30 employees on the mine site at any time. It is anticipated that one drilled domestic water well will be required to provide water for sanitary usage as domestic wells in this area generally yield 5 to 10 L/min based on a literature review of several sources and the demand is estimated at less than 5 L/min. The use of a storage tank on-site and water demand equipment will keep extraction rates within the well capability.

A mobile vehicle wash down unit likely consisting of manually directed water jets and a high-pressure hot water and steam generator cleaner will be utilized at the Beaver Dam Mine Site.

Surface water runoff from truck washing will be contained and directed to the site collection pond. Sampling will determine whether this wastewater stream will require treatment prior to release to the receiving environment.

Sewage from the Beaver Dam Mine Site office facility will flow by gravity drain via a piped network buried below the frost line to septic tanks equipped with leach drains. No chemical waste will be disposed of through the septic system. The septic tanks will be pumped out as required by a contractor.

Hazardous wastes, such as used oil, lubricants, batteries and antifreeze will be collected by qualified hazardous waste contractors and taken off-site for re-cycling or disposal in accordance with relevant legislation. General non-mine waste will be collected by a contractor and transported off site for disposal.

2.9.2.1.2 Ore Management

Ore will be loaded into off-highway haul trucks for transport out of the open pit. From there, ore will be separated into low and ROM stockpiles prior, while non-ore bearing waste rock will be stockpiled for final disposal.

Waste Rock will either be directed to the Waste Rock Storage Area (NAG) or to the PAG Storage Area. The design capacities are described in Section 2.7.2.3.

The ROM stockpile will likely have up to a 30-day capacity for storing ore during plant shut-downs or short-term periods where ore extraction from the mine exceeds crusher or plant capacity. The ROM stockpile can also accommodate plant feed if ore hauling from the mine is reduced for weather or other reasons.

2.9.2.1.3 Waste Rock Management

Material storage at the mine site will include six topsoil stockpiles, two till stockpiles, and two non-ore bearing waste rock stockpile comprising a total of 98 ha.

2.9.2.1.4 Surface Water Management

Mine Water Management is described Appendix P.4 and is described in Section 2.7.2.9.

2.9.2.1.5 Petroleum Products Management

The site will be serviced by both propane and diesel. Diesel will be stored primarily at the mobile equipment fuelling station meant to serve both the mining fleet and the transport fleet. The fueling station consists of a 3,000 heated and insulated tank with a hybrid pump. The fueling system will supplied and owned by a third party vendor who will rent to the site as part of the fuel contract.

The generators will also be supplied with fuel tanks at 13,200 litres each and will be filled by the 3rd party vendor. Propane will be stored at site in two 7,500 L tanks which will be owned by the same vendor as the diesel fuel supplier. Propane will then be plumbed to the various buildings for heating.

The delivery of diesel fuel will be conducted by tanker trucks from suppliers who routinely transport and distribute petroleum products. Transfer of these products from the tanker truck to double-walled tanks with bollards will be constantly supervised by the delivery person to ensure constant observation and immediate response should a spill occur. Based on anticipated equipment, associated efficiency ratings, and hours of operation, diesel fuel consumption by operational equipment and haul trucks has been

estimated to be approximately 9.02 million litres of diesel fuel per year during full scale operations. During construction and decommissioning, diesel fuel consumption will be approximately 3.7 million litres per year.

2.9.2.2 Haul Road

During operation and maintenance of the Haul Road the following activities will be undertaken:

- ore transport; and
- Haul Road maintenance and repairs.

The only change in Haul Road is the removal of the Preferred Alternative Haul Road option, which has been noted in each the VC Sections (Section 6). It may be necessary to use the Public Roads during start-up (i.e., 6-8 months) depending on approval and permitting timelines and construction restrictions.

During operation and maintenance of the Haul Road the following activities will be undertaken:

- ore transport; and
- Haul Road maintenance and repairs.

2.9.2.2.1 Ore Transport

Crushed ore, either from either a primary crusher or small blasts in the pit, from the Beaver Dam Mine Site will be transported to the Touquoy Mine Site by truck travelling along the upgraded Haul Road. The route is Beaver Dam Mines Road to Hwy 224 to logging roads herein referred to as the Moose River Cross Road to Mooseland Road for a total distance of 31 km. It is anticipated that ore will be hauled under contract between the two sites, however, this is subject to further review and availability of suitable qualified contractors.

Approximately 20 highway trucks will be required to transport the ore from the Beaver Dam Mine Site to the Touquoy Mine Site. The exact number will depend on final payloads and the hauling schedules, which will likely be a single 12-hour shift, or two 8-hour shifts per day operating between the hours of 7:00 a.m. to 11:00 p.m. The number of return haul truck trips per day will be an annual average of approximately 190 round trips per year but will vary with production schedule (Table 2.7-1) for 353 days per year for the anticipated duration of the Project (5 years). Approximately 12 days a year the site will require shutdowns due to maintenance and/or weather events. This will result in an increase from the current average daily traffic on the Haul Road (when forestry operations are not occurring) which is estimated to be approximately 10 vehicles per day. Hours of operation during active hauling will likely occur between 7:00 a.m. to 11:00 p.m. The exact number trucks will depend on final payloads, production schedule and the hauling schedules. During construction and pre-production truck traffic will be reduced and will be associated with construction and upgrade of the Haul Road and transportation of equipment between the Touquoy Mine Site and the Beaver Dam Mine Site.

2.9.2.2.2 Haul Road Maintenance and Repairs

All grading, maintenance, snow clearing, gritting and dust suppression conducted on the Haul Road will be completed by a third-party contractor. With regards to Haul Road maintenance, it is anticipated that only minor surface repairs will be undertaken during the planned haulage schedule. Most of the road maintenance will occur outside of the planned hauling schedule so as not to impede the haul trucks and increase the safety risk on the road. Apart from road surface maintenance it is anticipated that major repairs will be localized in kept to a minimum with appropriate road design.

Snow clearing will be undertaken using an on-highway truck outfitted with a snow plough sand spreader. Clearing will occur on an as needed basis throughout the winter months and will require operations outside the planned haulage schedule depending upon the snowfall event. The sand spreader will be utilized during the winter months for traction control. In addition, localized salting during significant ice events will occur for safety reasons. Salting will be restricted to road sections with steeper grades and at least 30m from any watercourses.

Dust control will occur as required and will consist of a combination of chemical suppressant and/or water on unpaved surfaces. In order to provide longer term dust suppression, particularly throughout the winter months where water is not practical, an approved chemical dust suppressant will be applied to the road surface. Periodic application is anticipated depending upon road conditions and traffic. To support chemical dust suppression and provide short term suppression of dust throughout the warmer drier months, water will be applied. A water truck will spray the width of the Haul Road and operate during the haulage period.

Increased environmental disturbance is anticipated during peak transport times (7AM to 11 PM) and during maintenance activities along the Haul Road.

All grading, maintenance, snow clearing, gritting and dust suppression conducted on the Haul Road will be completed by a third-party contractor. With regards to Haul Road maintenance, it is anticipated that only minor surface repairs will be undertaken during the planned haulage schedule. Most of the road maintenance will occur outside of the planned hauling schedule so as not to impede the haul trucks and increase the safety risk on the road. Apart from road surface maintenance it is anticipated that major repairs will be localized and kept to a minimum with appropriate road design.

Snow clearing will be undertaken using an on-highway truck outfitted with a snow plough sand spreader. Clearing will occur on an as needed basis throughout the winter months and will require operations outside the planned haulage schedule depending upon the snowfall event. The sand spreader will be utilized during the winter months for traction control. In addition, localized salting during significant ice events will occur for safety reasons. Salting will be restricted to road sections with steeper grades and will only be applied at least 30m from any fish bearing watercourses.

Dust control will occur as required and will consist of a combination of chemical suppressant and/or water on unpaved surfaces. In order to provide longer term dust suppression, particularly throughout the winter months where water is not practical, an approved chemical dust suppressant will be applied to the road surface. Predictive modelling and evaluation of potential effects within this EIS has been completed based on 80-90% effective dust mitigation. Periodic application is anticipated depending upon road conditions and traffic. To support dust suppression and provide short term suppression of dust throughout the warmer drier months, water will be applied. A water truck will spray the width of the Haul Road and operate during the haulage period.

2.9.2.3 Touquoy Mine Site

During operation and maintenance of the Touquoy Mine Site the following activities will be undertaken:

- ore processing; and
- tailings management (exhausted pit).

2.9.2.3.1 Ore Processing

Other than the primary ore crushing, no mineral processing will be undertaken at the Beaver Dam Mine Site. All processing will be completed at the Touquoy Mine Site after mining from the Touquoy pit has been exhausted.

The Touquoy plant is designed to treat Beaver Dam ore with no modifications other than an increase in the total weight of grinding balls in the ball mill to accommodate the slightly harder ore from the Beaver Dam pit. This will not require any larger equipment.

Details regarding water and tailings management (exhausted pit) are provided in the Integrated Water and Tailings Management Plan presented in Appendix F.7. A summary is provided below for operational and closure phases of the project.

2.9.2.3.2 Tailings Management - Operations

There is no requirement for tailings management at the Beaver Dam Mine Site as all mineral processing will be undertaken at the Touquoy Mine Site. Tailings generated from this operation will be pumped to the mined-out Touquoy pit for storage and covered with water to create a lake during reclamation. The approved Touquoy Environmental Assessment stated that the pit would be allowed to fill naturally with water over a period of time through precipitation, surface flow and groundwater in-flow. No change to this method is planned to follow the deposition of Beaver Dam tails, except that the time frame for refilling will be shorter given the decrease in available volume taken by the tailings.

The processing of Beaver Dam ore at Touquoy involves the continued use of Touquoy water management facilities but flow patterns will be altered and rerouted as described, below. The Tailings Management Facility (TMF) will continue to receive surface runoff from the waste rock pile, seepage collection ditches, and direct precipitation and will continue to operate under the existing Industrial Approval (IA) which includes TMF effluent treatment plant operation and discharge to Scraggy Lake. Runoff from the mill site pond and run-of-mine (ROM) stockpile will continue to be collected and routed to the plant for use as make up water for the processing of Beaver Dam ore. Dewatering of the open pit to the TMF will cease at the end of Touquoy open pit mine life which will allow water inflows to accumulate in the open pit. At initial stages of Beaver Dam ore processing, reclaim water will be directed to the mill from the TMF through the existing decant tower or floating barge infrastructure for processing of Beaver Dam ore. Delay of water reclaim from the open pit will allow time for water inflows to collect in the pit as a start-up process water supply. When water is to be reclaimed from the open pit, the existing floating barge and associated infrastructure will be relocated from the TMF to the exhausted open pit. The barge will raise with the water and tailings elevation in the pit, decreasing pump head and associated pumping costs over time. If required, additional Beaver Dam ore processing start-up water supply will be sourced from Scraggy Lake, subject to NSE water withdrawal approval. Freshwater make-up for the process will continue to be sourced from Scraggy Lake as provided in existing water withdrawal approvals. Additional make-up process water required in a dry year will be sourced from effluent from the TMF treatment plant or Scraggy Lake, subject to NSE approval. Beaver dam tailings will be deposited in the open pit. The existing tailings slurry pipeline from the mill will be redirected from the TMF to the Touquoy open pit.

2.9.2.3.3 Tailings Management - Closure

During the closure phase, the objective is for water in the pit lake to meet the reclamation regulatory water quality requirements or site-specific criteria. Key water management features are described below.

The existing TMF effluent treatment plant and downstream discharge facilities will continue to be in operation to treat TMF water surplus. At the cessation of tailings deposition to the Touquoy open pit, the open pit will fill with water. During this period, there may be an opportunity to treat the pit lake as a batch reactor with the objective of adjusting the pH to precipitate metals thus improving discharge quality. Surplus water in the open pit will be pumped to the TMF for treatment, until such time as water quality

monitoring indicates that water quality is suitable for direct discharge to the environment. Until water quality meets discharge criteria, the water level in the pit lake will be maintained at or below elevation 104 masl (i.e., corresponding to the shallow permeable zone), thus reducing seepage to Moose River and normalizing treatment rates to the extent feasible. A minimum of 1 m water cover will be maintained above the deposited tailings to facilitate pumping. The water cover depth will vary over the tailings depositional period. The effluent treatment plant will operate intermittently during non-frozen periods (April - November, inclusive) to lower the pit lake to 103 masl seasonally by the end of November, thus providing storage over the period when the effluent treatment plan is shut down during the winter months. Assuming the existing effluent treatment rate of 400 m^3/hr, the effluent treatment plant would be in operation for an additional 4.4 months to pump and treat the annual climate normal surplus of the open pit watershed of 436,000 m^3. Operation of the existing effluent treatment plant will be modified to accommodate Beaver Dam water surplus or additional capacity will be added to effluent treatment plant to treat water over a shorter period simultaneously.

The effluent treatment plant and downstream discharge facilities are not required for the Project once effluent discharge meets regulatory discharge criteria and will not require treatment. Surplus water in the open pit will be discharged via a constructed spillway/conveyance channel to Moose River, subject to meeting regulatory discharge criteria. The spillway and conveyance channel will be sized to accommodate the inflow design flood in accordance with the Canadian Dam Association (CDA) guidelines. The spillway invert is set at elevation 108 m, approximately 2 m below the lowest open pit elevation to prevent overtopping.

2.9.2.4 Existing Environmental Mitigation Requirements Associated with Operations

There is an existing IA for the Touquoy Project which has specific environmental mitigation and monitoring requirements. This is relevant to the Beaver Dam Mine Project in two ways:

- Monitoring data is being collected since 2016 and will continue to be collected through to the start of the Beaver Dam Mine Project as part of requirements under the existing IA. This provides much background data to support the follow up programs anticipated at the Touquoy Mine Site for the Beaver Dam Mine Project.
- Mitigation measures required as part of the IA and other associated Touquoy Gold Mine environmental management plans will continue to be implemented as part of the Beaver Dam Mine Project.

Given the operational activities at the Touquoy Mine Site are limited to processing of ore and management of tailings (exhausted pit), existing mitigation and monitoring requirements applicable are directly related to atmospheric emissions, surface water and groundwater.

2.9.3 Active Reclamation (Years 5 to 7)

2.9.3.1 Reclamation Objectives and Goals

The objective of the Final Reclamation Plan is to return the site to a safe and stable condition, compatible with the surrounding landscape and anticipated final land use. The plan will employ recognized reclamation best practices, acknowledged principles of ecological restoration, and consultation with stakeholders and First Nations including the Millbrook First Nation and other Mi'kmaq communities. In the past, the site has hosted numerous mining/exploration activities (exploration declines, roads, camps, settling ponds, and small waste piles of rock and overburden), along with successive tree harvesting and silviculture operations. Evidence of recreational land use (hunting and off-road vehicles) and surface water use (fishing and boating) directly within the Beaver Dam Mine Site is limited and suggests these activities could be re-instated once the surface mine ceases operation and reclamation activities have been completed.

The goals of a successful Final Reclamation Plan include:

- remove all equipment and infrastructure not necessary for future use and care of the site;
- Create a physically, chemically and biologically stable site.
- stabilize the terrestrial environment and revegetate the site to encourage regrowth of native species;
- minimize disruption to the aquatic environment; and
- restore land and surface water use potential.

The reclamation goals are designed to enable eventual abandonment of the site in a safe and stable state. In order to achieve these goals, AMNS will undertake general decommissioning and reclamation activities as described below.

2.9.3.1.1 Beaver Dam Mine Site

A draft Reclamation and Closure Plan has been developed for the Beaver Dam Mine Project and is provided in Appendix P.2. Figures 2.9-4 and 2.9-5 show closure landforms during active and post-closure.

2.9.3.1.2 Final Land Use

The goal of reclamation is to return the physical, chemical, and biological qualities of the land and water regimes disturbed by the Project to a state that is safe, stable, and compatible with the surrounding landscape and final land use.

The final land use of the Crown lands will require the landowner's (Nova Scotia Crown Lands) approval and the acceptance by Nova Scotia Department of Lands and Forestry (NSLF), Nova Scotia Environment and Climate Change (NSECC) and the Nova Scotia Department of Energy and Mines (NSDEM).

Specific objectives, criteria, planned reclamation activities and performance monitoring to achieve the closure goals are also outlined (Section 2.9.3.1).

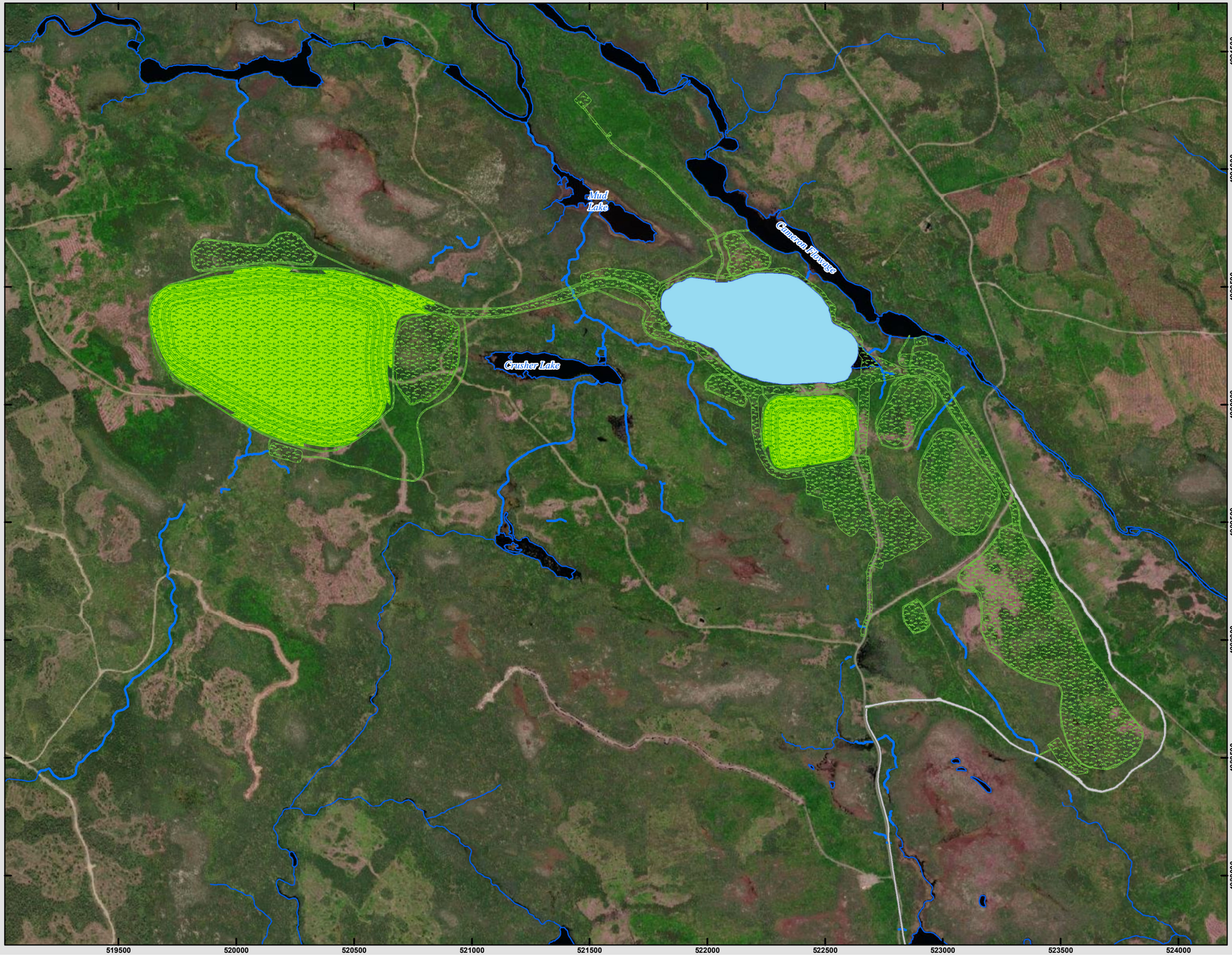
2.9.3.1.3 Engagement

Initial land use activities identified by stakeholders for the post-mining landscape included outdoor recreation, commercial forestry and traditional land uses (AMNS 2021). Specific engagement is summarized below.

Continued engagement with the public and traditional land users regarding the mine's operational and closure planning will be undertaken through a combination of groups, as described in the Beaver Dam Mine Engagement Plan (AMNS 2021), including but not limited to:

- Millbrook First Nations;
- Mi'kmaq of Nova Scotia;
- Community Liaison Committee (CLC); and
- Reclamation and Closure working group that is anticipated to include representatives from members of the public, ATV association and other stakeholder groups.

It is anticipated, based on the results of this ongoing engagement, that the final land use concepts during post-closure will continue to evolve. It should be noted that future land use will need to comply with some restrictions related to minimizing disturbance and maintaining the structural, chemical and biological integrity of some of the closure measures. A brief description of the current closure vision for each major mine component is included in Table 2.9-3.



Prepared For:

Atlantic Gold

FIGURE 2.9-4

Beaver Dam Mine Project Active Closure

BD Mine Site Planned Infrastructure

- Reclaimed Site Infrastructure Removed
- Reclaimed Stockpile - Stabilized, Covered and Vegetated
- Pit Lake
- Multiuse Bypass Road



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 200 400 800 m

1:15,000 Scale when printed @ 11" x 17"

Drawn By: LP
Reviewed By: XX

Date: 5/11/2021

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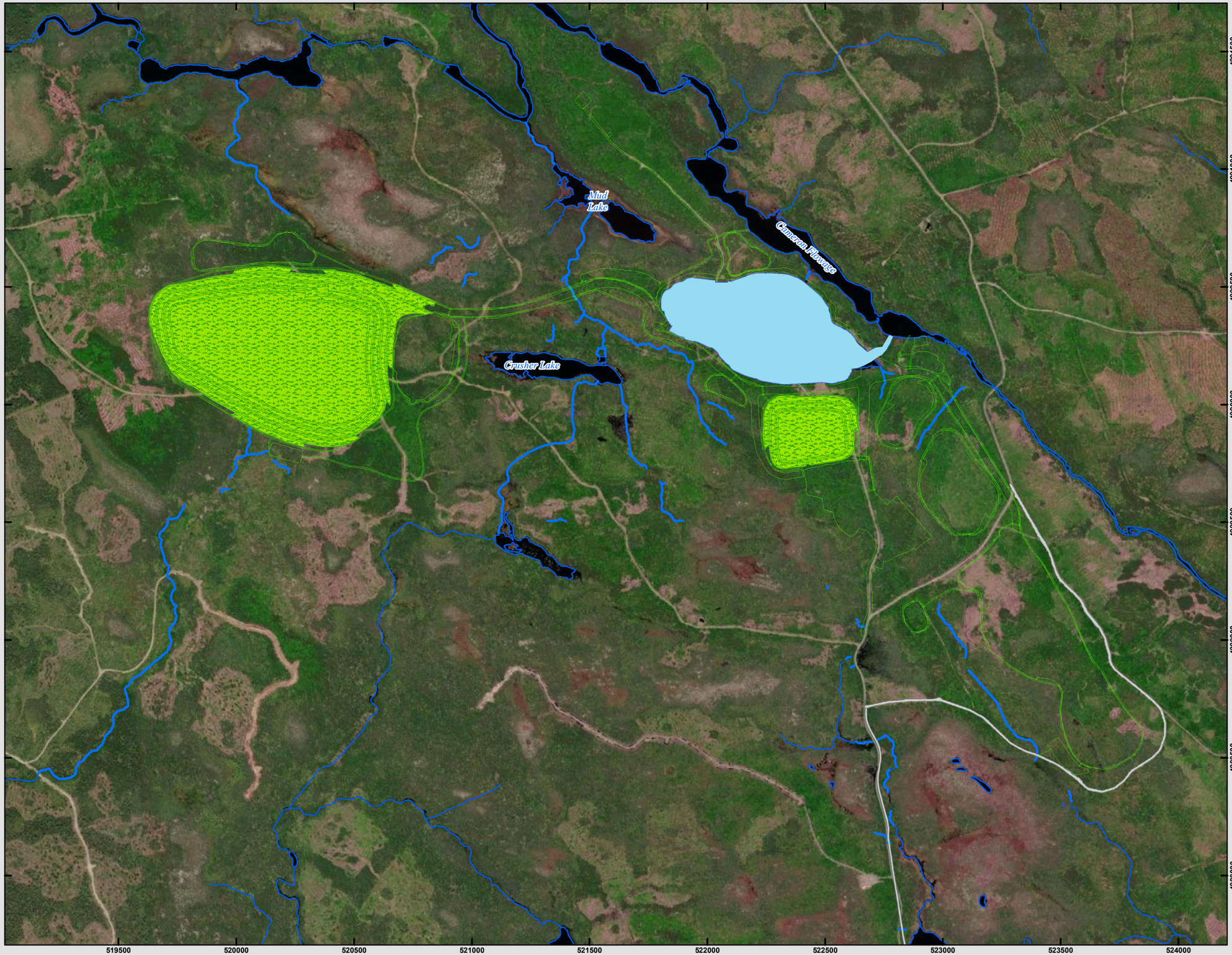

Prepared For:

Atlantic Gold

Beaver Dam Mine Project

Post-Closure Far Futrue

- Multiuse Bypass Road
- Reclaimed Site - returned to similar mixed habitat types as surrounding area
- Reclaimed Stockpile - Hill revegetated to mixedwood forest
- Pit Lake - connection to Cameron Flowage established



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 200 400 800 m

1:15,000 Scale when printed @ 11" x 17"

Drawn By: LP
Reviewed By: XX

Date: 5/12/2021

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Document Name: BD_EIS_Fig2.1-X RemediatedSiteAfter

Table 2.9-3: Overview of Preliminary Closure Objectives/Criteria

Mine Component	Closure Vision	Closure Objective	Closure Criteria	Primary Reclamation Activity	Post-Closure Inspection/Monitoring	Notable Uncertainty/ Research
Administration and Ancillary Areas	The Mill Site will have all buildings, equipment, and related items removed, and the area will be revegetated. The area will be safe for the public to use for potentially outdoor recreation (e.g., hiking, trails, etc.).	Physical Stability	Buildings and equipment removed. Soil capping and revegetation treatments demonstrate early succession has been successful. No signs of significant erosion or sloughing prior to revegetation cover establishment.	Buildings demolished and removed from site. Equipment and other infrastructure removed from site. Surfaces graded and seeding/planting to allow drainage and prevent erosion.	Periodic inspections by a professional engineer will be completed.	No major uncertainties.
		Chemical Stability	Confirmatory soil sampling and ESA (as required) have been completed and results accepted by NSE. Runoff water quality is suitable for discharge to surrounding area.	Removal of impacted soils (if required) as recommended by the confirmatory soil sampling program and/or ESA.	Confirmatory soil sampling and ESA (as required) have been completed. Surface water quality monitoring completed in adjacent watercourses.	
		Ecological and Land Use	Wildlife and the public can travel across the area safely.	Following building removal, area is graded, soil cover placed and revegetated.	Vegetation and soil monitoring will be completed.	
Open Pit and Spillway	The Open Pit will flood, and overflow will discharge to Cameron Flowage/Killag River via an engineered spillway. The shoreline will be designed with shallow grading at the predicted water level to allow safe egress for wildlife, and a shallow water zone that can provide riparian and wetland habitat. The existing mine ramp at the northeast shoreline will be maintained to allow safe access to the pit lake. (e.g., boat launch site). The presence of self- sustaining fish populations is not intended and will be limited. The riparian zone and shallow water may provide habitat for avifauna, amphibians, and other species.	Physical Stability	Final conditions of the open pit walls, overburden slopes and spillway (once constructed) are confirmed to be within approved design constraints by a professional engineer. No visual indications of significant deformation and degradation is observed during a final inspection by a professional engineer.	Annual geotechnical inspections will be completed during the mine's operation to manage pit wall stability prior to final closure. The overburden bench and barrier berm materials will be re-sloped.	Periodic inspections by a professional engineer will be completed.	No major uncertainties.
		Chemical Stability	Water quality in the Pit Lake demonstrates a stable and/or decreasing trend and meets approved criteria. Decant elevation is suitable for discharge to Cameron Flowage/Killag River.	Dewatering will cease at the end of mining and the pit will be allowed to flood, eventually discharging via spillway to Cameron Flowage/Killag River. No treatment of this water is expected to be required prior to discharge.	Pit water quality and water levels will be monitored during flooding, and after discharge to Cameron Flowage/Killag River via spillway.	Pit flooding timelines and the Pit Lake water quality are uncertain. These processes will be assessed as part of ongoing monitoring and updated predictions completed prior to closure and during flooding.
		Ecological and Land Use	Safe access and egress options are available where practical to the Pit Lake once flooding is complete. Shallow water zones (< 5 m deep) are created along the Pit Lake perimeter where practical.to provide options for ecosystem restoration design.	Retreat blasting and benching and waste rock deposition is completed to allow construction of a shallow water zone where practical along the Pit perimeter. Final Pit slopes and shoreline are approved by a professional engineer.	Periodic inspections by a professional engineer will be completed.	The post-closure aquatic habitat quality and quantity is uncertain. As predictions for post-closure pit lake water quality are refined, options for riparian and littoral zone habitat enhancement will be considered for various flora and fauna.
Waste Rock Storage Area	The WRSA will consist of benched outer slopes and be revegetated, likely resembling a grass/shrub land and/or open meadow condition.	Physical Stability	Inspection and monitoring results indicate structures are stable and performing as intended. Soil cover is stabilized by means of a sustainable vegetative cover. Acceptable rates of erosion are observed, soil/vegetation cover is not adversely affecting the surrounding environment.	Design and construction of the WRSA within the approved design. Geotechnical stability analysis to be updated as required as part of the detailed design. Detailed design is signed by a professional engineer. The WRSA will be re-sloped progressively during mining, the final lift will be completed at closure. A soil cover is placed and revegetated to reduce erosion concerns to acceptable levels. Detailed design includes surface grading and drainage structures that will prevent erosion.	Periodic inspections by a professional engineer and vegetation specialist will be completed.	Desktop studies are planned to complete numerical simulations for runoff on the existing WRSA shape and identify any areas of erosion concern during construction and closure. Revegetation trials will be completed to confirm effective methods for establishing a vegetated cover.
		Chemical Stability	Water quality of runoff and seepage discharging from WRSA to perimeter ditches and WC-4 demonstrates a stable and/or decreasing trend and meets approved criteria.	Deposition of waste rock will occur as designed. Construction of a revegetated soil cover, properly graded, will reduce infiltration rates and water-rock interactions.	Surface water and groundwater monitoring will be completed through operations and following final sloping and soil cover placement.	Water quantity and quality of the runoff and seepage discharge from the WRSA are uncertain. These processes will be assessed as part of ongoing monitoring and updated predictions prior to closure.
		Ecological and Land Use	Wildlife travel and forage, and public use for safe outdoor recreation activities (e.g., hiking) that can be conducted across the WRSA.	Construction of a revegetated soil cover at the WRSA surface.	Periodic inspections by a professional engineer and vegetation specialist will be completed.	No major uncertainties.

Table 2.9-3: Overview of Preliminary Closure Objectives/Criteria (continued)

Mine Component	Closure Vision	Closure Objective	Closure Criteria	Primary Reclamation Activity	Post-Closure Inspection/Monitoring	Notable Uncertainty/ Research
Site Wide Revegetation	The various disturbed areas will have a soil cover placed and be revegetated to promote a mix of habitats suitable for the post-mining landscape (e.g., grassland/open meadow, shrubland, forest). The composition of habitats may be unique relative to surrounding area due to the changed landforms. Native seed mix will be used suitable to the area will be applied. Potentially traditional shrub species will be considered. Vegetation Trials at Touquoy and Beaver Dam will inform revegetation efforts.	Physical Stability/ Land Use[a]	Soil cover and revegetation treatments demonstrate early succession has been successful. Soil cover quality does not pose an elevated risk to humans and wildlife compared to surrounding areas.	Salvaged material stockpiling and management during operations. Revegetation trial plots will be completed to assess practical post-mining ecosystems possible and determine effective treatment applications prior to final closure. A soil cover and seeding/planting treatments will be applied to all disturbed sites as designed in the Final Plan.	Vegetation, soil and biodiversity monitoring.	Revegetation studies and field trials will be completed to assess practical post-mining ecosystems at each of the mine areas. An ad hoc committee will be established to confirm final land uses and provide input into final closure

Notes: [a] Additional land uses may be identified through ongoing engagement efforts with the Millbrook First Nations, the Mi'kmaq of Nova Scotia, CLC and Reclamation and Closure Working Group. Final approval of land uses requires the approval of NS Crown Lands, and acceptance by NSECC, DEM, and NSL.

2.9.3.1.4 Administration and Ancillary Areas

The reclamation of the Administration and Ancillary Areas consists of removal of buildings and other infrastructure, grading and revegetation. The final layout is shown on Figure 2.7-3.

The buildings will be removed during the first year of reclamation and either demolished, sold or re-used at other sites. Fuel, reagents, hazardous materials, chemicals etc. will be removed from structures prior to demolishing or removed from site. The wood-frame structures will be dismantled, with reusable parts being salvaged for recycling or re-use. The steel-frame and fabric-covered structures can be dismantled and removed from site. Trailer/mobile office units will be hauled from site. Crushing infrastructure, if used, will be dismantled, and removed from site. Septic tanks will be removed from site and disposed of at an approved facility.

Concrete foundation and slabs will be broken up into pieces with a maximum size of 0.5 m, any protruding reinforcing steel removed, and provided with a minimum of 0.5 m of cover using overburden soils.

The Stormwater/Evaporation Retention Pond will be drained, backfilled with overburden material, and re vegetated.

Following the removal of buildings and burial of foundations, the Administration and Ancillary area will be covered in salvaged overburden and topsoil, graded tore-establish drainage thereby prevent pooling, and revegetated.

2.9.3.1.5 Petroleum and Hazardous Waste

Petroleum products and waste will be removed from site at closure. Unused fuel will be returned to the supplier or disposed through a recognized waste management company. The contents of all fuel tanks will be pumped out by the fuel distributor or a waste management contractor. The petroleum and propane tanks owned by the suppliers will be removed form site by the supplier at the time of reclamation.

Reagents and other chemicals used in the mining/milling process remaining on site will be returned to the supplier or disposed of offsite at an approved facility.

2.9.3.1.6 Non-Hazardous Waste

Non-hazardous waste such as domestic waste will be removed from site. There is no landfilling on site.

2.9.3.1.7 Explosive Storage

Explosives onsite will be managed by contractors and will be removed from site once no longer required. Infrastructure associated with explosive storage will be removed following removal of explosives.

2.9.3.1.8 Touquoy Site

The Touquoy Mine Site will be reclaimed under a separate plan developed for the Touquoy Project and already approved by regulatory agencies. As mentioned previously, the currently approved Reclamation Plan will be updated to reflect the above changes associated with processing Beaver Dam ore and re-submitted. Water treatment at discharge location into the Moose River from the pit, as required, will occur, and monitoring programs will be on-going.

Ultimately the land will be returned to conditions similar to its original state as a natural woodland and wetland habitat used for recreation and forestry. The existing conditions at the site have been previously described as being in a disturbed state in many areas and therefore improvements at the site will be realized through the reclamation activities proposed.

2.9.4 Post-closure Monitoring (Year 7 to 10+ Years)

GHD has completed a predictive water quality assessment and developed a mass balance model which shows that zinc and cobalt are the only likely exceeded parameters during the PC phase. However, the exceedances are not significantly higher than the discharge limit and a passive water treatment system could reduce the concentration of these elements below discharge criteria. In mine-related settings, passive treatment systems are often designed to neutralize acidity and remove metals in drainage waters. Such systems do not require continuous chemical inputs because they are sustained by naturally occurring chemical and biological processes. Anoxic limestone drains (ALDs) have been selected as the passive alternatives for addressing high concentrations of metals in impacted water during the PC phase.

In this treatment approach, impacted water will initially pass through a settling pond for the removal of suspended solids. Then, water will pass through a trench ALDs. ALDs generate alkalinity and increase the pH of the impacted water. By increasing the pH, metals such as zinc and cobalt will precipitate in their hydroxide forms. The ALDs will be followed by an aeration cascade, pond, or aerobic wetland that oxidizes and removes the precipitated metals. A settling pond will then provide adequate hydraulic retention time to let those formed metal hydroxides precipitate. This treatment system is proposed due to its passive nature and the fact that utilities are not required for implementation. The success of an ALD depends on site-specific conditions, primarily on low dissolved oxygen, and minimal ferric iron and aluminum concentrations in the drainage.

The operation and maintenance of this alternative is minimal as no labour or power is required. The primary maintenance would be replacing depleted limestone which is dependent on-site condition and water chemistry. In suitable conditions, limestone could work efficiently for several years.

2.9.4.1 Beaver Dam Mine

During decommissioning, the pit will be filled with water, creating a lake, with the re-establishment of a connection between the newly formed lake and Cameron Flowage. Figure 2.9-4 and 2.9-5 show landforms during active and post-closure.

GHD has completed a predictive water quality assessment and developed a mass balance model which shows that zinc and cobalt are the only likely exceeded parameters during the PC phase. However, the exceedances are not significantly higher than the discharge limit and a passive water treatment system could reduce the concentration of these elements below discharge criteria. In mine-related settings, passive treatment systems are often designed to neutralize acidity and remove metals in drainage waters. Such systems do not require continuous chemical inputs because they are sustained by naturally occurring chemical and biological processes. Anoxic limestone drains (ALDs) have been selected as the passive alternatives for addressing high concentrations of metals in impacted water during the PC phase.

In this treatment approach, impacted water will initially pass through a settling pond for the removal of suspended solids. Then, water will pass through a trench ALDs. ALDs generate alkalinity and increase the pH of the impacted water. By increasing the pH, metals such as zinc and cobalt will precipitate in their hydroxide forms. The ALDs will be followed by an aeration cascade, pond, or aerobic wetland that oxidizes and removes the precipitated metals. A settling pond will then provide adequate hydraulic retention time to let those formed metal hydroxides precipitate. This treatment system is proposed due to its passive nature and the fact that utilities are not required for implementation. The success of an ALD depends on site-specific conditions, primarily on low dissolved oxygen, and minimal ferric iron and aluminum concentrations in the drainage.

The operation and maintenance of this alternative is minimal as no labour or power is required. The primary maintenance would be replacing depleted limestone which is dependent on-site condition and water chemistry. In suitable conditions, limestone could work efficiently for several years.

Water treatment will continue as described above and in Appendix P.4 monitoring programs will be on-going until such time that discharge water quality meets appropriate confirmed criteria at the point of discharge. This post closure phase is estimated to be 10+ years in length and is subject to revision with expected refinements to model predictions.

2.9.4.2 Touquoy Mine

During decommissioning, the tailings will be covered with water and the pit will fill, creating a lake, with the re-establishment of a connection between the newly formed lake and Moose River. Water treatment will continue, as required, at this discharge location and monitoring programs will be on-going until such time that discharge water quality meets appropriate confirmed criteria at the point of discharge. This post closure phase is estimated to be 15 to 20 years in length and is subject to revision with expected refinements to model predictions.

During decommissioning, the tailings will be covered with water and the pit will fill, creating a lake, with the re-establishment of a connection between the newly formed lake and Moose River. Water treatment will continue, as required, at this discharge location and monitoring programs will be on-going until such time that discharge water quality meets appropriate confirmed criteria at the point of discharge. This post closure phase is estimated to be 15 to 20 years in length and is subject to revision with expected refinements to model predictions.

2.9.4.3 Reclamation Schedule

The estimated timeline for decommissioning reclamation for the Beaver Dam Mine Site is presented in Table 2.9-4.

Table 2.9-4: Beaver Dam Reclamation Schedule

Reclamation Activity	No. of Years	Start Date[(a)]	End Date
Construction	1	2022	2023
Operations	5	2023	2028
Active Closure	0.5	2028	2030
Post Closure (Monitoring)	10+	2029	2032+

(a) Schedule is preliminary based on permitting and current model predictions that are subject to refinement.

2.9.5 Greenhouse Gas Emissions

A significant adverse environmental effect for Greenhouse Gases (GHG) has not been predicted for the Project for the following reasons, with consideration of the ecological and social context of the LAA surrounding the Project:

- **During Construction:** GHG will be elevated above baseline but not a significant contributor with a low magnitude (above 1% NS 2018 levels) that will be intermittent and short-term in duration and reversible.
- **During Operations:** GHG will be elevated above baseline during this period but not a significant contributor with a low magnitude (i.e., combined 21.69 kt CO_2e 21.69 kt CO_2e - approximately 0.128% above NS 2018 levels) that will be continuous but mid-term in duration and reversible.

- **During Active closure:** GHG will be elevated above baseline but expected to be negligible in magnitude (i.e., less that 0.1% above NS 2018 Levels) intermittent to allow for earthworks and reclamation activities and medium-term duration (i.e., 2 years in duration) and reversible.

Mitigations presented in Section 6.4 (Greenhouse Gases), Table 6.4-8 will be established to reduce the impact to GHGs from Project activities.

2.10 Alternative Means of Carrying out the Project

In accordance with Section 19(1)(g) of CEAA 2012, environmental assessments for designated projects must consider alternative means of carrying out the Project that are technically and economically feasible, as well as the environmental effects of any such alternatives.

The process for consideration of alternative means is outlined in the CEAA Operational Policy Statement entitled "*Addressing "Purpose of" and "Alternative Means" under the Canadian Environmental Assessment Act, 2012*" and includes the following steps:

- Step 1 - identify technically and economically feasible alternative means.
- Step 2 - list their potential effects on valued components.
- Step 3 - select the approach for the analysis of alternative means.
- Step 4 - assess the environmental effects of alternative means.

The evaluated alternative means of carrying out the Project are discussed following identification of alternative means.

2.10.1 Identification of Alternative Means

Alternative means of carrying out the Project are defined as means of similar technical character or methods that are functionally the same. Alternative means differ from alternatives in that they represent the various technical and economically-feasible ways that a project can be carried out, and which are within AMNS's scope and control.

As a minimum, the EIS Guidelines require AMNS to conduct an alternative means analysis for the following Project components:

- mine type;
- ore extraction methods;
- ore processing methods;
- ore processing locations;
- ore transportation;
- energy source;
- project component locations;
- water supply and management; and
- mine waste management facilities.

A qualitative approach primarily utilizing the professional knowledge and judgement of the Consultant Contributors has been employed for the assessment of alternative means in Section 1 (Introduction) of this EIS.

2.10.2 Mine Type

The potential alternatives to mining the Beaver Dam ore are through open pit (ramp access) and underground (shaft access) methods.

2.10.2.1.1 Open Pit Mining

Open pit mining requires the removal of overburden (topsoil, till) and non-ore bearing waste rock, followed by the stepped development of concentric levels into the deposit with an inclined roadway connecting subsequent levels. Open pit mining methods are best suited to:

- shallow ore deposits at or near surface that are covered by shallow overburden;
- large deposits with a uniformly distributed ore body or scattered randomly distrusted pockets; and
- high tonnage, low grade deposits which are not economical using underground mining methods.

2.10.2.1.2 Underground Mining

Underground mining typically requires the construction of a vertical, underground shaft from surface to a targeted depth into the ore body. Horizontal tunnels are then driven from the shaft at strategic intervals to access the ore body. Underground mining methods are best suited for:

- smaller ore bodies which are higher in grade; and
- disseminated ore bodies that easily traceable underground.

2.10.2.1.3 VCs Potentially Affected

The environmental effects of underground mining would be similar to those of open pit mining at the Beaver Dam Mine Site with the need for the infrastructure noted for the surface operation with a smaller disturbed footprint but likely a longer duration for ore extraction and overall project activities.

2.10.2.1.4 Preferred Approach

In this particular instance the gold at the Beaver Dam Mine Site is relatively uniformly distributed, and at relatively low grades, throughout the local rock mass to the extent that large scale, high volume throughput from an open pit is commercially viable. Concentrations of gold of sufficient grade, continuity or predictability in quartz veins, or other specific sites at the Beaver Dam Mine Site to support a commercially viable underground operation have not been identified through exploration and feasibility studies completed to date. An underground mine configuration for the Beaver Dam gold deposit is not currently a viable option.

Mining can theoretically be undertaken by either underground or open pit methods, but underground mining as a primary extraction method does not make practical or economic sense in this situation. In this particular case, the resource is near surface. The proximity to surface and lower grade make it amenable to open pit methods. A continuation of the surface mining into an underground operation may be viable depending on the final depth of the deposit but this is currently not under consideration and would not be economic unless there was a dramatic increase in gold price.

2.10.3 Ore Extraction Methods

2.10.3.1.1 Drilling and Blasting

Drilling and blasting is proposed to extract ore at the Beaver Dam Mine Site. Drilling and blasting is generally accepted as the most efficient method of breaking large volumes of rock. Drilling and blasting will generate noise; however, the noise from drilling would be significantly less than that generated by rock breaking. Blasting will generate short duration noise less frequently.

2.10.3.1.2 Rock Breaking (Ripping)

Rock breaking, or ripping, involves the use of heavy equipment that breaks the rock by inserting hardened metal teeth or prongs into fractures or planes of weak within the rock. Rock breaking creates continuous significant noise. Due to the extremely hard nature of the ore in the vicinity of the Beaver Dam Mine Site, rock breaking is not considered to be economically, technically, or environmentally feasible.

2.10.3.1.3 VCs Potentially Affected

The atmospheric environment is the key VC that would be affected by both drilling and blasting, and rock breaking (ripping); however, ripping would create significantly more noise over a continuous time period whereas drilling and blasting creates noise at lower levels and blasting occurs less frequently.

2.10.3.1.4 Preferred Approach

Drilling and blasting is the preferred approach for ore extraction from the Beaver Dam Mine Site. Alternative methods of extracting ore, such as rock breaking (ripping), are not technically or economically feasible due to the extremely hard nature of the ore in the vicinity of the mine site. There are no feasible alternatives to ore extraction at the Beaver Dam Mine Site.

2.10.4 Ore Processing Methods

2.10.4.1.1 Gravity/CIL Processing

The gravity/CIL processing methodology described in Section 2.9.2.3 of this EIS represents the most conventional processing option. It is the preferred processing option in Canada and is used worldwide in almost all major gold mining/processing operations. Two independent experienced consultant gold metallurgists have determined that gravity/CIL processing is extremely well suited to this particular ore in that gold recoveries are very high (about 95%) resulting in maximum use of the resource, and the cyanide destruction process is highly efficient (Ausenco 2015). Furthermore, gold ore is produced at the Touquoy facility, with minimal off-site value-adding.

2.10.4.1.2 Gravity/Flotation

Regardless of the above, a second processing option, gravity/flotation with either intense cyanidation or smelting of the flotation concentrate, has been explored. Gravity/flotation recoveries are also very high (about 95%), with the flotation concentrate comprising 4 to 5% of the total throughput. On the basis of expected daily throughput, about 200 tonnes of concentrate would be produced per day. The gold in the flotation concentrate may be recovered either by high intensity cyanidation or by off-site smelting.

High intensity cyanidation of the float concentrate will require at least the same quantity of sodium cyanide as conventional CIL (since the same amount of gold is available for dissolution) or possibly more. This multi-stage process is unorthodox, inherently more complex than conventional CIL processing and commercially unattractive with no perceived advantage.

This multi-stage process could potentially be undertaken off site with the concentrate transported to an existing CIL plant for contract treatment, the closest plants being in Quebec and Ontario. Enquiries have been made to eleven such operations with no availability offered. Indicative costs, including freight, determined from this exercise show this option to be commercially unattractive, with the added disadvantage of substantial off-site value-adding and reduced benefits to Nova Scotia.

The flotation concentrate could also potentially be transported elsewhere for smelting to recover the gold. Indicative costs for freight and contract treatment of the concentrate at Falconbridge's Horne smelter in Rouyn-Noranda have been obtained and these confirm this option to be commercially unviable, and again with substantial resultant off-site value-adding and reduced benefits to Nova Scotia.

2.10.4.1.3 VCs Potentially Affected

Environmental effects are generally similar in both alternatives. The same quantity of sodium cyanide is required in both alternatives, if not more for gravity/flotation. Smelting required during the flotation process would require transport to an off-site facility, thereby generating additional GHG emissions. The key VCs affected by the use of gravity/flotation processing would include the atmospheric environment.

2.10.4.1.4 Preferred Approach

Having carefully examined the above processing options AMNS has selected conventional gravity/CIL as its preferred processing methodology. The required equipment is in place at the Touquoy Mine Site prior to the Beaver Dam operation beginning thus reducing infrastructure needs at the Beaver Dam Mine Site.

2.10.5 Ore Processing Locations

2.10.5.1.1 Touquoy Mine Site

No new processing or tailings facility is planned for this site - ore will be trucked to Touquoy for milling and tailings will be deposited in the exhausted Touquoy pit. The Touquoy plant is designed to treat Beaver Dam ore with no modifications other than an increase in the total weight of grinding balls in the ball mill to accommodate the slightly harder ore from the Beaver Dam pit.

2.10.5.1.2 Beaver Dam Mine Site

If the economics of the Project change significantly such that this Project could be developed without Touquoy then a mill and a tailings storage plan for the Beaver Dam Mine Site would be required, which would involve a significant increase in the Project footprint. Alternatives to processing ore at the Touquoy Mine Site are cost prohibitive and environmentally inferior.

2.10.5.1.3 VCs Potentially Affected

Construction of an additional processing and tailings management facility would affect all VCs being considered in this EIS.

2.10.5.1.4 Preferred Approach

The preferred approach for ore processing locations is to utilize the Touquoy Mine Site for the milling of Beaver Dam ore, and depositing tailings in the exhausted Touquoy pit.

2.10.6 Ore Transportation

Off-site processing at the Touquoy Mine Site involves the transport of material via local roadways. This haul is an increase in the cost of production and will generate additional greenhouse gases from the highway truck fleet as compared to on-site processing. This will be at least partially offset by the significant environmental benefits of processing Beaver Dam ore at the Touquoy mill and the storage of tailings in the exhausted Touquoy pit. No other gold processing facilities exist within the economic trucking limit that can handle the planned volume of material. In addition, no new construction or expansion of the approved processing or tailings storage facilities at Touquoy to process Beaver Dam ore is required.

2.10.6.1.1 Alterative Haul Road Routes

Alternative Haul Road routes were considered to transport the Beaver Dam ore to Touquoy for processing. The original Haul Road route considered included approximately 5.1 km of travel along Hwy 224 (Alternate Section 2; Figure 2.3-3) and 3.9 km along Moose River Cross Road (Alternate Section 3A). The current Haul Road configuration includes a more direct route on the Moose River Cross Road. Specifically, the travel along Hwy 224 itself has been replaced with a direct route of 4.0 km of new construction which allows direct crossing of Hwy 224 (Section 3B; Figure 2.3-3). This increases the travel along private logging roads and eliminates the travel along Hwy 224 completely as only a direct crossing is required. The total Haul Road is then reduced by 5 km (from 35.1 km to 30.1 km).

Included as part of this revised EIS is a Preferred Alternative Haul Road section of road, approximately 5.75 km in length, which if adopted would avoid residences and private land. This alternative section of road would replace approximately 4.3 km of the proposed Mooseland Cross Road (Section 4B) and approximately 4.0 km of Mooseland Road (Section 5A). The total haul distance would be reduced from 30.1 km to 27.5 km. This Preferred Alternative Haul Road has been proposed as a secondary option in order to address potential landowners and residential locations with the proposed updated alignment and is fully evaluated in this EIS.

It is intended to use sized waste rock from the local borrow pits or Beaver Dam waste rock as the surge rock base material to reduce the cost and disturbance of the road upgrading and new construction activity.

2.10.6.1.2 VCs Potentially Affected

The key VCs affected by the Alternative Haul Road locations are the atmospheric environment, Indigenous Peoples populations, and socio-economic conditions due to additional noise and dust being generated along Hwy 224, near Beaver Lake IR 17. Air, noise and light considerations are also evaluated for the Preferred Alternative Haul Road, as this route is farther away from residences and private land considerations.

2.10.6.1.3 Preferred Approach

The Haul Road as currently planned is the preferred approach. The current Haul Road route for the Project reduces the total length and eliminates travel along Hwy 224, including the passing of Beaver Lake IR 17 which is a satellite community of Millbrook First Nation.

2.10.7 Energy Source

2.10.7.1.1 Diesel-Powered Generators

Two (duty and standby) self-contained, skid mounted, 500-kilowatt (kW) diesel powered generators will provide 600 volt (V) electrical power to all Beaver Dam surface consumers via 60 hertz (HZ), three phase, four wire overhead power lines. The generator fuel tank will receive diesel fuel from the dedicated refueling truck and has a one-day capacity at maximum power demand.

2.10.7.1.2 Alternative Energy Sources

The power demand required for the Beaver Dam Mine Site is insufficient to justify construction of a permanent grid tie-in to the existing electrical distribution lines.

Renewable energy sources are considered technically feasible but would also not be economically feasible or practicable due to the short duration of the Project.

2.10.7.1.3 VCs Potentially Affected

The key VCs affected by the use of diesel-powered generators on the mine site include the atmospheric environment, surface water, wetlands, fish and fish habitat, and habitat and flora.

The key VCs affected by a permanent grid tie-in include the atmospheric environment, wetlands, habitat and flora, and terrestrial fauna due to disturbances caused by constructing a right-of-way for the power lines.

The environmental effects associated with a renewable energy source would depend on the renewable energy technology used; however, air emissions would likely be reduced.

2.10.7.1.4 Preferred Approach

The preferred approach based on economic and environmental feasibility is to provide electrical power to the Beaver Dam mine site through the use of diesel-powered generators.

2.10.8 Project Component Locations

There are no alternatives for the positioning of the open pit - the gold deposit is fixed and the open pit has been designed to envelope the existing settling pond (wetland 59). The settling pond that had been previously established on the Beaver Dam Mine Site will largely become part of the proposed open pit

and thereby reclaimed. The Project components have also been placed to generally avoid heritage resources that have been identified during field investigations.

The waste rock stockpiles have been re-positioned to be located down-gradient of nearby watercourses and waterbodies and removed from the Boreal Felt Lichen Critical Function Zone. The site configuration, including other Project components, has been specifically designed to avoid interference with aquatic habitat, and hence it is the preferred option to minimize environmental effects. Wetlands were avoided to the greatest extent possible for the placement of site infrastructure and the use of existing roads has been maximized in site layout planning as well.

2.10.8.1.1 VCs Potentially Affected

The key VCs affected by altering the Project component locations include wetlands, surface water, fish and fish habitat, and physical and cultural heritage resources.

2.10.8.1.2 Preferred Approach

The preferred approach is to maintain project component locations as shown on Figure 2.3-2. This limits the impacts to watercourses, avoids wetlands to the greatest extent possible, and avoids the Critical Function Zone for the Boreal Felt Lichen.

2.10.9 Water Supply and Management

2.10.9.1.1 On-Site Water Supply and Management

Water use on the Beaver Dam Mine Site will be limited to water required for dust control, the vehicle wash down facility, fire protection, and domestic water usage. Sources of raw water include water collected during mine dewatering, surface water runoff from waste rock piles and constructed areas and, if needed, raw water pumped from Cameron Flowage. Raw water drawn from Cameron Flowage, if needed, would be pumped by a single duty submersible water pump to a combination raw water and firewater reserve storage tank. Two (duty and standby) centrifugal pumps will supply various users including, but not limited to, the vehicle wash down facility and the de-dusting crusher area locations. Potable water will be delivered via specialized truck to the site for use in facilities at the crusher area for personnel. It is anticipated that one drilled domestic water well will be required to provide water for sanitary usage as domestic wells in this area generally yield 5 to 10 L/min and the demand is estimated at less than 5 L/min. Dust control will occur as required and will consist of wet suppression controls on unpaved surfaces using water, or chemical dust suppressants, as required.

2.10.9.1.2 Off-Site Water Supply

Alternatives for water supply, such as transporting all required water to the Beaver Dam Mine Site were considered but the availability of adequate water for site operations (for site staff only and dust control) is a more reasonable approach, is economically sound and is technically feasible. One domestic water well will be required based on the demand anticipated and regional water resources studies confirm the low amount (less than 10 litres per minute) is easily available.

2.10.9.1.3 Surface Water Management

Surface water run-off from the Beaver Dam Mine Site crusher pad will flow by gravity, with the aid of berms and channels, to a collection pond located to the south of the crusher pad. A culvert located beneath the mine entrance road will facilitate decant overflow from the collection pond to a discharge channel that will run down gradient to the south and ultimately discharges into wetland area (Wetland 64) located to the south of the Beaver Dam Mine Site. Surface water run-off from the eastern and western waste rock stockpiles, low grade ore stockpiles, Beaver Dam Mine Site roads, and some natural area will flow by gravity, with the aid of berms and channels, to the north settling pond, located west of the pit. This settling pond will also receive water from the pit dewatering program. Overflow from the north settling pond is directed to the Killag River outfall (Cameron Flowage). On-site control of water with batch discharges when water quality meets applicable standards is typical for this type of operation and the most technically and economically feasible.

Runoff from the till stockpiles located to the southeast of the open pit and east of the mine facilities area will be captured with the aid of channels around the stockpile perimeter and diverted north to Cameron Flowage by gravity via separate water discharge

structures and engineered channels. At this time, it is not anticipated that a collection pond would be required, however such a pond can be constructed should settling of solids prior to discharge be required.

No alternatives for water supply management were considered to be technically or environmentally feasible. Cameron Flowage is a valuable local and regional watercourse and direct discharge without settling and back-up ability for other treatment is not acceptable to AMNS.

2.10.9.1.4 VCs Potentially Affected

The key VCs affected by the transportation of potable water to the Beaver Dam Mine Site include the atmospheric environment. If all required water were transported to the Project, a greater volume of emissions would be generated during the transport of water.

2.10.9.1.5 Preferred Approach

On-site water collected from surface water run-off and pit dewatering will be used for dust control, the vehicle wash down, and fire protection. Domestic water requirements will be fulfilled by potable water delivery, and an on-site drilled well for sanitary usage.

2.10.10 Mine Waste Management Facilities

2.10.10.1 Waste Rock Storage

2.10.10.1.1 Stockpile

The two waste rock stockpiles will have capacities of 20.7 Mt and 14.8 Mt of material and final peak grade elevations of 210 masl and 190 masl respectively. Waste rock will be stored in multiple lifts of 15 m with each lift having an active slope of 1.5:1. This approach will minimize the amount of exposed waste rock at any given time and reduce the potential for erosion and acid rock drainage (ARD). A safety berm will separate each lift resulting in overall slope angle of 2.6:1. A 20 m wide dual lane Haul Road running up the side of each stockpile will provide progressive access to all lifts. At reclamation, the waste rock stockpile will be reclaimed with topsoil and growing medium to a depth matching the native surroundings. After final shaping and vegetating, the piles will mirror current local topography and landscapes.

2.10.10.1.2 Backfill

Backfilling of the open pit with waste rock would eliminate the permanent storage stockpile as described above. However, the same stockpile would still be required to be constructed over the life of the mine and then re-handled to place back in the pit at closure and the footprint would require reclamation. Such re- handling would result in additional emissions due to equipment use and would be cost prohibitive for the overall Project viability. As well, backfilling with broken rock would overfill the open pit due to the swell factor, requiring reclamation of the open pit area as well as the remaining excess waste rock.

2.10.10.1.3 VCs Potentially Affected

Environmental effects are generally similar in both alternatives as the stockpile is required in both cases and either the stockpile itself or the footprint would be reclaimed at closure. Additional atmospheric effects are associated with the backfill alternative due to the extensive equipment use requirements associated with re-handling the waste rock.

2.10.10.1.4 Preferred Approach

The preferred approach for mine waste rock management includes the on-site management of using the waste rock stockpile.

2.10.10.2 Tailings Storage

2.10.10.2.1 Touquoy Open Pit

As processing of Beaver Dam ore at the Touquoy Mine Site is not scheduled to commence until mining at Touquoy is complete, the mined out open pit at Touquoy will be available for storage of tailings. The mined out Touquoy open pit will provide a very stable natural containment structure for tailings and will have the capacity to store all projected Beaver Dam tailings. Hydrogeological assessments of the Touquoy open pit indicate that it will eventually fill with water from rainfall, runoff and groundwater infiltration creating an in-pit lake which is in accordance with the approved closure plan. Tailings storage in the pit will therefore be sub-aqueous and will require no additional disturbance.

2.10.10.2.2 Touquoy TMF

The existing TMF at Touquoy was designed to accommodate projected tailings volumes generated from processing of Touquoy ore and does not have the capacity to store all the projected Beaver Dam tailings under the approved design. The tailings dams were constructed using a downstream construction technique. As a result, expansion of the Touquoy TMF to accommodate Beaver Dam tailings would require continued raising of the dams by downstream construction. This would result in substantially higher dams and a much larger footprint. Such expansion would also impact other existing infrastructure such as the polishing pond which would have to be decommissioned and re-established further away. For these reasons, this alternative is not considered to be favorable economically, technically, or environmentally.

2.10.10.2.3 Beaver Dam TMF

There is no requirement for tailings management at the Beaver Dam Mine Site as all mineral processing is proposed be done at the Touquoy Mine Site as per Section 2.7.2. It is not considered economically or environmentally feasible for tailings to be transported back to the Beaver Dam Mine Site following processing at Touquoy.

Processing of ore at the Beaver Dam Mine Site would require construction of a new gravity/CIL cyanide processing facility as described in Section 2.9.2.3, duplicating the existing facility at the Touquoy Mine Site. As well, storage of tailings on-site at the Beaver Dam Mine Site would require construction of a new Tailings Management Facility along with all of the associated raw water requirements and water management structures, including pumphouse, raw water line, tailings line, reclaim water line and water storage tanks. All of this additional infrastructure would substantially increase the disturbance footprint at the Beaver Dam Mine Site and potential environmental effects. For these reasons, this alternative is not considered to be favorable economically, technically, or environmentally.

2.10.10.2.4 VCs Potentially Affected

The key VCs potentially affected by the use of the exhausted Touquoy open pit for tailings storage are surface water and groundwater quality as described in more detail in Sections 6.7 (Surface Water Quantity and Quality) and 6.6 (Groundwater Quality and Quantity). It should be noted however that an existing monitoring program is already in place under the Touquoy Industrial Approval and that groundwater and surface water quality and quantity will continue to be monitored over the life of the Touquoy Mine Site as part of existing approvals for approved life span of the facility and for the proposed extended life of the Touquoy Mine

Site associated with processing of Beaver Dam ore. As well, there will be over 7 years of data available prior to the Beaver Dam tailings being introduced to the exhausted Touquoy pit, which will enhance water quality modeling and predictions.

The key VCs potentially affected by the expansion and use of the Touquoy TMF are the same as for using the open pit, surface and groundwater quality, plus additional VCs associated with the increased disturbance area.

Construction of an additional processing and tailings management facility at the Beaver Dam Mine Site would affect all VCs being considered in this EIS.

2.10.10.2.5 Preferred Approach

The preferred approach for tailings management is to manage Beaver Dam tailings at the Touquoy Mine Site by storage in the mined out open pit.

2.10.11 The Preferred Approach

Based on the consideration of technical and economic feasibility, environmental effects, and socioeconomic effects, the preferred approach for the Project consists of:

- an open pit gold mine located at the Beaver Dam Mine Site;
- ore extraction methods that employ drilling and blasting;
- ore processing methods that employ gravity/CIL processing methodology which represents the most conventional processing option and is the preferred processing option in Canada;
- processing Beaver Dam ore at the Touquoy Mine Site once reserves at Touquoy have been exhausted;
- transportation of ore from the Beaver Dam Mine Site to the Touquoy Mine Site for processing via a 30.1 km Haul Road, which will include upgrades to approximately 15.4 km of existing road and approximately 4.0 km of new road construction through a greenfield environment;
- the use of two (duty and standby) self-contained, skid mounted, 500-kilowatt (kW) diesel powered generators to provide) electrical power to the Beaver Dam Mine Site;
- Project component locations as shown on Figure 2.3-2;
- on-site water supply and management, with delivery of potable water;
- waste rock management stockpiles located on the Beaver Dam Mine Site; and
- tailings management by storage of tailings from Beaver Dam ore processed at the Touquoy facility in the mined out Touquoy open pit.

A summary of the review of alternative means to carry out the Project is presented in Table 2.10-1 for each Project component of activity. This provides justification on the preferred approach for the Project relative to technical feasibility, economic feasibility and environmental and social effects. The VCs considered are noted as applicable under the environmental and social effects.

Table 2.10-1: Summary of Alternative Means of Undertaking the Project

Project Component or Activity	Alternative Means	Technical Feasibility	Economic Feasibility	Environmental Effects	Preferred Option
Mine Type	Surface Mine	Technically Feasible	Economically Feasible	Environmental effects are associated with the surface mine construction and operation; however, no significant residual environmental effects are anticipated for the Beaver Dam Mine Site.	Yes
	Underground Mine	Not Technically Feasible considering the configuration of the gold deposit.	Not Economically Feasible	Not assessed	No
Ore Extraction Methods	Blasting	Technically Feasible	Economically Feasible	Environmental effects include noise and dust impacts; however, blasting will be conducted in shorter duration and will be controlled.	Yes
	Rock Breaking	Not Technically Feasible considering the hardness of the ore deposit	Not Economically Feasible based on the hardness of the ore deposit	Environmental effects include continual noise and dust impacts.	No
Ore Processing Methods	Gravity/CIL	Technically Feasible considering it is the preferred processing option in Canada and is used worldwide in almost all major gold mining/processing operations. Well suited to this particular ore	Economically Feasible	Environmental effects are generally similar in both alternatives: the same quantity of sodium cyanide is required in both alternatives, if not more for gravity/flotation.	Yes
	Gravity/Flotation	Not Technically Feasible based on an unorthodox complex multi-stage process for cyanidation or off-site smelting.	Not Economically Feasible as it requires a complex multi-stage process or additional off-site smelting.	Environmental effects are generally similar in both alternatives: the same quantity of sodium cyanide is required in both alternatives, if not more for gravity/flotation. Smelting would require transport to an off-site facility.	No

Table 2.10-1: Summary of Alternative Means of Undertaking the Project (continued)

Project Component or Activity	Alternative Means	Technical Feasibility	Economic Feasibility	Environmental Effects	Preferred Option
Ore Processing Locations	Touquoy	Technically Feasible as the Touquoy facility is already designed to treat Beaver Dam ore with minimal modifications.	Economically Feasible as the infrastructure for processing Beaver Dam ore is already in place. Haul Road upgrades will need to be completed but are off-set by the benefits or using the existing processing facility.	Environmental effects for the Touquoy facility have previously been identified. Processing Beaver Dam ore at the Touquoy facility will result in an additional four years of processing beyond the current lifespan of the Touquoy Project and will result in an increase in the cost of production and greenhouse gas emissions due to transporting ore to Touquoy.	Yes
	Beaver Dam	Technically Feasible	Not Economically Feasible as the infrastructure for processing Beaver Dam ore is already in place at the Touquoy facility.	Environmental effects of processing ore at the Beaver Dam Mine Site are greater in this scenario as a second processing facility and tailings management facility would be required to be constructed and operated. Construction of an additional processing and tailings management facility would affect all VCs being considered in this EIS.	No
Ore Transportation	Haul Road avoiding Hwy 224 via new construction	Technically Feasible	Economically Feasible	Environmental effects are similar for both alternatives. Construction of 4.0 km of new Haul Road will cause additional environmental effects than simply upgrading the Haul Road; however, the new road eliminates travel along Hwy 224 and the passing of Beaver Lake IR 17, which reduces potential effects on those residents. The Preferred Alternative Haul Road reduces interaction with residence and private landowners.	Yes
	Haul Road along Hwy 224	Technically Feasible	Economically Feasible	Environmental effects are similar for both alternatives. Travel along Hwy 224 through the Beaver Lake IR will cause noise and dust issues for residents due to the increased truck traffic.	No
Energy Source	On-site Generators	Technically Feasible	Economically Feasible	Environmental effects will include emissions associated with two diesel fuel-powered generators.	Yes
	Provincial Grid Tie-in	Technically Feasible	Not Economically Feasible as the current power demand is insufficient to justify the construction of a permanent grid tie-in.	Environmental effects would include construction of a right- of-way for electrical lines, including noise and emissions generated during construction and habitat and vegetation loss in the right-of-way.	No
	Renewable Energy Sources	Technically Feasible	Not Economically Feasible due to short duration of Project	Environmental effects would depend on renewable energy technology used; however, air emissions would be reduced	No

Table 2.10-1: Summary of Alternative Means of Undertaking the Project (continued)

Project Component or Activity	Alternative Means	Technical Feasibility	Economic Feasibility	Environmental Effects	Preferred Option
Project Component Locations	As shown in Figure 2.3-2	Technically Feasible	Economically Feasible	Environmental effects will include loss of habitat; however, this configuration avoids interference with aquatic habitats and Critical Function Zone for Boreal Felt Lichen.	Yes
	Alternative Locations	Technically Feasible	Not Economically Feasible as this would require the reconfiguration of the components	Environmental effects would be similar in both scenarios; however, the alternative location of the waste rock stockpile could interfere with nearby aquatic habitat and Boreal Felt Lichen. Project components have also been positioned to generally avoid identified heritage resources.	No
Water Supply and Management	On-site water supply and management, with delivery of potable water	Technically Feasible	Economically Feasible	Environmental effects will include emissions associated with the transport of potable water to the mine site.	Yes
	Alternative sources of water	Technically Feasible	Not Economically Feasible to transport all water requirements to the mine site.	Environmental effects would include a greater volume of emissions generated during the transport of all water to the mine site.	No
	Waste rock stockpiles	Technically Feasible	Economically Feasible	Stockpiles to be rehabilitated at closure	Yes
Mine Waste Management Facilities	Waste rock backfill in open pit	Technically Feasible	Not Economically Feasible	Stockpile disturbed area footprint backfilled open pit and excess waste rock require reclamation after backfill	No
	Beaver Dam tailings stored in Touquoy open pit	Technically Feasible	Economically Feasible	Potential environmental effects on surface and groundwater	Yes
	Beaver Dam tailings stored in expanded Touquoy TMF	Technically Feasible	Not Economically Feasible	Potential environmental effects on surface and groundwater; Increased disturbed footprint area; higher TMF dams increasing failure risk.	No
	Beaver Dam tailings stored in new TMF at Beaver Dam Mine site	Technically Feasible	Not Economically Feasible to transport tailings back to Beaver Dam; Not Economically Feasible to construct new processing facility at Beaver Dam; Not Economically Feasible to construct new TMF at Beaver Dam	Potential effects on all VCs. Substantially larger disturbed area at Beaver Dam and potential environmental effects associated with significant additional infrastructure development.	No

2.11 Conclusions

The environmental benefits of the Project to Nova Scotia are numerous to correct past practices with respect to the environment. Given the area has been subjected to extensive exploration, mining, and logging activity over several decades, baseline conditions show obvious effects from these historic activities (Section 6.5 Geology, Soil, and Sediment Quality). The current condition at the Beaver Dam Mine Site is disturbed, and fragmented habitat based on significant timber harvesting, associated road building and yarding areas and historic exploration/mining activity. The PA contains a diversity of habitat types and landscape features but has experienced a considerable amount of disturbance and habitat fragmentation as a result of these activities. The level of disturbance within the Beaver Dam mine site disproportionately affects uplands, over wetlands. The level of new fragmentation associated with the Project is anticipated to be moderate, given the existing disturbance. Historic tailings and waste rock will be removed from the site and encapsulated in the Touquoy exhausted pit. Water will be treated during construction to remove metals associated with historic tailings.

The poor condition of the majority of existing Haul Road culvert crossings directly contributes to poor surface water quality and fish passage in watercourses and wetlands along the Beaver Dam Mines Road and the Moose River Cross Road (Figure 2.3-3) Upgrades to this existing Haul Road will include culvert replacements at over 20 locations and 3 new bridges, where determined to be necessary (Section 2.7.3 and Section 6.9 Fish and Fish Habitat). It is expected that correctly installed culverts will increase fish passage and positively affect fish habitat through improved surface water quality.

All environmental baseline investigations for the Project have added to the scientific understanding of the area and improved background data held by the province. Background data helps increase the knowledge base of its users and increases public ecological awareness and promotes conservation of natural ecosystems.

At closure, reclamation will occur at the Project Site and Touquoy Mine Site. The reclamation plan will be secured with a bond held by the Province of Nova Scotia to ensure there are sufficient funds to reclaim the site at any point during the Project. The plan for reclamation requires approval of the Nova Scotia Department of Lands and Forests.

KPMG International completed an Economic Impact Assessment of the Moose River Consolidated (MRC) Project to evaluate the economic benefits stemming from the Proponent's mining projects in Nova Scotia (KPMG 2015). This assessment considered the Touquoy and Beaver Dam Mine Projects together and found that socio-economic benefits will stem primarily from the construction and operation phases of the Project.

Construction activities will involve preparing the Project Site, setting up infrastructure and facilities, and purchasing mining processing equipment to enable the MRC Project to reach full production. Much of the spending associated with these activities will be incurred in Nova Scotia and Canada. As per the KPMG report, it was projected that construction costs will be approximately $146 million, with approximately $97.6 million, or 67%, being spent in Nova Scotia, and approximately $111.9 million, or 77%, being spent in Canada. As a result of this spending, it is anticipated that 391 full time equivalent jobs will be created in Nova Scotia per year during construction. For Canada as a whole, the construction phase will create 437 full time equivalent jobs per year. Tax revenues stemming from the construction phase are expected to be $4.1 million for the Government of Nova Scotia and $5.5 million for the Government of Canada. This is a conservative estimate as corporate income taxes paid by contractors and suppliers cannot be estimated.

Operational mining and processing activities will involve the deployment and operation of new mining production capacity. Similar to the construction phase, much of the spending associated with operation of the MRC Project will be incurred in Nova Scotia and Canada. As per the KPMG report, it was projected that annual operating costs will be approximately $52.3 million, with

approximately $38.1 million, or 73%, being spent in Nova Scotia, and approximately $39.4 million, or 75%, being spent in Canada. The costs include several spending components, the most important being:

- salaries and benefits for 27% of total annual operating costs;
- cyanide, lime, and reagents for 24% of total annual operating costs;
- diesel for 22% of total annual operating costs;
- wear parts and spare parts for 15% of total annual operating costs; and
- electricity (Touquoy only) for 7% of total annual operating costs.

As a result of this spending, it was anticipated in the KPMG report that 228 yearly and recurrent full-time equivalent jobs will be created in Nova Scotia during operation. For Canada as a whole, the operation phase will create 278 yearly and recurrent full-time equivalent jobs during operation. Tax revenues stemming from the operation phase are expected to be $10.2 million annually for the Government of Nova Scotia and $8.1 million annually for the Government of Canada. These represent conservative estimates as corporate income taxes paid by suppliers cannot be estimated.

The Province of Nova Scotia's unemployment rate is higher than the national average (8.8%>6.9%) and its gross domestic product (GDP) growth was the slowest of all Canadian provinces the last few years. In addition, the GDP per capita is the second lowest in Canada. The MRC Project would greatly benefit the Province of Nova Scotia due to substantial upfront investments and significant annual operation costs contributing to job creation and government tax revenue.

AMNS is committed to working with local communities and the Mi'kmaq of Nova Scotia to maximize socio-economic benefits as the Company developments its projects in the Province, including the Beaver Dam Mine Project.

3 PUBLIC ENGAGEMENT

3.1 Introduction

AMNS believes that engagement is a critical component of an Environmental Assessment (EA) and has dedicated significant efforts and resources to develop meaningful, two-way relationships with stakeholders and rightsholders. Engagement is important to resolve problems, create a shared understanding with local stakeholders and rightsholders, and build trust around projects that may be controversial. Engagement can also help communities and stakeholders seize and build upon opportunities that the mine project may present. Atlantic Mining NS Inc. (AMNS) is committed to working with stakeholders and rightsholders throughout the EA process and mine life.

This section outlines the public engagement activities, tools, and commitments related to the Beaver Dam Mine Project (the Project). The section establishes the objectives for community engagement, the specific tools used in the engagement strategy, the public engagement activities that have occurred to date, the concerns that have arisen resulting from engagement activities and any mitigation measures.

3.1.1 Summary of Public Engagement Before the Updates

AMNS began engagement specifically for the Project in 2015, which provided input into the identification of valued components, and identified key concerns for stakeholders and rightsholders. This engagement was summarized in the original 2017 Environmental Impact Statement (EIS) submission (AGC 2017).

In 2018, AMNS established a variety of engagement tools to improve stakeholder communication and engagement. These included a Community Liaison Committee (CLC; the mandate of the Touquoy Mine CLC was expanded to include Beaver Dam in 2018 [Appendix A.3]), community relations email and dedicated phone line, a community newsletter and a website. AMNS conducted engagements with stakeholder organizations that included the Nova Scotia Salmon Association (NSSA), the Sheet Harbour Chamber of Commerce, the Eastern Shore Forestry Watch Association (ESFWA).

3.1.2 Summary of Updates to Public Engagement

This update includes activities, initiatives and concerns that occurred after the submission of the Revised 2019 EIS (AMNS 2019) and in response to Round 2, Information Requests (IR2s). AMNS conducted a supplementary engagement program in 2020, which identified additional areas of concern for some members of the public not identified through the previous engagement activities described in Section 3.1.1 and provided updates on technical conclusions. This engagement included:

- Meeting and discussions with ATV and snowmobiling groups: ATV Association of Nova Scotia, Pleasant Valley Upper Musquodoboit (PUMA) ATV Club, Sheet Harbour ATV Snowmobile and ATV Club and the Lake Charlotte ATV Club. Engagements including initial meetings to identify concerns, a validation meeting where the input of the Clubs was reviewed, and various emails and calls to discuss potential bypass route options.
- Mooseland and Area Community Association meetings. There were three in-person meetings held with representatives of the Association, including a validation meeting where the input of MACA was reviewed for accuracy. There also has been regular email and phone communication.
- Rocky Brook Lake resident online meeting to discuss the Beaver Dam Mine Project, review proposed bypass roads and to identify recreational usage.

- Individual stakeholder meetings – Although AMNS attempted to hold a community meeting in Mooseland, this was not possible due to COVID-19 public health restrictions. AMNS went door to door within the community of Mooseland.

An up-to-date public engagement database is provided as Appendix A.4a.

AMNS recent discussions with Nova Scotia Salmon Association (NSSA) in 2019 and 2020 to engage their input on the proposed BDM Project Description and how best AMNS accommodate their ongoing important mitigation and research on the Killag River and adjacent watersheds. Recent engagements include a meeting on September 9, 2020 to provide an infrastructure update, introduce EEM monitoring and data collection. Notes where shared from this meeting and follow up phone call occurred on November 30, 2020, AMNS send a follow up letter on March 2, 2021 seeking clarification on the NSSA's Current and Future Programs (Appendix A.4b) , AMNS reached out to confirm our understanding of cumulative effects and potential interactions with NSSA existing and future plans in the area (Appendix A.4b). The NSSA communicated in December 2020 that they do not want to engagement with AMNS at this time. AMNS values a cooperative relationship with NSSA and look for opportunities where we can support their work and also share information and data. AMNS will continue to reach out to the NSSA regarding the Project.

AMNS has reached out to the Eastern Shore Forestry Watch Association (ESFWA) President Barb Markowitz to communicate that AMNS will address their IRs and are open to a follow-up meeting to discuss the Project. AMNS plans to reach out to ESFWA to review responses and answer follow-up questions.

AMNS prepared a draft Public Engagement Plan (Appendix A.6) in 2021 which will guide engagement over the life of the mine. AMNS would like to review the draft Public Engagement Plan before finalizing. A summary of updates to the public engagement are presented in Table 3.1-1.

Table 3.1-1: Updated Subsections from the 2019 Revised Environmental Impact Statement for Public Engagement

2019 Revised EIS Submission (February 28, 2019)	Updated in 2021	Corresponding 2021 EIS Update Section Number	Reason for Update
-	-	3.1 Introduction	• new
3.1 Objective	Yes	3.2 Objectives	• included list of objectives for the Public Engagement Plan
-	-	3.3 Spatial Boundary	• new included as indicated in IR2s from ESFWA (ESFWA 2-22)
3.2 Engagement Strategy	Yes	3.4 Engagement Strategy	• Included additional detail regarding AMNS public engagement strategy (ESFWA 2-14b, ESFWA 2-20 and ESFWA 2-22) • Included description and reference to AMNS Public Engagement Plan (Appendix A.6) included description regarding Complaint Resolution Plan and Form
3.3 Regulatory Consultation	No	3.5 Regulatory Consultation	-
3.4 Public Engagement Activities	Yes	3.6 Public Engagement Activities	• Updates on CLC as indicated in IR2s from ESFWA (ESFWA 2-14b, ESFWA 2-20 and ESFWA 2-22) • Updated to include additional detail regarding commitments from previous community stakeholder engagement meetings • Added information on 2020 Beaver Dam Mine Project supplemental engagement and stakeholder meetings
3.5 Key Issues Raised and Proponent Responses	Yes	3.7 Key Concerns Raised and Proponent Responses	• Included additional detail regarding key concerns from public engagement from 2015 to 2019 • Added information, key concerns and AMNS responses from the 2020 supplemental engagement
3.6 Ongoing Community Engagement	Yes	3.8 Ongoing Community Engagement	• Updated to include public engagement commitments table

Notes: AMNS = Atlantic Mining NS Inc.; CLC = Community Liaison Committee; ESFWA = Eastern Shore Forestry Watch Association; IR2 = Round 2, Information Requests; - = no update.

3.2 Objectives

AMNS is committed to stakeholder and rightsholders engagement as part of its Beaver Dam Mine Project. Using key values of openness, transparency, collaboration, and respect, AMNS has continued to work with the local community, non-governmental organizations (NGOs), regulatory agencies, and interested members of the public for over a decade. As part of the planning and permitting of the Touquoy Gold Mine, AMNS developed relationships with members of the local community and NGOs, such as the Moose River Gold Mine Museum Society. A CLC has been in place since 2011 (Appendix A.3).

Both federal and provincial EA legislation requires engagement with the public to recognize concerns about adverse effects of the environment and identification of steps taken by AMNS to address these concerns; therefore, these are specifically identified in the EIS related to the Project. Beyond the regulatory requirements, AMNS strongly believes that meaningful engagement is crucial to the success of any development. AMNS is committed to maintaining stakeholder engagement throughout the life of the Project; these activities extend well beyond the EA process.

The objectives of AMNS's draft Public Engagement Plan are:

- to listen and incorporate into the EIS the community knowledge gathered from stakeholders and rightsholders;
- to determine opportunities to include participation of stakeholders during the development and implementation of the follow up program and future management plans;
- to seek input and feedback on the spatial and temporal boundaries used by this EIS;
- to provide information to stakeholders, particularly those most potentially impacted by the Project;
- to build meaningful, two-way relationships with communities most impacted to address any current or potential future land use conflicts; and
- to gather and consider local and regional knowledge and expertise during construction, operations and post-closure.

3.3 Spatial Boundary

The draft Public Engagement Plan for AMNS's Beaver Dam Mine Project (Appendix A.6) recognizes the local communities, and the people who live in them which are located near the mine. The communities of Mooseland, River Lake, Jacket Lake, Pleasant Valley, Marinette, and Sheet Harbour are the primary areas for focused engagement. The Public Engagement Study Area was developed based on engagement efforts in 2020 with local community members who live, own seasonal dwellings or are affiliated with these communities (Figure 3.3-1). These communities use the lands in and around the mine site and the Haul Road extensively for recreational purposes, such as ATV usage, hunting, fishing, and snowmobiling (Figure 3.3-2).

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FIGURE3.3-1

Beaver Dam Mine Project

Public Engagement Study Area

Beaver Dam Mine Site
Rocky Dam Lake
Beaver Lake IR
Touquoy Mine Site
Haul Road
Marinette
Mooseland

- Local Community
- Public Engagement Study
- Project Area



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 4.5 9 18 km

1:352,000 Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed By: XX

Date: 2021-05-09

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

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Atlantic Gold

FIGURE 3.3-2

Beaver Dam Mine Project Haul Road and Recreational

Beaver Dam Mine Site

Haul Road

Touquoy Mine Site

Beaver Lake IR 17

Beaver Dam Mine Road

Mooseland Road

HWY 224

- Secondary Access Point
- Stop Sign and Crossing Location
- Proposed Trail End
- Proposed Alternative ATV route
- Proposed Trail Connector
- Proposed Multi-use Bypass
- Haul Road Centerline
- ATVANS Active Trail
- Collector Road
- Local Road
- Seasonal Road
- Diveways (>300 m)
- Track
- Trail
- Streams
- Proposed Infrastructure
- Touquoy Infrastructure Layout
- Lakes
- Beaver Lake IR
- Proposed Property Boundary



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 0.75 1.5 3 Kilometers

1:78,600 Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed By: LP

Date: 2021-06-01

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri

McCallum Environmental Ltd.

Document Name: BD_EIS_Fig3.3-X Haul Road Recreation

3.4 Engagement Strategy

A community engagement strategy was developed by AMNS for the Project to guide engagement during preparation of the Project Description and the original 2017 EIS (AGC 2017). It set out the formal engagement activities that AMNS will undertake throughout all phases of its exploration activities and mining operations in Nova Scotia. This includes the development, operation and reclamation of the Project, which includes the permitted Touquoy Mine Site and the proposed Beaver Dam Mine Site. AMNS is also active in efforts to provide broader awareness relative to advanced exploration activities at Fifteen Mile Stream Gold Project and Cochrane Hill Gold Project.

A successful community engagement strategy provides flexibility to allow adaptation to the needs of the community. In 2016, AMNS developed its strategy for community engagement to coincide with the start of construction of the permitted Touquoy Mine and the development of the EA for the Project. AMNS drafted a Public Engagement Plan to reflect changes in the Beaver Dam Mine Project since the initial engagement occurred in 2015 to 2016. This draft Public Engagement Plan is included in Appendix A.6.

The draft Public Engagement Plan (Appendix A.6) uses the values of St Barbara as its foundations to create meaningful, two-way conversations throughout the life of the mine. AMNS Corporate Values are:

Figure 3.4-1: Atlantic Mining NS Inc. Corporate Values



Note: AMNS Corporate Values are adopted from St Barbara Limited.
AMNS is a wholly owned subsidiary of St Barbara Limited.

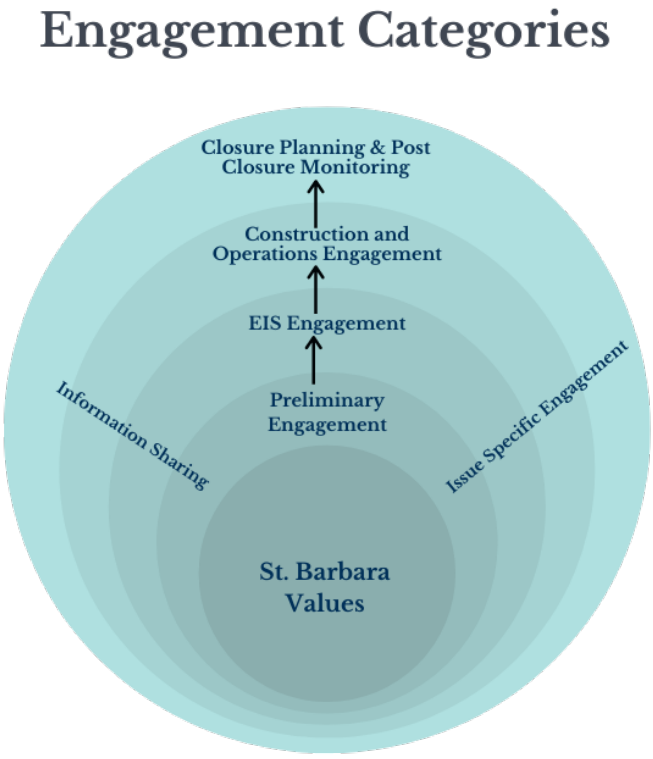
Engagement will occur according to a familiar process that includes several elements. The engagement elements are centred on an adaptive management approach for managing ongoing concerns and emerging issues. Adaptive management is a term that arose from the environmental field but also has applicability for general management principles. Essentially, it is the process of working with stakeholders to identify outcomes, implementing a particular course of action to meet that outcome, measuring the outcome and then making changes in an iterative way (adapting) as needed based on data and input received from stakeholders and other sources to reach the desired outcome.

Using adaptive management principals, the Project will update and adjust its management plans to reflect what is being heard from stakeholders.

The draft Public Engagement Plan (Appendix A.6) outlines various engagement categories that generally, but not necessarily, link to the different phases of the mine (Figure 3.4-2). Information sharing and specific key concerns engagement occur throughout the mine life. This Public Engagement Plan will be reviewed and updated yearly, or as required, using the adaptive management approach.

The draft Public Engagement Plan identifies and groups stakeholders, outlines the reasons why each stakeholder group needs to be engaged, the frequency of the engagement and the engagement tools. AMNS has also identified indicators of success for engagement activities which link to the engagement objectives. The indicators of success will enable regular reporting, tracking, and evaluation of effectiveness of the draft Public Engagement Plan (Appendix A.6).

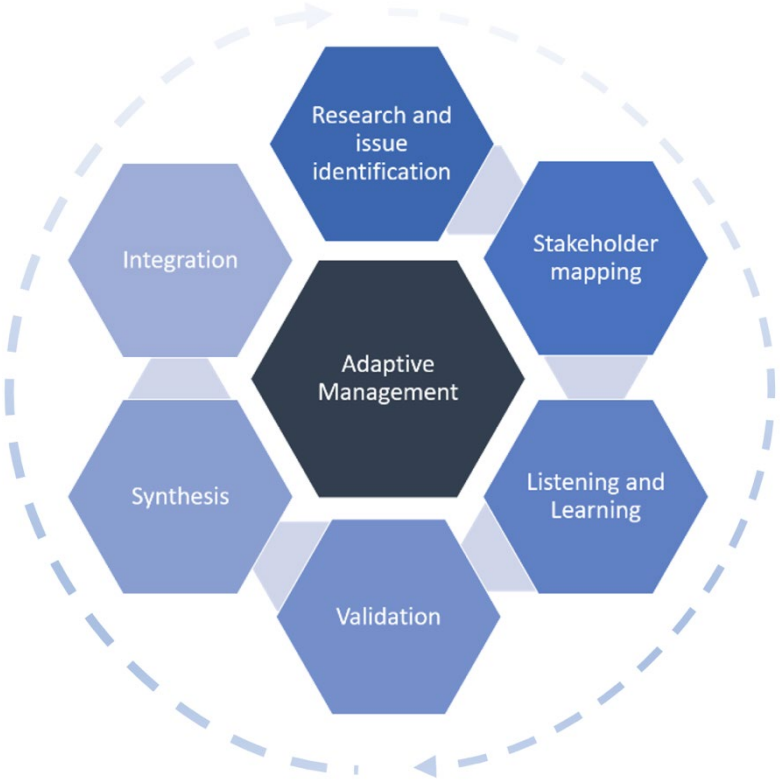
Figure 3.4-2: Engagement Categories



3.4.1 Adaptive Management

Adaptive management is the process of working with stakeholders to identify outcomes, implementing a particular course of action to meet that outcome, measuring the outcome and then making changes in an iterative way (adapting) as needed based on data and input received from stakeholders and other sources to reach the desired outcome.

Figure 3.4-3: Adaptive Management Cycle



AMNS plans to integrate the adaptive management approach into their other mine projects, including Fifteen Mile Stream Gold and Cochrane Hill Gold projects as part of ongoing updates throughout the regulatory process. Environmental Assessments are intended to be iterative and updates to engagement plan for the Fifteen Mile Stream Gold and Cochrane Hill Gold projects are anticipated

AMNS has created its own adaptive management process, which includes the following steps:

- **Research and preliminary concern identification** – This basic information gathering includes understanding the history, context of the project, key sensitivities, and community and regional perspectives so that preliminary concerns can be identified for further discussion and exploration with the stakeholders.
- **Stakeholder mapping and identification** – At this stage, the "who needs to be contacted or communicated with" is determined. This allows for a fuller understanding of the stakeholder ecosystem.
- **Listening and Learning** – Through focused efforts to engage the initial list of stakeholders and identifying other stakeholders who were missed in the previous step, the project team will listen and learn. Key questions are asked, such as:
  - What is important to you about this project?

  - Tell us about your community, organization or group? What is critical for you over the next few years? What do you value about your community?
  - What are your concerns about the project?
  - What additional information do you need to better understand the project? What information can you share to help us better understand your point of view?
  - How do you want to be involved? What is the best way to communicate with you?
  - How can Atlantic Gold support the work you are already doing? Are you active in the area of the proposed mine site?
  - What benefits, if any, do you hope your community, organization or group realizes from this project?
  - Are you interested in partnering around a potential key concern or project?
  - Who else should we talk to?
  - What does AMNS need to understand?
- **Validation** – Throughout and after the listening and learning, we will validate our understanding of what we heard through follow up communications, summary documents, and other validation tools.
- **Synthesis** – The engagement perspectives and key concerns will be synthesized to identify themes, trends, areas of concerns and opportunities.
- **Integration** – The engagement data will be integrated into the appropriate project category. This could include the EIS, construction, operation or post closure phase of the mine. It is through the integration step that changes and adaptations to plans, operations and activities will occur.

Engagement will occur to support adaptive management and will feed into planning and operational processes throughout the life of the mine.

3.4.2 Community Liaison Committee

Community engagement is important to AMNS and the CLC is one of its foundations. The CLC is diverse with representation from the surrounding communities; it was expanded to a nine-member CLC. The volunteer membership acts as an advisory board to AMNS. The CLC provides a mechanism for information exchange between communities and the company, as well as a forum to share questions, concerns, and input regarding the Touquoy Mine Site and the Beaver Dam Mine Site (Appendix A.3). The CLC meet quarterly with the potential for additional meetings depending on interest and Project developments.

The current members are: Charles Brown (Musquodoboit Harbour), Rick Deale (Middle Musquodoboit), Gilbert Fahie (Mooseland), Robin Webber (Oyster Pond) Gary Leslie (Upper Musquodoboit), Brice Kennedy (Tangier) and Barry Prest (Mooseland). The CLC is currently recruiting for members to bring the membership back to full.

A draft Terms of Reference for the CLC was developed and approved by the CLC on June 24, 2017 (Appendix A.3). The Terms of Reference sets out the governance for the CLC and defines its objective as an advisory body to AMNS with volunteer members representing local communities. On October 13, 2018 the CLC made a formal motion to include the Project in the Terms of Reference and will provide advice to AMNS on concerns related to this Project in addition to the Touquoy Mine. Fifteen Mile Stream Gold Project and Cochrane Hill Gold Project will have their own separate CLCs.

As defined in the Terms of Reference, guests, such as technical consultants or community groups, may be invited to the CLC meetings where topics of interest are planned. To date, the CLC has received presentations from Intrinsik Corp. on Metal and Dimond Mining Effluent Regulations (MDMER), Cyanco on Cyanide, and from a local community group (Eastern Shore Forestry Watch Association).

3.4.3 Open Houses and Town Hall Meetings

Open houses allow a proponent to inform the general public about a proposed project, and conversely, interested members of the public have the opportunity to view information and speak directly with representatives of AMNS. This allows one-on-one discussions to answer questions of the visitor. For many members of the public, this can be a more comfortable form of communicating with AMNS than town hall type meetings.

The meetings can take many forms but usually involve information boards and displays showing the location of the proposed project in relation to nearby communities, fact and figures pertaining to the development, and an update of the general public on the status and progress of development activities, such as the EA and anticipated construction schedule.

Many open houses have been held as part of the Touquoy Gold Project over the past decade. In spring 2016, four meetings were held to update the local communities on the construction start of the Touquoy Gold Project and provide specific details on the proposed Project. In response to concerns on traffic potentially associated with the work at the Touquoy Gold Project, a town hall meeting was held in Mooseland in late 2016. AMNS attempted to organize an in-person open house in the community of Mooseland for the Beaver Dam Mine Project; however, with an outbreak of COVID in the fall of 2020 in the Halifax region that meeting was moved to an online forum. Additional details regarding the open house is provided in Section 3.6.1.

3.4.4 Presentations and Meetings with Local Community Groups

AMNS has made presentations to many organizations, community groups and educational institutions on its exploration and mine development activities in Nova Scotia. To date, these organizations include but are not limited to, Sheet Harbour Chamber of Commerce, Council of the Municipality of the District of St. Mary's, and engineering students at Dalhousie University. Depending on interest of community groups, AMNS will continue to make presentations to share information about its operations in Nova Scotia.

In 2020, AMNS undertook extensive engagement activities with local and provincial ATV groups, the Mooseland and Area Community Association, the Icelandic Heritage Society, a group from the Rocky Brook Lake area and individual landowners. The learnings from this most recent engagement are outlined in Sections 3.6, 3.7, and Appendix A.4a.

AMNS has and will continue to meet with local community groups in a smaller venue, including the ESFWA, Moose River Gold Mines Museum Society, and NSSA. Depending on interest of community groups as the Project develops, AMNS will continue to meet with community groups to provide information and respond to any concerns. This may include local ATV clubs, environmental groups, business development organizations and other interested community groups.

3.4.5 Community Bulletins (Newsletter)

May 2018 AMNS launched a quarterly community bulletin (Appendix A.4c). The purpose of the bulletin is to keep the community informed about the AMNS activities, update the public on the status of all Project EAs, provide information on AMNS's activities in the local community and provide basic technical information on AMNS's projects. The bulletin will continue indefinitely so that community members are kept informed throughout all stages of the Project.

As of January 7, 2021 had 369 email addresses on its distribution list. AMNS has issued eight Community Bulletins, and seven Special Bulletins to announce things such as the public comments periods for the Fifteen Mile Stream and Cochrane Hill Gold Projects or special meetings. The September 11, 2020 bulletin was delivered to 346 people and had an open rate of 46.9. The open rate demonstrates interest in the bulletin and that people are opening the email. The bulletin has also been forwarded by the initial recipients meaning the distribution network is wider than the initial recipients (Appendix A.4c).

3.4.6 Signage

AMNS posts, and will post, signs at their Project sites with contact details and other general information. For example, in the instance of the Touquoy Mine, the blasting schedule is posted for public information. Working with local groups, such as the Moose River Gold Mine Museum Society, interpretative panels on AMNS Projects may be integrated into the Moose River Gold Mine Provincial Park.

AMNS will also work with the local community and ATV clubs to post signage along the Haul Road. A signage plan will be included in the Operational and Safety Management Plan for the Haul Road.

3.4.7 Website, Email, Phone Line and other Digital Media

AMNS has a website (atlanticgold.ca) where information on the Beaver Dam Mine Project can be found. The website continues to be populated with new information and AMNS intends for the website to be a hub of information for reference by the community.

The purpose of this website is to:

- inform and update the public about the Project;
- address community questions gathered from other communication channels; and
- provide information for further engagement.

The website provides a sign-up location for the quarterly community bulletin (newsletter) and provides access to meeting notes for the CLC.

AMNS has established a regularly monitored email address - communityrelations@atlanticgold.ca- specifically as a point of contact for the public.

AMNS will continue to monitor various social media channels for posts and comments regarding the Project. The purpose of this monitoring will be to check for information being shared regarding the Project, to better understand public questions and concerns, and to identify opportunities to engage. AMNS is evaluating opportunities to include social media platforms as well.

AMNS established a community phone line (902-391-4653) in March 2018 where the public can call/text when there are questions or concerns, or to request a meeting with a representative. This phone line is answered during business hours. This phone line has been advertised on the website, in all newsletters and on a business card given out to those who have expressed interest in further communicating with AMNS.

3.4.8 Media and Press Releases

AMNS posts news releases to promote accurate information about the Project. Most news releases to date are associated with AMNS's business interests; however, this has been expanded to include Nova Scotia media outlets to better communicate the benefits of the mine developments with the broader community, address public questions and concerns, and encourage engagement.

AMNS is also considering regular advertising and content in the Guysborough Journal to assist in sharing information on the Project.

3.4.9 Meetings with Local Residents and Landowners

Meetings with residents, landowners and community organizations are vital to understanding concerns, potential impacts and proposed mitigation strategies. Until early 2018, meetings with local residents and landowners have occurred opportunistically where specific interests are expressed.

In the spring of 2018, AMNS initiated a more active engagement process with adjacent landowners by sending letters and offering to meet with property owners potentially impacted by the Haul Road and the Beaver Dam Mine Site. AMNS has also reached out to landowners whose land may be required for mine infrastructure. AMNS will continue to communicate directly with potentially impacted landowners to resolve land issues.

In 2020, engagement efforts with residents and landowners used the steps of adaptive management to reinvigorate and guide engagement activities. This involved undertaking additional research, updating stakeholder mapping, listening and learning, validation, synthesis, and finally integration (Appendix A.4a).

3.4.10 Complaints Response Procedure

Associated with the ongoing work for the Touquoy Mine, a Complaint Resolution Plan and Form is being developed and will be used by AMNS when a complaint is received from the public. This Plan is intended to standardize the formal response procedure to complaints from members of the public. AMNS is committed to addressing complaints in a timely and respectful manner. Information gathered under the Complaint Resolution Plan is shared with the CLC and Nova Scotia Environment on a quarterly basis, including any corrective actions.

AMNS keeps a complaints log that tracks all engagements and communications associated with the complaint. The Complaints Resolution Plan is a component of the adaptive management approach adopted by AMNS.

3.5 Regulatory Consultation

Regulatory engagement on the Project has been ongoing since October 2014 with a Provincial "One Window Process: Mineral Development in Nova Scotia" meeting. This initial meeting was intended to present the planned Project and to receive feedback on the regulatory regime and regional expertise.

Departments from federal and provincial governments have been consulted on the Project, including:

- IAAC Impact Assessment Agency of Canada (formerly the Canadian Environmental Effects Agency [CEAA]) ;
- Fisheries and Oceans Canada (DFO);

- Environment and Climate Change Canada (ECCC);
- Canadian Wildlife Service (CWS);
- Health Canada;
- Transport Canada;
- Natural Resources Canada (NRC);
- Nova Scotia Environment (NSE);
- Nova Scotia Transportation and Infrastructure Renewal;
- Nova Scotia Lands and Forestry (formerly Nova Scotia Department of Natural Resources);
- Nova Scotia Energy and Mines (formerly Nova Scotia Department of Natural Resources); and
- Nova Scotia Office of Aboriginal Affairs.

Engagement includes one-on-one meetings or correspondence, larger meetings or workshops and site visits. A one-day workshop was held on May 13, 2016 for interested provincial and federal regulators. On November 29, 2016 a site visit and tour was held for interested provincial and federal regulators and representatives of the two closest Mi'kmaq communities, Sipekne'katik and Millbrook, and staff of the Kwilmu'kw Maw-klusuaqn Negotiation Office (KMKNO). A description of recent engagement activities with the First Nations is provided in Section 4.

3.6 Public Engagement Activities

While broader engagement on the Project has occurred for over a decade and will continue as per the draft Public Engagement Plan (Appendix A.6), specific public engagement activities have occurred to support the environmental assessment process for the Project since the federal process was commenced in December 2015. A summary of engagement activities conducted with stakeholders is included (Appendix A.4a).

3.6.1 Community Open Houses

Four open houses were held in May 2016; two of these were open to the public while the other two were open to First Nations community members as described under Indigenous Peoples engagement. Two more open houses were held in 2018 with Millbrook First Nation and are outlined in the Indigenous Peoples Engagement section (Section 4).

The two public open houses were advertised in the local papers, including the Eastern Shore Cooperator (monthly print issued on May 5), Guysborough Journal (weekly print issued on May 16) and the Town Cryer (monthly print issued on May 2). The members of the CLC also circulated information. Flyers were also posted in local communities. The dates and locations were as follows:

- May 18, 2016 at Natural Resources Education Centre, 12014 Hwy 224, Middle Musquodoboit.
- May 19, 2016 at Sheet Harbour Lions Club, 183 Pool Road, Sheet Harbour.

The format and layout were the same for all open houses. Each open house was hosted from 3:00 pm to 8:00 pm with refreshments provided. Upon entry, attendees were asked to sign in and were provided a comment form to complete at end of their stay. Maps were also available for viewing and a 3D model of the Beaver Dam Mine Site was used to demonstrate the existing conditions, proposed full mine development (including pit and waste rock pile) and reclamation of the site.

A total of fifteen of large informational poster boards (panels) were placed on easels with AMNS and its consultants hosting the panels. After a welcome and introduction to AMNS and the Project background (three panels), an overview of open pit mining, process of gold recovery, and economic benefits of the Project was provided (three panels). The next three panels provided an update on the Touquoy Gold Project which was soon to begin construction (June 2016). Before the one closing panel, the remaining five panels focused on the Project and the engagement opportunities, specifically:

- presentation of the site location, the gold deposit and the existing site features;
- map of the proposed Beaver Dam Mine site plan;
- information on the transportation of ore, including both options considered for the route and the trucking rate;
- overview of the EA process for the Project including the ongoing baseline studies for the VCs and the regulatory process with opportunities for public participation; and
- opportunities for community and Mi'kmaq engagement, including an overview of the CLC and an invitation for expressions of interest from residents who are interested in joining the CLC.

A total of 94 interested community members attended these two open houses (i.e., Middle Musquodoboit had a total of 61 attendees with 49 providing contact information; Sheet Harbour had a total of 33 attendees with 32 providing name and/or contact information). In total, nine comment forms were completed, two expressed interest in joining the CLC, and many resumes were provided to AMNS.

In 2020, AMNS attempted to hold an Open House on November 27 and 28 in the community of Mooseland. This Open House was organized in response to a request from the local community to provide information on concerns relating to the proposed Haul Road and the Beaver Dam Mine Site. AMNS recognized that additional engagement was required with the community as the last open house was in 2016. Due to the COVID-19 pandemic, the Open House format had to be modified to small information sessions to meet Nova Scotia Public Health directives. AMNS created an internal plan to guide the delivery of information sessions in Mooseland to address concerns identified, in part, by the Mooseland and Area Community Association.

Invitations to the Information Sessions were delivered by hand, email or phone to most property owners in Mooseland and several residences in Jacket Lake. MACA also placed a notification of the meeting on the community sign located in front of the community hall in Mooseland. At least one property owner in Ferry Lake was notified of the meeting. Individuals were asked to pre-register to meet with an AMNS representative to discuss concerns or learn more about the Project.

Due to an increase in COVID-19 cases in HRM, the Office of Public Health issued an order on November 26, 2020[1] that restricted non-essential travel of people within most of HRM. AMNS cancelled the Information Session on November 26, 2020 in the interest of public safety and notified the local community through both formal means (phone calls and emails) and informal means (informing key community leaders about the cancellation and asking them to spread the word). AMNS will hold an Open House in Mooseland after the Updated 2021 EIS is submitted.

As the Information Sessions could not occur on November 27 and 28, 2020, AMNS provided copies of the Plain Language Summary (Appendix A.1) to the 36 mailboxes in Mooseland along with a covering letter with the community relations phone line and email address, to which questions or concerns could be sent.

[1] https://novascotia.ca/coronavirus/restriction-updates/

3.6.2 Community Liaison Committee

The Touquoy CLC was activated in 2016. Due to the operational links between the Touquoy operation and the proposed Beaver Dam Mine, and the fact that the community of Mooseland is geographic link between the operating mine and the proposed mine from a, the mandate of the Touquoy CLC was expanded to include the Project in 2018.

Six CLC meetings were held in 2016. Of these, the last two meetings held on October 29, 2016 and December 3, 2016 included the expanded membership of nine. In 2016, the CLC membership represented different communities, including: Middle Musquodoboit, Millbrook First Nation, Mooseland, Musquodoboit Harbour, Sheet Harbour, Sipekne'katik First Nation, Pleasant Harbour, and Upper Musquodoboit.

Due to the ongoing preparation of the EIS for the Project, a special meeting on December 3, 2016 was held to focus on the Project. As per the Terms of Reference, the CLC may invite guests who may be interested in topics in forthcoming meetings. The CLC invited representatives from the Eastern Shore Forestry Watch (Barbara Markovits and two guests) and the NSSA (Eddie Halfyard and guest).

The meeting was about 2.5 hours in duration. Presentations were made by staff of AMNS and the EA Study Team, maps were provided and a 3D model of the Beaver Dam Mine Site was used to demonstrate the existing conditions, proposed full mine development (including pit and waste rock pile), and reclamation of the site. Questions and answers were facilitated. The agenda included:

- introduction and special purpose of the meeting;
- overview of the Project;
- review of participation opportunities in the federal and provincial EA processes;
- presentation of summary assessment for each VC; and
- description of timelines of the Project.

Offers to meet with specific members of the CLC and/or NGOs present to provide additional information on the Project were made by AMNS.

The CLC has continued to meet regularly:

- in 2017, the CLC met two times;
- in 2018, the CLC has met three times;
- in 2019, the CLC met four times; and
- in 2020, the CLC met three times. Due to the COVID-19 Pandemic, meetings did not occur between January 2020 and November 2020.

The CLC membership continues to fluctuate as members resign and new ones are recruited. The most significant membership change is the agreed upon withdrawal of Millbrook First Nation and Sipekne'katik First Nation on the CLC in 2017. Both First Nation Communities have elected to not participate in the CLC and have decided to directly engage with AMNS. AMNS has made it clear to both Millbrook and Sipekne'katik First Nations that they are welcome to rejoin the CLC or attend as guests. Information regarding specific Indigenous Peoples engagement is provided in Section 4.

In an effort to promote transparency and understanding of the role of the CLC, AMNS publishes meeting notes for the Touquoy/Beaver Dam CLC, which can be found at https://stbarbara.com.au/community/nova-scotia/

3.6.3 Stakeholder Meetings

AMNS regularly reviews the stakeholder mapping associated with the Project. This is done by continuously scanning the stakeholder ecosystem for individuals, communities and groups who may be impacted or interested in this Project. AMNS keeps a database of stakeholders, along with contact information, to ensure communication occurs as required. As the Project develops, AMNS will continue to review and update the stakeholder mapping to ensure stakeholders and rightsholder are consulted and engaged. For example, if a property sells near the Project Area, then AMNS update the stakeholder mapping.

A complete list of the stakeholder meetings is shown in (Appendix A.4a).

Through the preliminary engagement, four main organizations arose where a closer relationship is required. Although the draft Public Engagement Plan identifies many important stakeholders, two of these organizations, the NSSA and the ATV clubs, are particularly impacted by the proposed Beaver Dam Mine Project due to the significant infrastructure investments each have made. The other two organizations, MACA and the Sheet Harbour Chamber of Commerce, are links to community groups that represent community perspectives near the mine site. When AMNS works with a community organization or other non-governmental organization, information will be provided with a request that it be shared through the NGO's membership and broader network.

3.6.3.1 Nova Scotia Salmon Association

AMNS acknowledges the significant and important activities of the Nova Scotia Salmon Association. The Acid Rain Mitigation (ARM) Project on the West River is of particular importance as it is a multi-year, science-based project active in the watershed in which the proposed Beaver Dam mine is located. The West River Acid Mitigation Project started in 2005 and is.., " being developed as a model for the restoration of acid-stressed rivers in the region."[2] In 2016, the NSSA installed and operates a lime doser on the Killag River near the proposed mine site.

In recent years, the NSSA has received funding from the federal government, "to improve the water quality of fish habitat using aquatic, in-stream liming."[3] The Acid Rain Mitigation Project is just one of the many initiatives that support the overarching goal of the NSSA to "maximize the likelihood of survival and sustainability of our fish, rivers and recreation." (NSSA 2020).

AMNS has been meeting regularly with the NSSA to share information, learn more about its activities along the West River and provide information on the Project as it develops. AMNS will continue to meet with the NSSA to share its future activities, share information and look for collaborations to benefit the fish and fish habitat of the watershed.

Over the course of several meetings, emails and phone calls with AMNS over the last several years, the NSSA has shared information regarding the scope and importance of the ARM Project on the West River. The ARM project is focused on addressing acidification by conducting in-stream liming. The NSSA has expressed concerns about the potential impact of AMNS mine rocks piles, potentially acid generating (PAG) mine rock and organic stockpiles. NSSA also has concerns regarding river drawdown

[2] https://www.salmonconservation.ca/projects/the-west-river-acid-mitigation-project/

[3] https://www.nssalmon.ca/acid-rain-mitigation (web reference December 2020)

resulting from pit development, loss of catchment area and water loss during and until the pit is refilled. On September 9, 2020, AMNS presented updates on the Project (Appendix A.4b).

AMNS supports the NSSA's efforts on the Killag River and is actively seeking opportunities to work with the NSSA. Offsetting opportunities, data sharing and ongoing communication throughout the Project are currently being explored. In addition, AMNS, through its adaptive management process, will seek NSSA input into the Project to ensure all management plans developed for the Project are updated and improved through the life of the Project.

3.6.3.2 Mooseland and Area Community Association

The Mooseland and Area Community Association (MACA) is active in the community of Mooseland and includes the smaller communities of Jacket Lake and River Lake. This community organization manages the Mooseland Community Centre and hosts occasional community activities. MACA has established a working committee that has met with AMNS representatives to discuss potential community investments and to provide input and feedback on the proposed Beaver Dam Mine. The northern boundary of Mooseland is located approximately 850 m from the entrance to the proposed Haul Road (known locally as the "old dump road"). The community is comprised of a mixture of full-time and seasonal residents. The seasonal residents often have historical family connections in the area and treasure the lifestyle and access to the wilderness that Mooseland provides. The proposed Haul Road is a major recreational corridor for Mooselanders.

Given the small population of the Mooseland community, AMNS has worked with this organization and will continue to do so, as many of the permanent and seasonal residents of the area are affiliated with it. AMNS is committed to working with this community on potential mitigation options, adaptive management inputs and to identify community development opportunities.

The MACA members have identified the following as concerns:

- access by residents and user groups of the ATV trails and recreation lands in and around the proposed Haul Road;
- truck traffic and truck noise; and
- impacts on residents' lifestyle.

Many residents have also acknowledged the importance of local employment and the opportunities a mine project can bring.

Detailed technical results related to truck traffic and noise are detailed in Section 6.1 and Appendix B.2 (Updated Noise Impact Assessment). To mitigate impacts of perceived or actual impacts on recreational land use on or around the proposed Haul Road, AMNS is committing to the construction of bypass roads that will allow recreational vehicles, light trucks, and active transportation users to access the desired recreational areas. In addition to the bypass roads, AMNS will identify crossings for the Haul Road for recreational users and include specific protocols in the Access and Safety Management Plan for road usage. Using the adaptive management process, AMNS will work with recreational users to monitor the effectiveness of the mitigation strategy.

3.6.3.3 Sheet Harbour and Area Chamber of Commerce

The Sheet Harbour Chamber of Commerce is a business organization located in Sheet Harbour, but also hosts a website promoting the Sheet Harbour area. Under the Atlantic Gold banner, AMNS is a member of this organization. This membership will be maintained over the life of the Project.

Although Sheet Harbour is approximately 25 minutes from the Beaver Dam Mine Site, it is the largest community in the vicinity. Direct impacts from construction and operations on Sheet Harbour will be related to socio-economic impacts and generally will be

positive; however, AMNS needs to establish a feedback loop with the community to monitor this assumption which is included as part of the draft Public Engagement Plan (Appendix A.6). Housing availability, the local hospital and businesses could experience changes if the mine begins operation. AMNS also sees community and economic development opportunities that can align with the provincial economic development priorities of improved social wellbeing, increased population and economic growth (Section 6.16 Socio-Economic Conditions).

3.6.3.4 All Terrain Vehicle Groups

AMNS has clearly heard that the areas in and around the Beaver Dam Mine Site and Haul Road are used extensively for recreational land uses, such as ATV riding, hiking, hunting, fishing and snowmobiling. Local ATV clubs (PUMA, Sheet Harbour and Lake Charlotte) (Figure 3.3-1), along with the All-Terrain Vehicle Association of Nova Scotia (ATVANS) have made considerable investments in the construction and maintenance of trails and related infrastructure for its members use. These same trails are used also by non-members, and it is believed many of these are local residents. The local clubs are run by groups of committed, passionate volunteers who build and manage their own trails systems (Figure 3.3-2).

The Haul Road and mine site intersect with the ATV and snowmobile trails managed by the ATV clubs, some of which provide provincial and regional connections. These trails are well travelled throughout the year. The proposed Haul Road will include both crossings for recreational land users and bypass routes for continued connectivity. The safety of all parties – recreational land users, AMNS staff and contractors, and the public – is critical and AMNS will work closely with the ATV clubs on the concerns of safety and accessibility.

AMNS is also interested in having discussions with the ATV clubs on potential community investment opportunities and partnerships that further shared interests. These could include:

- trail construction;
- trail maintenance; and
- safety and education programs.

3.6.4 Summary of Supplementary Engagement - 2020

In 2020, AMNS implemented a supplementary engagement program. The supplementary engagement program included contacting environmental groups, community associations, ATV Clubs and landowners with an offer to meet. In 2020 alone, AMNS had over 322 communications with stakeholders regarding the Project EIS. The supplementary engagement program also includes contacting property owners near the Project Area. All property owners were contacted by phone, letter or email and provided updated information and offered a meeting to answer questions or discuss concerns.

AMNS, in July 2020, began meeting regularly with the MACA where concerns regarding the Haul Road, recreational land use, potential community investment projects and other concerns were raised by the Association. At the request of MACA, AMNS organized and planned a series of community information sessions with the local community (Section 3.6.1).

A property owner from the Ferry Lake area contacted AMNS in 2020 expressing concerns regarding the Project. AMNS has attempted to meet with the property owner several times. AMNS continues to welcome the opportunity to answer questions, address concerns and develop a relationship with the property owners along Ferry Lake.

Also in 2020, AMNS met with property owners near Rocky Brook Lake, which is located in Pleasantville approximately 8 km from the intersection of the Beaver Dam Mines Road and Hwy 224. These residents expressed concern about their ability to continue

to access the lands in and around the Beaver Dam Mine Site, for recreational uses. Specific recreational uses included fishing, hunting, ATV riding, hiking, accessing camps and snowmobiling. AMNS held a video call with five property owners in the area on December 14, 2020 to answer questions, validate information gathered about recreational land usage in the area, and review proposed mitigation measures. The main mitigation proposed to address recreational land access concerns is to construct alternative access routes or bypass roads to the desired recreational locations. A map showing proposed new bypass routes was reviewed with attendees and there was general agreement that the proposed bypass roads were acceptable (Figure 3.3-2).

Through the supplementary engagement program, new stakeholders were identified that have camps or land that are accessed from the proposed Haul Road. All known landowners were contacted and provided information on the Haul Road. Further contact and communication will occur as the Project progresses. Landowners and camps owners include:

- Marilyn Prest and family;
- Deepwood Estates;
- Harry Casey;
- Darren Lasaga;
- Jeff Bevis;
- Deborah Marlborough;
- Musquodoboit Lumber Company;
- Prest Brothers Ltd.; and
- Northern Pulp.

AMNS will continue to identify other potentially impacted property owners and camp owners as the Project progresses.

Through the public engagement in 2020, the stakeholders identified the follow community sites presented in Table 3.6-1 and described in Section 6.16.5 Socio-economic Conditions.

Table 3.6-1: Community Sites

Community Site	Location	Discussion
Date Rock	Along the Haul Road between Mooseland Road and Highway 224	Request by community members to maintain the rock. Rock will be maintained or, if required, moved to a site acceptable to the community.
Otter Lake	Otter Lake is a popular recreational area located to the north of the Haul Road, along Trail #320	This area is a destination for family and outdoor recreational pursuits. The cabin, located on the shore of Otter Lake, is a known stopping location. Access to Otter Lake will not be restricted and the Haul Road bypass will include a crossing to access Trail #320. Otter Lake can also be directly accessed from Hwy 224.
Lake Alma	Lake Alma is located to the south of the Haul Road	Lake Alma is a fishing and boating, and there are a l camps located near it on or on its shores. During engagement, at least one person indicated that he left his boat moored during the summer in Lake Alma. Lake Alma can be accessed from Highway 224 and via Trails #394 and 106. Access to Lake Alma from Mooseland will be maintained via the Haul Road bypass.

Table 3.6-1: Community Sites (continued)

Community Site	Location	Discussion
10 Mile Lake	Located west of the Mine Site and Cameron Flowage	There are camps located on 10 Mile Lake and this area is also identified for recreational uses. This area is accessed via Trail #394. Trail #106 and #320 both connect to Trail #394. Trail #320 will be dead-ended at the Project Area boundary. A new connector trail between Trail #320 and the BDMR Bypass will be created, as will a Mine Site Bypass that will allow ATV and light vehicles to access Trail #394 and the 10 Mile Lake area.
Otter Lake Demonstration Forest (OLDF)	To the southeast of the community of Mooseland	The OLDF is, "…a place for all Nova Scotians to learn about forest ecology and the sustainable management of our nature.
Mooseland and Area Community Hall	4032 Mooseland Road	This is a community centre that is used for local residents. AMNS is in talks with the Mooseland and Area Community Association (MACA) to develop a partnership. MACA is identified in the Public Engagement Mitigation Plan as a key stakeholder and includes several commitments regarding ongoing information sharing and relationship development.
Ferry Lake	Located approximately 4 km southwest from the Haul Road	Seasonal dwellings are located on the southern shore of Ferry Lake. No impact to residents are predicted based on the impact assessment. A technical memorandum assessing possible linkages is provided in Appendix F.9. The technical memorandum concludes that there are no impacts from dust, noise or surface and groundwater quality to Ferry Lake residents.,

Notes: AMNS = Atlantic Mining NS Inc.; ATV = All-terrain vehicle; BDMR = Beaver Dam Mines Road.

3.7 Key Concerns Raised and Proponent Responses

AMNS began stakeholder engagement in 2015, in advance of the June 12, 2017 submission of the EIS to CEAA, now referred to as IAAC for the Project. In previous submissions of the EIS, these engagements were documented and detailed. This section breaks the historical engagement into two distinct historical periods: engagement between 2015 and 2019 and engagement that occurred in 2020 under the draft Public Engagement Plan (Appendix A.6).

3.7.1 Public Engagement 2015 to 2019

The main concerns, along with AMNS responses are outlined in Table 3.7-1. The table includes key concerns identified by stakeholders, the response from AMNS to these concerns and the section of the EIS where the concern is dealt with in detail.

3.7.2 2020 Supplementary Engagement Strategy

In the spring of 2020, AMNS submitted a Supplementary Engagement Strategy (Appendix A.4a) that focused on contacting local property owners, seasonal residents and recreational users regarding the proposed Beaver Dam Mine. This additional engagement was requested by IAAC and agreed to by AMNS due to the length of time the Project has been under review by IAAC, the more refined technical analysis and conclusions and to ensure that new and existing stakeholders were engaged.

The objectives of the 2020 Supplementary Engagement Strategy were:

- To notify potential receptor locations of summary conclusions from the updated modeling for air, noise, light and water.
- To notify property owners near the Haul Road of summary conclusions from the updated modeling for air, noise, light and water.
- To provide information to the local community on the status of the Beaver Dam Mine Project Environmental Assessment.
- To ensure local residents, landowners and local community groups are aware of AMNS engagement tools, which include a newsletter, dedicated phone line, email address and website.
- To meet with any local resident or property owner who may have questions about the Beaver Dam Mine Project.
- To offer to meet with any community group active in the area to review summary conclusions related to updated modeling for air, noise, light and water, or any other information that is of interest.

Additional key concerns were raised during the 2020 supplementary public engagement. AMNS continued engagement beyond the original scope to ensure a fuller understanding of the concern and to, if appropriate, identify mitigations strategies. This included identifying any stakeholders missed during the 2015 to 2019 engagement period, identifying any additional impacted landowners in and around the Project Area, the identification of new concerns or questions, researching and exploring each concern, validating what was heard, synthesizing the information and adapting plans or processes to mitigate concerns, where appropriate. AMNS developed a draft Public Engagement Plan (Appendix A.6) based on the historical engagement activities and the results of the 2020 Engagement to inform the Project. Adaptive management is the foundation of the 2021 draft Public Engagement Plan for Project.

AMNS made significant efforts to reach out to and listen to the public in 2020 to 2021. AMNS tracks each contact with stakeholders and assessed the atmosphere of each communication. Positive reflects a productive conversation where topics are discussed and explored in a spirit of cooperation. It does not reflect endorsement of the Project or that concerns are resolved but rather that the tone of the meeting was positive and productive. Neutral reflects engagements where information is simply provided and data share. Negative reflects engagements where there is dissatisfaction or a breakdown in discussions. Similarly, negative atmosphere does not necessarily indicate opposition but rather that the engagement itself was unsatisfactory to the stakeholder (Figure 3.7-1).

Table 3.7-1: Summary of Key Concerns Raised During Stakeholder Engagement 2015 to 2020

Key Concerns	Summary of Proponent Response	Corresponding Updated 2021 EIS Section Reference[(a)]	Follow-up/ Commitment
2015 to 2019 Engagement			
Concern about metals leaching from waste rock pile, including arsenic, and acid rock drainage.	Leaching of metals is not expected, e.g., arsenic is expected to be within baseline conditions. PAG will be covered using an engineered cover that reduces infiltration rate and thereby limiting potential acid drainage. If necessary, water treatment will be put in place. Runoff from NAG and PAG will be monitoring during construction, operation, closure, and post closure to determine if adaptive management should be applied.	Section 6.5.4 Bedrock Geology; Section 6.7 Surface Water Quality and Quantity, including Surface Water Quality and Quantity Mitigation (Section 6.7.9) and Groundwater Mitigations (Section 6.6.8)	Monitoring, Mitigations and Adaptive Management of waste rock throughout life of mine

Table 3.7-1: Summary of Key Concerns Raised During Stakeholder Engagement 2015 to 2020 (continued)

Key Concerns	Summary of Proponent Response	Corresponding Updated 2021 EIS Section Reference[(a)]	Follow-up/ Commitment
Concern about effect on water quantity in Cameron Flowage from pit development.	Local hydrogeological conditions ensure that groundwater will be maintained to recharge Cameron Flowage. Baseline and ongoing monitoring of surface water and groundwater levels will be in place to identify trends.	Section 6.6.7 Project Activities/Interaction with Groundwater Quality and Quantity	Implement Aquatic Effects Monitoring Program and Groundwater Monitoring Program.
Questions about contingency planning for accidents and malfunctions.	Hazards have been identified and assessed based on risk with mitigations and contingency planning in place. Future detailed planning and implementation of the Project will further address potential accidents and malfunctions.	Section 6.18 Accidents and Malfunctions	Establish Emergency Response Plan and Operational Procedures to manage planned and unplanned events.
Concern about wetlands being impacted at Beaver Dam Mine Site and future compensation.	Where possible, wetlands have been avoided; otherwise minimization of effects was incorporated into Project planning. Any wetlands altered must have NSE approval and will require compensation.	Section 6.8 Wetlands, including Wetlands Mitigation (Section 6.8.8)	Limit mine footprint and compensate for wetlands that cannot be avoided
Questions about addressing species at risk if identified in Project area.	Species of conservation interest (SOCI) and species at risk (SAR) have been assessed. Effect is minimal and where a potential Project interaction, mitigation and monitoring plans are identified for priority species, including fish, vascular flora and lichens, terrestrial fauna and birds.	Section 6.13.8 Mitigation for SOCI and SAR	Monitoring, Mitigation and Adaptive Management of SOCI and SAR
Concern about effect on habitat from Haul Road construction.	Effects of road construction will be minimized by using existing corridors where possible and improving drainage where damaged culverts exist. Effects and mitigation measures are specifically identified for ecological VCs, including habitat and flora.	Section 2.8.2 Haul Roads for Transporting Ore, and key sections for each VC in Section 6 Environmental Effects Assessment	Limit the size of Haul t the extent possible. Replace culverts and
Concern about volumes of truck traffic in context of safety on public roadways and recreational vehicles.	Potential interaction exists with operation of the Haul Road and the public; the risk of a mobile equipment accident has been assessed as low with mitigations in place including design of Hwy 224 crossing, appropriate signage, and haul truck driver training.	Section 2.8.2 Haul Road; Section 6.16.10 Project Activities and Socio-economic Interactions and Effects; and Section 6.18.5.4 Mobile Equipment Accident	Implement Haul Road Operations and Safety Management Plan will be developed by an ad hoc advisory committee
Request to prefer Haul Road option that does not travel along Hwy 224.	Based comments received on two options during the stakeholder and Mi'kmaq engagement, AMNS completed a feasibility review of the second option which does not pass by any residences. This was selected and is carried forward in the EA.	Section 2.8.2 Haul Roads for Transporting Ore;	Re-Routing of Haul Road to avoid permanent residents and Beaver Lake IR 17

Table 3.7-1: Summary of Key Concerns Raised During Stakeholder Engagement 2015 to 2020 (continued)

Key Concerns	Summary of Proponent Response	Corresponding Updated 2021 EIS Section Reference[(a)]	Follow-up/ Commitment
Concern on cyanide use at plant for gold processing.	The approved Touquoy Gold Project includes a gravity/CIL processing of the ore using a highly efficient cyanide destruction process. This use of this existing plant will be extended for the processing of ore from the Beaver Dam Mine Site. Mitigations for transportation, handling storage and processing will be incorporated into the extended use of the plant.	Section 2.8.3 Operations and Maintenance associated with the processing plant: Section 2.8.3 and AppendixF10 Tailings and Water Management	Maintain Operation and Maintenance Plan for Cyanide Use
Concern on effect of tailings disposal in mined-out Touquoy pit.	Use of the approved pit as part of the Touquoy Gold Project allows the existing footprint to be used and eliminates the need to process the tailings at the Beaver Dam Mine Site. Geological conditions predict minimal effect on the receiving environment; conditions will be monitored and compared with the developing baseline data set for the Touquoy Gold Project.	Section 2.8.3 Operations and Maintenance associated with tailings management (exhausted pit), and key sections for surface water and groundwater in Section 6 Environmental Effects Assessment	Establish operational plan for deposit of tailings into the mined-out pit and ongoing monitoring of surface and groundwater water will determine if adaptive management should be applied
Request to be informed on the Project activities.	AMNS is committed to maintaining its CLC for the life of the Project. Other aspects of community engagement will continue as per Engagement Plan.	Section 3.6 Public Engagement; Section 6.16.11 Mitigation for Socio-economic Conditions	Implement Engagement Plan
2020 Engagement			
Concerns about access to ATV and snowmobile trails.	Restrictions on usage are required for safety reasons. Alternative access for ATVs, snowmobiles and light vehicles are being considered.	Section 6.16.5.4 Land Use, Recreational and Indigenous, Section 6.16.11 Mitigation and Appendix A.4a Summary of Public Engagement as Completed for the Beaver Dam Mine Project	Construct bypass roads to maintain access during operations
Concerns about access to camps, hunting and fishing locations.	Access to camps, hunting areas and fishing areas will be maintained. Camps, hunting and fishing areas have been identified by stakeholders and AMNS will work with stakeholders to allow continued access.	Section 6.16.5.4 Land Use, Recreational and Indigenous, Section 6.16.5.5 Parks and Open Space, Tourism, Section 6.16.11 Mitigation and Appendix A.4a Summary of Public Engagement as Completed for the Beaver Dam Mine Project To-date	Construct bypass roads to maintain access during operations
Concerns about traffic through Mooseland.	Traffic is not expected to impact Mooseland. As AMNS is developing routes for ATVs, snowmobiles and light vehicles, no traffic increases are expected in Mooseland.	Section 6.16.5.4 Land Use, Recreational and Indigenous, Section 6.16.5.6 Roads and Traffic, Section 6.16.11 Mitigation and Appendix A.4a Summary of Public Engagement as Completed for the Beaver Dam Mine Project To-date	Construct bypass roads to maintain access during operations Implement engagement plan to address public concerned during life of Mine

Table 3.7-1: Summary of Key Concerns Raised During Stakeholder Engagement 2015 to 2020 (continued)

Key Concerns	Summary of Proponent Response	Corresponding Updated 2021 EIS Section Reference[(a)]	Follow-up/ Commitment
Concerns about noise in Mooseland.	Noise modeling shows that all residences and receptors in Mooselands meet guidelines.	Section 6.1 Noise, Section 6.16.5.4 Land Use, Recreational and Indigenous, Section 6.16.11 Mitigation, Appendix A.4a Summary of Public Engagement as Completed for the Beaver Dam Mine Project To-date and Appendices B.1 Beaver Dam Mine Construction Noise Assessment and B.2 Updated Noise Impact Assessment Technical Report	Implement a Noise Complaint Protocol and Engagement Plan
Concerns about safety of the road network and trail network on Haul Road.	AMNS Haul Road Operations and Safety Management Plan will be developed by an ad hoc advisory committee.	Section 6.16.5.4 Land Use, Recreational and Indigenous, Section 6.16.5.6 Roads and Traffic, Section 6.16.11 Mitigation and Appendix A.4a Summary of Public Engagement as Completed for the Beaver Dam Mine Project To-date	Implement Haul Road Operations and Safety Management Plan will be developed by an ad hoc advisory committee
Questions and concerns regarding receiving communications and information during the life of the Project.	Draft Public Engagement Plan has been drafted and will be circulated to stakeholders for feedback and comment. Community relations telephone line, email, website and news releases will continue. AMNS is evaluating opportunities to include social media platforms as well.	Sections 3.2 Objectives, Section 3.4 Engagement Strategy, and Appendix A.6 draft Public Engagement Plan	Implement Engagement Plan
Identification of potential mainland moose in the area.	The information provided by a stakeholder is being reviewed as of the updated 2021 EIS.	Section 6.11.4.1.1 Mainland Moose and Appendix A.4a Summary of Public Engagement as Completed for the Beaver Dam Mine Project To-date	Implement Engagement Plan
Concerns regarding slurry and dust from the Mooseland Road related to the Touquoy operations.	AMNS has a skid steer with a broom dedicated to cleaning the crossing. AMNS commits improving visibility and removing debris at the Mooseland Road crossing.	Sections 2.11.11 The Preferred Approach	Implement Operational Procedure to Manage Haul Roads
Concerns that the original EIS incorrect statements regarding the distances between residents and the Mooseland entrance to the Haul Road (known as the “old dump road”).	Updated 2012 EIS will be corrected as appropriate.	Section 2.3 Project Location and 2.5Project History, Section 6.16.4.12 Land and Resource Use, Section 6.16.5.6 Roads and Traffic	Corrected in EIS
Requested signage be placed on the “old dump road” to notify non-local residents that AMNS is considering construction of a Haul Road.	It is premature to place signage until project is approved. Also signage would require landowner approval. Business cards are being provided to local residents for them to distribute so that anyone with questions can contact community relations.	Section 6.16.5.6 Roads and Traffic, Section 6.16.10 Project Activities and Socio-economic Integrations and Effects, and Section 6.16.11 Mitigation	Implement Haul Road Operations and Safety Management Plan will be developed by an ad hoc advisory committee

Table 3.7-1: Summary of Key Concerns Raised During Stakeholder Engagement 2015 to 2020 (continued)

Key Concerns	Summary of Proponent Response	Corresponding Updated 2021 EIS Section Reference[(a)]	Follow-up/ Commitment
Concerns that the life of the Beaver Dam project use of the Haul Road will extend beyond 5 years.	The life of mine for the Project is 5 years but Fifteen Mile Stream Gold Project and Cochrane Hill Gold Project will also use the Haul Road.	Section 1.2 Atlantic Mining NS Inc. Information and Section 8 Cumulative Effects Assessment	Implement Engagement Plan
Request to have truck and ATV access between the Mooseland Road and Hwy 224.	truck and ATV access between the Mooseland Road and Hwy 224 is accommodated via bypass roads.	Section 6.16.5.6 Roads and Traffic and Appendix A.4a	Implement Haul Road Operations and Safety Management Plan will be developed by an ad hoc advisory committee
Request to have the Mooseland Road entirely paved between Touquoy and the entrance to the Hwy 224.	The Mooseland Road is a provincially owned road and decisions regarding paving at made at the provincial level. This concern has been forwarded to the CLC to assess next steps and possibly providing letter of support for paving.	Section 6.16.5.6 Roads and Traffic and Section 6.16.8 Consideration of Engagement Results	CLC Follow-up
Questions regarding the safety monitoring of the Mooseland road.	AMNS has a close working relationship with NS Department of Transportation and Active Transportation and will work collaboratively with an ad hoc advisory committee.	Section 6.16.5.6 Roads and Traffic, Section 6.16.11 Mitigation, and Appendix A.4a	Implement Haul Road Operations and Safety Management Plan will be developed by an ad hoc advisory committee
Question regarding if the Haul Road can have blended traffic	AMNS explored this option and determined that for safety and operational reasons, that blended traffic is not the best option and instead is pursuing a dedicated bypass option for ATVs, snowmobiles and light vehicles.	Section 6.16.5.6 Roads and Traffic	Commitment to reconsider blended traffic after Beaver Dam Mine operations is completed
Request for a public meeting in Mooseland.	AMNS organized an open house for Mooseland residents on November 27 and 28, 2020. Public Health restrictions issued by the province required that this meeting be cancelled. An open house potentially will occur in Q2/Q3, determined on health restrictions due to COVID-19.	Sections 3.6 Public Engagement and Section 3.8 and Appendix A.6 Ongoing Engagement	Implement Engagement Plan
Request for input into the operational and safety plan for the Haul Road.	AMNS will seek input in the operations and safety plan for the Haul Road. AMNS may established an ad hoc advisory committee to solicit advice.	Section 6.16.5.6 Roads and Traffic, Section 6.16.11 Mitigation, and Appendix A.4a and A.6	Implement Haul Road Operations and Safety Management Plan will be developed by an ad hoc advisory committee
Concerns about impacts on hunting near the Haul Road.	Hunting will be governed by provincial hunting requirements, which will restrict hunting near the Haul Road.	Section 6.14.7.1 Project Interactions with Traditional Use/Rights	Implement Engagement Plan
Concerns about providing access to Marilyn Prest's land.	Access will be provided to this particular landowner.	Section 6.16.5.4 Land Use, Recreational and Indigenous	Construct by-pass roads and provide landowner access
Concerns about AMNS is communicating its plan for the Haul Road to the general population outside of the immediate area.	Communication and engagement with this stakeholder will occur as per the draft Public Engagement Plan.	Appendix A.6 draft Public Engagement Plan	Implement Engagement Plan

Table 3.7-1: Summary of Key Concerns Raised During Stakeholder Engagement 2015 to 2020 (continued)

Key Concerns	Summary of Proponent Response	Corresponding Updated 2021 EIS Section Reference[a]	Follow-up/ Commitment
Concerns about Impacts on Ferry Lake.	Ferry Lake is not modeled to be impacted by the Beaver Dam Mine Project. Ferry Lake property owners who have expressed interest in the project have been contacted.	Section 3.6 and Appendix F.9 (Response to IR2s. CEAA 2-36, CEAA 2-37, and NSE 2-130 Evaluation of Potential Impacts from Metals COCs to Groundwater and Surface Water from Dust Deposition along the Haul Road)	Implement Engagement Plan
Impacts on NSSA West River Project and fish habitat.	Fish and fish habitat assessment, mitigation and monitoring plans to address ongoing concerns. Develop an aquatic Effects Monitoring Program.	Section 6.9.8 Mitigation (Fish), Section 6.16.11 Mitigation (Socio-economic) and Section 8 Cumulative Effects Assessment	Implement Aquatic Effects Monitoring Program
Speeding by AMNS vehicles on the Mooseland Road.	Complaints from residents will be investigated. All AMNS vehicles include a GPS so that vehicle speeds can be tracked. AMNS committed to installing digital speed sign as a pilot project.	Section 6.16.8 Consideration of Engagement Results	Implement Haul Road Operations and Safety Management Plan will be developed by an ad hoc advisory committee
Concerns about the widening of the Haul Road on private landowners.	The width of the Haul Road right of way is approximately 100 m. The Haul Road and bypass road will remain within this right of way and no additional land is required for the bypass roads.	Section 2.8.2 Haul Road for Transporting Ore, Section 2.8.2 Project Activities	Implement Haul Road Operations and Safety Management Plan will be developed by an ad hoc advisory committee

Notes: NSE = Nova Scotia Environment; SOCI = Species of Conservation Interest; SAR = Species at Risk; VC = Valued Component; EA = Effects Assessment; CLC = Community Liaison Committee; AMNS = Atlantic Mining NS Inc.; CIL = Carbon in Leach.

Figure 3.7-1: Number of Communication in 2020 by Quarter

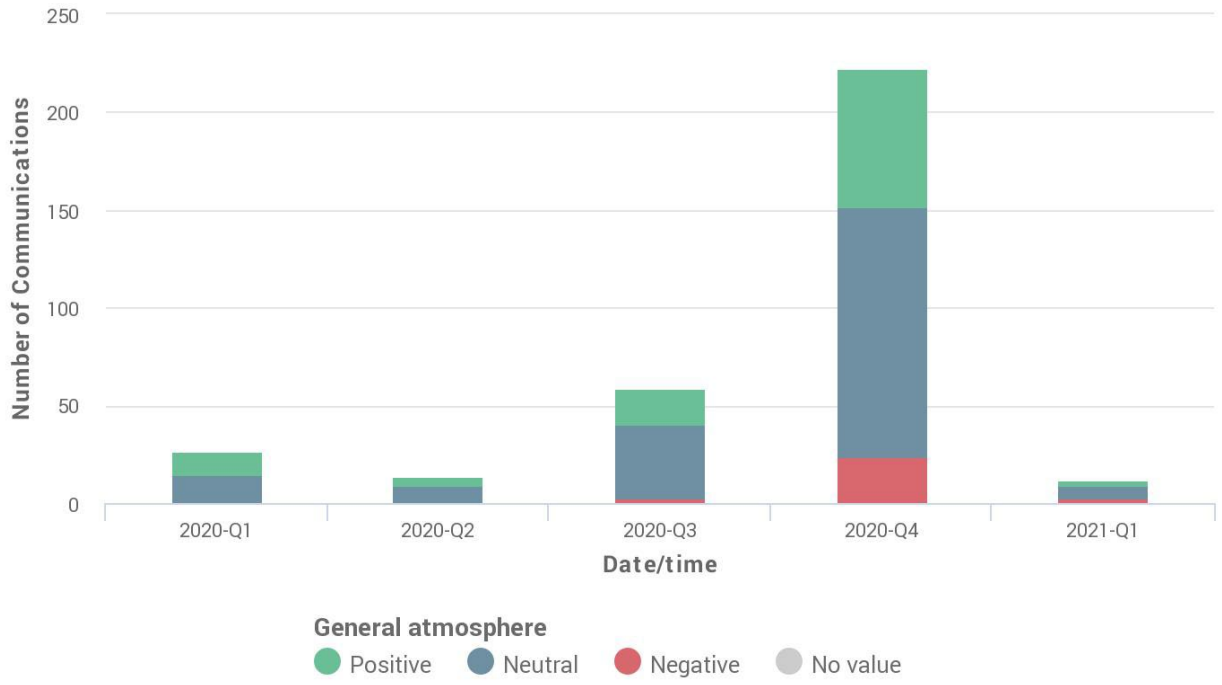
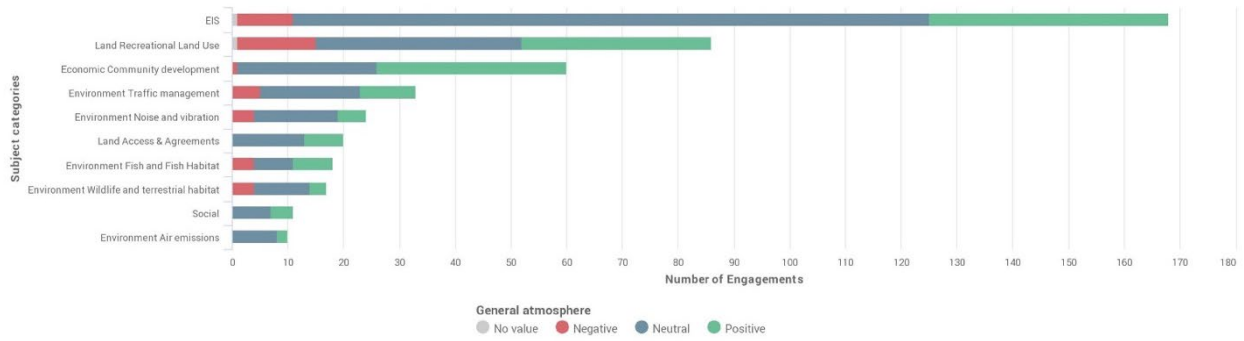


Figure 3.7-2: Key Subject Categories in 2020 to 2021



The key subject categories (Figure 3.7-2) show the topics of discussion during 2020 and the atmosphere related to each concern. This kind of tracking helps AMNS identify topics and concerns where additional focus is required. Please note that each engagement may have more than one subject category associated with it (Figure 3.7-2).

In total, AMNS had approximately 322 communications with over 147 individuals or organizations in 2020. Key concerns which arose from the 2020 engagements are shown in Table 3.7-2. Although many of the concerns were previously identified and mitigations proposed in the pre-2020 engagement summary, additional concerns did arise which required additional mitigation and/or analysis. Table 3.7-2 outlines the key concerns heard during this engagement period.

The concerns raised during all the public engagement activities since 2015 were incorporated into the design of the Project and the development of the EIS. Improvements to planning and design as a result of feedback from this engagement includes, but is not limited to, minimizing Project footprint, including limiting direct effects to watercourses and wetlands, and changing the Haul Road to cross Hwy 224 rather than travel along Hwy 224 to avoid passing by residences and to minimize travel on Hwy 224. AMNS commitments and mitigations regarding the construction of bypass roads, using adaptive management principles and identifying crossing of the Haul Road for recreational users are detailed in the Socio-economic Conditions Sections 6.16.5, 6.16.8, 6.16.10 and 6.16.11. The proposed bypass roads are also shown on Figure 3.3-2.

The meetings, site visits, telephone calls, emails, and other correspondence that formed the Public stakeholder and the Mi'kmaq of Nova Scotia engagement activities are included in Appendices A.4a and A.5, respectively.

Table 3.7-2: Key Concerns Raised during 2020 Public Engagement Meetings

Key Concerns	Summary of Proponent Response	Corresponding EIS Reference/Appendix
Concerns about access to ATV and snowmobile trails.	Restrictions on usage are required for safety reasons. Alternative access for ATVs, snowmobiles and light vehicles are being considered.	Section 6.16.5.4 Land Use, Recreational and Indigenous, Section 6.16.11 Mitigation and Appendix A.4a Summary of Public Engagement as Completed for the Beaver Dam Mine Project To-date
Concerns about access to camps, hunting and fishing locations.	Access to camps, hunting areas and fishing areas will be maintained. Camps, hunting and fishing areas have been identified by stakeholders and AMNS will work with stakeholders to allow continued access.	Section 6.16.5.4 Land Use, Recreational and Indigenous, Section 6.16.5.5 Parks and Open Space, Tourism, Section 6.16.11 Mitigation and Appendix A.4a Summary of Public Engagement as Completed for the Beaver Dam Mine Project To-date
Concerns about traffic through Mooseland.	Traffic is not expected to impact Mooseland. As AMNS is developing routes for ATVs, snowmobiles and light vehicles, no traffic increases are expected in Mooseland.	Section 6.16.5.4 Land Use, Recreational and Indigenous, Section 6.16.5.6 Roads and Traffic, Section 6.16.11 Mitigation and Appendix A.4a Summary of Public Engagement as Completed for the Beaver Dam Mine Project To-date
Concerns about noise in Mooseland.	Noise modeling shows that all residences and receptors in Mooselands meet guidelines.	Section 6.1 Noise, Section 6.16.5.4 Land Use, Recreational and Indigenous, Section 6.16.11 Mitigation, Appendix A.4a Summary of Public Engagement as Completed for the Beaver Dam Mine Project To-date and Appendices B.1 Beaver Dam Mine Construction Noise Assessment and B.2 Updated Noise Impact Assessment Technical Report
Concerns about safety of the road network and trail network on Haul Road.	AMNS Haul Road Operations and Safety Management Plan will be developed by an ad hoc advisory committee.	Section 6.16.5.4 Land Use, Recreational and Indigenous, Section 6.16.5.6 Roads and Traffic, Section 6.16.11 Mitigation and Appendix A.4a Summary of Public Engagement as Completed for the Beaver Dam Mine Project To-date
Questions and concerns regarding receiving communications and information during the life of the Project.	Draft Public Engagement Plan has been drafted and will be circulated to stakeholders for feedback and comment. Community relations telephone line, email, website and news releases will continue. AMNS is evaluating opportunities to include social media platforms as well.	Sections 3.2 Objectives, Section 3.4 Engagement Strategy, and Appendix A.6 draft Public Engagement Plan
Identification of potential mainland moose in the area.	The information provided by a stakeholder is being reviewed as of the updated 2021 EIS.	Section 6.11.4.1.2 Mainland Moose and Appendix A.4a Summary of Public Engagement as Completed for the Beaver Dam Mine Project To-date

Table 3.7-2: Key Concerns Raised during 2020 Public Engagement Meetings (continued)

Key Concerns	Summary of Proponent Response	Corresponding EIS Reference/Appendix
Concerns regarding slurry and dust from the Mooseland Road related to the Touquoy operations.	AMNS has a skid steer with a broom dedicated to cleaning the crossing. AMNS commits improving visibility and removing debris at the Mooseland Road crossing.	Sections 2.11.11 The Preferred Approach
Concerns that the original EIS incorrect statements regarding the distances between residents and the Mooseland entrance to the Haul Road (known as the "old dump road").	Updated 2012 EIS will be corrected as appropriate.	Project Location and History (Section 2.3 and 2,5), Land and Resource Use Section 6.16.4.12, Section 6.16.5.6 Roads and Traffic
Requested signage be placed on the "old dump road" to notify non-local residents that AMNS is considering construction of a Haul Road.	It is premature to place signage until project is approved. Also signage would require landowner approval. Business cards are being provided to local residents for them to distribute so that anyone with questions can contact community relations.	Section 6.16.5.6 Roads and Traffic, Section 6.16.10 Project Activities and Socio-economic Integrations and Effects, and Section 6.16.11 Mitigation
Concerns that the life of the Beaver Dam project use of the Haul Road will extend beyond 5 years.	The life of mine for the Project is 5 years but Fifteen Mile Stream Gold Project and Cochrane Hill Gold Project will also use the Haul Road.	Section 1 Proponent Information and Section 8 Cumulative Effects Assessment
Request to have truck and ATV access between the Mooseland Road and Hwy 224.	truck and ATV access between the Mooseland Road and Hwy 224 is accommodated via bypass roads.	Section 6.16.5.6 Roads and Traffic and Appendix A.4a
Request to have the Mooseland Road entirely paved between Touquoy and the entrance to the Hwy 224.	The Mooseland Road is a provincially owned road and decisions regarding paving at made at the provincial level. This concern has been forwarded to the CLC to assess next steps and possibly providing letter of support for paving.	Section 6.16.5.6 Roads and Traffic and Section 6.16.8 Consideration of Engagement Results
Questions regarding the safety monitoring of the Mooseland road.	AMNS has a close working relationship with NS Department of Transportation and Active Transportation and will work collaboratively with an ad hoc advisory committee.	Section 6.16.5.6 Roads and Traffic, Section 6.16.11 Mitigation, and Appendix A.4a
Question regarding if the Haul Road can have blended traffic	AMNS explored this option and determined that for safety and operational reasons, that blended traffic is not the best option and instead is pursuing a dedicated bypass option for ATVs, snowmobiles and light vehicles.	Section 6.16.5.6 Roads and Traffic
Request for a public meeting in Mooseland.	AMNS organized an open house for Mooseland residents on November 27 and 28, 2020. Public Health restrictions issued by the province required that this meeting be cancelled. An open house potentially will occur in Q2/Q3, determined on health restrictions due to COVID-19.	Sections 3.6 Public Engagement and Section 3.8 Appendix A.6 Ongoing Engagement
Request for input into the operational and safety plan for the Haul Road.	AMNS will seek input in the operations and safety plan for the Haul Road. AMNS may established an ad hoc advisory committee to solicit advice.	Section 6.16.5.6 Roads and Traffic, Section 6.16.11 Mitigation, and Appendix A.4a

Table 3.7-2: Key Concerns Raised during 2020 Public Engagement Meetings (continued)

Key Concerns	Summary of Proponent Response	Corresponding EIS Reference/Appendix
Concerns about impacts on hunting near the Haul Road.	Hunting will be governed by provincial hunting requirements, which will restrict hunting near the Haul Road.	Section 6.14.7.1 Project Interactions with Traditional Use/Rights
Concerns about providing access to Marilyn Prest's land.	Access will be provided to this particular landowner.	Section 6.16.5.4 Land Use, Recreational and Indigenous
Concerns about AMNS is communicating its plan for the Haul Road to the general population outside of the immediate area.	Communication and engagement with this stakeholder will occur as per the draft Public Engagement Plan.	Appendix A.6 draft Public Engagement Plan
Concerns about Impacts on Ferry Lake.	Ferry Lake is not modeled to be impacted by the Beaver Dam Mine Project. Ferry Lake property owners who have expressed interest in the project have been contacted.	Section 3.6 and Appendix F.9 (Response to Information Request Nos. CEAA 2-36, CEAA 2-37, and NSE 2-130 Evaluation of Potential Impacts from Metals COCs to Groundwater and Surface Water from Dust Deposition along the Haul Road)
Impacts on NSSA West River Project and fish habitat.	Fish and fish habitat assessment, mitigation and monitoring plans to address ongoing concerns.	Section 6.9.8 Mitigation (Fish), Section 6.16.11 Mitigation (Socio-economic) and Section 8 Cumulative Effects Assessment
Speeding by AMNS vehicles on the Mooseland Road.	Complaints from residents will be investigated. All AMNS vehicles include a GPS so that vehicle speeds can be tracked. AMNS committed to installing digital speed sign as a pilot project.	Section 6.16.8 Consideration of Engagement Results
Concerns about the widening of the Haul Road on private landowners.	The width of the Haul Road right of way is approximately 100 m. The Haul Road and bypass road will remain within this right of way and no additional land is required for the bypass roads.	Section 2.8.2 Haul Road for Transporting Ore

Notes: ATV = all-terrain vehicle; AMNS = Atlantic Mining NS Inc.; EIS = Environmental Impact Statement; GPS = Global Positioning System; CLC = Community Liaison Committee; m = metre; NSSA = Nova Scotia Salmon Association.

3.8 Ongoing Public Engagement

As per the draft Public Engagement Plan, there are many tools to engage stakeholders, including members of the local community, government regulators, NGOs, landowners, and members of the public. AMNS has a broad objective to continue to engage the community and will continue to implement its strategy.

Within the draft Public Engagement Plan specific commitments are made by AMNS to engage during the next steps in the EA processes and beyond, including:

- sharing key aspects of the EIS with interested NGOs and/or CLC members;
- holding meetings with interested NGOs, including ESFWA and NSSA;
- aligning in data collection and mitigation measures with local organizations, specifically with the ongoing field work of NSSA; and
- answering specific questions posed directly to the company by providing additional information where feasible.

As part of the understanding that engagement plans need to be flexible, AMNS will address and respond to additional stakeholders identified or concerns noted as the Project moves forward and into construction, operation and active closure.

The Public Engagement Plan (Appendix A.6) is a long-term plan which makes a series of commitments that will be delivered over the life of the Project.

4 INDIGENOUS PEOPLES ENGAGEMENT PROGRAM

4.1 Introduction

4.1.1 Summary of Indigenous Peoples Engagement Before the Updates

AMNS is committed to developing a long-term, positive and productive relationship with the Mi'kmaq of Nova Scotia based on principles of mutual respect, transparency, honesty and integrity, and a partnership approach to engagement. Meaningful engagement is a key component of the Project and began as part of planning and environmental assessment of the Touquoy Gold Project over a decade ago. The engagement has focused on building relationships with the Assembly of Nova Scotia Mi'kmaq Chiefs and the Kwilmu'kw Maw-klusuaqn Negotiation Office (KMKNO), as well as the community members, staff and Chief and Council of nearby Mi'kmaq communities, specifically Millbrook First Nation, and Sipekne'katik First Nation. AMNS has, and will continue to, exchange important Project information and answer questions; discuss the concerns and interests of the Mi'kmaq, including traditional and current use and the importance of the area; discuss potential impacts on the Mi'kmaq and develop avoidance and mitigations strategies together to address their concerns; and, to develop opportunities for involvement in environmental monitoring, and other aspects of the Project.

The focus of engagement has, and will continue to be, with the Assembly, the KMKNO, and the communities of Millbrook and Sipekne'katik. Focused engagement has and will continue with Millbrook due to their proximity to the Project. Aligning mutual interests, such as environmental protection specifically related to current use of land and resources for traditional purposes, is a core part of the engagement.

4.1.2 Summary of Updates to Indigenous Peoples Engagement

Participation of the Mi'kmaq of Nova Scotia has been ongoing to identify impacts to the Mi'kmaq, in consideration of traditional knowledge as part mine planning and development of the EIS. AMNS respects the consultation, decision-making and governance structures that the Mi'kmaq of Nova Scotia have put in place within their organizations and communities. The focus of engagement has, and will continue to be, with the Assembly, the KMKNO, and the communities of Millbrook and Sipekne'katik. Egagement has and will continue with Millbrook due to their proximity to the Project. Aligning mutual interests, such as environmental protection specifically related to current use of land and resources for traditional purposes, is a core part of the engagement.

With the receipt of Information Requests from the Agency after AMNS submitted the EIS in 2017 and revised 2019 EIS (AMNS 2017 and 2019), AMNS has continued to engage with the Mi'kmaq of Nova Scotia on a regular basis to better understand existing land uses. Millbrook initiated a Traditional Land and Resource Use Study (TLRUS) in 2018 and delivered the results in 2019 just prior to the revised 2019 EIS (i.e., response Round 1 Information Requests submission [AMNS 2019]). AMNS has been working with Millbrook to review TLRUS results and continue ongoing and regular engagement throughout the Round 2, Information Requests (IR2) process.

The two closest Mi'kmaq communities of Millbrook and Sipekne'katik First Nations have registered total populations of 1,995 and 2,771, respectively (CBU 2020). As stated above, the two communities have chosen to represent themselves directly in consultation with the Crown. There are two communities near the Beaver Dam Mine Project: Beaver Lake IR 17 (49.4 ha) is located approximately 5km southwest from the Beaver Dam Mine Site, and Sheet Harbour IR 36 (32.7 ha) is located 20 km south of the Project. Both these reserves belong to the Millbrook First Nation which is located in Truro, Nova Scotia, 54 km northwest of the Beaver Dam Mine Site. Beaver Lake Indian Reserve (IR) I7 with an on-reserve population of about 21 and Sheet Harbour IR 36 with an on-reserve population of about 25 (Statistics Canada 2017).

Updates have been focused on engagement as well as information that has become available since the submission of the 2019 Revised EIS. This includes but not limited to responses to IR2.

Table 4.1-1: Updated Subsections from the 2019 Revised Environmental Impact Statement – Indigenous Peoples

Section 4 from the 2019 Revised EIS Submission (February 28, 2019)	Updated in 2021	Reason for Update
4.1 Objectives	Yes	Ongoing and continued engagement
4.2 Indigenous People in Nova Scotia	Yes	Ongoing and continued engagement
4.3 Engagement Strategy	Yes	Ongoing and continued engagement
4.4 Indigenous Peoples Engagement Activities	Yes	Ongoing and continued engagement
4.5 Key Issues Raised and Proponent Responses	Yes	Ongoing and continued engagement
4.6 Ongoing Indigenous Peoples Engagement	Yes	Ongoing and continued engagement

4.2 Objectives

AMNS is committed to developing a long-term, positive and productive relationship with the Mi'kmaq of Nova Scotia based on principles of mutual respect, transparency, honesty and integrity, and a partnership approach to engagement. Meaningful engagement is a key component of the Project and began as part of planning and environmental assessment of the Touquoy Gold Project over a decade ago. The engagement has focused on building relationships with the Assembly of Nova Scotia Mi'kmaq Chiefs and the Kwilmu'kw Maw-klusuaqn Negotiation Office (KMKNO), as well as the community members, staff and Chief and Council of nearby Mi'kmaq communities, specifically Millbrook First Nation, and Sipekne'katik First Nation. AMNS has, and will continue to, exchange important Project information and answer questions; discuss the concerns and interests of the Mi'kmaq, including traditional and current use and the importance of the area; discuss potential impacts on the Mi'kmaq and develop avoidance and mitigations strategies together to address their concerns; and, to develop opportunities for involvement in environmental monitoring, and other aspects of the Project.

The Beaver Dam Mine Project EIS Guidelines prepared by the Impact Assessment Agency of Canada (IAAC; formerly the Canadian Environmental Assessment Agency [CEAA 2016]) provides guidance on specific aspects of Mi'kmaq engagement. For Mi'kmaq groups with potential to be most affected by the Project, it was expected that AMNS would strive toward developing a productive and constructive relationship based on ongoing dialogue with the groups to support information gathering and effects assessment. Further, the *Province of Nova Scotia's Proponent's Guide: The Role of Proponents in Crown Consultation with the Mi'kmaq of Nova Scotia, 2011* provides guidance on engaging with Indigenous groups. AMNS continues to follow the guidance from the federal and provincial governments and intends to build on and strengthen the relationship developed with the Mi'kmaq of Nova Scotia during the past decade.

As per Supreme Court of Canada instruction and subsequent guidance from governments, such as the Updated Guidelines for Federal Officials to Fulfill the Duty to Consult (Government of Canada, 2011) and AMNS's Guide: Engagement with the Mi'kmaq of Nova Scotia (Province of Nova Scotia, 2012), the Crown may delegate procedural aspects of consultation to proponents. However, the duty to consult, and constitutional obligation remains with the Crown. As noted in the EIS Guidelines (CEAA 2016) the results of the AMNS's Mi'kmaq of Nova Scotia engagement program *"helps to contribute to the Crown's understanding of any potential adverse impacts of the project on potential or established Aboriginal or treaty rights, title and related interests, and the effectiveness of measures proposed to avoid or minimise those impacts"*.

The Made-in-Nova Scotia Process is the forum for the Mi'kmaq, Nova Scotia, and Canada to resolve issues related to Mi'kmaq treaty rights, Aboriginal rights, including Aboriginal title, and Mi'kmaq governance. The process involves the Mi'kmaq of Nova Scotia as represented by the Assembly of Nova Scotia Mi'kmaq Chiefs and the provincial and federal governments. Both the federal and provincial governments have requirements for consultation under the *Updated Guidelines for Federal Officials to Fulfill the Duty to Consult: 2011*, and the *Mi'kmaq-Nova Scotia-Canada Consultation Terms of Reference. Further, the Nova Scotia Environmental Assessment Regulations* include a requirement to identify concerns of Indigenous People about potential adverse effects and steps taken, or proposed to be taken, by AMNS to address concerns, as well as the steps taken to identify these concerns.

Participation of the Mi'kmaq of Nova Scotia has been ongoing to identify impacts to the Mi'kmaq, in consideration of traditional knowledge as part mine planning and development of the EIS. AMNS respects the consultation, decision-making and governance structures that the Mi'kmaq of Nova Scotia have put in place within their organizations and communities. The focus of engagement has, and will continue to be, with the Assembly, the KMKNO, and the communities of Millbrook and Sipekne'katik. Focused engagement has and will continue with Millbrook due to their proximity to the Project. Aligning mutual interests, such as environmental protection specifically related to current use of land and resources for traditional purposes, is a core part of the engagement.

With the receipt of Information Requests from the Agency after AMNS submitted the EIS in 2017 and revised 2019 EIS (AGC 2017 and AMNS 2019), AMNS has continued to engage with the Mi'kmaq of Nova Scotia on a regular basis to better understand existing land uses. Millbrook initiated a Traditional Land and Resource Use Study (TLRUS) in 2018 and delivered the results in 2019 just prior to the revised 2019 EIS (i.e., responses Round 1 Information Requests [AMNS 2019]). AMNS has been working with Millbrook to review TLRUS results and continue ongoing and regular engagement throughout the IR2 process.

4.3 Indigenous People in Nova Scotia

The Mi'kmaq are the original people of Nova Scotia and remain the predominant Indigenous Peoples within the Province. The courts have confirmed that the Mi'kmaq of Nova Scotia have both Aboriginal and Treaty rights protected under Section 35 of the *Constitution Act*. The nature and extent of those rights, as well as the responsibilities and authorities of governments with respect to those rights, are the subject of negotiation between the federal and provincial governments and the Mi'kmaq of Nova Scotia, as described above.

The Mi'kmaq Nation of Nova Scotia has a general interest in all lands and resources as the Mi'kmaq Nation maintain that they did not give up their land rights through treaty, voluntary cessation, or otherwise. The Mi'kmaq of Nova Scotia maintains a claim of Aboriginal title to the lands and waters of Nova Scotia and adjacent areas of the offshore.

As part of the Umbrella and Framework Agreements developed for the Made-in-Nova Scotia Process, a draft Consultation Terms of Reference (TOR) was adopted in 2007. After a three-year pilot period the thirteen Mi'kmaq communities, through the Assembly of Nova Scotia Mi'kmaq Chiefs, signed the Mi'kmaq-Nova Scotia-Canada Consultation TOR in 2010 with the Governments of Canada and Nova Scotia. The TOR lays out a process for the parties to follow when governments wish to consult with the Mi'kmaq of Nova Scotia. The Made-in-Nova Scotia Negotiation Process and the historic development of the Consultation TOR are based on the principle of the Mi'kmaq of Nova Scotia as one Mi'kmaq Nation.

Nova Scotia has thirteen Mi'kmaq First Nations with a total registered population of 16,760 as of 2017, including both on- and off-reserve populations (AANDC 2019). The Assembly of Nova Scotia Mi'kmaq Chiefs (ANSMC) represents all thirteen communities in dealings with the Crown. The Kwilmu'kw Maw-klusuaqn Negotiation Office (KMKNO) is the administrative group that represents the ANSMC in the consultation and negotiations with the Province of Nova Scotia and the Government of Canada. Millbrook and Sipekne'katik First Nations have chosen to consult through their own community Chief and Councils, rather than the KMKNO.

As part of engagement of the Mi'kmaq of Nova Scotia, the following are groups who were listed in the EIS Guidelines (CEAA 2016) as being possibly affected by the Project. These include the thirteen Mi'kmaq First Nations in Nova Scotia, the Assembly of Nova Scotia Mi'kmaq Chiefs, and the KMKNO:

- Acadia First Nation;
- Annapolis Valley First Nation;
- Bear River First Nation;
- Potlotek First Nation;
- Eskasoni First Nation;
- Glooscap First Nation;
- Membertou First Nation;
- Millbrook First Nation;
- Paq'tnkek (Afton) First Nation;
- Pictou Landing First Nation;
- Sipekne'katik First Nation;
- Wagmatcook First Nation;
- We'koqma'q First Nation; and
- Assembly of Nova Scotia Mi'kmaq Chiefs and the KMKNO.

In addition, the Native Council of Nova Scotia (NCNS) is a self-governing authority for the community of Mi'kmaq or other Indigenous Peoples residing off-reserve in Nova Scotia. The Native Council has established thirteen geographic zones encompassing the Province of Nova Scotia and has an elected Office of Chief and President.

The two closest Mi'kmaq communities of Millbrook and Sipekne'katik First Nations have registered total populations of 1,995 and 2,771, respectively (CBU 2020). As stated above, the two communities have chosen to represent themselves directly in consultation with the Crown. There are two communities near the Beaver Dam Mine Project: Beaver Lake IR 17 (49.4 ha) is located approximately 5 km southwest from the Beaver Dam Mine Site, and Sheet Harbour IR 36 (32.7 ha) is located 20 km south of the Project. Both these reserves belong to the Millbrook First Nation which is located in Truro, Nova Scotia, 54 km northwest of the Beaver Dam Mine Site. Beaver Lake IR I7 with an on-reserve population of about 21 and Sheet Harbour IR 36 with an on-reserve population of about 25 (Statistics Canada 2017).

AMNS's approach to Mi'kmaq engagement and development of the EIS has respected the current framework for engaging the Mi'kmaq of Nova Scotia – providing Project information, summaries of Project conclusions, descriptions of mitigation measures and monitoring programs through a variety of methods (direct face to face meetings, written correspondence, virtual meetings and phone calls) to the KMKNO, Millbrook and Sipekne'katik First Nations.

AMNS has used a similar approach to the discussion of potential benefits and opportunities related to the Project – focusing on discussions with the ANSMC/KMKNO, Millbrook and Sipekne'katik First Nation communities. Focused engagement has and will continue with Millbrook due to their proximity to the Project.

4.4 Key Engagement Activities

As part of an overall Indigenous Peoples Plan, AMNS's approach to Mi'kmaq engagement allows for flexibility to permit adaptation based on discussions and feedback from the Mi'kmaq and ongoing development of AMNS's projects.

AMNS uses the following methods, depending on the need, to engage with the Mi'kmaq of Nova Scotia:

- one-window regulatory meetings;
- face-to-face meetings with Mi'kmaq organizations, Chiefs and Councils and communities;
- one point of contact for the Mi'kmaq of Nova Scotia;
- phone calls;
- emails;
- dropbox and FTP sites for document sharing;
- Mi'kmaq community open houses;
- public open houses and town hall meetings;
- site visits and tours;
- newsletters and regular Project Updates; and
- website and other digital and social media;

In addition to AMNS's engagement program related to the EIS the following elements are being discussed to further develop the company's decade-long relationship with the Mi'kmaq of Nova Scotia – one that has been built on mutual understanding and transparency, maintaining flexibility and open lines of communication to adjust implementation as the relationship and Project develops:

- Providing opportunities and benefits to all Mi'kmaq in Nova Scotia. Benefits can take the form of, but are not limited to, opportunities for training and capacity building, contracting and procurement, support for education and employment. Supporting cultural and traditional activities of the Mi'kmaq of Nova Scotia; and, providing cultural learning exchange opportunities for mining staff.
- Engagement to date has been positive and productive; the relationship was formalized in a Memorandum of Understanding (MOU) with the ANSMC through the KMKNO from 2014-2016 with a renewed MOU proposed in 2018 and pending approval by ANSMC as of January 2021. AMNS initiated the engagement program for the Beaver Dam Mine Project in early 2016 with Mi'kmaq community open houses and Public open houses to provide general information on the proposed Project to all interested community members. The public open houses were followed by a series of face-to-face meetings with Millbrook and Sipekne'katik First Nations, and the KMKNO through to the end of 2020. Information regarding the EIS and the EA process was shared and discussed during these meetings, including archaeological reports, summaries of potential impacts and mitigations, and other key details of the Project. AMNS also arranged a tour of the area and invited both Millbrook and Sipekne'katik First Nations to participate in the Community Liaison Committee (CLC).

In 2016, AMNS developed its strategy for Mi'kmaq engagement to coincide with the start of construction of the permitted Touquoy Gold Mine and the development of the EA for the Beaver Dam Mine Project. These elements listed below are specific to Mi'kmaq engagement and are often supported by community engagement activities listed above. These elements of the Mi'kmaq engagement strategy will be built upon over time as the Project develops.

In 2018, AMNS continued to exchange information with the KMKNO, and Millbrook and Sipekne'katik First Nations, and attempted to organize meetings to discuss Project information, traditional and current use of the area by the Mi'kmaq of Nova Scotia, and potential impacts and mitigations. Millbrook undertook a TLRUS in 2018 and delivered the results to AMNS in early 2019, just prior to submission of the Round 1 IR responses to the CEA Agency. Meetings were held to discuss further IR requests, the integration of TLRUS and land use date into the EIS, and the ongoing engagement process through 2019 and 2020.

AMNS met with the ANSMC/KMKNO in early 2020, prior to the global pandemic that was declared on March 11, 2020. Since that time, AMNS continued internal work to further understand any potential impacts of the proposed project on Mi'kmaq rights, such as ensuring all Indigenous perspectives that have already been shared with AMNS were considered, and any additional opportunities to understand specific impacts on current and traditional practices and perspectives identified. It is anticipated that these discussions will continue during the EIS review process.

AMNS suspended all Project-related engagement activities in early March 2020 as everyone began to contend with protection and prevention in communities, and the associated uncertainties and risks. AMNS kept in contact with communities during Nova Scotia's "lockdown" period from March to June 2020, through 2020, and again in 2021 and moved all engagement activity online. Specifically, AMNS has recently completed the following engagement activities:

- An online/virtual meeting was held with Millbrook First Nation's Chief and Council in early May 2020 to provide an overview of the Beaver Dam Mine Project and other Proponent projects to new council members.
- A Plain Language Summary (PLS) was prepared and shared with Millbrook First Nation on September 1, 2020, with the KMKNO on November 2, 2020 and with the Sipekne'katik First Nation on May 7, 2021.
- As part of on-going engagement and Project discussions specifically with the Millbrook First Nation, a draft Summary of Effects document outlining preliminary Project summaries, mitigation measures and cumulative effects was shared with the community in September 2020.
- On February 16, 2021, a draft response to Round 2 Information Requests CEAA-48/49 was shared with the Millbrook First Nation to support pending Millbrook community meetings. This draft response and associated mapping were also reviewed in a virtual meeting with Gerald Gloade on February 3, 2021.
- On April 1, 2021, the Mi'kmaq of Nova Scotia draft section of the EIS was shared with the Millbrook First Nation for review and feedback. The purpose of this review was twofold:
  - a request to validate and provide feedback of impact conclusions and proposed mitigation; and
  - to provide feedback on the level of specificity regarding the referencing of data in the TLRUS and to ensure the presentation is acceptable in consideration that the TLRUS is considered restricted and confidential.
- At the time of submission of this updated EIS, no specific feedback has been received from the Millbrook First Nation. AMNS understands that community meetings have taken place and that a report summarizing these meetings is drafted. Regular and consistent communications to receive this feedback has been ongoing with Millbrook First Nation through April and May 2021. Although the feedback has not been received, AMNS will continue to reach out and find opportunities to address feedback in the Projects development plans.

It is anticipated that engagement will continue throughout and beyond the current environmental assessment process. This will require ongoing dialogue regarding potential impacts on Mi'kmaq communities, and AMNS is committed to continuing those discussions. AMNS looks forward to receiving feedback and commits to discussing with Millbrook First Nation how best to address their feed back into Project design, mitigation and monitoring measures and potentially additional monitoring and mitigation measures.

A record of all engagement activities conducted between 2016 and the current date is provided in the Summary of Mi'kmaq of Nova Scotia Engagement Activities in Appendix A.5.

4.5 Mi'kmaq of Nova Scotia Engagement Activities

The objective of Mi'kmaq engagement relative to the development of the EIS for the Project is to gather views from Mi'kmaq groups with respect to both potential environmental effects of the Project and the potential adverse impacts of the Project on potential or established Aboriginal or treaty rights, title and related interests.

While broader engagement on the Touquoy Project has occurred for over a decade and will continue as per the Mi'kmaq engagement strategy, specific public engagement activities have occurred to support the EA for the Project since the federal process was commenced in December 2015.

These include aspects specific to the Project including:

- CLC, where two members were appointed by their Chief and Council as representatives of Millbrook First Nation and Sipekne'katik First Nation. Although Millbrook First Nation and Sipekne'katik First Nation have both withdrawn from the CLC, AMNS will continue to invite them to the CLC as guests.
- Open houses, specifically two community open houses occurred in May 2016 on lands of Millbrook and Sipekne'katik First Nations prior to the two public open houses.
- Presentations to Chief and Council of Millbrook First Nation and of Sipekne'katik First Nation, as well as the Benefits Committee Chiefs of the Assembly.
- Meetings, information sharing and correspondence with the KMKNO and thirteen Mi'kmaq First Nations of Nova Scotia, as well as the Nova Scotia Native Council for the purpose of good governance.
- Mini employment fairs set up in collaboration with staff of Millbrook and Sipekne'katik First Nations, as well as sharing of employment opportunities with Millbrook and Sipekne'katik First Nations and the KMKNO, with Mi'kmaq employment during the construction of the Touquoy Gold Project exceeding ten percent.
- Ongoing dialogue on formal agreements in terms of participation and benefits sharing with Millbrook First Nation, Sipekne'katik First Nation and the Assembly of Nova Scotia Mi'kmaq Chiefs.
- Participation of staff of KMKNO and Millbrook and Sipekne'katik First Nations in a site visit and tour of the proposed Beaver Dam Mine Project with provincial and federal regulators on November 29, 2016.
- Use of many tools for Mi'kmaq engagement that are used for the general community engagement, such as newsletters, signage, website, email and other digital media, media and press releases, meetings with local residents, and a complaints response procedure.
- Two Open Houses in January 2018 with Millbrook First Nation (one in Millbrook and one in Sheet Harbour) to address specific technical questions.
- Review of Project mitigation and monitoring with Sipekne'katik and KMKNO on September 12 and September 18, 2018, respectively.
- An online/virtual meeting was held with Millbrook First Nation's Chief and Council in early May 2020 to provide an overview of the Beaver Dam Mine Project and other Proponent projects to new council members.

- A Plain Language Summary (PLS) was prepared and shared with Millbrook First Nation on September 1, 2020, with the KMKNO on November 2, 2020 and with the Sipekne'katik First Nation on May 7, 2021.
- As part of on-going engagement and Project discussions specifically with the Millbrook First Nation, a draft Summary of Effects document outlining preliminary Project summaries, mitigation measures and cumulative effects was shared with the community in September 2020.
- On February 16, 2021, a draft response to Round 2 Information Requests CEAA-48/49 were shared with the Millbrook First Nation to support pending Millbrook community meetings that were being planned. This draft response and associated mapping were also reviewed in a virtual meeting with Gerald Gloade on February 3, 2021.
- On April 1, 2021, the Mi'kmaq of Nova Scotia section of the EIS was shared with the Millbrook First Nation for review and feedback.

These meetings, calls, site visits and correspondence are included in the summary of engagement activities conducted with the Mi'kmaq of Nova Scotia since EA commencement in December 2015 and are provided in Appendix A.5.

4.5.1 Community Open Houses

As discussed in Section 3.4.1 of this EIS, four open houses were held in May 2016; two of these were open to the public while the other two were specific to community members of Millbrook First Nation and Sipekne'katik First Nation.

The two Mi'kmaq community open houses were advertised by staff of each community. In addition, community members were invited to attend the two public open houses if convenient (held on May 18, 2016 in Middle Musquodoboit and on May 19, 2016 in Sheet Harbour). The dates and locations for the two Mi'kmaq community open houses were:

- May 16, 2016 at Millbrook Community Hall, 72 Church Rd, Truro; and,
- May 17, 2016 at Saint Kateri Tekakwitha (Church Basement), Indian Brook.

The format and layout were the same for all community open houses. Each open house was hosted from 3pm to 8pm with refreshments provided. Upon entry, attendees were asked to sign in and were provided a comment form to complete at end of their visit. Maps were also available for viewing on table and a 3D model of the Beaver Dam Mine Site was used to demonstrate the existing conditions, proposed full mine development (including pit and waste rock pile) and reclamation of the site.

A total of fifteen panels were placed on easels with AMNS and its consultants hosting the panels. After a welcome and introduction to AMNS and their Projects' background (three panels), an overview of open pit mining, process of gold recovery, and economic benefits of the projects was provided (three panels). The next three panels provided an update on the Touquoy Gold Project which was soon to begin construction (June 2016). Before the one closing panel, the five panels focused on the Beaver Dam Mine Project and the engagement opportunities, specifically:

- presentation of the site location, the gold deposit and the existing site features;
- map of the proposed site plan at the Beaver Dam Mine Site;
- information on the transportation of ore, including both options considered for the route and the trucking rate;
- overview of the EA process for the Project including the ongoing baseline studies for the VCs and the regulatory process with opportunities for public participation; and

- opportunities for community and Mi'kmaq engagement, including an overview of the CLC and an invitation for expressions of interest from residents who are interested in joining the CLC.

A total of 32 interested community members attended these two open houses. Millbrook First Nation had a total of 16 attendees with 9 providing name and/or contact information. Sipekne'katik First Nation had a total of 16 attendees with 14 providing name and/or contact information. In total, four comment forms were completed; many attendees expressed an interest in employment and some provided resumes to AMNS.

To address specific technical questions posed by Millbrook First Nation, AMNS held two information sessions at Millbrook First Nation in Truro and Sheet Harbour IR #36 in Sheet Harbour in January 2018 that provided information on:

- Cyanide;
- Reclamation and Contingency Planning;
- Ore Processing and Mine Processes; and
- Haul Road information.

Both information sessions included 17 poster boards which provided detailed information on each topic area. The poster boards showed, among other things, a map of the proposed location of mine infrastructure, an infographic that detailed ore processing, specific information on cyanide handling, shipping and use, a map of the Haul Road, and a list of Contingency and Management Plans that will be developed.

On January 23, 2018 at the Millbrook Community Hall at 72 Church Road, Truro 14 members of the public, including the two consultants undertaking the IRTLUS for Millbrook First Nation and two representatives from the Agency attended the 2-hour session. AMNS provided a PowerPoint presentation and hosted a question and answer session with attendees. The event ended with an Open House session where people were able to have one-on-one discussions with AMNS's technical experts.

On January 24th at the Albert Noel Howe Multi-Purpose Community Center, 83 Church Point Rd, Sheet Harbour 16 members of the public, including the two consultants undertaking the IRTLUS for Millbrook First Nation, attended the 1-hour session. AMNS also received requests from 7 people for additional information on the Project. This session took an open house format, where the poster boards were placed in the room and attendees reviewed them and had the opportunity to engage with AMNS representatives to discuss specific issues or ask questions.

4.5.2 Community Liaison Committee

As discussed in Section 3.6.2 of this EIS, in 2016 the CLC was expanded to a nine-member committee including representation of the two closest Mi'kmaq communities, Millbrook First Nation and Sipekne'katik First Nation. In the Spring of 2018, representatives of Millbrook First Nation and Sipekne'katik First Nation decided to cease participating in the CLC and prefer direct engagement with AMNS. AMNS continues to welcome Mi'kmaq participation on the CLC either as guests or with full membership.

4.6 Key Concerns Raised by the Mi'kmaq of Nova Scotia and Proponent Responses

As part of submitting the EIS and EARD to respective government authorities, the Mi'kmaq engagement to date associated with the Beaver Dam Mine Project was documented, including a summary of key issues raised, Proponent responses and associated adjustments to Project design. This summary also includes general and specific feedback received from the Mi'kmaq of Nova Scotia. Note that Project adaptation will continue, as needed and practicable, through engagement with the Mi'kmaq.

For each key concern identified in the following table, a summary of proponent response is provided along with reference(s) to sections in this EIS which address the issue.

Table 4.6-1: Summary of Key Concerns Raised During Mi'kmaq Engagement

Key Concern	Summary of Proponent Response	Updated 2021 EIS Reference
Concern about air emissions and noise associated with mining operations and trucking.	Air emissions and noise will be minimized with mitigation measures. Monitoring for air quality, including total suspended particulates, will be completed. Dust suppression (water and/or chemical treatment); 80% for the BD Haul Road. Additional Human Health Risk Assessments to assure the communities that plants and animals are safe to eat and that water is safe for swimming.	Section 6.2.8 Mitigation - Air
Concern about how elevated noise and light levels may impact hunting near the mines.	Engagement with communities to understand where they hunt and whether elevated light and noise levels in close proximity to the mines is a concern, based on hunting patterns. Minimize impact by reducing noise and light from trucks and mine operations. Modelling to show dust, noise and light meet guidelines at the Property Boundary.	Section 6.1 Noise Section 6.2 Air
Concern about quality and quantity of water in streams, rivers and lakes & potential effect on fish and other aquatic species.	Manage site water to a single point of discharge, where possible. Treat water prior to discharge, when needed. Robust monitoring program to confirm water quality; opportunity for Indigenous participation in monitoring programs including Environmental Effects Monitoring in receiving waters.	Section 6.7 Surface Water; Section 6.9.6 Project Activities/Interactions with Fish and Fish Habitat
Concern about impacts to fish and fish habitat.	Reduce impact by moving infrastructure to avoid fish habitat. Predictive modelling to understand how the mine operations may indirectly impact fish habitat; and, monitoring to confirm predictions and adapt as required. Offsetting Plans – Indigenous participation in plan development and implementation.	Section 6.9.6 Project Activities/Interactions with Fish and Fish Habitat
Concern about effect on groundwater, specifically related to domestic wells at Beaver Lake, from development of pit at Beaver Dam.	As the nearest domestic well is over 5 km from the Beaver Dam Mine Site, no effect is expected on groundwater quality or quantity at Beaver Lake. A network of monitoring wells will be used to monitor groundwater quality and quantity at the Beaver Dam Mine Site.	Section 6.6.6 Project Activities/ Interactions with Groundwater Quality and Quantity
Questions about plans for reclamation at the Beaver Dam Mine Site	The Beaver Dam Mine Site facilities will be removed, the pit will naturally fill with water and disturbed surfaces covered with stockpiled topsoil and re-vegetated. The site will be returned to landowner for forestry and recreational use.	Section 2.9.3 Decommissioning and Reclamation
Questions about contingency planning for accidents and malfunctions	Hazards have been identified and assessed based on risk. Mitigation measures and contingency planning will be in place to address potential accidents and malfunctions.	Section 6.18 Accidents and Malfunctions

Table 4.6-1: Summary of Key Concern Raised During Mi'kmaq Engagement (continued)

Key Concern	Summary of Proponent Response	Updated 2021 EIS Reference
Concern on habitat loss from Project development, including forest, wetlands, flora and fauna.	Disturbance exists on the Beaver Dam Mine Site which will be reclaimed at end of operation. The existing alignment of Haul Road was used where feasible and practical to minimize footprint. Existing facilities will be used for processing and tailings management (exhausted pit). Effect on habitat is minimal. Reduce mine site footprints. Wetland and fish habitat restoration will be completed to compensate for lost wetland and fish habitat. Commitment to reclamation providing an opportunity for Indigenous participation in reclamation planning and implementation. Re-vegetate impacted areas with a native mix of plants determined in consultation with Millbrook and other Indigenous communities.	Section 2.3 Project Location and Section 2.5 Project History, as well as the Valued Components effects assessments in Section 6
Concern about effect of haul truck traffic on birds.	There is potential effect on birds due to noise and dust from haul truck traffic as well as potential bird strikes. This effect is limited to operational phase and was assessed to not be significant.	Section 6.12.7 Project Activities/Interactions with Avifauna
Concern about effect on traditional uses of the Mi'kmaq of Nova Scotia.	Working with Millbrook First Nation to understand their use through data sharing of the TLRUS findings and project mapping. Multi-use bypass roads to maintain access to areas around the mine and haul road. Commitment to reclamation with the opportunity for Mi'kmaq participation in planning and implementation to restore habitats and allow traditional practices to resume within the Beaver Dam Mine Site. Re-vegetation with a native mix of plants determined in consultation with Mi'kmaq communities.	Section 6.14.6 Project Activities/Interactions with the Mi'kmaq of Nova Scotia; Appendix M.1 Mi'kmaq Ecological Knowledge Study, and Section 2.3.2 Haul Road (multiuse bypass road)
Changing landscape within Eskikewa'kik. Cumulative loss of access to the area for traditional purposes.	Reduced waste and mine footprint at Beaver Dam due to Project design. Use of existing transportation routes, wherever possible Evaluation of Crown land loss in Eskikewa'kik from all known and planned projects.	
Request to prefer Haul Road option that does not travel along Hwy 224.	Based on comments received on two option during the stakeholder and Mi'kmaq engagement, AMNS completed a feasibility review of the second option which does not pass by residences, including Beaver Lake IR17. This was selected and is carried forward in the EA.	Section 2.2.1.7 Haul Roads for Transporting Ore; Section 2.3.5 Summary of Changes to Project Activities; Section 2.6.6 Ore Transportation
Questions about cumulative effects of multiple projects in the region.	A cumulative effects assessment was completed for each VC including current use of lands and resources for traditional purposes. Ongoing engagement specific to AMNS existing and any future projects will also occur with the Mi'kmaq of Nova Scotia.	Section 8.6 Cumulative Effects Summary; Section 4.7 Ongoing Indigenous Peoples Engagement
Request ongoing engagement of the Mi'kmaq of Nova Scotia.	AMNS is committed to ongoing Mi'kmaq engagement for the life of the MRC Project, including Beaver Dam Mine Project. Other aspects of Mi'kmaq engagement will continue as per the Mi'kmaq engagement strategy with focus on issues identified as part of the EA and additional issues that may arise as the Project develops.	Section 4.6 Ongoing Indigenous Peoples Engagement; Section 6.14.8 Mitigation and Monitoring associated with Indigenous Peoples

The issues raised during Mi'kmaq engagement activities were incorporated into the design of the Project and the development of the EIS. The fundamental change to the Project as a result of Mi'kmaq engagement was the change to the Haul Road to cross Hwy 224 which eliminated the haul trucks passing by the Mi'kmaq community of Beaver Lake. This addressed many concerns with safety, noise, air, and light emissions and other issues related to health and socio-economic aspects. In 2020, a multiuse bypass road was added to further reduce project impacts to traditional use and allow for continued access to areas around the Beaver Dam Mine Site and Haul Road during operations. It is the understanding of AMNS based on engagement with the Mi'kmaq that the changed Haul Road and addition of the multi-use bypass road were seen as positive change as effects on the community of Beaver Lake were greatly reduced through these project design changes.

In terms of the development of the EIS, there were no additional VCs included in addition to those identified in the CEA Agency Guidelines associated with the input from the Mi'kmaq of Nova Scotia. The VCs listed in the CEA Agency Guidelines addressed the issues brought forward during engagement. However, specific attention was paid to effects assessment of specific VCs, in particular groundwater and its potential effect on the potable water supply of Beaver Lake and the effect on local surface and groundwater quantity from pit development. In addition, focused questions from the Mi'kmaq of Nova Scotia on potential effects of accidents and malfunctions enhanced the development of this portion of the EIS, including the commitments to contingency planning.

As part of AMNS's engagement of the Mi'kmaq completed to date on the Beaver Dam Mine Project, the potential effects and the proposed mitigation measures and monitoring programs were presented and discussed directly with interested Mi'kmaq communities and organizations. The objective was to provide information on the Project to the Mi'kmaq and for AMNS to better understand the views of the Mi'kmaq on the potential effects and proposed mitigation measures and monitoring programs; this supported the development of the EIS. Specifically, alongside on-going meetings with the KMKNO and Mi'kmaq communities, documents have been shared, with requests for feedback and input from the Mi'kmaq communities, to support communication of EIS conclusions, summary of technical VC impacts, summary of Mi'kmaq impacts, mitigation measures and proposed monitoring plans. Exchange has also taken place to support Proponent knowledge and learning relating to specificity of traditional use of the land in the area surrounding the Project, and also to support broader understanding of potential effects of the Project on the economic, social and mental well-being of the Mi'kmaq of Nova Scotia.

In response to the interest of the Mi'kmaq, AMNS has made strong commitments to ongoing Mi'kmaq engagement, including specific activities to further support the participation of the Mi'kmaq in this EA process for the Beaver Dam Mine Project. The ongoing engagement ensures that the potential effects of the Project and the proposed mitigation measures and monitoring programs are understood by the Mi'kmaq of Nova Scotia in order to evaluate the effects on their communities and potential or established Aboriginal or treaty rights, title and related interests.

It is anticipated that engagement will continue throughout and beyond the current environmental assessment process. This will require ongoing dialogue regarding potential impacts on Mi'kmaq communities, and AMNS is committed to continuing those discussions. AMNS looks forward to receiving feedback and commits to discussing with Millbrook First Nation how best to address their feed back into Project design, mitigation and monitoring measures and potentially additional monitoring and mitigation measures.

The key meetings, site visits, telephone calls, emails, and other correspondence with Mi'kmaq groups engaged are included in Appendix A.5.

4.7 Ongoing Mi'kmaq of Nova Scotia Engagement

As mentioned above, Atlantic Mining is committed to ongoing engagement with the Mi'kmaq of Nova Scotia throughout the lifecycle of all of its projects. As part of submitting the EIS and EARD to respective government authorities, the engagement to date associated with the Beaver Dam Mine Project was documented, including a summary of issues raised and proponent responses and adjustments to the project. AMNS has a broad objective to continue to meet with KMKNO, Millbrook and Sipekne'katik First Nations to continue dialogue on the Project, review AMNS conclusions, proposed mitigation measures, and opportunities for Mi'kmaq participation in the EIS.

Relative to the Beaver Dam Mine Project, specific commitments are made by AMNS in terms of Mi'kmaq engagement during the next steps in the EA processes, including:

- Offering to share key aspects of the EIS with staff of Millbrook and Sipekne'katik First Nations and the Assembly, including the MEKS.
- Holding meetings with key staff of KMKNO and Millbrook and Sipekne'katik First Nations.
- Offering opportunities for presentations and site visits to Chief and Councils, specifically Millbrook and Sipekne'katik First Nations.
- Having additional community open houses or site visits as deemed appropriate in consultation with staff and/or leadership of Mi'kmaq communities.
- Answering specific questions posed directly by the Mi'kmaq to AMNS by providing additional information and/or holding meetings where feasible.
- Request for feedback on EIS and information response conclusions. AMNS looks forward to receiving feedback and commits to discussing with Millbrook First Nation how best to address their feed back into Project design, mitigation and monitoring measures and potentially additional monitoring and mitigation measures.

Develop an opportunity for potential partnerships with Mi'kmaq environmental groups on specific ecological monitoring and restoration projects. Engagement planning needs to be flexible. AMNS will continue to address and respond to additional questions or concerns identified or issues noted as the EA moves forward into Project development, operation and closure. AMNS is strongly committed to continue its engagement with the Mi'kmaq of Nova Scotia in the ongoing spirit of cooperation and with mutual benefit and respect.

5 ENVIRONMENTAL EFFECTS ASSESSMENT METHODOLOGY

5.1 Introduction

5.1.1 Summary of Environmental Effects Assessment Methodology Before the Updates

The Project being assessed through this EIS is a proposed surface gold mine consisting of the construction, operation, and decommissioning of a surface mine, Haul Road, and processing facility, known as the Beaver Dam Mine Project. The project will encompass three primary locations spanning from Marinette to Moose River Gold Mines, Halifax County, Nova Scotia.

The scope of the Project to be assessed in accordance with CEAA 2012 and the Environmental Assessment Regulations made under the *Nova Scotia Environment Act* includes Project components and activities outlined in Section 5.2.1. The methodology used to conduct this EA is based on the identification and assessment of potential environmental effects of the Project on Valued Components (VC), as defined in Section 5.4.

An effects assessment was conducted for each to determine the potential direct and indirect interactions between Project activities and VCs. The results of the effects assessments, in consideration of mitigation measures, were used to assess residual effects and determine the significance of Project effects on each VC. Follow-up management and monitoring programs area proposed as required

5.1.2 Summary of Updates to Environment Effects Assessment Methodology

The EIS has been updated due to changes in Project Description since the Revise 2019 EIS submission (AMNS 2019). While the general methods presented in this section by which the EA was conducted have not changed, VC specific baseline and effects assessments have been updated in consideration of revised baseline conditions and Project interactions. Additional analysis as defined in Section 5.11, Table 5.11-1 is also identified and supports the characterization and significance determination for residual effects. In response to Round 2, Information Request (IR2) from the Impact Assessment Agency of Canada (IAAC; formerly the Canadian Environmental Assessment Agency [CEAA 2019]) CEAA 2-02 criteria to assess significance thresholds, particularly magnitude have been defined quantitively to the extent possible. Detailed VC information and updates are presented in the corresponding subsection within Section 6 of this EIS update.

Table 5.1-1: Updated Subsections from the Revised 2019 Environmental Impact Assessment – Environmental Effects Assessment Methodology

2019 Revised EIS Submission (February 28, 2019)	Updated in 2021	Corresponding 2021 EIS Update Section Number	Reason for Update
-	-	5.1 Introduction	• New
5.1 Scope of Environmental Assessment	No	5.2 Scope of Environmental Assessment	• N/A
5.2 Overview of Approach	No	5.3 Overview of Approach	• N/A
5.3 Valued Component Selection	No	5.4 Valued Component Selection	• N/A
5.4 Project Boundaries	Yes	5.5 Project Boundaries	• Regional Study Areas have been considered for VCs; updates to length of time for each Project Phase
55 Standards or Thresholds for Characterization and Determining Significance	Yes	5.6 Standards or Thresholds for Characterization and Determining Significance	• Minor updates
5. 6 Baseline Condition	No	5.7 Baseline Conditions	• N/A
5.7 Anticipated Project Environment Interactions	No	5.8 Anticipated Project Environment Interactions -	• N/A
5.8 Effects Prediction	No	5.9 Effects Predicted	• N/A
5.9 Mitigation	No	5.10 Mitigation	• N/A
5.10 Residual Effects and Determination of Significance	Yes	5.11 Residual Effects and Determination of Significance	• Reference to updates to the characterization of effects as requested in CEAA 02-2
5.11 Follow-up and Effects Monitoring	No	5.12 Follow-up and Effects Monitoring	• N/A
5.12 Effects of Environment on the Project	Yes	5.13 Proposed Compliance and Effects Monitoring Program	• Minor updates to reference CEAA 2-03

PA = Project Area; LAA = Local Assessment Area; RAA = Regional Assessment Area; - = no update; IR2 = Round 2, Information Requests; CEAA = Canadian Environmental Assessment Agency; EIS = environmental impact statement N/A = Not Applicable

5.2 Scope of the Environmental Assessment

5.2.1 Designated Project

The Project being assessed through this EIS is a proposed surface gold mine consisting of the construction, operation, and decommissioning of a surface mine, Haul Road, and processing facility, known as the Beaver Dam Mine Project. The project will encompass three primary locations spanning from Marinette to Moose River Gold Mines, Halifax County, Nova Scotia.

The scope of the Project to be assessed in accordance with CEAA 2012 and the Environmental Assessment Regulations made under the *Nova Scotia Environment Act* include the following components and activities:

Physical Components

- surface mine for extracting ore and waste rock;
- Mine Site roads;
- waste material storage piles for waste rock, till, and topsoil;
- run-of-mine (ROM), high grade, and low-grade ore stockpiles;
- crusher and operational facilities;
- water management;
- haul road for transporting ore; and
- Touquoy Mine Site (processing and tailings management using the exhausted Touquoy pit).

Physical Activities

- clearing, grubbing, and grading;
- drilling and rock blasting;
- topsoil, till, and waste rock management;
- existing settling pond dewatering;
- watercourse and wetland alteration;
- Mine Site road construction;
- surface infrastructure installation and construction;
- collection and settling pond construction;
- culvert and bridge upgrades and construction;
- Haul Road construction and upgrades;
- ore processing equipment upgrades;
- tailings line alteration;
- surface mine dewatering;
- ore management;
- waste rock management;
- surface water management;
- petroleum products management;
- site maintenance and repairs;
- ore transport;
- Haul Road maintenance and repairs;
- tailings management (exhausted pit);
- infrastructure demolition;

- site reclamation;
- environmental monitoring; and
- general waste management.

These components and activities reflect the scope of the Project outlined in Section 3.1 of the EIS Guidelines (CEAA 2016) and reflect the components and activities that would occur throughout the duration of the Project. The effects assessment outlined in Section 6 of this EIS is formed based on these components and activities.

Additional details regarding Project components and activities can be found in Section 2.7 and Section 2.9. A review of the potential interactions between valued components (VCs) and the Project components/activities outlined above can be found in Section 5.8, Tables 5.8-1, 5.8-2, and 5.8-3.

5.2.2 Factors to be Considered

This EIS considers all factors outlined in Section 19(1) of CEAA 2012 and Section 3.2 of the EIS Guidelines (CEAA 2016). Specifically, this includes the following:

- environmental effects of the Project, including the environmental effects of malfunctions or accidents that may occur in connection with the Project and any cumulative environmental effects that are likely to result from the Project in combination with other physical activities that have been or will be carried out;
- the significance of effects;
- comments from the public;
- mitigation measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the Project;
- the requirements of the follow-up program in respect of the Project;
- the purpose of the Project;
- alternative means of carrying out the Project that are technically and economically feasible and the environmental effects of any such alternatives (Project Description Sections 2.10);
- any change to the Project that may be caused by the environment; and
- the results of any relevant regional study pursuant to CEAA 2012.

5.2.3 Scope of Factors to be Considered

The scope of the factors to be considered focuses this EIS on relevant issues and concerns. As indicated in Section 5(1) of CEAA 2012, the environmental effects that are to be considered regarding an act or thing, a physical activity, a designated project, or a project are:

(a) a change that may be caused to the following components of the environment that are within the legislative authority of Parliament:

(i) fish and fish habitat as defined in subsection 2(1) of the Fisheries Act,

(ii) aquatic species as defined in subsection 2(1) of the Species at Risk Act,

(iii) migratory birds as defined in subsection 2(1) of the Migratory Birds Convection Act, 1994, and

(iv) any other component of the environment that is set out in Schedule 2;

(b) a change that may be caused to the environment that would occur

(i) on federal lands,

(ii) in a province other than the one in which the act or thing is done or where the physical activity, the designated project or the project is being carried out, or

(iii) outside Canada; and

(c) with respect to aboriginal peoples, an effect occurring in Canada of any change that may be caused to the environment on

(i) health and socio-economic conditions,

(ii) physical and cultural heritage,

(iii) the current use of lands and resources for traditional purposes, or

(iv) any structure, site, or thing that is of historical, archaeological, paleontological, or architectural significance.

Certain additional environmental effects must be considered under Section 5(2) of CEAA 2012 where the carrying out of the physical activity, the designated project, or the Project requires a federal authority to exercise a power or perform a duty or function conferred on it under any Act of Parliament other than CEAA 2012. As the Project may require an authorization from DFO, the following environmental effects have also been considered:

(a) a change that may be caused to the environment and that is directly linked or necessarily incidental to a federal authority's exercise of a power or performance of a duty or function that would permit the carrying out, in whole or in part, of the physical activity, the designated project or the Project; and

(b) an effect, other than those referred to in paragraph 1(c), of any change referred to in paragraph (a) on

(i) health and socio-economic conditions,

(ii) physical and cultural heritage, or

Any structure, site or thing that is of historical, archaeological, paleontological, or architectural significance.

These categories of direct and indirect environmental effects have been considered in defining the scope of the assessment, including the selection of VCs and identification of spatial and temporal boundaries.

5.3 Overview of Approach

The methodology used to conduct the EA and predict the effects of the Project was developed to meet the requirements of the EIS Guidelines issued by CEAA on January 19, 2016. The EIS Guidelines include requirements for EA's under CEAA 2012 and the Nova Scotia Environmental Assessment Regulations made under the Nova Scotia Environment Act. In addition to these requirements, the EA methodology was developed to incorporate:

- input from Indigenous Peoples and the public throughout the duration of the Project;
- environmental and social points of interest to the scientific and regulatory communities; and
- other federal, provincial, and municipal legislative and regulatory requirements that may apply to the Project.

The following sections will describe the methodology used to derive:

- the general rationale in VC selection;
- the spatial, temporal, administrative, and technical boundaries for assessing effects on VCs;
- the standard and/or threshold for characterizing and determining significance of residual effects;
- the programs developed to assess the baseline condition of those VCs;
- the anticipated Project and environment interactions for the duration of the Project;
- the prediction of effects that Project activities may have on VCs;
- the mitigation measures that will be used to eliminate, reduce, or control the potential effects of Project activities;
- the residual effects that may remain after mitigation measures are applied and the significance of those residual effects;
- the cumulative effects of the Project may have in combination with the residual effects of other projects within temporal and spatial confines of the Project;
- the follow-up and monitoring programs proposed to verify the accuracy of predicted impacts; and
- the effects of the environment on the Project.

The defined methodology described herein has allowed the Consultants to carefully examine Project activities to ensure they will not cause serious or irreversible harm to the environment.

5.4 Valued Components Selection

The methodology used to conduct this EA is based on the identification and assessment of potential environmental effects of the Project on VCs. VCs refer to environmental, biophysical, or human features that may be affected by the Project that are of value or interest because they have been identified to be of concern to Indigenous Peoples, regulators, the Consultants, and/or the general public. Their value not only relates to its role in the ecosystem, but also the value humans place on it.

The selection of VCs was based on consideration of the following:

- regulatory guidance and requirements, specifically those outlined in Section 6.2 of the EIS Guidelines provided by CEAA on January 19, 2016 and Section 5 of CEAA 2012. For a discussion of CEAA 2012 Section 5 requirements refer to Section 5.4 of this EIS;

- a review of federal, provincial, and municipal legislation, including an appraisal of species of conservation interest (SOCI) and SAR. Guidelines specifically requires consideration of the factors listed in Section 79 of SARA are provided in Section 6.13 and 6.17 of the EIS;
- workshops and discussions with representatives of CEAA, DFO, Environment and Climate Change Canada (ECCC), TC, NSE, and NSL&F;
- concerns raised by the public through open house meetings hosted by the Proponent;
- concerns raised by Indigenous Peoples, including traditional ecological knowledge obtained through completion of a Mi'kmaq Ecological Knowledge Study (MEKS);
- technical aspects of the Project, including the nature and extent of Project activities;
- the existing physical, biophysical, and socio-economic conditions and characteristics of the Project area;
- a review of publicly available information and reports submitted in support to nearby and similar environmental assessments; and
- the professional experience of the Consultants.

Based on these considerations, the following VCs were selected to facilitate a focused and effective EA:

Physical VCs

- noise, light, greenhouse gases, and air;
- geology, soil, and sediment quality;
- surface water quality and quantity; and
- groundwater quality and quantity.

Biophysical VCs

- wetlands;
- fish and fish habitat;
- habitat and flora;
- terrestrial fauna;
- avifauna; and
- species of conservation interest and species at risk.

Socio-economic VCs

- Mi'kmaq of Nova Scotia;
- physical and cultural heritage; and
- socio-economic conditions

A summary of the rationale for the selection of each VC can be found in Table 5.4-1, detailed selection information is presented in the VCs corresponding subsection within Section 6 of this EIS update.

Table 5.4-1: Rationale for Selection of Valued Components

Environment	Valued Component	Relevance to Environmental Impact Statement										Valued Component Selection Rationale
		Project – Environment Interaction (Direct/Indirect [D/I])	Legal Requirement	Scientific Interest	Biophysical Context	Socio-economic Context	Human Health	Human Quality of Life	Cultural	IAAC or Public Concern	Requirement of EIS Guidelines	
Physical Environment	Noise	D, I	X		X		X	X		X		• Potential for increases in noise
	Light	D, I	X		X		X	X		X		• Potential for increases in ambient light levels
	Air	D, I	X		X		X	X		X		• Potential for direct adverse effects to air quality
	Greenhouse Cases	D, I	X		X		X	X		X		• Potential for direct contributions to climate change
	Geology, Soil and Sediment	D, I			X		X			X		• Potential for direct adverse effects to soil and sediment • Potential for ARD from Halifax Formation bedrock • Pathway for potential adverse effects to surface water quality, wetlands, fish and fish habitat, habitat and flora, birds, fauna, SOCI/SAR, and human health
	Surface Water Quality and Quantity	D, I	X	X	X		X	X		X		• Potential for direct adverse effects to surface water quality • Potential for direct adverse effects to surface water quantity • Pathway for potential adverse effects to wetlands, fish and fish habitat, birds, fauna, SOCI/SAR, and human health
	Groundwater Quality and Quantity	D	X	X						X		• Potential for direct adverse effects to groundwater quality • Potential for direct adverse effects to ground water quantity
Biophysical Environment	Wetlands	D, I	X	X	X					X		• Potential for direct loss and/or adverse effects to wetlands and their function • Pathway for potential adverse effects to surface water quality and quantity, fish and fish habitat, habitat and flora, birds, fauna, and SOCI/SAR
	Fish and Fish Habitat	D, I	X	X	X	X	X	X		X	X	• Potential for direct adverse effects to fish and fish habitat • Pathway for potential adverse effects to birds, fauna, SOCI/SAR and human health
	Habitat and Flora	D, I	X	X	X	X	X	X		X		• Potential for direct loss of habitat • Potential for direct adverse effects to flora • Pathway for potential adverse effects to the atmospheric environment, surface water quality and quantity, wetlands, fish and fish habitat, birds, fauna, SOCI/SAR, Indigenous Peoples, and human health
	Avifauna	D, I	X	X	X	X	X	X		X	X	• Potential for direct adverse effects to birds • Pathway for potential adverse effects to fauna, Indigenous Peoples, and human health
	Terrestrial Fauna	D, I	X	X	X	X	X	X		X		• Potential for direct adverse effects to fauna • Pathway for potential adverse effects to birds, Indigenous Peoples, and human health
	Species of Conservation Interest/Species at Risk	D, I	X	X	X					X	X	• Potential for direct adverse effects to SOCI/SAR • Pathway for potential adverse effects to birds and fauna
Socio-economic Environment	Mi'kmaq of Nova Scotia	D	X			X	X	X	X	X	X	• Potential for direct adverse effects to the current use of land and resources for traditional purposes
	Physical and Cultural Heritage	D	X			X			X			• Potential for direct adverse effects to archaeological sites
	Socio-economic Conditions	D				X						• Employment opportunities • Economic spin-off • Contribution to government revenue through taxation

Note: Refer to Section 5.8 Anticipated Project-Environment Interaction definitions and examples relating to direct and/or indirect interactions. D = Direct; I = Indirect; CEAA = Canadian Environmental Assessment Agency; SOCI/SAR = Species of Conservation Interest/Species at Risk

5.5 Project Boundaries

5.5.1 Temporal Boundaries

The temporal boundaries represent the duration over which Project activities interact with each valued component VC. Generally, the temporal boundary encompasses all Project phases (construction, operation, active closure, and post-closure); however, the temporal boundary can vary depending on the valued component VC being considered.

The construction phase will be completed in one year, while the operation phase will last approximately five years. Active closure (i.e., decommissioning and reclamation) activities will commence after operation has ceased and likely occur over approximately two years. Post closure involves the required monitoring period once active reclamation and decommissioning is completed and is estimated to be 10+ years in length (timeline for this phase will be refined through on-going geochemical testing and water quality modelling and will documented in updated closure plans).

Temporal boundaries for each VC are described in their corresponding subsection within Section 6 of this EIS.

5.5.2 Spatial Boundaries

The spatial boundaries represent anticipated geographic limits that will aid in defining the scale and range of interactions between Project activities and VCs. The following spatial boundaries will be used for this EIS.

5.5.2.1 Project Area (PA)

The PA encompasses the immediate area in which Project activities may occur and are likely to cause direct and indirect effects to VCs. This area has also been identified as the study area for the purposes of baseline investigations. The PA includes three primary components from Marinette to Moose River Gold Mines, Halifax County, NS. The Beaver Dam Mine Site will be located at the north end of the Beaver Dam Mines Road and the Haul Road will span from the Beaver Dam Mine Site west to Moose River Gold Mines, where the Touquoy Mine Site (processing and exhausted pit [to be used to dispose Beaver Dam tailings]) is located. The three PA's (i.e., study areas) are outlined in Figure 5.5-1.

5.5.2.2 Local Assessment Area (LAA)

The LAA encompasses adjacent areas outside of the PA where Project related effects to VCs are reasonably expected to occur. Generally, the LAA is limited to the area in which Project activities are likely to have indirect effects on VCs; however, the size of the LAA can vary depending on the VC being considered, and the biological and physical variables present.

5.5.2.3 Regional Assessment Area (RAA)

The RAA encompasses all Project and VC interactions including diffuse or longer-range effects such as those from Project activities are presented in Table 5.5-1. The RAAs may vary in size depending on the VC being considered, and the biological and physical variables present.

Spatial boundaries will vary for each VC and are described in Table 5.5-1, as well as the corresponding subsections within Section 6 of this EIS.

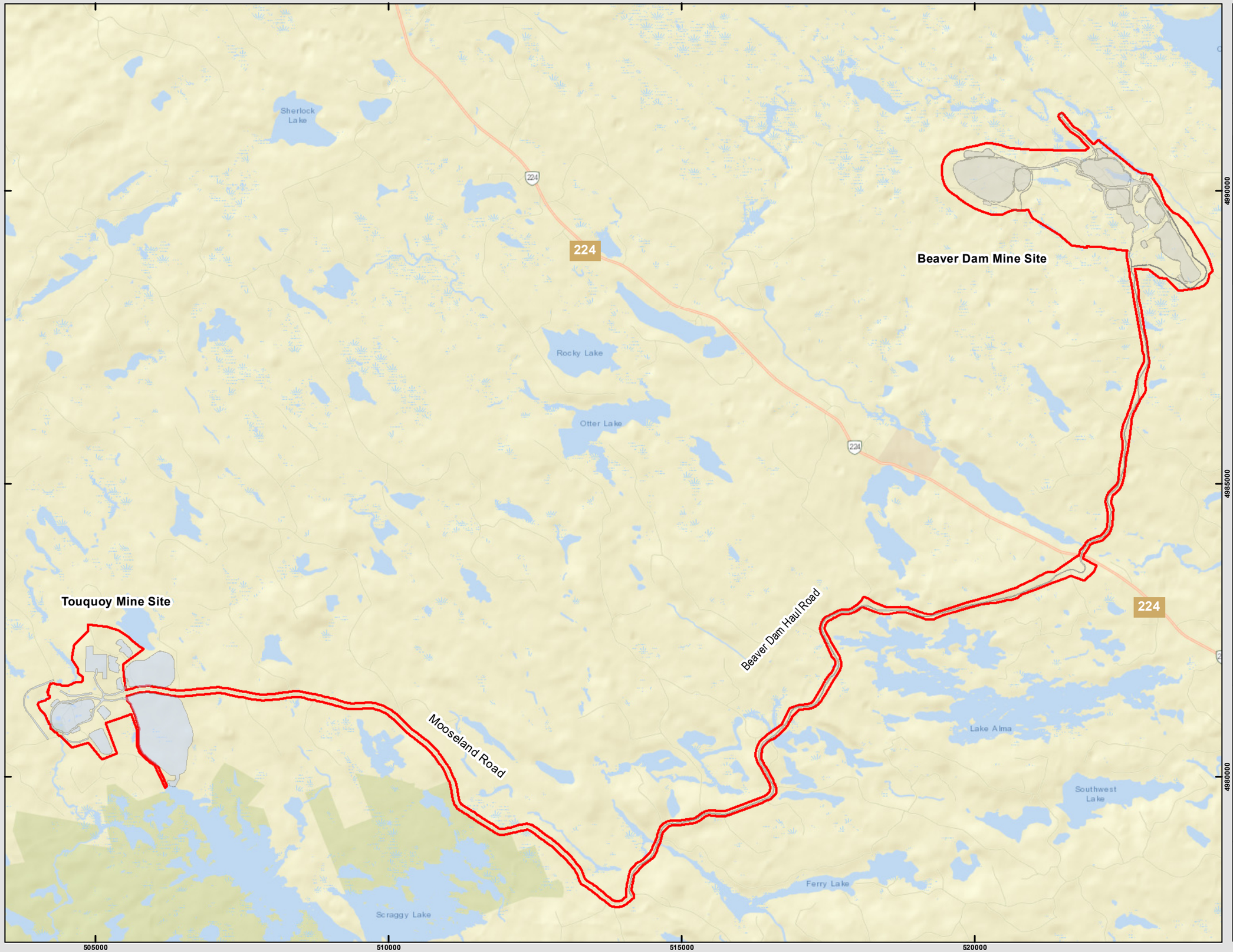
Prepared For:

Atlantic Gold

FIGURE 5.5-1

Beaver Dam Mine Project

Project Area



- Proposed Infrastructure
- Touquoy Mine Infrastructure
- Project Area



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 0.75 1.5 3 km

1:60,000

Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed by: XX

Date: 2021-05-09

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

McCallum Environmental Ltd.

Table 5.5-1: Spatial Boundary Assessment by Valued Component

Environment	Valued Component	Project Area	Local Assessment Area	Regional Assessment Area	Spatial Boundary Selection Rationale
Physical Environment	Noise	X	X	X	Effects from the Project on noise may potentially occur within and immediately adjacent to the Project area, therefore, the Project Area, Local Assessment Area and Regional Assessment Areas are considered.
	Light	X	X	X	Effects from the Project on ambient light may potentially occur within and immediately adjacent to the Project Area, therefore, the Project area, Local Assessment Area and Regional Assessment Areas are considered.
	Air	X	X	X	Effects from the Project on air may potentially occur within and immediately adjacent to the Project Area, therefore, the Project area, Local Assessment Area and Regional Assessment Areas are considered.
	Greenhouse Gases	X	X	X	Effects from the Project on greenhouses gasses may potentially occur over a diffuse area and are related to provincial initiatives, therefore, the Project Area, Local Assessment Area, and Regional Assessment Area are considered.
	Geology, Soil, and Sediment Quality	X	X		Effects from the Project on geology, soil, and sediment may potentially occur within and immediately adjacent to the Project Area, therefore, the Project Area and Local Assessment Area are considered.
	Surface Water Quality and Quantity	X	X	X	Effects from the Project on surface water quality and quantity may potentially occur within and immediately adjacent to the Project Area, therefore, the Project area, Local Assessment Area and Regional Assessment Areas are considered. are considered
	Groundwater Quality and Quantity	X	X	X	Effects from the Project on groundwater quality and quantity may potentially occur within and immediately adjacent to the Project Area, therefore, the Project Area and Local Assessment Area are considered.
Biophysical Environment	Wetlands	X	X	X	Effects from the Project on wetlands may potentially occur within and immediately adjacent to the Project Area, therefore, the Project Area, Local Assessment Area and Regional Assessment Areas are considered. are considered.
	Fish and Fish Habitat	X	X	X	Effects from the Project on fish and fish habitat may potentially occur within and immediately adjacent to the Project Area, therefore, the Project Area Local Assessment Area, and Regional Assessment Areas are considered. are considered are considered.
	Habitat and Flora	X	X	X	Effects from the Project on habitat and flora may potentially occur within and immediately adjacent to the Project Area, therefore, the Project Area Local Assessment Area and Regional Assessment Areas are considered. are considered are considered.
	Avifauna	X	X	X	Effects from the Project on birds may potentially occur within and immediately adjacent to the Project Area, therefore, the Project Area, Local Assessment Area and Regional Assessment Areas are considered.

Table 5.5-1: Spatial Boundary Assessment by Valued Component (continued)

Environment	Valued Component	Project Area	Local Assessment Area	Regional Assessment Area	Spatial Boundary Selection Rationale
	Terrestrial Fauna	X	X	X	Effects from the Project on fauna may potentially occur within and immediately adjacent to the Project Area, therefore, the Project Area, Local Assessment Area and Regional Study Area, and Regional Assessment Areas are considered.
	Species of Conservation Interest/Species at Risk	X	X	X	Effects from the Project on species of conservation interest and species at risk may potentially occur within and immediately adjacent to the Project Area, therefore, the Project Area, Local Assessment Area and Regional Assessment Areas are considered.
Socio-economic Environment	Mi'kmaq of Nova Scotia	X	X	X	Effects from the Project on Indigenous Peoples may potentially occur within and immediately adjacent to the Project Area, therefore, the Project Area, Local Assessment Area and Regional Assessment Areas are considered.
	Physical and Cultural Heritage	X			Effects from the Project on physical and cultural heritage are likely limited to the Project area, therefore, only the Project Area is considered.
	Socio-economic Conditions	X	X	X	Effects from the Project on socio-economic considerations of the area may potentially occur over a diffuse area, therefore, the Project Area, Local Assessment Area, and Regional Assessment Area are considered.

5.5.3 Administrative Boundaries

The administrative boundaries represent the regulatory, public policy, and/or economic limitations placed on the execution of the Project. Administrative boundaries for each VC are described in their corresponding subsection within Section 6 of this EIS.

5.5.4 Technical Boundaries

The technical boundaries represent the limits of the Consultant team's ability to assess a VC. The limitations to measure, assess, and/or monitor the effects of the Project on VCs may be theoretical or physical. These technical boundaries may create gaps in knowledge and understanding related to key conclusions, therefore, limiting the Consultant's ability to predict potential effects of the Project on a VC. Technical boundaries for each VC are described in their corresponding subsection within Section 6 of this EIS.

5.6 Standards or Thresholds for Characterizing and Determining Significance of Effects

Criteria or established thresholds for determining the significance of residual effects from Project activities are described for each VC in their corresponding subsection within Section 6 of this EIS. These criteria or threshold were developed through the following avenues:

- consultation with appropriate regulatory agency responsible for each VC;
- using information obtained in stakeholder and right holder consultation;
- using available information on the status and characteristic of each VC;
- using applicable regulatory documents, environmental standards, guidelines, and/or objectives, and
- using professional judgement of the Consultant Team.

These criteria or thresholds establish a level beyond which a residual effect would be considered significant. Thresholds may be based on regulations, standards, resource management objectives, scientific literature, and/or ecological processes. Significance criteria has been defined quantitatively where possible, and qualitatively with supporting justifications where no standards exist.

Additional analysis as defined in Section 5.11 and Table 5.11-1 also identifies and shows the characterization and significance determination for residual effects with cross-referencing to respective sections where this information has been updated from the Revised 2019 EIS (AMNS 2019).

5.7 Baseline Conditions

Baseline conditions for each physical, biophysical, and socio-economic VC are described in their corresponding subsection within Section 6 of this EIS in order to characterize the existing environment for which the Project is being undertaken, to establish an understanding of the receiving environment, and to provide sufficient context to enable an understanding of how the Project may affect existing environmental conditions. Inclusion of existing conditions is limited to that which is necessary to assess the effects of the Project and support the development of mitigation measures, monitoring and follow-up programs. Existing conditions consider the effects of past and current projects occurring within and outside of the PA.

Various methodologies were employed to obtain baseline conditions for each VC. Methodologies are outlined for each VC in their corresponding subsection within Section 6 of this EIS.

5.8 Anticipated Project-Environment Interaction

Interactions between Project activities, and the VCs outlined in Section 5.4 of this EIS will either be direct or indirect.

Direct interactions between the Project and VCs are typically more obvious and can be logically expected based on a good understanding of Project activities, and existing physical, biophysical, and socio- economic conditions and characteristics of the Project Area. Indirect interactions are less obvious and typically require an active pathway between Project activities and the VCs they are affecting. A pathway provides a link between a Project component or activity and VC and facilitates the interaction and potential effect.

As an example, a direct effect may be the potential loss of a wetland through clearing, grubbing, and grading in preparation of surface mine construction. Clearing, grubbing, and grading may also decrease infiltration and therefore increase runoff from the site; resulting in a potential indirect effect on surface water quality and quantity. Poor surface water quality and quantity may then affect fish and fish habitat; this is an example of a VC acting as both the receptor of an effect and the pathway for an effect.

In order to determine the potential direct and indirect interactions between Project activities, and VCs the Consultants conducted the following:

- reviewed the anticipated components and activities required to construct, operate, and decommission the Project;
- selected VCs that may have the potential to be directly or indirectly affected by Project activities;
- assessed the direct effects that Project activities may have on VCs;
- identified anticipated pathways between Project activities and any receiving VCs; and
- assessed the indirect effect that Project activities may have on VCs.

Once the direct or indirect interaction between Project activities and VCs is established, assessing the magnitude, duration, and other criteria for significance determination of the effects of those interactions becomes much easier. Subsequently, evaluating mitigation measures to eliminate, reduce, or control the effects of those interactions becomes easier as well.

Accidents and malfunctions have been considered for every phase of the Project; however, they are separated in the Project-VC interaction table to present the actual accidents and malfunctions that may occur during these phases.

The anticipated Project component and activities, and VCs interaction for the Beaver Dam Mine Site, Haul Road, and Touquoy Mine Site is presented in Tables 5.8-1, 5.8-2, and 5.8-3.

Interactions noted in Table 5.8-3 are specific to those that relate to new interactions as a result of the Project and not those that pre-exist at Touquoy Mine Site as part of that site's development, operation and reclamation.

Table 5.8-1: Potential Valued Components Interactions with Project Activities at Beaver Dam Mine Site

	Valued Components															
	Physical							Biophysical						Socio-economic		
	Noise	Light	Air	Greenhouse Gases	Geology, Soil. And Sediment Quality	Groundwater Quality and Quantity	Surface Water Quality and Quantity	Wetlands	Fish and Fish Habitat	Habitat and Flora	Terrestrial Fauna	Avifauna	Species of Conservation Interest/Species at Risk	Mi'kmaq of Nova Scotia	Physical and Cultural Heritage	Socio-economic Conditions
Site Preparation and Construction																
Clearing, Grubbing, and Grading	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Drilling and Rock Blasting	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Topsoil, Till, and Waste Rock Management	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Existing Settling Pond Dewatering					X	X	X	X	X	X		X	X	X		
Watercourse and Wetland Alteration	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Mine Site Road Construction, including lighting	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Surface Infrastructure Installation and Construction, including lighting	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Collection and Settling Pond Construction, including lighting	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Environmental Monitoring														X		X
General Waste Management	X	X	X	X				X				X	X	X		
Operation and Maintenance																
Drilling and Rock Blasting	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X
Surface Mine Dewatering	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X
Ore Management	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X
Waste Rock Management	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Surface Water Management					X	X	X	X	X	X	X	X	X	X		X
Petroleum Products Management				X	X	X	X	X	X	X	X	X	X	X		X
Site Maintenance and Repairs, including lighting	X	X	X	X			X				X	X	X	X		X
Environmental Monitoring														X		X
General Waste Management	X	X	X	X			X				X	X	X			
Decommissioning and Reclamation																
Infrastructure Demolition	X	X	X	X	X		X				X	X		X		X
Site Reclamation	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X
Environmental Monitoring														X		X
General Waste Management	X	X	X	X			X				X	X	X			
Accidents and Malfunctions																
Fuel and/or other Spills		X	X	X	X	X	X	X	X	X	X	X	X	X		X
Fire		X	X	X	X	X	X	X	X	X	X	X	X	X		X
Slope Failure					X	X	X	X	X	X	X	X	X		X	X
Collection/Settling Pond Failure					X	X	X	X	X	X	X	X	X	X		X
Unplanned Explosive Event	X		X	X	X		X	X	X	X	X	X	X	X		X
Mobile Equipment Accident	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X

Table 5.8-2: Potential Valued Components Interactions with Project Activities along Haul Road

	Valued Components																
	Physical							Biophysical						Socio-economic			
	Noise	Light	Air	Greenhouse Gases	Geology, Soil. And Sediment Quality	Groundwater Quality and Quantity	Surface Water Quality and Quantity	Wetlands	Fish and Fish Habitat	Habitat and Flora	Terrestrial Fauna	Avifauna	Species of Conservation Interest/Species at Risk	Mi'kmaq of Nova Scotia	Physical and Cultural Heritage	Socio-economic Conditions
Site Preparation and Construction																
Clearing, Grubbing, and Grading	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Drilling and Rock Blasting	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Topsoil, Till, and Waste Rock Management	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X
Watercourse and Wetland Alteration	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Culvert and Bridge Upgrades and Construction/Removal	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X
Haul Road Construction and Upgrades	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X
Environmental Monitoring														X		X
General Waste Management	X	X	X	X	X		X	X	X	X	X	X	X			
Operation and Maintenance																
Ore Transport	X	X	X	X	X	X	X				X			X		X
Road Lighting		X									X	X	X	X		X
Haul Road Maintenance and Repairs	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X
Environmental Monitoring														X		X
Accidents and Malfunctions																
Fuel and/or other Spills			X	X	X	X	X	X	X	X	X	X	X	X		X
Fire		X	X	X	X	X	X	X	X	X	X	X	X	X		X
Haul Truck Accident	X	X	X	X	X	X	X	X	X	X	X			X		X

Table 5.8-3: Potential Valued Components Interactions with Project Activities at Touquoy Mine Site

	Valued Components																
	Physical							Biophysical						Socio-economic			
	Noise	Light	Air	Greenhouse Gases	Geology, Soil. And Sediment Quality	Groundwater Quality and Quantity	Surface Water Quality and Quantity	Wetlands	Fish and Fish Habitat	Habitat and Flora	Terrestrial Fauna	Avifauna	Species of Conservation Interest/Species at Risk	Mi'kmaq of Nova Scotia	Physical and Cultural Heritage	Socio-economic Conditions
Site Preparation and Construction																
Ore Processing Equipment Upgrades	X	X	X	X						X				X		
Tailings Line Alteration	X						X									
Environmental Monitoring														X		X
General Waste Management	X	X	X	X			X				X	X	X			
Operation and Maintenance																
Lighting of facility and Mine Site roads		X										X				
Ore Management and Processing	X	X				X	X									
Tailings Management (exhausted pit)	X	X				X	X		X			X	X			
Environmental Monitoring														X		X
General Waste Management	X	X	X	X		X	X	X	X	X	X	X	X			
Decommissioning and Reclamation																
Environmental Monitoring														X		X
Accidents and Malfunctions																
Fuel and/or other Spills			X		X	X	X	X	X	X	X	X	X	X		X
Fire	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X
Mobile Equipment Accident	X	X	X	X	X	X	X	X	X	X	X			X		X
Tailings/Reclaim Waterline Event							X		X							
Cyanide Release			X			X	X		X	X	X	X	X	X		X

5.9 Effects Prediction

Potential Project-related effects are changes to the physical, biophysical, and/or human environment that are caused by Project activities. Interactions between VCs and Project activities are described in corresponding subsections within EIS Section 6 and form the basis for effects prediction. Establishment of interaction relationships between VCs and Project activities is described in EIS Section 5.8. Once these interaction relationships are established, determination of changes to VCs, defined as effects, as a result of Project activities is accomplished through:

- predicting adverse effects from Project activities, and evaluating the scope and scale of those effects;
- detailing mitigation measures triggered through regulatory requirements and/or best management practices to eliminate, reduce, or control the effect Project activities have on VCs;
- predicting cumulative effects from other projects occurring in the same spatial and temporal boundaries; and
- determining residual effects remaining after mitigation measures are considered and cumulative effects are identified, to assess the significance of those effects in the context of each VC.

5.10 Mitigation Measures

A variety of mitigation measures are typically available to eliminate, reduce, or control the effect Project activities have on the environment. These measures range from procedures within standard industry best management practices for construction and operation, policies and practices communicated through training programs and management plans, and/or engineering controls incorporated into the final design. Given the Proponents' experience with gold mining in the region, specifically the Touquoy Project, as well as past experience outlined in EIS Section 1.4, a number of mitigation measures were proactively incorporated into the Project design in order to eliminate, reduce, and/or control the effect of Project activities on the environment. Mitigation measures for each VC are described in the corresponding subsections within Section 6. A summary of all mitigation measures is provided in Section 9 and 10 of this EIS update, as per Information request CEAA 2-03 (AMNS 2021).

5.11 Residual Effects and the Determination of Significance

Residual effects are effects to VCs that are predicted to remain even after the implementation of mitigation measures. The process by which they are identified is as follows:

- Determine the potential interactions between VCs and Project activities and the effects those interactions will have.
- Assess effect of each mitigation strategy applied to the interactions.
- Characterize the extent and nature of the remaining, residual effects after mitigation measures have been applied for the Project.
- Evaluation of the Project including Haul Road.

In order to identify if residual effects are significant or not, consideration of the magnitude, geographical extent, duration, frequency, and reversibility is required. A description of these effects characteristics and the varying degrees in which they can contribute to the significance of an effect is presented in Table 5.11-1. Where possible, criteria will be described quantitatively. When residual effects cannot be characterized quantitatively, they will be characterized qualitatively.

Table 5.11-1: Characterization Criteria for Residual Environmental Effects

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories	Valued Component Specific Definitions
Significance Threshold	The definition of a significant adverse effect based on Project interactions with each Valued Component.	Determinations of Significance based on characterization criteria as defined for each VC..	Noise – 6.1.6.2 Air – 6.2.6.2 Light – 6.3.6.3 Greenhouse Gases – 6.4.6.2 Geology, Soils and Sediment – 6.5.6.2 Groundwater Quality and Quantity-6.6.6.4 Surface Water Quality and Quantity 6.7.7.2 Wetlands – 6.8.6.3 Fish and Fish Habitat – 6.9.6.2 Habitat and Flora – 6.10.6.2 Terrestrial Fauna – 6.11.6.2 Avifauna – 6.12.7.2 SAR and SOCI – 6.13.6.2 Mi'kmaq of Nova Scotia – 6.14.6.2 Physical and Cultural Heritage – 6.15.6.2 Socioeconomic Conditions - 6.16.12 Assessment of VC within Federal Jurisdiction NA Accidents and Malfunctions 6.18.7 and 6.18.8 Effects of the Environment 7.

Table 5.11-1: Characterization Criteria for Residual Environmental Effects (continued)

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories	Valued Component Specific Definitions
Magnitude	The size or degree of the effects compared against baseline conditions or reference levels, and other applicable measurement parameters (i.e., standards, guidelines, objectives)	Negligible (N) – Differing from the average value for the existing environment/baseline conditions to a small degree, but within the range of natural variation and below a threshold value Low (L) – Differing from the average value for the existing environment/baseline conditions, outside the range of natural variation, and less than or equal to appropriate guideline or threshold value Moderate (M) – Differing from the existing environment/ baseline conditions and natural variation, and marginally exceeding a guideline or threshold value High (H) – Differing from the existing environment/ baseline conditions and natural variation, and exceeding a guideline or threshold value	Noise-6.1.6.2 Air – 6.2.6.2 Light – 6.3.6.3 Greenhouse Gases 6.4.6.2 Geology, Soils and Sediment -6.5.6.2 Groundwater Quality and Quantity-6.6.6.4 Surface Water Quality and Quantity 6.7.7.2 Wetlands – 6.8.6.3 Fish and Fish Habitat – 6.9.6.2 Habitat and Flora – 6.10.6.2 Terrestrial Fauna – 6.11.6.2 Avifauna – 6.12.7.2 SAR and SOCI – 6.13.6.2 Mi'kmaq of Nova Scotia – 6.14.6.2 Physical and Cultural Heritage – 6.15.6.2 Socioeconomic Conditions - 6.16.12 Assessment of VC within Federal Jurisdiction NA Accidents and Malfunctions – 6.18.7

Table 5.11-1: Characterization Criteria for Residual Environmental Effects (continued)

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories	Valued Component Specific Definitions
Geographic Extent	The geographic area over or throughout which the effects are likely to be measurable	Project Area (PA) – the residual environmental direct and indirect Local Assessment Area (LAA) – Occurs beyond the PA and LAA and within the RAA Regional Assessment Area (RAA) – Occurs beyond the PA and LAA and within the RAA	Noise – 6.1.6.1 Air – 6.2.6.1 Light – 6.3.6.1.1 Greenhouse Gases – 6.4.6.1 Geology, Soils and Sediment – 6.5.6.1 Groundwater Quality and Quantity – 6.6.6.1 Surface Water Quality and Quantity – 6.7.7.1 Wetlands – 6.8.6.1.1 Fish and Fish Habitat – 6.9. 6.1.1/6.9.6.2 Habitat and Flora – 6.10.6.1.1 Terrestrial Fauna – 6.11.6.1.1 Avifauna – 6.12.7.1.1 SAR and SOCI – 6.13.6.1.1 Mi'kmaq of Nova Scotia – 6.14.6.1.1 Physical and Cultural Heritage – 6.15.6.1.1 Socioeconomic Conditions - 6.16.9.1 Assessment of VC within Federal Jurisdiction NA Accidents and Malfunctions – 6.18.7 and 6.18.8
Timing	Considers when the residual environmental effect is expected to occur. Timing considerations are noted in the evaluation of the residual environmental effect, where applicable or relevant.	Not Applicable (N/A) — seasonal aspects are unlikely to affect VC's (i.e., fisheries productivity). Applicable — seasonal aspects may affect VC's (i.e., fisheries productivity)	Light – 6.3.6.3 Groundwater Quality and Quantity-6.6.6.4 Surface Water Quality and Quantity 6.7.7.2 Fish and Fish Habitat – 6.9.6.2 No specific definitions for other VCs
Duration	The time period over which the effects are likely to last	Short-term (ST) – effects are limited to occur from as little as 1 day to 24 months Medium-term (ML) – effects can occur beyond 24 months and up to 4 years Long-term (LM) – effects extend beyond 4 years Permanent (P) – valued component unlikely to recover to baseline conditions	Groundwater Quality and Quantity-6.6.6.4 Surface Water Quality and Quantity 6.7.7.2 Fish and Fish Habitat – 6.9.6.2 No specific definitions for other VCs

Table 5.11-1: Characterization Criteria for Residual Environmental Effects (continued)

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories	Valued Component Specific Definitions
Frequency	The rate of recurrence of the effects (or conditions causing the effect)	Once (O) – effects occur once Sporadic (S) – effects occur at irregular intervals throughout the Project Regular (R) – effects occur at regular intervals throughout the Project Continuous (C) – effects occur continuously throughout the Project	No specific definitions for other VCs
Reversibility	The degree to which the effects can or will be reversed (typically measured by the time it will take to restore the environmental attribute or feature)	Reversible (R) – VCs will recover to baseline conditions before or after Project activities have been completed. Partially Reversible (PR) – mitigation cannot guarantee a return to baseline conditions Irreversible (IR) – effects to VCs are permanent and will not recover to baseline conditions	No specific definitions for other VCs

It should be noted that each of the criteria will also incorporate the social and ecological context, reflecting the importance of the environmental attribute or feature to ecosystem health and function as well as the influence of past and current human activity and the disturbance associated with that activity. Further, timing considerations will be noted in the evaluation of the residual environmental effect for each VC, where applicable or relevant. For example, if the VC has a period of time for sensitive life stages (i.e., breeding/spawning), the VC will provide a description of the timing considerations as part of the evaluation.

In conjunction with the effects characteristics outlined in Table 5.11-1, each VC assigns a standard or threshold as described in Section 5.6 of this EIS to determine the significance of an effect caused by the Project.

5.12 Follow-up and Effects Monitoring

Follow-up and monitoring recommendations for each VC are described in the corresponding subsections within Section 6. A summary of all monitoring recommendations is provided in Sections 9 and 10 of this EIS as per Information request CEAA 2-03 (AMNS 2021a).

The Proponent will also evaluate the need for effects monitoring to ensure regulatory compliance. To supplement the effects monitoring, the Proponent will also develop and implement environmental management and contingency plans to prevent or address accidents or malfunctions that have the potential to occur and produce unexpected effects throughout the life of the Project.

5.13 Effects of the Environment on the Project

Effects of the environment on the Project consider potential changes to the Project that may result from interactions with the environment. Project components and activities were reviewed for interaction with the natural environment and effects caused by variations in meteorological conditions from wind, ice, and extreme precipitation events, as well natural hazards like seismic activity. A significant effect on the Project from the environment would include, but not be limited to, the following:

- environmental conditions cause harm to Project personnel and/or the public;
- environmental conditions cause extended delays in construction or a shutdown of operations;
- environmental conditions damages infrastructure and compromises safety; and
- environmental conditions damages infrastructure to the point repair is not feasible.

The assessment of effects of the environment on the Project includes discussion regarding potential interactions, as well as details regarding planning, design, and construction strategies for reducing the likelihood of potential effects on the Project, thereby reducing the likelihood of accidents and malfunctions caused by the environment.

Project components and activities have been designed to consider the hazards and limitations imposed by the natural environment on the Project. The effects of the environment on the Project are discussed further in Section 7.

6 ENVIRONMENTAL EFFECTS ASSESSMENT

6.1 Noise

6.1.1 Introduction

6.1.1.1 Summary of Noise Before the Updates

This section describes the methods and results of baseline characterization as well as predictive studies that were undertaken to support characterization of potential Project effects on the Noise Valued Component (VC). Noise is a physical aspect of the environment that may be altered by the Beaver Dam Mine Project (the Project) that can, in turn, affect related biophysical and socioeconomic VCs (Sections 6.10 to 6.12 and Section 6.16).

6.1.1.2 Summary of Updates to Noise

The Noise Environmental Impact study for the Project has been updated to reflect updates of the Project Description (Section 2) and to address Round 2, Information Requests (IR2) issued by the Impact Assessment Agency of Canada (IAAC, formerly the Canadian Environmental Assessment Agency [CEAA 2019]) and Nova Scotia Environment (NSE 2019). The following key changes to the Project Description (Section 2) and approach for predictive modelling include the following:

- Duration of Construction Phase reduced to less than 1 year (previously 1 to 2 years);
- Duration of Operation Phase extended to 5 years (previously 3 to 4 years);
- Maximum daily volume of Project truck traffic on the haul road reduced to 95 trips per day (previously 190 trips per day);
- Two options for raw material processing considered at the Beaver Dam Mine Site (Option A: jaw crusher at crusher pad; and Option B: secondary blasting and rock breaking in the pit); and
- Truck traffic used in the noise assessment and related modelling has been adjusted to a 16-hour shift, including the nighttime hour of 6:00 AM to 7:00 AM.

Direct responses to IR2s are provided in Appendix B.1 and Appendix B.2 and in the combined AMNS IR2 response submission (AMNS 2021). An outline of updates to the Noise Environmental Effects Assessment are summarized in Table 6.1-1.

Table 6.1-1: Updated Subsections from the Revised 2019 Environmental Impact Statement - Noise

2019 Revised EIS Submission (February 28, 2019)	Updated in 2021	Corresponding 2021 EIS Update Section Number	Reason for Update
-	-	6.1.1 Introduction	• new
6.1.1 Rationale for Valued Component Selection	Yes	6.1.2 Rationale for Valued Component Selection	• -Minor updates to show linkages to wildlife, terrestrial and human health
6.1.2 Baseline Program Methodology	Yes	6.1.3 Baseline Program Methodology	• Updated to show option without primary crusher
6.1.3 Baseline Conditions	Yes	6.1.4 Baseline Conditions	• Minor updates
6.1.4 Consideration of Consultation and Engagement Results	No	6.1.5 Consideration of Engagement Results	• Minor updates to note engagement undertaken in since the 2019 submission

Table 6.1-1: Updated Subsections from the Revised 2019 Environmental Impact Statement – Noise (continued)

2019 Revised EIS Submission (February 28, 2019)	Updated in 2021	Corresponding 2021 EIS Update Section Number	Reason for Update
6.1.5 Effects Assessment Methodology – **Boundaries**	Yes	6.1.6 Effects Assessment Methodology and Modelling – **Boundaries**	• Effects assessment methodology has been updated to include a quantitative evaluation of the Noise VC for the Construction Phase, using the approach described in Health Canada (2016).The approach for modelling is described is section 6.1.7; the associated results are presented in Section 6.1.8.
6.1.5 Effects Assessment Methodology – **Thresholds for Determination of Significance**	Yes	6.1.6 Effects Assessment Methodology and Modelling – **Thresholds for Determination of Significance**	• Effects assessment methodology has been updated to include a quantitative evaluation of the Noise VC for the Construction Phase, using the approach described in Health Canada (2016).The approach for modelling is described is section 6.1.7; the associated results are presented in Section 6.1.8.
6.1.6 Project Activities and Noise Interactions and Effects	No	6.1.7 Project Activities, Noise Interactions and Predicted Effects	• Effects assessment methodology has been updated to include a quantitative evaluation of the Noise VC for the Construction Phase, using the approach described in Health Canada (2016).The approach for modelling is described is section 6.1.7; the associated results are presented in Section 6.1.8.
6.1.7 Preferred Alternative Haul Road	Yes	-	• Preferred Alternative Haul Road sections and references are removed from the EIS.
6.1.8 Mitigation and Monitoring	Yes	6.1.8 Mitigation	• Additional mitigation measures that reduce noise at the property boundary have been added for the Project
6.1.9 Residual Effects and Significance	Yes	6.1.9 Residual Effects and Significance	• Updates to ratings
6.1.10 Proposed Compliance and Effects Monitoring Program	No	6.1.10 Proposed Compliance and Effects Monitoring Program	• Section removed

Notes: PA = Project Area; LAA = Local Assessment Area; RAA = Regional Assessment Area; - = no update; IR2 = Round 2, Information Requests; CEAA = Canadian Environmental Assessment Agency; EIS = environmental impact statement.

6.1.2 Rationale for Valued Component Selection

Noise is a physical aspect of the environment, that can affect local wildlife, traditional land use and human health. Activities associated with the proposed Project will introduce Noise to the surrounding environment, potentially creating adverse noise effects to receptors located within the vicinity of the Project. Project-related noise levels are therefore assessed to allow for comparison to relevant benchmarks and guidance levels for the protection of wildlife and human health (Sections 6.10 to 6.12 and Section 6.16).

Noise will be generated throughout the life of the Project at the Beaver Dam Mine Site, Haul Road, and Touquoy Mine Site. Sources of Project-related noise will include heavy machinery during the construction phase and heavy truck traffic during the construction and operational phases. The majority of mining operations will occur in the pit well below current ground surface, which will

attenuate the effects of noise. During the construction and operation phase of the Beaver Dam Mine Site, rock blasting using explosives is a source noise and vibration that would be generated.

Noise and Vibration is provincially regulated via the Workplace Health and Safety Regulations and the Pit and Quarry Guidelines (1999), which protects the health of site workers and the general public at Project area boundaries, respectively.

6.1.3 Baseline Program Methodology

The objective of the noise baseline study was to collect information on baseline noise conditions before commencement of the proposed Project.

Baseline ambient noise levels were evaluated using a Quest Sound Pro-DL Class 1 Precision Integrating sound level metre (serial number BGG040024). Data collected was evaluated against the provincial Pit and Quarry Guidelines as a reference. Sound level measurements were collected at several sample locations near the Beaver Dam Mine Site boundary and along the Haul Road, and one location at the Touquoy Mine Site, taking into consideration the nearest receptors and proposed mining equipment operational locations. Sound level measurements were not undertaken at any additional locations (such as at the nearest residence to the Beaver Dam Mine Site). Ambient noise levels in the vicinity of the Beaver Dam Mine Site and the Haul Road provide a more conservative baseline for comparative purposes.

Table 6.1-2 summarizes the baseline noise monitoring locations these locations are shown on Figure 6.1-1.

Table 6.1-2: Baseline Noise Monitoring Locations

Sample Location	General Area	Sample Location Rationale
Location #1 (2008)	Approx. 450 m south of Crusher Lake	On site boundary, near Waste Rock Storage area
Location #2 (2008)	West end of Crusher Lake	500 m west of site boundary, northwest of Waste Rock Storage
Location #3 (2008)	Near northwest end of Cameron Flowage, east of Mud Lake	North edge of site boundary, at pit and water diversion channel
AN#1	North of Cameron Flowage	North of Pit
AN#2	West end of Crusher Lake	400 m west of site boundary, northwest of Waste Rock Storage; in close proximity to Location #2 (2008)
AN#3	East southeast of proposed stockpile area and ROM Pad	400 m east of site boundary, in Stockpile and ROM Pad area.
AN#4	Near junction of Beaver Dam Mines Road and Hwy 224, approx. 1.35 km NNW of Hwy 224	Proposed crusher location
Beaver Dam Road	Near junction of Beaver Dam Mines Road and Hwy 224, approx. 300 m NNW of Hwy 224.	East end of Haul Road
Mooseland Road	130 m north of Mooseland Road, 560 m east of Haul Road	West end of Haul Road
Location 1 (Touquoy)	North of the proposed open pit	Proposed open pit location

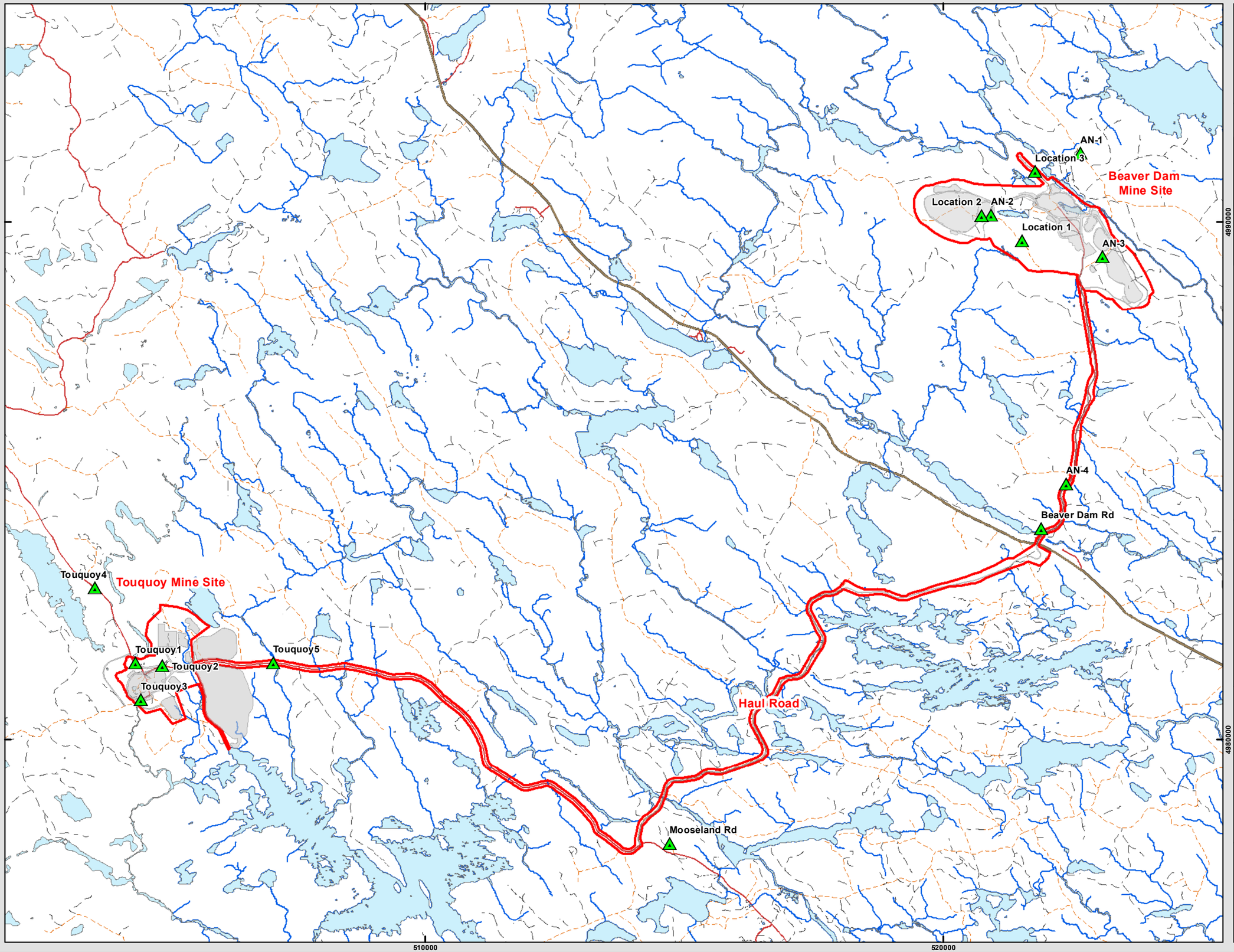


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FIGURE 6.1-1

Beaver Dam Mine Project

Noise Baseline Monitoring Locations

Air / Noise Baseline Monitoring Locations

Planned Infrastructure

Project Area



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 1 2 4 km

1:68,000 Scale when printed @ 11" x 17"

Drawn By: EP Date: 2021-05-09

Reviewed By: XX

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

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Document Name: BD_EIS_Figure6-1-1Noise Baseline

6.1.4 Baseline Conditions

6.1.4.1 Overview

Baseline ambient sound level monitoring was conducted at several locations in the Project Area between January 2007 and September 2016 (Appendix B.1 and Figure 6.1-1). Based on the data obtained from these sound level monitors, ambient sound levels are generally low, as expected for a characteristically rural environment. Specific non-residential locations of traditional land use and recreation have not been identified for inclusion in the analysis; however, it is understood that traditional uses such as hunting may occur in areas close to the Project Area.

6.1.4.2 Ambient Noise

Ambient noise has been sampled at several representative locations (Table 6.1-3). The key sensitive receptor in the area is the Beaver Lake IR 17; a satellite community of the Millbrook First Nation located approximately 5 km south of the Beaver Dam Mine Site. At its nearest point, the Haul Road is approximately 3 km east of Beaver Lake IR 17. Other receptors in the area include a permanent residence, and seasonal camps/cottages near the Beaver Dam Mines Road at Highway 224, seasonal camps/cottages on the Cross Road near Mooseland Road, and residences along Mooseland Road (Figure Section . Receptors are located further along Highway 224 and Mooseland Road up to 18 km over considerable changes in topography and are generally forested. Activities in these areas are ongoing and include recreational use (hunting, ATVs, etc).

Camp Kidston, which operates only in the summer months, is located 3.5 km northeast of the Touquoy Mine Site. The nearest permanent full-time occupied residences from the Touquoy Mine Site are located approximately 5.8 km to the north of the open pit along Caribou Road. The next closest permanent residences to the Touquoy Mine Site are approximately 7.4 km to the northwest and 11.7 km to the southeast. Sampling locations are shown in Figure 6.1-1.

Noise data was recorded in A-weighted decibels (dBA) and presented as equivalent continuous noise level (Leq) averaged over a time period and compared to Nova Scotia Environment criteria by time of day.

Sound level measurements for all sample locations, except for Location #1 at the Beaver Dam Mine Site, met NSE Pit and Quarry criteria for all time intervals. Sample Location #1 was approximately 10 feet from a hauling road that was in use during the monitoring period contributing to elevated noise level readings. Typical sound sources would include recreational vehicles, traffic on local roadways and contribution from existing forestry operations. The degree to which these sources would influence the existing noise levels would vary depending on the time of day and season.

The noise monitoring locations were chosen to be representative receptors and also to understand the ambient noise at the Beaver Dam Mine Site, along the Haul Road, and at the Touquoy Mine Site. Location #1, 2 and 3 and AN #1, 2, and 3 were placed so to understand the noise levels directly around the Beaver Dam Mine Site. The Beaver Dam Mines Road site was chosen as the closest receptor to a permanent resident to the Beaver Dam Mine Site and the Haul Road. It is a surrogate for the Beaver Dam IR 17 location because the monitoring site would be more greatly affected by noise than the IR but would also record the same vehicle traffic from Highway 224 as would pass by the Beaver Dam IR. The IR is located approximately 3 km north of this monitoring location. The Mooseland Road monitoring location was chosen as a mid-point between the nearest dwelling on the Mooseland Road and the Haul Road. Location #1 at Touquoy was chosen to understand the noise levels directly around the Touquoy Mine Site and proposed open pit.

Table 6.1-3: Baseline Ambient Noise Levels

Monitoring Location	Date	Time	Average Leq Value	NSE Criteria
Location #1 Waste Rock Pile (near current secondary logging road)				
	June 16, 2008	12:00 - 18:59	50.5	0700-1900 <65 dBA
	June 16, 2008	19:00 - 22:59	47.3	1900-2300 <60 dBA
	June 16-17, 2008	23:00 - 06:59	48.1	2300-0700 <55 dBA
	June 17, 2008	07:00 - 18:59	55.1	0700-1900 <65 dBA
	June 17, 2008	19:00 - 22:59	47.2	1900-2300 <60 dBA
	June 17-18, 2008	23:00 - 06:59	**58.9**	2300-0700 <55 dBA
	June 18, 2008	07:00 - 18:59	**67.0**	0700-1900 <65 dBA
	June 18, 2008	19:00 - 22:59	**62.0**	1900-2300 <60 dBA
	June 18-19, 2008	23:00 - 06:59	**60.2**	2300-0700 <55 dBA
	June 19, 2008	07:00 - 09:51	59.1	0700-1900 <65 dBA
Location #2 Northwest of Beaver Dam Mine Site (near secondary logging road)				
	June 11, 2008	11:30 - 18:59	32.0	0700-1900 <65 dBA
	June 11, 2008	19:00 - 22:59	31.0	1900-2300 <60 dBA
	June 11-12, 2008	23:00 - 06:59	30.2	2300-0700 <55 dBA
	June 12, 2008	07:00 - 18:59	41.6	0700-1900 <65 dBA
	June 12, 2008	19:00 - 22:59	38.1	1900-2300 <60 dBA
	June 12-13, 2008	23:00 - 06:59	31.6	2300-0700 <55 dBA
	June 13, 2008	07:00 - 18:59	51.1	0700-1900 <65 dBA
Location #3 North of Beaver Dam Mine Site (wilderness location on topographic high)				
	June 6, 2008	15:00 - 18:59	34.7	0700-1900 <65 dBA
	June 6, 2008	19:00 - 22:59	29.2	1900-2300 <60 dBA
	June 6-7, 2008	23:00 - 06:59	28.4	2300-0700 <55 dBA
	June 7, 2008	07:00 - 18:59	34.3	0700-1900 <65 dBA
	June 7, 2008	19:00 - 22:59	30.0	1900-2300 <60 dBA
	June 7-8, 2008	23:00 - 06:59	31.0	2300-0700 <55 dBA
	June 8, 2008	07:00 - 18:59	34.2	0700-1900 <65 dBA
	June 8, 2008	19:00 - 22:59	35.3	1900-2300 <60 dBA
	June 8-9, 2008	23:00 - 06:59	33.2	2300-0700 <55 dBA
	June 9, 2008	07:00 - 14:40	38.1	0700-1900 <65 dBA
AN#1 Northeast of Beaver Dam Mine Site (beside primary logging road)				
	October 20, 2014	13:26 - 18:59	45.8	0700-1900 <65 dBA
	October 20, 2014	19:00 - 22:59	30.9	1900-2300 <60 dBA
	October 20-21, 2014	23:00 - 06:59	30.0	2300-0700 <55 dBA
	October 20-21, 2014	07:00 - 11:58	32.4	0700-1900 <65 dBA
AN#2 Northwest of Beaver Dam Mine Site (near secondary logging road)				
	November 20, 2014	11:36 - 18:59	33.6	0700-1900 <65 dBA
	November 20, 2014	19:00 - 22:59	34.6	1900-2300 <60 dBA
	November 20-21, 2014	23:00 - 06:59	27.4	2300-0700 <55 dBA

Table 6.1-3: Baseline Ambient Noise Levels (continued)

Monitoring Location	Date	Time	Average Leq Value	NSE Criteria
	November 21, 2014	07:00 - 11:30	32.4	0700-1900 <65 dBA
AN#3 South of crusher location (along primary logging road)				
	November 20, 2014	11:13 - 18:59	36.4	0700-1900 <65 dBA
	November 20, 2014	19:00 - 22:59	38.5	1900-2300 <60 dBA
	November 20-21, 2014	23:00 - 06:59	29.3	2300-0700 <55 dBA
	November 21, 2014	07:00 - 11:12	29.9	0700-1900 <65 dBA
Beaver Dam Road (Haul Road) (near Highway 224)				
	September 8, 2016	11:26 – 18:59	44.2	0700-1900 <65 dBA
	September 8, 2016	19:00 - 22:59	43.1	1900-2300 <60 dBA
	September 8-9, 2016	23:00 - 06:59	42.5	2300-0700 <55 dBA
	September 9, 2016	07:00 - 11:59	44.6	0700-1900 <65 dBA
Mooseland Road (Haul Road) (south of proposed truck route)				
	September 20, 2016	15:42 - 18:59	31.1	0700-1900 <65 dBA
	September 20, 2016	19:00 - 22:59	34.1	1900-2300 <60 dBA
	September 20-21, 2016	23:00 - 06:59	36.0	2300-0700 <55 dBA
	September 21, 2016	07:00 - 15:37	36.9	0700-1900 <65 dBA
Location #1 (Touquoy Mine Site) (north of proposed open pit)				
	January 9, 2007	19:00 - 22:59	44.8	1900-2300 <60 dBA
	January 10, 2007	07:00 - 14:59	44.9	0700-1900 <65 dBA
	January 10, 2007	15:00 - 23:59	40.9	1900-2300 <60 dBA
	January 11, 2007	0:00 - 06:59	40.2	2300-0700 <55 dBA
	January 11, 2007	07:00 - 18:59	42.9	0700-1900 <65 dBA
	January 11, 2007	19:00 - 22:59	41.4	1900-2300 <60 dBA
	January 11-12, 2007	23:00 - 06:59	40.7	2300-0700 <55 dBA

At the measurement locations around the Beaver Dam Mine Site, based on the 2014 values (AN# 1,2,3) the average value is 33 dBA ±. The dominant noise sources noted are natural, including birds, the movement of leaves, and possibly the odd vehicle on a logging road. The measurement locations at Beaver Dam Mines Road and Mooseland Road would be mostly from natural sources. Mooseland Road measurements are comparable to the Beaver Dam Mine Site. It is located on a little used gravel road. The Beaver Dam Mines Road is elevated and is near a paved highway with regular traffic. This road also passes through Beaver Dam IR and ambient sound will be the same as at the measured location.

Based on the measured ambient sound levels discussed above, the estimated lowest baseline ambient sound levels throughout the Study Area are as follows:

- 7:00 AM to 7:00 PM 33 dBA;
- 7:00 PM to 11:00 PM 31 dBA; and
- 11:00 PM to 7:00 AM 27 dBA.

At the Touquoy Mine Site, noise monitoring will be undertaken throughout the operation of the facility if any complaints or concerns are received. To date, no noise complaints have been received or are anticipated.

6.1.5 Consideration of Engagement Results

Key concerns raised during public and Mi'kmaq engagement relating to atmospheric environment include noise from mining operations at the Beaver Dam Mine Site and trucking along the Haul Road. The change to the Haul Road alleviated these concerns with respect to passing by existing residences, especially concerns of Millbrook First Nation regarding its residents in Beaver Lake. Concerns about greenhouse gas emissions and noise specifically associated with the trucking were also noted.

The results of the public and Mi'kmaq engagement have been considered in the environmental effects assessment, including the Proponent's commitments on mitigation and monitoring measures and proposed compliance and effects monitoring programs, as well as the Proponent's broader commitment to ongoing public and Mi'kmaq engagement. Specific to evaluating the effect on atmospheric environment, these are found within the following environmental effects assessment.

Engagement undertaken since the 2019 Revised EIS that included public, stakeholders and Mi'Kmaq of Nova Scotia, including Millbrook First Nation are documented in updates to Sections 3 and 4 and Appendices A.4 and A.5.

6.1.6 Effects Assessment Methodology and Modelling

The scope of this assessment is to quantify Construction and Operations noise at property lines and at identified sensitive receptors within the spatial boundaries defined for the Noise VC. Effects assessment boundaries, modelling methodologies and assumptions for the Noise VC are provided in this section.

As described in Section 6.1.1.2, the effects assessment has been updated to address IR2 issued by Canadian Environmental Assessment Agency and Nova Scotia Environment as well as updated estimates of truck traffic on the Haul Road; technical studies informing the effects assessment presented in the underlying sections are provided in Appendix B.1 and Appendix B.2.

6.1.6.1 Boundaries

6.1.6.1.1 Spatial Boundaries

The spatial boundary used for the assessment of effects of noise are described below and presented in Figure 6.1-2.

The Project Area (PA) encompasses three primary components from Marinette to Moose River Gold Mines, Halifax County, NS. The Beaver Dam Mine Site will be located at the end of the Beaver Dam Mines Road and the Haul Road will span from the Beaver Dam Mine Site to Moose River Gold Mines, where the Touquoy Mine Site (processing and exhausted pit [to be used to dispose Beaver Dam tailings]) is located.

The Local Assessment Area (LAA) encompasses adjacent areas outside of the PA where Project related effects to Noise are reasonably expected to occur. The LAA constitutes the noise modelling domain based on the location of the Project noise emission sources and predicted noise levels for Project Constriction and Operations phases, as well as the location of potential sensitive receptors. The Noise modelling domain was established so that it would be inclusive of, at minimum, any predicted noise contours above 35 dBA, a threshold value criteria for baseline nighttime noise levels adopted from the Alberta Energy and Utilities Board (Alberta ERCB 2007).

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FIGURE 6.1-2

Beaver Dam Mine Project

Spatial Boundaries: Noise

Beaver Dam Mine Site

Touquoy Mine Site

Haul Road

- Local Assessment Area
- Regional Assessment Area
- Project Area



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 1.25 2.5 5 km

1:90,000 Scale when printed @ 11" x 17"

Drawn By: EP Date: 2021-04-28

Reviewed By: XX

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

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Document Name: BD_EIS_Figure6.1-2 Noise Spatial Boundaries

500000 510000 520000

4990000 4980000

The Regional Assessment Area (RAA) extends beyond the LAA as to encompass potential indirect effects of Noise with other related VCs, such as human health and wildlife. Direct effects on the Noise VC from the Project are not expected to occur in the RAA.

6.1.6.1.2 Temporal Boundaries

The temporal boundaries used for the assessment of effects to ambient noise are the Construction phase, Operational phase, and Active Closure.

Construction Phase (1 Year)

In the updated Project Description, the timeline for construction is now planned to be less than 1 year; and was previously anticipated to be up to 2 years. For construction activities lasting less than one year, Health Canada's "Guideline for Evaluating Human Health Impacts in Environmental Assessment: Noise" (Health Canada 2017) categorizes the noise effects as 'short-term construction noise exposure'.

Operations Phase (5 Years)

Crushed ore from the Project will be transported by truck via the Haul Road to the existing and fully permitted Touquoy Mine. Processing of ore from the Beaver Dam gold deposit at the existing the Beaver Dam Mine Site is anticipated to begin construction in 2022, come into production in 2023, cease operations in 2027 and then be reclaimed.

Active Closure (2 Years)

Decommissioning phase will involve infrastructure demolition, site reclamation and environmental monitoring activities. Anthropogenic noise during Active Closure (and Post-Closure) periods will be substantially lower than noise generated during Construction and Operations phases. Therefore, predictive modelling and subsequent assessment of potential effects focus on the Construction and Operations phases, which are the temporal boundaries associated with the greatest amount of anthropogenic noise. Active Closure and post-closure phases will not be considered further in this assessment.

6.1.6.1.3 Technical Boundaries

No technical boundaries were identified for the effects assessment of noise.

6.1.6.1.4 Administrative Boundaries

Noise within the Project site is regulated by the province through the Workplace Health and Safety Regulations, which establishes the noise environment needed to maintain worker health. The Nova Scotia Pit and Quarry Guidelines (NSE 1999) indicate that noise levels at the boundaries of the Beaver Dam Mine Site and Touquoy Mine Site are not to exceed the following levels:

- Leq $\leq$ 65 dBA between 0700 to 1900 hours (daytime);
- Leq $\leq$ 60 dBA between 1900 to 2300 hours (evening); and
- Leq $\leq$ 55 dBA between 2300 to 0700 hours (night-time, Sunday and statutory holidays).

The *Guidelines for Environmental Noise Measurement and Assessment* (NSE 2005) also require these noise levels to be met at locations where people normally live, work, or take part in recreation.

6.1.6.2 Thresholds for Determination of Significance

Residual effects are effects to VCs that are predicted to occur even after the implementation of mitigation measures (Section 5.10). Significant residual effects for the Noise VC would be defined as having high magnitude (i.e., an **exceedance** of the maximum noise or vibration limits), occur beyond the PA and LAA, be of long-term to permeant duration, occur at regular intervals or be continuous throughout the Project, and be only partially reversible to irreversible (Table 6.1-4). The screening of project effects, and mitigation measures, are assessed in aggregate to determine whether the residual impacts are "Not Significant" or "Significant" according to the following definitions.

Table 6.1-4: Noise Quality Characterization Criteria

Criteria	Groundwater Quality Impact Description
Magnitude	• **Negligible**: predicted change to noise is less than 35 dBA, a threshold value criteria for baseline nighttime noise levels adopted from the Alberta Energy and Utilities Board (Alberta ERCB 2007) and less than 45 dBA, which has been used to assess effects to Wildlife . • **Low**: Exceeds 35 dBA, a threshold value criteria for baseline nighttime noise levels adopted from the Alberta Energy and Utilities Board (Alberta ERCB 2007) but does not exceed 45 dBA, which has been used to assess effects to Wildlife . • **Medium**: Exceeds not exceed 45 dBA, which has been used to assess effects to Wildlife. • **High**: Predicted Noise Levels exceeds NSE (1999) Guidelines that include: • Leq $\leq$ 65 dBA between 0700 to 1900 hours (daytime); • Leq $\leq$ 60 dBA between 1900 to 2300 hours (evening); and • Leq $\leq$ 55 dBA between 2300 to 0700 hours (night-time, Sunday and statutory holidays).
Geographical Extent	• **Discrete**: effect is limited to the immediate footprint or Project Area (PA). • **Local**: effect is limited to the near-field Local Assessment Area. • **Potential Regional**: effect persists to the far-field Local Assessment Area and Regional Assessment Area.
Timing	• Timing represents seasonal occurrence of the effect. Nice propagation in winter months may be higher than spring summer when deciduous attenuate noise.
Duration	• **Short term**: effect is restricted to Construction and/or Operations Phases. • **Medium term**: effect occurs in Construction Phase and Operations. • **Long term**: Effect persists in PC.
Frequency	• **Intermittent**: VC interaction or effect will occur at irregular intervals throughout any Project Phase. • **Regular**: effect occurs on a regular basis but not continuous basis. • **Continuous**: effect occurs constantly.
Reversibility	• **Reversible**: effect can be reversed. • **Partially reversible**: effect can be partially reversed. • **Irreversible**: effect cannot be reversed, is of permanent duration.

6.1.6.3 Noise Modelling Methodology

Potential Noise interactions and effects for Construction and Operations are quantitatively assessed by acoustic modelling. The technical reports documenting the updated approach and inputs for Noise modelling (Construction, Operations) are provided in Appendix B.1 and Appendix B.2, and are summarized in this section.

The updated noise analysis results presented herein include all identified worst-case human receptor locations (R1 to R9, Figure 6.1-3). Specific non-residential locations of traditional land use and recreation have not been identified for inclusion in the analysis; however, it is understood that traditional and recreational uses such as hunting may occur in areas close to the Project Area.

In summary, an updated acoustical model was undertaken to provide an order of magnitude estimation of the estimated noise from the crushing operations at the Beaver Dam Mine Site and haul truck travel along the Haul Road. The noise sources and topography were input into an industry standard acoustic model. Computer Aided Noise Abatement Acoustical Modeling Software (Cadna A), version 4.6, is based on the ISO 9613-2 standard "Acoustics - Attenuation of Sound During Propagation Outdoors - Part 2: General Method of Calculation." The Cadna A model is the industry standard for environmental noise modeling in Canada.

To predict the future worst-case noise impacts from the Project activities, representative octave band noise data was used, measured from processing equipment similar to what is noted to be required for the Project. This data was obtained from the Department of Environment Food and Rural Affairs (DEFRA) "Update of Noise Database for Prediction of Noise on Construction and Open Sites, 2005 and 2006". The United States Department of Transportation, Federal Highway Administration (FHWA) document "FHWA Roadway Construction Noise Model User's Guide, 2006" was used as a supplemental document to obtain sound level data for equipment not listed by DEFRA.

For the Touquoy Mine Site An acoustic assessment was conducted as part of the 2007 Focus Report, focusing on sound emissions from noise sources identified at the facility and determining effects on sensitive receptors including; Camp Kidston (3 km north of the Touquoy mine), the nearest permanent resident (5 km north of the proposed open pit) and the Scraggy Lake area. Sound level impacts were compared to the Nova Scotia Guidelines for Environmental Noise Measurement and Assessment. An estimated worst case facility sound level measurement for a 1-hour period was estimated for each receptor near Touquoy Mine Site.

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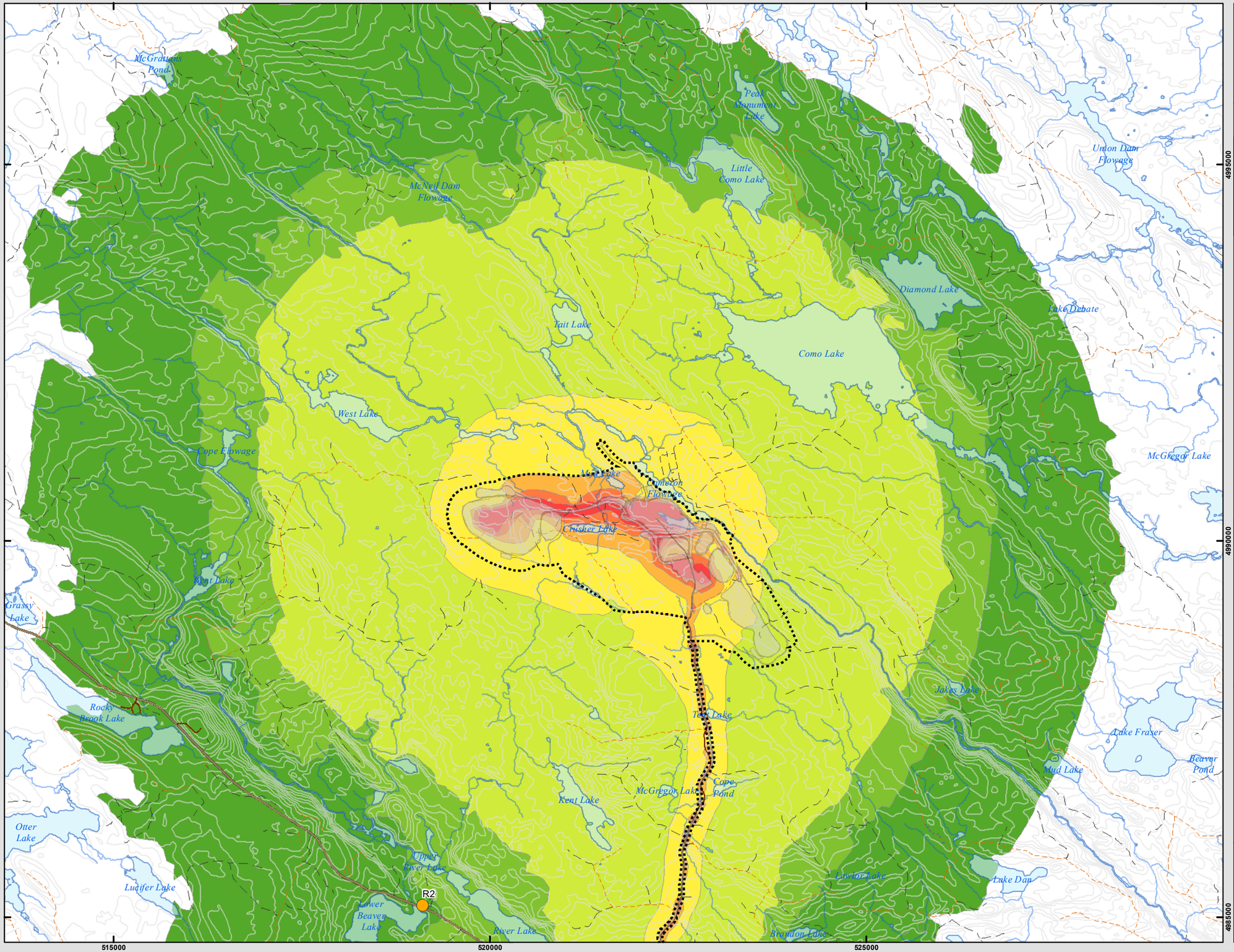
FIGURE 6.1-3A

Beaver Dam Mine Project Noise Modelling Contours Day Time



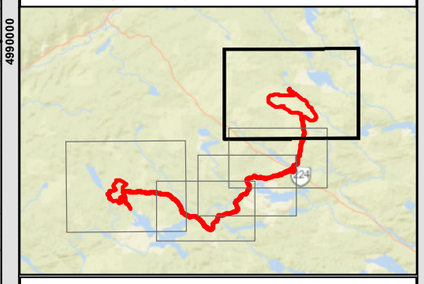
Receptor

Noise Modelling Contours (dBa)

- 65
- 60
- 55
- 45
- 33
- 31
- 27

- Collector Road
- Local Road
- Dry Weather / Seasonal Road
- Track
- NSTDB Mapped Watercourses
- Lakes
- Proposed Infrastructure
- Proposed Property Boundary

Note: Background noise level at all receptors conservatively assumed to be 33 dBA during the day based on ambient sound level monitoring conducted at several locations in the Project Area between 2007 and 2016 (GHD, 2018)



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Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 0.5 1 2 km

1:46,790 Scale when printed @ 11" x 17"

Drawn By: EP Date: 2021-05-09
Reviewed By: XX

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

McCallum Environmental Ltd.

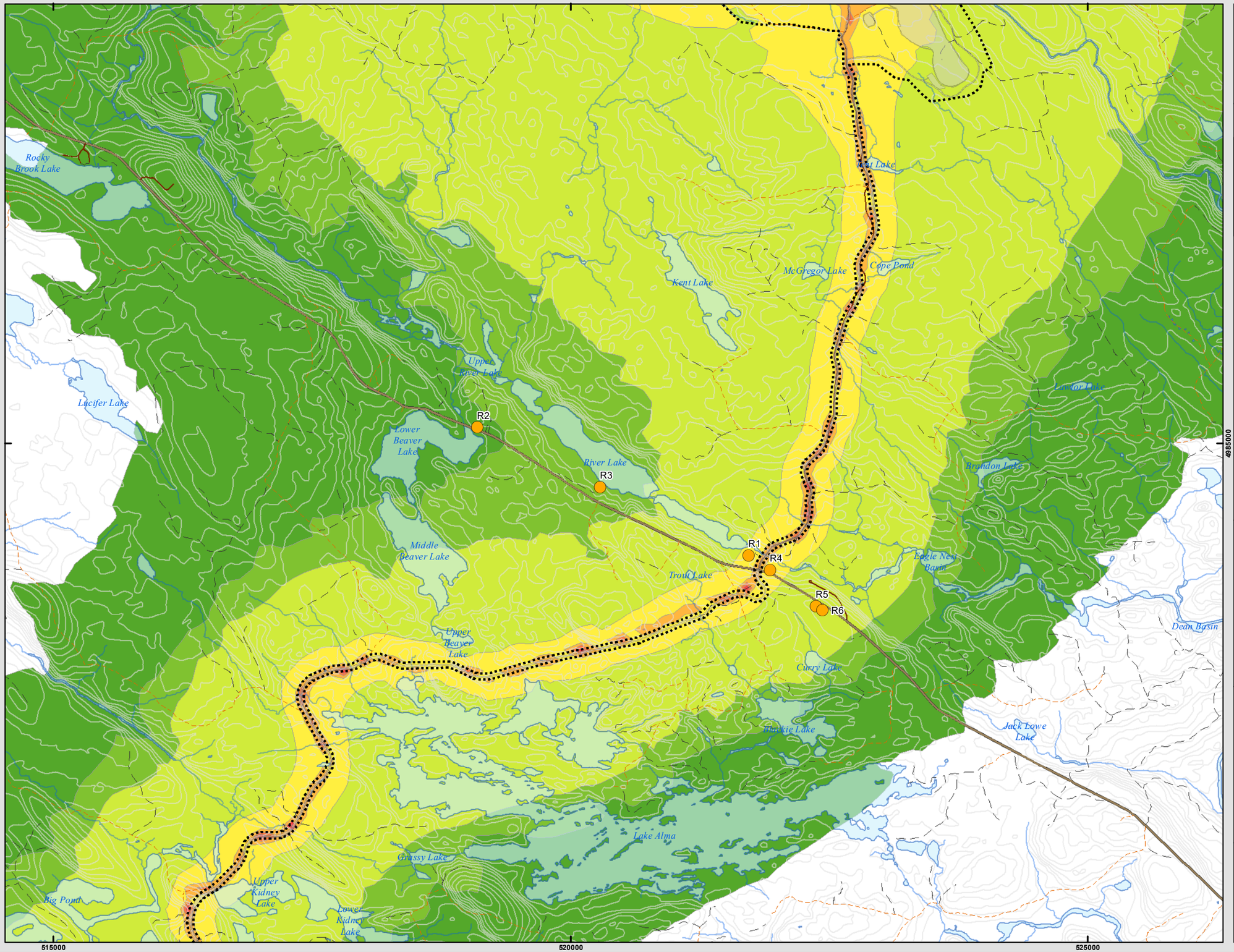
Document Name: BD_EIS_Figure6-1-XNoise

Prepared For:

Atlantic Gold

FIGURE 6.1-3B

Beaver Dam Mine Project Noise Modelling Contours Day Time



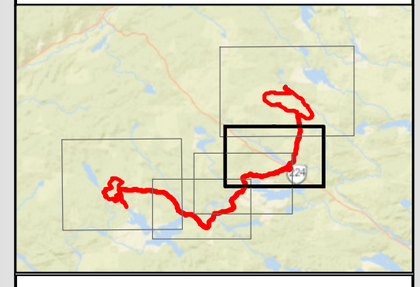
Receptor

Noise Modelling Contours (dBa)

- 65
- 60
- 55
- 45
- 33
- 31
- 27

- Collector Road
- Local Road
- Dry Weather / Seasonal Road
- Track
- NSTDB Mapped Watercourses
- Lakes
- Proposed Infrastructure
- Proposed Property Boundary

Note: Background noise level at all receptors conservatively assumed to be 33 dBA during the day based on ambient sound level monitoring conducted at several locations in the Project Area between 2007 and 2016 (GHD, 2018)



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 0.45 0.9 1.8 km

1:34,040 Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed By: XX

Date: 2021-05-09

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

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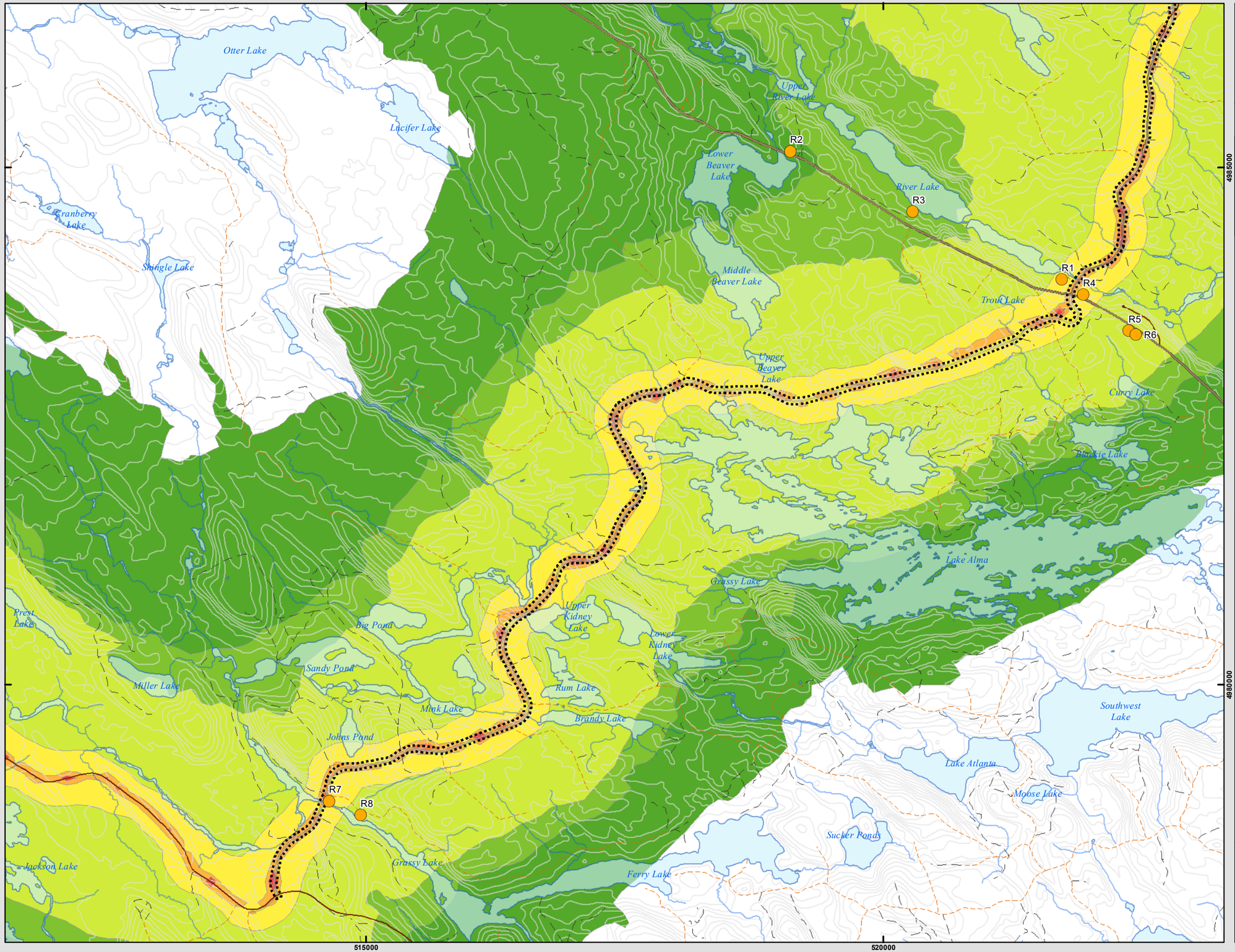
Document Name: BD_EIS_Figure6-1-XNoise



Prepared For:

Atlantic Gold

FIGURE 6.1-3C

Beaver Dam Mine Project Noise Modelling Contours Day Time

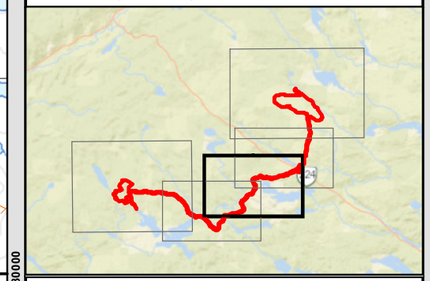
Receptor

Noise Modelling Contours (dBa)

- 65
- 60
- 55
- 45
- 33
- 31
- 27

- Collector Road
- Local Road
- Dry Weather / Seasonal Road
- Track
- NSTDB Mapped Watercourses
- Lakes
- Proposed Infrastructure
- Proposed Property Boundary

Note: Background noise level at all receptors conservatively assumed to be 33 dBA during the day based on ambient sound level monitoring conducted at several locations in the Project Area between 2007 and 2016 (GHD, 2018)



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 0.45 0.9 1.8 km

1:34,040 Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed By: XX

Date: 2021-05-09

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

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Document Name: BD_EIS_Figure6-1-XNoise

Prepared For:

Atlantic Gold

FIGURE 6.1-3D

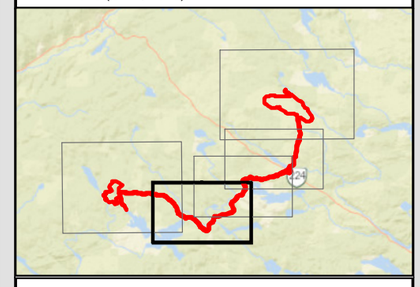
Beaver Dam Mine Project Noise Modelling Contours Day Time

Receptor

Noise Modelling Contours (dBa)
- 65
- 60
- 55
- 45
- 33
- 31
- 27

Local Road
Dry Weather / Seasonal Road
Track
NSTDB Mapped Watercourses
Lakes
Proposed Infrastructure
Proposed Property Boundary

Note: Background noise level at all receptors conservatively assumed to be 33 dBA during the day based on ambient sound level monitoring conducted at several locations in the Project Area between 2007 and 2016 (GHD, 2018)



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 0.45 0.9 1.8 km

1:34,040 Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed By: XX

Date: 2021-05-09

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

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Document Name: BD_EIS_Figure6-1-XNoise

510000

515000

4980000

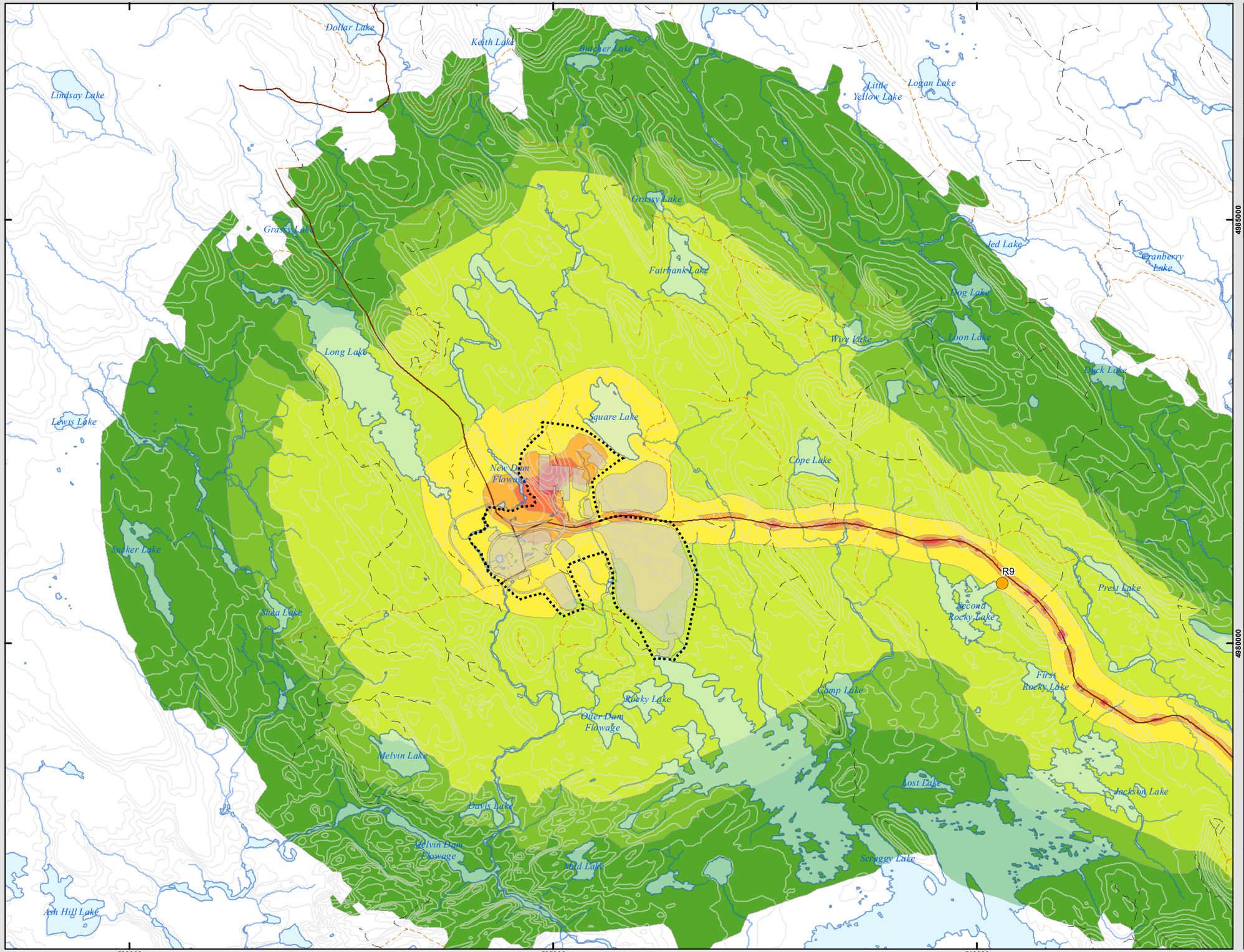
Shingle Lake
Middle Beaver Lake
Wire Lake
Loon Lake
Duck Lake
Upper Beaver Lake
Cope Lake
R9
Prest Lake
Second Rocky Lake
Big Pond
Upper Kidney Lake
Grassy Lake
Lower Kidney Lake
Sandy Pond
Miller Lake
Rum Lake
Mink Lake
Brandy Lake
First Rocky Lake
Camp Lake
Johns Pond
R7
R8
Lost Lake
Jackson Lake
Grassy Lake
Ferry Lake
Scraggy Lake
Bear Lake
Philip Lake
Boot Lake
Moose Lake
German Lake
Weeks Lake

Prepared For:

Atlantic Gold

FIGURE 6.1-3E

Beaver Dam Mine Project Noise Modelling Contours Day Time



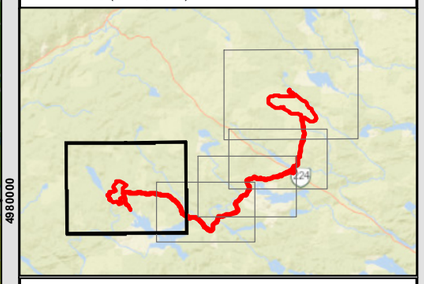
Receptor

Noise Modelling Contours (dBa)

- 65
- 60
- 55
- 45
- 33
- 31
- 27

- Local Road
- Dry Weather / Seasonal Road
- Track
- NSTDB Mapped Watercourses
- Lakes
- Proposed Infrastructure
- Proposed Property Boundary

Note: Background noise level at all receptors conservatively assumed to be 33 dBA during the day based on ambient sound level monitoring conducted at several locations in the Project Area between 2007 and 2016 (GHD, 2018)



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 0.5 1 2 km

1:41,880 Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed By: XX

Date: 2021-05-09

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

McCallum Environmental Ltd.

Document Name: BD_EIS_Figure6-1-XNoise

6.1.7 Project Activities, Noise Interactions, and Predicted Effects

6.1.7.1 Overview

The Project will operate as a satellite open pit mine. Crushed ore from the Project will be transported by truck via the Haul Road to the existing and fully permitted Touquoy Mine. Noise will be generated at the Beaver Dam Mine Site, the Haul Road, and the Touquoy Mine Site. Sources of Project-related noise include heavy machinery and trucking during the Construction phase and haul truck and mining machinery traffic during Operations. The majority of mining operations will occur in the pit well below current ground elevation, which will attenuate the effects of noise. During the Construction and Operation phase of the Project, rock blasting using explosives was also considered as noise and vibration that would be generated.

Table 6.1-5 and Table 6.1-6 present specific potential Noise interactions with Project activities for Construction and Operation phases.

Potential Noise interactions and effects for Construction and Operations were subsequently quantitatively assessed by acoustic modelling (Section 6.1.6.3). The Noise contour plots and overall study area are provided in Figures 6.1-3 and 6.1-4 and indicate the predicted noise levels produced by the Project. These noise contours are used to assess effects on wildlife, birds, traditional uses and socioeconomic conditions (Section 6.11 to 6.12 and 6.16); details for all isopleths are provided in Appendix B.1 and B.2.

Table 6.1-5: Potential Noise Interactions with Project Activities at Beaver Dam Mine Project Area during the Construction

Project Area Location	Duration	Relevant Project Activity
Beaver Dam Mine Site	<1 Year	• Clearing, grubbing, and grading in preparation of construction • Drilling and rock blasting in preparation of construction • Till and waste rock removal from site preparation transport and storage • Existing settling pond dewatering in preparation of for construction • Watercourse and wetland alteration in preparation of construction • Mine Site road construction • Equipment to power lighting at Mine Sites and along roads • Surface infrastructure installation and construction • Collection and settling ponds construction • General management of wastes derived from site • General Construction activities
Along Haul Road	<1 Year	• Clearing, grubbing, and grading in preparation of construction • Till and waste rock from site preparation transport and storage • Watercourse and wetland alteration in preparation of construction • Haul road construction and upgrades
Touquoy Mine Site	<1 Year	• Tailings pipeline, make-up water pipeline alteration, and relocation of reclaim infrastructure

Table 6.1-6: Potential Noise Interactions with Project Activities at Beaver Dam Mine Site During the Operation Phase

Project Area Location	Duration	Project Interaction
Beaver Dam Mine Site	5 Years	• Rock blasting to access and extract ore • Management of waste rock produced from crushing and/or blasting and preparing ore for transport • Petroleum products management • Site maintenance and repairs • Equipment to power lighting at Mine and along roads • General management of wastes derived from operation activities
Along Haul Road	5 Years	• Ore transport • Road lighting • Equipment to power lighting at Mine Sites and along road • Haul road maintenance and repairs
Touquoy Mine Site	5 Years	• Ore management and processing • Lighting equipment for on-site facilities and Mine roads

The key sensitive receptor in the area is the Beaver Lake IR 17; a satellite community of the Millbrook First Nation located approximately 5 km south of the Beaver Dam Mine Site. A permanent resident is located along the Beaver Dam Mines Road near Highway 224. A seasonal dwelling is located on the Cross Road near Mooseland Road.

Camp Kidston, which operates only in the summer months, is located 3.5 km northeast of the Touquoy Mine Site. According to the Proponent, the nearest permanent full-time occupied residences are located approximately 5.8 km to the north of the open pit along Caribou Road.

The Touquoy Mine Site is in production. The primary effect of the continued use of the Touquoy Mine Site is the continued generation of noise due to haul truck traffic on the site, processing of Beaver Dam ore. There are no new or additional effects from noise anticipated to be caused by the processing of ore and the management of tailings (exhausted pit) from the Project, as no new construction or disturbance is required at the Touquoy Mine Site related to the processing of Beaver Dam ore. The effects of noise previously described for the Touquoy Mine Site in the EARD and Focus Report are presented in the sections below.

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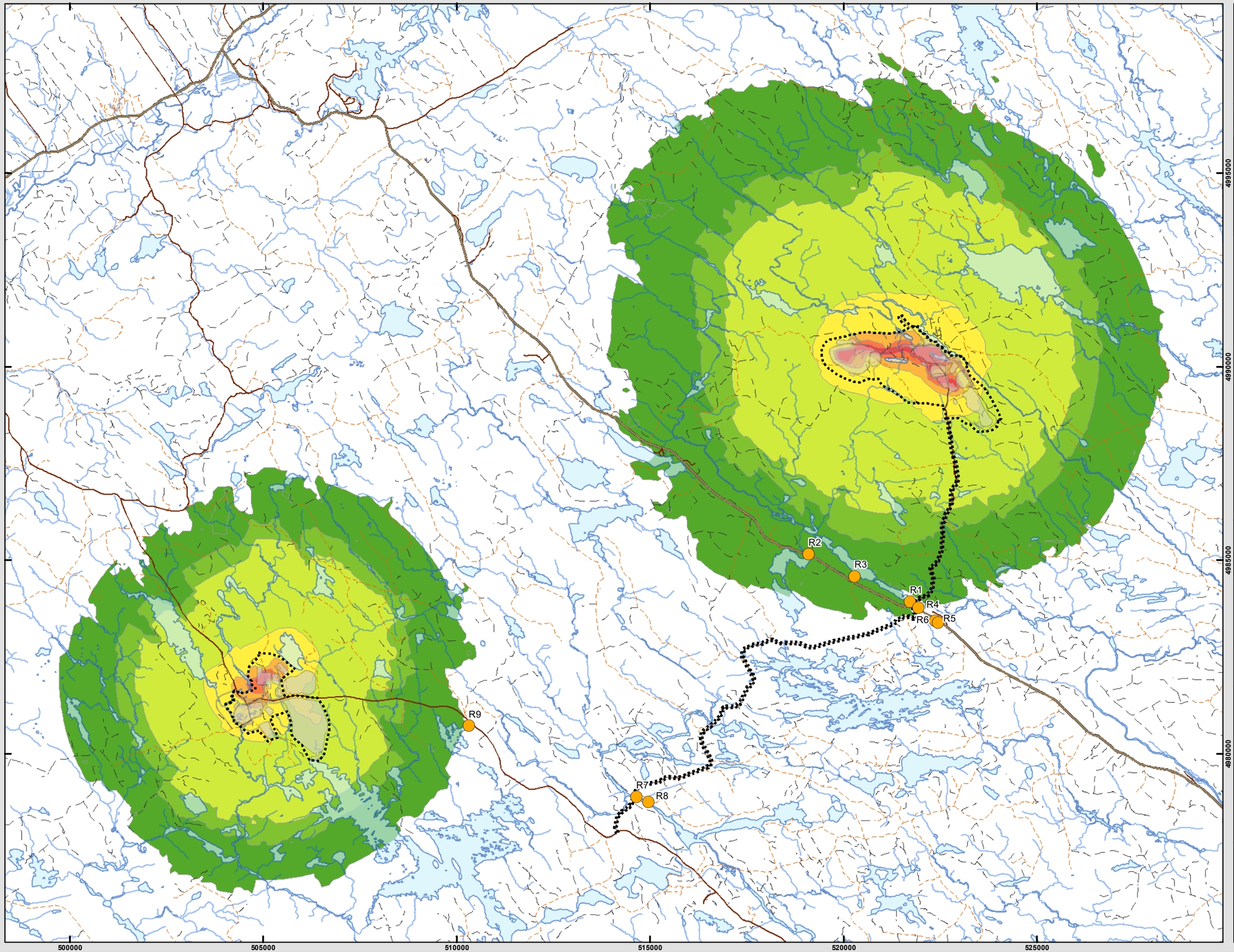
FIGURE 6.1-4

Beaver Dam Mine Project Noise Modelling Contours Night Time



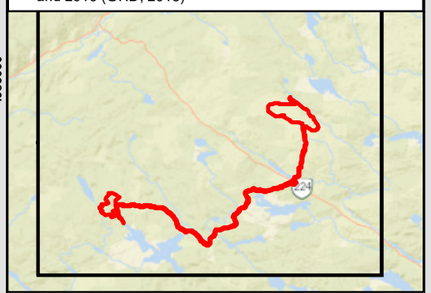
Receptor

Noise Modelling Contours (dBa)

- 65
- 60
- 55
- 45
- 33
- 31
- 27

- Collector Road
- Local Road
- Dry Weather / Seasonal Road
- Track
- NSTDB Mapped Watercourses
- Lakes
- Proposed Infrastructure
- Proposed Property Boundary

Note: Background noise level at all receptors conservatively assumed to be 33 dBA during the day based on ambient sound level monitoring conducted at several locations in the Project Area between 2007 and 2016 (GHD, 2018)



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 0.75 1.5 3 km

1:91,000 Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed By: XX

Date: 2021-05-09

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McCallum Environmental Ltd.

Document Name: BD_EIS_Figure6-1-3 Noise_Night

6.1.7.2 Model Results: Prediction of Noise Effects, Construction

The acoustic modelling has been updated to reflect the current infrastructure layouts for the Project and estimates of construction activities (Appendix B.1). An assessment of predicted construction noise has been included in accordance with Health Canada's "Guideline for Evaluating Human Health Impacts in Environmental Assessment: Noise" (Health Canada 2017). Site specific topography and mine layout was used for the model, as well as all mobile sources, and equipment.

Construction activities at the Project have a planned duration of less than one year (Table 6.1-5). The Health Canada guideline for noise suggests that noise from construction activities lasting less than one year (i.e., short-term construction) be assessed using the United States Environmental Protection Agency (US EPA 1974) methodology. This methodology provides mitigation noise levels (MNLs) as criteria with various correction factors to evaluate whether adverse effects are likely, and if mitigation should be considered.

To support the Noise Assessment for Construction, the suggested base MNL is 47 dBA, which is specified in terms of the day-night sound level (Ldn), and assumes that the dominant sources of noise are tonal/impulsive. Ldn is an equivalent continuous sound level taken over 24 hours, with the night-time (10:00 PM to 7:00 AM) sound levels adjusted by +10 dB to account for increased noise sensitivity at night (Health Canada 2017). The Health Canada guideline also specifies correction factors that should be applied to the base MNL dependent on the type of community in which the construction activities occur, as well as some other additional corrections. These correction factors are summarized in Table 6.1-7.

Table 6.1-7: Corrections to Determine Appropriate Mitigation Noise Levels for Short-Term Construction

Community Description	Applied Correction Factors	Suggested MNL
Quiet suburban or rural	-	7 dBA Ldn
Norman suburban	+5 dB	52 dBA Ldn
Urban residential	+10 dB	57 dBA Ldn
Noisy urban	+15 dB	62 dBA Ldn
Very noisy urban	+20 dB	67 dBA Ldn
Other Additional Correction Factors		
Construction duration less than 2 months	+10 dB	-
Winter (or windows always closed)	+5 dB	-
Negligible tonal or impulsive noise	+5 dB	-

Source: Health Canada 2017.

Notes: bB = decibels; Ldn = day-night sound level; MNL = mitigation noise levels; - = not applicable.

The Project is located in an area best described as rural, where the corresponding suggested MNL is 47 dBA Ldn. Other additional correction factors, where applicable. Nine worst-case human receptor locations have been identified for assessment (R1 to R9; Figure 6.1-3).

At the worst-case residential receptors, noise emissions from construction activities at the Beaver Dam Mine Site are negligible in comparison to noise emissions from road construction and material transport on the roads. It is predicted that construction of Section 3B of the Haul Road (Section 2, Figure 2.3-3) will produce the most significant noise levels at residential receptors. At the beginning of construction of this section of the Haul Road, construction activities will occur approximately 120 m from R4 and 170 m from R1. However, as construction of Section 3B of the Haul Road progresses (Section 2, Figure 2.3-3), construction equipment will move farther from these receptors and noise impacts will decrease.

Construction noise was evaluated using the following two model scenarios to represent worst-case noise emissions during the Construction Phase:

- **Scenario A:** Road construction near R1 and R4 (less than 2 months of construction of Section 3B of the Haul Road).
- **Scenario B**: Road construction minimum 500 metres from R1 and R4 (after approximately 2 months of construction of Section 3B of the Haul Road).

For Scenario A, the dominant sources of noise are heavy road construction equipment, which are conservatively assumed to include one dozer, one wheeled loader, and one excavator conducting excavation/earthworks continuously for the entire daytime period, as well as one dump truck unloading for 2.5 hours per day at each road construction location (i.e., at each end of Section 3B and 4C of the Haul Road [Section 2, Figure 2.3-3].). Since this scenario represents construction activities that are estimated to have a duration of less than 2 months (i.e., correction of +10 dB applies), the corrected MNL for this scenario is 57 dBA Ldn.

For Scenario B, the dominant sources of noise are trucks carrying raw materials along the haul road and other roadways to deposit material for construction of Section 3B of the haul road. It is assumed that truck traffic will include 95 one-way trips per day on the haul road, and up to 60 one-way trips per day on Highway 224 through Beaver Lake IR 17. This assumption is conservative, as road construction material will be sourced primarily from three quarries along the length of Section 3B, with additional construction materials, if required, sourced from either the Touquoy or Beaver Dam Mine Sites or other local approved facilities (Section 8). Truck traffic is not considered a tonal/impulsive source of noise (i.e., correction of +5 dB applies), therefore the corrected MNL for this scenario is 52 dBA Ldn.

Based on the model scenarios, assuming concurrent construction of the Haul Road and Beaver Dam Mine Site facilities, predicted construction noise effects at each of the identified receptors are summarized in Table 6.1-8 and Figure 6.1-4; complete details are provided in Appendix B.1.

Table 6.1-8: Predicted Noise Effects during the Construction Phase of the Project

Receptor ID	Receptor Description	Scenario A: Road Construction Near R1 and R4 (<2 months)		Scenario B: Remainder of Construction (>2 months)		Compliance
		Predicted Noise Level (Ldn)	MNL[a] (Ldn)	Predicted Noise Level (Ldn)	MNL[a] (Ldn)	
R1	9 Beaver Dam Mine Road (Marlborough Property)	53	57	49	52	Yes
R2	4112 Highway 224 (Beaver Lake IR 17)	52	57	52	52	Yes
R3	4115 Highway 224 (Cottage on Crown Land)	43	57	43	52	Yes
R4	3492 Highway 224 (Hobbs Property)	56	57	49	52	Yes
R5	3379 Highway 224 (McLeod Property)	41	57	40	52	Yes
R6	3373 Highway 224 (Smith Property)	38	57	39	52	Yes
R7	Tangier River (Deepwood Estates Property)	52	57	52	52	Yes
R8	Tanger River (Musqudoboit Lumber Co. Ltd. Property/John Dickson Lease)	41	57	41	52	Yes
R9	5579 Mooseland Road (Lloy Property)	49	57	49	52	Yes

The prediction results for Construction (Table 6.1-8; Figure 6.1-4) represent the typical expected construction activities and equipment from the Beaver Dam Mine Site and Haul Road, at the predictable worst-case locations, assuming Construction activities will be limited to the day and evening time periods only (7:00 AM to 11:00 PM). Noise level contributions at each receiver due to each noise source are provided in Appendix B.1.

During the worst-case scenario, noise effects from the Construction Phase activities are within the suggested MNL criteria. For Scenario A, these worst-case effects are predicted at the start of construction of Section 3B of the Haul Road, and will diminish significantly as construction progresses due to the increased distance from the receptors. Based on these results, adverse effects are expected to be unlikely, and mitigation is not required.

6.1.7.3 Model Results: Predicted of Noise Effects, Operations

The methodologies used and assumptions made for the Noise Impact Study are provided in Appendix B.2. The assessment considered residential points of reception (POR) and property boundary (PBR) assessments. Site specific topography and mine layout was used for the model, as well as all mobile sources, equipment, and open pit operations were included.

The calculated noise impacts at each POR are presented below. For the processing of raw materials at the Beaver Dam Mine Site during the Operation Phase, a jaw crusher (noise model source ID: S120) will be used at the crusher pad of the Beaver Dam Mine and is considered in the Noise Effects modelling. Truck traffic used in the noise assessment and related modelling has been adjusted to a 16-hour shift, 7:00 AM to 11:00 PM.

Figure 6.1-4 presents Noise contour plots for the overall study area, for day and night, respectively.

6.1.7.3.1 Residential Receptors

Nine worst-case human receptor locations have been identified for assessment (R1 to R9; Figure 6.1-3). During the Operation Phase, predicted noise levels at each of the identified residential receptors, inclusive planned and required noise mitigation measures, are summarized in Section 6.1.8. The predicted noise levels include equipment and activities at the Beaver Dam Mine Site, the Haul Road, and the Touquoy Mine Site.

Predicted noise effects during the Operation Phase of the Project are within the applicable sound level limits at all the identified receptors (Table 6.1-9). Most notably, predicted noise levels during the nighttime period are at least 27 dBA below the applicable nighttime sound level limit at all identified receptors.

Table 6.1-9: Predicted noise effects during the Operation Phase of the Project

Receptor ID	Receptor Description	Noise Level (dBA) (Day/Evening/Night)	Sound Level Limit [a] (dBA) (Day/Evening/Night)	Compliance
R1	9 Beaver Dam Mine Road (Marlborough Property)	48 / 48 / 27	65 / 60 / 55	Yes
R2	4112 Highway 224 (Beaver Lake IR 17)	30 / 30 / 28	65 / 60 / 55	Yes
R3	4115 Highway 224 (Cottage on Crown Land)	32 / 32 / 28	65 / 60 / 55	Yes
R4	3492 Highway 224 (Hobbs Property)	50 / 50 / 27	65 / 60 / 55	Yes
R5	3379 Highway 224 (McLeod Property)	39 / 39 / 27	65 / 60 / 55	Yes
R6	3373 Highway 224 (Smith Property)	37 / 37 / 27	65 / 60 / 55	Yes
R7	Tangier River (Deepwood Estates Property)	53 / 53 / 20	65 / 60 / 55	Yes
R8	Tanger River (Musqudoboit Lumber Co. Ltd. Property/John Dickson Lease)	42 / 42 / 20	65 / 60 / 55	Yes
R9	5579 Mooseland Road (Lloy Property)	50 / 50 / 27	65 / 60 / 55	Yes

Source: NSEL 1999.

6.1.7.3.2 Property Lines

Noise levels were evaluated at the property boundaries of the Beaver Dam Mine, Haul Road, and Touquoy Mine Site (Appendix B.2). All of the noise sources from the Operations at the Beaver Dam Mine, Haul Road, and Touquoy Mine Site were used in the property line noise level predictions (Appendix B.2). Predicted noise levels were also evaluated at the property lines for the Operation Phase. The NSEL regulates noise levels at the property lines of mines using noise level limits contained in the "Pit and Quarry Guidelines" (NSEL 1999). The noise level criteria contained in this guideline are as follows:

- Leq ≤ 65 dBA between 7:00 AM and 7:00 PM;
- Leq ≤ 60 dBA between 7:00 PM and 11:00 PM; and
- Leq ≤ 55 dBA between 11:00 PM and 7:00 AM.

Operations, infrastructure, and property boundaries for the Beaver Dam Mine have been updated to mitigate predicted noise levels at the property line; Figure 6.1-5 and Figure 6.1-6 presents Noise contour plot results for the overall study area. The following noise mitigation measures are incorporated into the current design of the Beaver Dam Mine:

- The pit entrance/exit has been relocated to the west side of the pit, farther from the northeast property boundary.
- No more than four drills will operate concurrently during any day, evening, or nighttime hour.
- Increase the height of the safety berm along the north boundary of the pit.

The maximum predicted noise levels at the property boundaries for each of the Beaver Dam Mine Site and Touquoy Mine Site, inclusive of planned mitigation measures for Noise, are presented in Table 6.1-10.

Predicted noise levels at the property line of the Beaver Dam Mine, along the length of the Haul Road, and the Touquoy Mine Site are within the sound level limits specified in the NSEL Pit and Quarry Guidelines (NSEL 1999) provided that the recommended mitigation measures for Option A or Option B are applied at Beaver Dam Mine Site (Table 6.1-10). Appendix B.2 provides the applicable noise level isopleths in areas of residential receptors, and at the Beaver Dam Mine Site, Touquoy Mine Site, and Haul Road.

Table 6.1-10: Maximum (Worst-case) Predicted Noise Levels at Property Boundaries

Property Line Description	Maximum Noise Level (dBA) (Day/Evening/Night)	Sound Level Limit [(a)] (dBA) (Day/Evening/Night)	Compliance
Beaver Dam Mine Site Property, Option A	55/55/55	65 / 60 / 55	Yes
Beaver Dam Mine Site Property, Option B	55 /55 /55	65 /60 /55	Yes
Haul Road[(a)] (30 m from centerline of road)	59 /59 /-	65 / 60 / 55	Yes
Touquoy Mine Site Property	54 /54 /54	65 / 60 / 55	Yes

Notes: [(a)] Truck traffic used in the noise assessment and related modelling has been adjusted to a 16-hour shift, including the nighttime hour of 6:00 AM to 7:00 AM.

(a) NSEL 1999.

6.1.7.4 Noise Effects Summary

6.1.7.4.1 Beaver Dam Mine Site and Haul Road

The nearest permanent residential dwelling from the Beaver Dam Mine Site is located in the Beaver Lake IR 17. This is located approximately 5 km south of the Beaver Dam Mine Site and is separated from the Beaver Dam Mine Site by forest and two topographic ridges. These ridges block direct views from the houses to all work areas. The pit is located in a topographic depression and the crusher is in a more elevated position; however, distance to any sensitive receptors would mitigate any effects. The modelling (Section 6.1.7.2, Section 6.1.7.3) supports a conclusion that the likelihood of any dwellings in this rural area being occasionally impacted by noise from the Beaver Dam Mine Site is very low. The majority of mining operations will occur in the pit well below ground surface thereby provide excellent noise shielding. The modelling used a conservative pit depth of 10 m, therefore, as the pit depth increases mining noise (blasting etc.) will diminish.

Sources of Project related noise on the Haul Road will include heavy machinery and truck traffic during the construction and operational phases. The nearest point of the Haul Road to the Beaver Lake IR 17 is approximately 3 km. The Haul Road is currently in use for forestry activities and occasional construction activities for road upgrades. The activities on the Haul Road related to the Beaver Dam Mine Site will be similar in nature but larger in scale. The predicted sounds levels at the IR are equivalent to the lowest average (30 dBA) ambient values measured during sampling. The likelihood of Beaver Lake IR 17 being impacted by sound from the Haul Road is also very low (Appendix B.2).

Further assessment of baseline monitoring before construction, during construction, and during mining operations will be conducted to ensure impacts are below the NSE guidelines and the Health Canada noise guidance which allows for an incremental increase in the percentage of highly annoyed population in the community to remain below 6.5% at sensitive receptors. At 500 m from the Beaver Dam Mine Site, the sound levels are predicted to be below the noise goals, with sound levels dropping towards the ambient levels with distance. Blasting events may provide a slight spike in the sound levels at distance for a brief period of time at the same time of day (daytime) once or twice a week. This assessment was conducted prior to the change in the waste rock stockpile (WRSP) configuration and the introduction of the western waste rock stockpile. Given the distance from receptors, the topography, and proposed operational scenarios for waste rock stockpile construction, the assessment conclusions for the revised site are anticipated to be the same.

Predicted noise impacts were estimated using an acoustical model for provincial guidelines. The model was undertaken to predict noise from during the Construction phase, mining and crushing operation, and haul truck travel along the Haul Road (Section 6.1.7.2, Section 6.1.7.3). The results are cumulative for the equipment that was evaluated. Additional monitoring could be undertaken in the future if required as part of the Industrial Approval process.

The mine operations are at times expected to increase the ambient sound levels for certain distances from the Beaver Dam Mine Site and Haul Road. Based on the baseline ambient sound level monitoring, ambient sound levels in the LAA are as low as 33 dBA during the day, 31 dBA in the evening, and 27 dBA at night. Predicted noise levels from the proposed mine operations attenuate over large distances to these low ambient conditions. For instance, sound levels at Beaver Lake IR are expected to be 33 dBA at night, so above baseline but well below the 55 dBA regulated threshold for the overnight period.

6.1.7.4.2 Effects Summary Touquoy Mine Site

At the Touquoy Mine Site, the primary source of noise during the processing of Beaver Dam ore will be the crushing circuit, CIL circuit, and service vehicles. All other processing equipment is located within the processing building. As indicated in the EARD, the maximum sound generated at the processing plant is 80 dBA, which attenuates to the background of 40 dBA over a distance

of 500 m. Based on an additional acoustic assessment conducted as part of the Focus Report, predicted values at the sensitive receptors ranged from 34.6 to 42.3 dBA. All estimated values are below the NSEL daytime sound level criteria on the dBA scale. Predicted noise levels at Scraggy Lake and Camp Kidston were approximately 2 dBA greater than daytime values measured in the baseline study. The predicted sound level at the farthest sensitive receptor from the proposed site was 34.6 dBA, which is below the baseline value measured. The Noise Impact Study (Appendix B.2) shows that the predicted levels for sound propagation from the Touquoy Mine Site for the Project will be below the noise thresholds (day/evening/night) at the property boundaries.

6.1.8 Mitigation

Table 6.1-11 summarizes mitigations measures being considered in the Explosive Management Plan will be developed during the permitting process to reduce noise and vibration impacts.

Table 6.1-11: Mitigation for Noise

Project Phase	Mitigation Measure
C, O	Restrict blasting to a specific and regular daytime schedule during weekdays. Specifically, blasting will not be undertaken on Sundays, or statutory holidays (NSEL 1999)
C	Haul road construction will be restricted to the day and evening periods
O	If necessary, construct a large safety berm along the entire north boundary of the pit, dependent on how raw materials are processed at the Beaver Dam Mine Site.
O	Operating hours for trucking on the Haul Road will be restricted to the day and evening periods only (7AM to 11PM)
O	Maximum 4 drills will operate at the Beaver Dam Mine Site pit at any time during the Operation Phase of the Project
C, O, CL	Implement preventative maintenance plans for all mobile and stationary equipment
C	Noise-reduction as criteria in equipment selection
C, O	Communicate general blasting schedule to the local community
C	Consider placement of stockpiles and infrastructure to mitigate noise migration from processing equipment
C	Consider the use of natural landforms when available as noise barriers when designing final site details and when placing fixed equipment
O	Operating hours for processing plants and trucking on the Haul Road will be limited to reduce nighttime noise levels
O	Regular check by site manager for excessive noise on site and in relation to sensitive receptors so that resolution can be timely
C, O, CL	Implement preventative maintenance plans for all mobile and stationary equipment
C	Noise-reduction as criteria in equipment selection
C, O	Speed reduction
C, O	Use equipment that meets appropriate noise emission standards for off- road diesel equipment
C, O	Subcontractor agreements will include an obligation to comply with environmental protection including noise reduction
C, O	Site design to reduce need for reversing and vehicle reversing alarms
C, O	A procedure, including a response plan, will be available for public to be able to register complaints regarding noise concerns

Noise from the equipment and lack of effective mufflers is a source of noise. Procurement of equipment that meets best practices in terms of noise emissions, and regular maintenance of the equipment will reduce noise levels. Site workers will be trained to ensure equipment is used in ways that minimize noise and are maintained regularly. As part of the workplace health and safety program, noise monitors may be attached to workers from time to time to measure and monitor noise exposure over a shift.

Haul Road construction activities will generally be restricted to the day and evening periods, which will minimize noise along the Haul Road during nighttime hours. The dense forest surrounding the Beaver Dam Mine Site and the Haul Road will also provide noise attenuation, which is not accounted for in the Construction Noise Model to be conservative. Topography and distance from receptors also contribute to a reduction of Project-generated sound at greater distances, and topographical elevation data has been included in the model to account for this effect.

During the Operations phase, the majority of mining will occur in the pit well below ground surface thereby provide excellent noise shielding and blasting will be restricted to daytime hours, per the NSE Pit and Quarry Guidelines (NSEL 1999). Additionally, traffic on the Haul Road will generally be restricted to 12 to 16 hours per day during the operational phase. This will minimize noise along the Haul Road during nighttime hours. The dense forest surrounding the Beaver Dam Mine Site and the Haul Road will also provide a dampening effect to any noise generated; i.e., noise attenuation. Note, this additional nose attenuation was not accounted for in the noise model and thus predictions can be considered conservative in this regard.. Topography and distance from receptors will also provide contribute to a reduction of Project-generated sound at a greater distances, and topographic elevation has been included in the model to account for this effect.

This combination of measures will adequately mitigate potential noise impacts. The mitigation procedures may vary as long as noise levels are in accordance with the regulatory approval.

Additionally, noise monitoring would be completed during each blasting event, as required as required by the NSEL Pit and Quarry Guidelines (NSEL 1999). Blast monitoring generally involves noise and vibration monitoring during each blasting event and includes monitoring at the nearest residence to the Beaver Dam Mine Site, which in this case would be at Beaver Lake IR 17. Monitoring and mitigations explicit to blasting will be described in the Explosive Management Plan that will be submitted as part of the permitting process. Elements of this plan will include site specific monitoring triggers and mitigations.

Under the existing IA for the Touquoy facility, maximum sound levels are prescribed at property boundaries for days, evenings and weekends and monitoring is only required when requested by NSE in response to a complaint or concern. Mitigation measures will be implemented as necessary where sound levels are a concern, i.e., causing annoyance, and monitoring demonstrates exceedances. Mitigation of noise excesses at the property lines are not considered to be critical, as predicted noise levels at the worst-case points of reception are within the applicable limits. To date, no noise complaints have been received or are anticipated. A complaint from the public and/or a First Nation community member would be a trigger for consideration of mitigation, as described below.

Noise monitoring will be completed as directed by regulators or as a result of a complaint or engagement. A draft Engagement Plan (Appendix A.6) will be implemented and based on feedback additional mitigations will be considered.

The existing community complaints process existing for the Touquoy Mine will be expanded to include the Beaver Dam Project. Complaints regarding noise will be documented and investigated immediately. AMNS will work with the local communities to understand specific concerns to determine if additional mitigation measures, adaptive management, will be necessary. This process will evolve through regulatory permitting, as well as public and Mi'kmaw engagement.

6.1.9 Residual Effects and Significance

Residual effects are effects to VCs that are predicted to occur even after the implementation of mitigation measures (Section 6.1.8). Noise is a physical aspect of the environment that may be altered by the Project that can, in turn, affect related biophysical and socioeconomic VCs (Section 6.11 to 6.12 and Section 6.16). Significant residual effects for the Noise VC would be defined as

having high magnitude, occur beyond the PA and LAA, be of long-term to permeant duration, occur at regular intervals or be continuous throughout the Project and be only partially reversible to irreversible (Section 6.1.6).

The effect to noise are predicted to be **low,** diverging from existing conditions but in compliance with appropriate guidelines; effects do not extend into the RAA, are long-term, and are considered reversible. The overall residual effect of the Project on noise is assessed as **not likely** to have significant adverse effects after mitigation measures have been implemented. Thus, predicted residual environmental effects of Project development and production on Noise are assessed to be **not significant** (Table 6.1-11).

A summary of overall conclusions of noise modelling and effects assessment (Section 6.1.6) informing the characterization of residual effects and significance determination is provided below.

In general, construction activities often produce significant noise levels that have the potential to impact the surrounding environment. Thus, noise levels produced by equipment planned for the Construction Phase of the Project have been assessed at the identified worst-case receptors to determine the future impact on residents of the nearest communities. Predicted noise levels produced by worst-case activities during the Construction Phase of the Project low, being are within the applicable Health Canada guideline limits at all identified receptors, including noise emissions from the Beaver Dam Mine Site, the Haul Road, and the Touquoy Mine Site. General guidance has been provided to help ensure that construction noise levels are acceptable, including a specification that construction activities should be restricted to the day and evening time periods.

Mining operations often produce elevated noise levels that have the potential to impact the surrounding environment. Thus, noise levels produced by equipment at the proposed Beaver Dam Mine Project have been assessed at the identified worst-case receptors to determine the future impact on residents of the nearest communities. This is not intended to preclude residents at farther distances but rather is presented to document those residence that are closest and represent a worst-case scenario. The predicted noise levels produced by worst-case activities during the Operation of the Project, including noise emissions from the Beaver Dam Mine Site, the Haul Road, and the Touquoy Mine Site, are considered to be low. That is, within the applicable guideline limits for all identified receptors. Based on these predictions, noise levels at nearby residential receptors are expected to be within the NSEL noise level limits, provided the mitigation measures identified in this report are followed.

The NSEL Pit and Quarry Guidelines also include noise level criteria for assessment at the property boundaries (NSEL 1999). The predicted noise levels from the Project meet the NSEL limits at all locations on the property boundaries of the Beaver Dam Mine Site, the Haul Road, and the Touquoy Mine Site, provided the mitigation measures identified (Section 6.1.8) are followed.

Table 6.1-12: Residual Environmental Effects for Noise

Project - VC Interactions	Summary of Mitigation	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction – Beaver Dam Mine Site and Haul Road Noise from haul trucks, Haul Road widening and construction, and blasting and drilling of in-situ rocks	Equipment maintenance, best management practices, minimize blasting events.	N-L	Beaver Dam Mine Site and Haul Road LAA: Noise generated will likely extend beyond the PA	A	ST Effects can occur up to 1 year	R Effects occur regularly in the construction phase of the Project	R VC will recover to baseline conditions	Increased ambient noise	Not significant
Operations - Beaver Dam Mine Site and Haul Road Noise from haul trucks, blasting and drilling of in-situ rocks and the crushing of ore heavy machinery operation, and site vehicles	Equipment maintenance, dust suppression, hardened surface where practical, vehicle speed reduction, use of large haul vehicles to minimize trips, stabilization of stockpile slopes, covering of haul trucks, minimize blasts. Equipment maintenance, haul truck operations < 24 hours per day to minimize noise disturbance, limited engine idling, shutting off vehicle when parked unless this is precluded for safety or maintenance reasons.	N-L	At Points of Reception for Beaver Dam Mine Site, Haul Road, Touquoy Mine Sire) At Property Lines for Beaver Dam Mine Site, Haul Road LAA: effect extend beyond the PA into the LAA	A	LT Effects may extend beyond 3 years	R Effects occur regularly in the operational phase of the Project	R VC will recover to baseline conditions	Increased ambient noise	Not significant
Operations – Touquoy Mine Site Noise from blasting, crushing of ore, heavy machinery operation and site vehicles	Equipment maintenance, haul truck operations < 24 hours per day to minimize noise disturbance, limited engine idling, shutting off vehicle when parked unless this is precluded for safety or maintenance reasons.	N	At Property Lines LAA Noise generated is predicted to extend beyond the PA	A	LT Effects may extend beyond 3 years	R Effects occur regularly in the operational phase of the Project	R VC will recover to baseline conditions	Increased ambient noise	Not significant

Notes: See Table 6.1-4 and Section 5.11, Table 5.11-1 for definitions of the below characteristics.

Magnitude		Geographic Extent			Timing		Duration		Frequency		Reversibility	
N	Negligible	PA	Project Area		N/A	Not Applicable	ST	Short-Term	O	Once	R	Reversible
L	Low	LAA	Local Assessment	Area	A	Applicable	MT	Medium-Term	S	Sporadic	IR	Irreversible
M	Moderate	RAA	Regional Assessment	Area			LT	Long-Term	R	Regular	PR	Partially Reversible
H	High						P	Permanent	C	Continuous		

6.2 Air

6.2.1 Introduction

6.2.1.1 Summary of Air Before the Updates

Air quality was assessed as part of the 2017 and 2019 Revised EIS (AMNS 2017 and 2019). The air compounds evaluated focused on particulate matter (i.e., total suspended particulates [TSP], particulate matter less than 10 micrometers in aerodynamic diameter [PM_{10}], particulate matter less than 2.5 micrometers in aerodynamic diameter [$PM_{2.5}$]), The Haul Road between the proposed Beaver Dam Mine and the Touquoy Mine site was determined to be the primary emission source responsible for maximum predicted concentration of particulate matter and total suspended solids (i.e., dust). The results of the assessment found that maximum predicted concentrations occurred within 30m of the road and predicted that concentrations would decrease with increasing distance from the road. An 80% to 90% dust mitigation would be required on the Haul road to limit the impacts from dust. A draft Fugitive Dust Control Plan is developed to provide site specific mitigations for the proposed Project.

6.2.1.2 Summary of Updates to Air

The updates to this section are based on the update to the Project Description (Section 2, Project Area [PA] boundary change) as well as in response to Round 2, Information Requests (IR2s) submitted by Impact Assessment Agency of Canada (IAAC, formerly Canadian Environmental Assessment Agency [CEAA 2019]), Nova Scotia Environment (NSE 2019), and Eastern Shore Forest Watch Association (ESFWA 2019), air subsection updates are summarized in Table 6.2-1. Effects assessment methodology have been updated to include updated air emissions and dispersion models, in response to comments from IR2s. Air compounds evaluated included TSP, PM_{10}, $PM_{2.5}$, nitrogen oxides (NO_X), sulfur dioxide (SO_2), and volatile organic compounds (VOC). Greenhouse gases (GHG) are described in Section 6.4. Detailed updated modelling results are presented in Appendix C.1 Air Emission Assessment Technical Report (GHD 2021).

The updated emissions and dispersion modeling show that there are no exceedances predicted for NO_2 and SO_2 (Section 6.2.6.3 and Appendix C.1). There are no guidelines for VOCs and therefore it was assessed relative to baseline, which is determined to be negligible. An 80 to 90% dust mitigation would be required on the Haul road to limit the impacts from dust. A draft Fugitive Dust Control Plan is developed to provide site specific mitigations for the proposed Project.

Air quality emission and dispersion modelling results have been used in the updated Human Health Risk Assessment (Appendix C.2 [Intrinsik 2021]). Cumulative Effects Assessment for Air is discussed in Section 8.

Table 6.2-1: Updated Subsections from the 2019 Revised Environmental Impact Statement

2019 Revised EIS Submission (February 28, 2019)	Updated in 2021	Corresponding 2021 EIS Update Section Number	Reason for Update
-	-	6.4.1 Introduction	• New
6.2.1 Rationale for Valued Component Selection	No	6.2.2 Rationale for Valued Component Selection	• N/A
-	Yes	6.2.3 Baseline Program Methodology	• Included baseline methodology summary from Appendix C.1.
6.2.2 Baseline Conditions	No	6.2.4 Baseline Conditions	• Updated with relevant local TSP background data from 2007 to 2017 is summarised and the 90th percentile used (NSE-2-24).
6.2.3 Consideration of Consultation and Engagement Results	No	6.2.5 Consideration of Consultation and Engagement Results	• This subsection has been updated to reflect recent public and the Mi'kmaq of Nova Scotia recent engagement.
6.2.4 Effects Assessment Methodology – Boundaries	Yes	6.2.6 Effects Assessment Methodology – Boundaries	• Updated to include descriptions for construction, operations, and active closure phases as per the updated Project Description (Section 2) that were used in the updated air emissions and dispersion modelling.
6.2.4 Effects Assessment Methodology – Thresholds for Determination of Significance	Yes	6.2.6 Effects Assessment Methodology – Thresholds for Determination of Significance	• Updated Air VC significant residual effects.
6.2.5 Project Activities and Air Interactions and Effects	Yes	6.2.7 Project Activities, Air Quality Interactions and Effects	• Section updated to summarize the updated air emissions and dispersion modelling from Appendix C.1 Air Emission Assessment Technical Report in response to IR2s CEAA-2-25, CEAA-2-31, NSE-2-128, NSE-2-129, ESFWA-2-33b). • Worst-case sensitive receptors included in the modelling. • All lands outside the property boundaries for the Beaver Dam Mine, the Touquoy Mine and Haul Road.
6.2.6 Modelling Results and Assessment	Yes	6.2.7.3 Air Effects Modelling, Summary	• Section moved under Section 6.2.7 Project Activities, Air Quality Interactions and Effects. • Section updated to summarize the updated air emissions and dispersion modelling from Appendix C.1 Air Emission Assessment Technical Report in response to IR2s CEAA-2-25, CEAA-2-31, NSE-2-128, NSE-2-129, ESFWA-2-33b). • Worst-case sensitive receptors included in the modelling. • All lands outside the property boundaries for the two mines and Haul Road have been modelled.
6.2.7 Preferred Alternative Haul Road	Yes	-	• The Preferred Alternative Haul Road is no longer being considered and has been removed from the Project Description and EIS.
6.2.8 Mitigation	Yes	6.2.8 Mitigation	• Updated to reflect an update to mitigation of 80% to 90% dust control on the Haul Road has been assumed (ESFWA-2-33b).
6.2.9 Residual Effects and Significance	Yes	6.2.9 Residual Effects and Significance	• Updated to reflect updated predictive modelling results and updated mitigation.
6.2.10 Proposed Compliance and Effects Monitoring Program	Yes	-	• Section Updated

Notes: PA = Project Area; LAA = Local Assessment Area; RAA = Regional Assessment Area; - = no update; IR2 = Round 2, Information Requests; CEAA = Canadian Environmental Assessment Agency; NSE = Nova Scotia Environment; ESFWA = Eastern Shore Forest Watch Association; EIS = environmental impact statement; N/A = Not Applicable; TSP = total suspended particulate.

6.2.2 Rationale for Valued Component Selection

Air quality is an important environment factor in ensuring the conservation of local vegetation, wildlife, water quality, and human health. The proposed Project activities will result in air emissions to the ambient environment. The potential change in ambient air quality needs to be assessed to support conservation of the environment and compliance with applicable federal and provincial regulations. Since ambient air quality is a broad term, it is important to define technical boundaries as to select measurable parameters to assess the potential effects of the Project (Section 6.2.6). For this assessment the Air VC is characterized by the following indicators:

- TSP matter;
- PM_{10};
- $PM_{2.5}$; and
- dust deposition.

NO_X as nitrogen dioxide (NO_2), SO_2, and VOCs and carbon monoxide (CO) are assessed in Appendix C.1. The modelling predictions indicate that NO_2, and SO_2, do not exceed guidelines and changes to VOCs from baseline are negligible (Table 6.2-2). Greenhouse Gases Assessment is provided in Section 6.4.

6.2.3 Baseline Program Methodology

The objective of the Air baseline study was to collect information on baseline conditions before commencement of the proposed Project; baseline report for air quality is summarized in the following sections and included in Appendix C.1.

6.2.4 Baseline Conditions

6.2.4.1 Climate and Meteorological Information

To assess air quality, meteorological conditions need to be considered. Meteorology is also a major consideration for the design, construction, and maintenance of the proposed development. Information on meteorological conditions, such as wind and air temperature, is required for air dispersion modelling as they have a large effect on the dispersion of pollutants in the atmosphere. Solar radiation and precipitation data also provide information for the design of water management infrastructure and water balance calculations.

The Project is located with the Eastern Nova Scotia climatic region, which is generally characterized by high rainfall and cool temperatures, due to the influence of the Nova Scotia Current. The nearest climate station with historical data is the Middle Musquodoboit climate station (ID# 8203535) operated by the Meteorological Service of Canada (MSC). The station is located approximately 15 kilometres (km) northwest of the proposed mine site, near Middle Musquodoboit (45° 04 N, 63° 06 N).

The following is a summary of average climate conditions at the Middle Musquodoboit station, based on climate normals published by Environment and Climate Change Canada for the period from 1971 to 2000. Wind data is taken from the Halifax Airport climate station (MSC ID# 202250), which is located approximately 45 km west of the mine site. This is the closest station to the site with wind data.

Mean annual total precipitation is 1,370 millimetres (mm), which includes 165 centimetres (cm) of average snowfall per year (165 mm water equivalent). Highest precipitation generally occurs in the months of October and November, with lowest

precipitation in the month of February. Measurable precipitation occurs on an average of 164 days per year, with 141 days of measurable rainfall, and 31 days of measurable snowfall.

The extreme one-day rainfall for the station is 173 mm on August 15, 1971 and extreme one-day snowfall is 70 cm on February 8, 1981. Average temperature is 6.2ºC, with an average range from -6ºC to 18.1ºC. Temperature extremes can range from -34ºC to 35ºC. There is an average of 312 days per year with an average temperature above 0ºC.

Wind direction is generally westerly to northerly in January through April, southerly in May through October and again westerly to northerly in November and December. Wind speeds average approximately 16.5 kilometres per hour (km/h), with an average range of 13.3 km/h in August to 18.5 km/h in March. Maximum hourly speeds can range from 56 km/h in August to 89 km/h in February, with maximum gusts of up to 132 km/h recorded.

6.2.4.2 Ambient Air Quality Standards

Nova Scotia Environment (NSE) regulates ambient air quality via the Nova Scotia Air Quality Standards (NSAQS). The Canadian Ambient Air Quality Standards (CAAQS) are recommended air quality standards, frequently applied in Provinces or Territories that do not have their own air quality criteria. These standards are summarized in the Table 6.2-2.

There is currently no Nova Scotia or Canada-Wide standard for PM_{10}. For the purposes of comparison, the table below lists an Interim Standard previously reported for the Province of Ontario (MECP 2020a).

Table 6.2-2: Air Quality Standards

Indicator Compound	Averaging Period	Concentration (µg/m³)	Source
Total Suspended Particulate	24-hour	120	NSAQS
	Annual	70	NSAQS
PM_{10}	24-hour	50	Ontario - Interim
$PM_{2.5}$	24-hour	27	CAAQS (2020)
	Annual	8.8	CAAQS (2020)

Note: Ontario Interim guideline for PM_{10} no longer in effect, provided for informational purposes only (MECP 2020b).

$PM_{2.5}$ 24-hour CAAQS for 2020 is based on the 3-year average of the 98th percentile of the daily 24-hour concentrations.

$PM_{2.5}$ Annual CAAQS for 2020 is based on the 3-year average of the annual average concentrations.

CAAQS = Canadian Ambient Air Quality Standards; NSAQS = Nova Scotia Air Quality Standards; PM_{10} = coarse particulate matter; $PM_{2.5}$ = fine particulate matter; µg/m³ = micrograms per cubic metre.

6.2.4.3 Baseline Air Quality Monitoring Program

Appropriate background data was investigated for the Project to evaluate the existing conditions versus the conditions when the proposed Project commences. There are currently no permanent air monitoring stations within the vicinity of the PA. The most recent three years of data (2014-2016) of continuous monitoring data available is sourced from the ambient air quality monitoring data from the National Air Pollution Surveillance Network (NAPS). Associated results are summarized in the underlying sections and detailed in Appendix C.1.

6.2.4.4 Regional Ambient Air Quality

Ambient air quality in Nova Scotia is monitored using a network of 10 sites operated by NSE and Environment and Climate Change Canada (ECCC) through the NAPS. Common air pollutants monitored at these stations include the following:

- SO_2;
- $PM_{2.5}$;
- ozone (O_3); and
- oxides of nitrogen (NO_2, NO, and total NO_X).

Data collected at these stations is used by NSE to report the Air Quality Index (AQI) and by ECCC to report the Air Quality Health Index (AQHI). There are currently no permanent air monitoring stations within the vicinity of the PA. The Beaver Dam Mine Site is located in a relatively undeveloped rural region of Nova Scotia with infrequent industrial operations that would affect air quality. As the NAPS monitoring stations are typically located in areas with local industry, measured concentrations of indicators are likely lower at the Beaver Dam Mine Site than at NAPS stations.

The nearest representative stations which report concentrations for the air quality parameters assessed include:

- Lake Major, Nova Scotia (Station ID 030120) – $PM_{2.5}$, NO_2, and SO_2;
- Port Hawkesbury, Nova Scotia (Station ID 030201) – $PM_{2.5}$, NO_2, and SO_2;
- Aylesford Mountain, Nova Scotia (Station ID 030701) – $PM_{2.5}$, and NO_2; and
- Pictou, Nova Scotia (Station ID 030901) – $PM_{2.5}$, and NO_2.

VOCs are not measured at these stations. PM10 are not measured in many areas in Canada. Of the locations which do measure PM_{10}, most are in British Columbia urban centres, four are in Manitoba cities, one is in Regina, Saskatchewan, and four are in the Northwest Territories. In terms of locations that are somewhat comparable to the Project site (human habitation, regional activities that may generate airborne particulate, etc.), Norman Wells, NWT Regional Office (Station ID 129102) appears the most appropriate location that has recent data available (Appendix C.1).

The NAPS background air concentrations are provided in Table 6.2-3, which shows the 25th, 50th, 75th, and 90th percentile values for 1-hour and 24-hour NO_2, 1-hour and 24-hour SO_2, and 24-hour PM_{10} and $PM_{2.5}$ for the 2014 through 2016 period (the most recent complete years for which continuous monitoring data are available for this reporting period). It is recognized that the nitrogen oxide (NO_X as NO_2), SO_2, and CO are also important indicators of greenhouse gases, which are assessed separately, as part of the Greenhouse Gases Assessment (Section 6.4).

Air quality was assessed using the 90th percentile measured concentration as “background”. This is a conservative approach but excludes extreme high values that are very rarely measured (the “maximum” values). The bolded values in Table 6.2-3 are those that were carried forward for use in the combined assessment case (i.e., proposed Beaver Dam Mine site, existing Touquoy Mine Site). Annual values for $PM_{2.5}$ and PM_{10} are represented by the “Average” values for 24-hour.

Table 6.2-3: Background Ambient Air Monitoring Results (NAPS) 2014 to 2016

	Concentration (µg/m³)					
	25th Percentile	50th Percentile	75th Percentile	90th Percentile	Average	Maximum
24-hour PM_{10}						
Lake Major (030120)	—	—	—	—	—	—
Port Hawkesbury (030201)	—	—	—	—	—	—
Aylesford Mountain (030701)	—	—	—	—	—	—
Pictou (030901)	—	—	—	—	—	—
Norman Wells, NWT (129102)	3.0	6.0	14.0	31.0	14.1	176.0
Halifax (030118)	—	—	—	—	—	—
Sydney (030310)	—	—	—	—	—	—
24-hour $PM_{2.5}$						
Lake Major (030120)	3.0	5.0	6.0	8.0	5.4	24.0
Port Hawkesbury (030201)	4.0	5.0	7.0	9.0	5.7	31.0
Aylesford Mountain (030701)	4.0	5.0	7.0	8.0	5.7	23.0
Pictou (030901)	4.0	5.0	8.0	12.0	6.7	37.0
Norman Wells, NWT (129102)	1.0	2.0	3.0	5.0	3.5	85.0
Halifax (030118)	—	—	—	—	—	—
Sydney (030310)	1.2	2.1	3.7	5.8	2.8	358.6
1-hour NO_2						
Lake Major (030120)	0.0	1.9	3.8	5.6	2.8	47.0
Port Hawkesbury (030201)	0.0	1.9	3.8	9.4	3.4	79.0
Aylesford Mountain (030701)	0.0	0.0	0.0	1.9	0.6	13.2
Pictou (030901)	0.0	1.9	1.9	5.6	2.2	39.5
Norman Wells, NWT (129102)	0.0	0.0	1.9	7.5	3.6	73.4
Halifax (030118)	11.3	19.8	28.2	41.4	21.4	131.6
Sydney (030310)	1.9	3.8	7.5	13.2	6.7	69.6
24-hour NO_2						
Lake Major (030120)	1.9	1.9	3.8	5.6	2.7	11.3
Port Hawkesbury (030201)	0.0	1.9	5.6	7.5	3.3	28.2
Aylesford Mountain (030701)	0.0	0.0	0.0	1.9	0.5	5.6
Pictou (030901)	0.0	1.9	3.8	3.8	2.2	13.2
Norman Wells, NWT (129102)	0.0	1.9	3.8	9.4	3.5	30.1
Halifax (030118)	4.6	7.7	11.6	17.0	8.8	54.1
Sydney (030310)	0.8	1.5	3.1	5.4	2.7	28.6
1-hour SO_2						
Lake Major (030120)	0.0	0.0	0.0	2.6	0.4	6.8
Port Hawkesbury (030201)	0.0	0.0	2.6	2.6	1.9	222.5
Aylesford Mountain (030701)	—	—	—	—	—	—
Pictou (030901)	—	—	—	—	—	—

Table 6.2-3: Background Ambient Air Monitoring Results (NAPS) 2014 to 2016 (continued)

	Concentration (µg/m³)					
	25th Percentile	50th Percentile	75th Percentile	90th Percentile	Average	Maximum
Norman Wells, NWT (129102)	0.0	0.0	2.6	2.6	0.7	5.2
Halifax (030118)	2.6	5.2	5.2	7.9	4.8	70.7
Sydney (030310)	0.0	2.6	2.6	5.2	2.3	172.9
24-hour SO_2						
Lake Major (030120)	0.0	0.0	0.0	2.6	0.3	7.9
Port Hawkesbury (030201)	0.0	0.0	2.6	5.2	1.9	31.4
Aylesford Mountain (030701)	—	—	—	—	—	—
Pictou (030901)	—	—	—	—	—	—
Norman Wells, NWT (129102)	0.0	0.0	0.0	2.6	0.5	2.6
Halifax (030118)	1.1	2.2	2.2	3.2	2.0	29.1
Sydney (030310)	0.0	1.1	1.1	2.2	0.9	71.0
1/2-hour CO						
Lake Major (030120)	—	—	—	—	—	—
Port Hawkesbury (030201)	—	—	—	—	—	—
Aylesford Mountain (030701)	—	—	—	—	—	—
Pictou (030901)	—	—	—	—	—	—
Norman Wells, NWT (129102)	—	—	—	—	—	—
Halifax (030118)	306.0	389.0	487.0	834.0	420.0	6,687.0
Sydney (030310)	264.0	334.0	417.0	695.0	397.0	2,099.0
1-hour CO						
Lake Major (030120)	—	—	—	—	—	—
Port Hawkesbury (030201)	—	—	—	—	—	—
Aylesford Mountain (030701)	—	—	—	—	—	—
Pictou (030901)	—	—	—	—	—	—
Norman Wells, NWT (129102)	—	—	—	—	—	—
Halifax (030118)	252.0	321.0	401.0	687.0	346.0	5,507.0
Sydney (030310)	218.0	275.0	344.0	573.0	327.0	1,729.0
8-hour CO						
Lake Major (030120)	—	—	—	—	—	—
Port Hawkesbury (030201)	—	—	—	—	—	—
Aylesford Mountain (030701)	—	—	—	—	—	—
Pictou (030901)	—	—	—	—	—	—
Norman Wells, NWT (129102)	—	—	—	—	—	—
Halifax (030118)	141.0	179.0	224.0	384.0	193.0	3,077.0
Sydney (030310)	122.0	154.0	192.0	320.0	183.0	966.0

NAPS = National Air Pollutant Surveillance program; µg/m³ = micrograms per cubic metre; PM_{10} = particulate matter less than 10 micrometres in aerodynamic diameter; $PM_{2.5}$ = particulate matter less than 2.5 micrometres in aerodynamic diameter; NO_2 = nitrogen dioxide; SO_2 = sulphur dioxide; CO = carbon monoxide; — = not measured or reported.

6.2.4.4.1 Project-Specific Baseline Studies

The RAA and LAA for air quality are presented in Section 6.2.6 and considered in baseline studies and subsequent effects assessment. Preliminary baseline particulate monitoring was undertaken for TSP and PM_{10}. Baseline air quality measurements were obtained from nine locations near the Beaver Dam Mine Site and along the proposed Haul Road, five locations on the Touquoy Mine Site, two locations near the proposed Fifteen Mille Stream Gold Project, and two locations near the proposed Cochrane Hill Gold Project and the data is presented in Table 6.2-4.

Table 6.2-4: Beaver Dam Mine Project Background Air Quality Sampling Data

Location	Program Date	24-hour Total Suspended Particulate (TSP) (µg/m³)	24-hour PM_{10} (µg/m³)
Location #1	June 5-6, 2008	19.4	9.1
Location #2	June 5-6, 2008	41.7	13.1
Location #3	June 5-6, 2008	12.9	7.1
AN#1	October 20-21, 2014	6.9	—
AN#2	October 20-21, 2014	4.6	—
AN#3	October 20-21, 2014	1.7	—
AN#4	October 20-21, 2014	3.9	—
Beaver Dam Road	September 7-8, 2016	9.7	—
Mooseland Road	September 7-8, 2016	5.8	—
Location #1 (Touquoy)	January 3, 2007	11.6	—
Location #2 (Touquoy)	January 3, 2007	10.5	—
Location #3 (Touquoy)	January 4, 2007	14.0	—
Location #4 (Touquoy)	January 4, 2007	16.1	—
Location #5 (Touquoy)	January 4, 2007	14.4	—
Fifteen Mile Stream	November 2017	9.6	9.2
Fifteen Mile Stream	November 2017	14.0	9.5
Cochrane Hill	November 2017	10.7	10.5
Cochrane Hill	November 1, 2017	10.7	9.7
Average		12.1	
90th percentile		17.1	

µg/m³ = micrograms per cubic metre; PM_{10} = particulate matter less than 10 micrometres in aerodynamic diameter.

Further, baseline particulate monitoring including TSP and PM_{10} was conducted following United States Environmental Protection Agency (USEPA) sample methodology (USEPA 2011). The locations during each monitoring event is shown in Figure 6.2-1, except Fifteen Mile Stream and Cochrane Hill Locations. The date and locations were determined based on meteorological forecasts for the sampling period, and the proximity to sensitive receptors and proposed mine features. A 24-hour sample was collected on an 8x10 filter utilizing a high-volume sampler calibrated at a flow rate of approximately 40 cubic feet per minute (CFM). Pre-weighed filters were submitted to Maxxam Analytics in Sydney, Nova Scotia, for final particulate weights. Concentrations of TSP and PM_{10} were calculated based on the final weight of particulate on the filters and the total volume of air sampled. Baseline particulate data was compared to the NSAQS (Table 6.2.4).

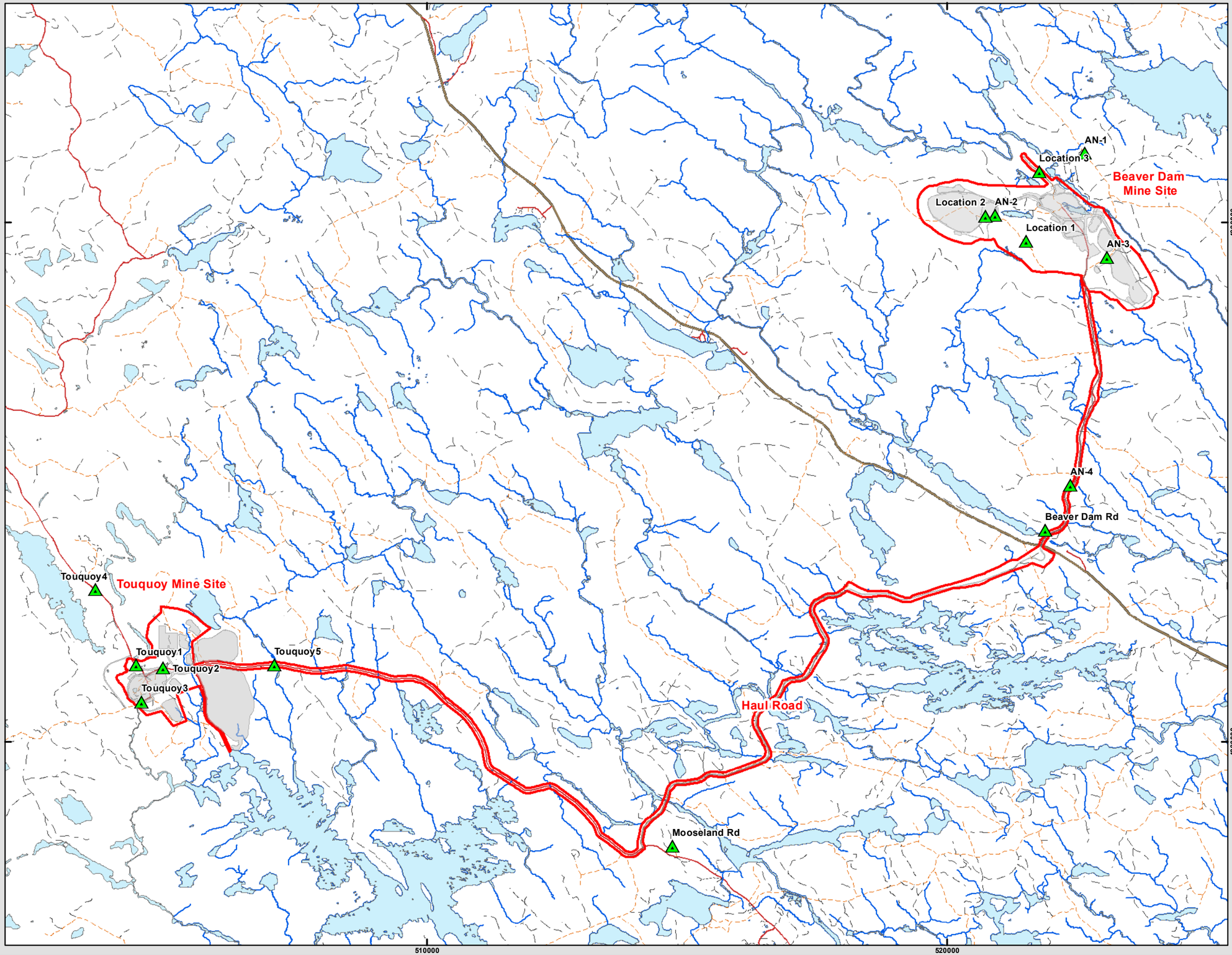

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FIGURE 6.2-1

Beaver Dam Mine Project

Air Baseline Monitoring Locations

- Air / Noise Baseline Monitoring Locations
- Planned Infrastructure
- Project Area



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 1 2 4 km

1:68,000 Scale when printed @ 11" x 17"

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Date: 2021-05-09

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Document Name: BD_EIS_Figure6-2-2Air Baseline

A summary of these baseline measurements is presented in Table 6.2-4. Baseline TSP concentrations ranged from 1.7 to 41.7 micrograms per cubic metre (µg/m³), with the highest value obtained at Location #2 during monitoring in June 2008. Results for PM_{10} concentrations ranged from 7.1 to 13.1 µg/m³, with the highest value also obtained at Location #2 during monitoring in June 2008. This monitoring station was located in a recently clear-cut area, which may have contributed to higher particulate levels in comparison to the other locations. This area was resampled in 2014 (AN#2). The 2014 results for that area were 4.6 µg/m³. All samples collected were below the NSAQS for TSP, there is no NSAQS for PM_{10}.

The data obtained as part of the baseline program reported herein provides a preliminary snapshot of air quality in the area of the Beaver Dam Mine Site and Haul Road, and a general understanding of local air quality. Due to a lack of other sources of data for ambient TSP, the background concentration for TSP is based on the maximum measured 24-hour TSP concentration (there are insufficient data to provide a meaningful 90th percentile value), and the average of all the TSP measurements. There is uncertainty in how representative these values might be for background, but they represent the best available data at this time.

6.2.5 Consideration of Engagement Results

Key concerns raised during public engagement (Section 3 and Appendix A.4a) and the Mi'kmaq of Nova Scotia engagement (Section 4 and Appendix A.5) relating to atmospheric environment include potential dust from mining operations at the Beaver Dam Mine Site and trucking along the Haul Road. The Haul Road was updated to include 4 km of new road to the south and away from existing turn-off from Highway 224 to address safety concerns communicated by Millbrook First Nation regarding the proximity of residents in Beaver Lake IR. Concerns about greenhouse gas emissions specifically associated with the trucking were also noted. Greenhouse gases are assessed in Section 6.4.

The results of the public and the Mi'kmaq of Nova Scotia engagement have been considered in the environmental effects assessment, including the AMNS' commitments on mitigation and monitoring measures and proposed compliance and effects monitoring programs, as well as AMNS' broader commitment to ongoing public and Mi'kmaq engagement throughout the life of the Project.

Recent engagement with the public and First nation undertaken since the February 2019 EIS submission is provided Section 3 and Section 4. Dust originate from the Haul Road has raised as the main concern with respect to Air.

6.2.6 Effects Assessment Methodology

6.2.6.1 Boundaries

6.2.6.1.1 Spatial Boundaries

The spatial boundary used for the air effects assessment are described below and presented in Figure 6.2-2.

The PA encompasses three primary components from Marinette to Moose River Gold Mines, Halifax County, Nova Scotia. The proposed Beaver Dam Mine Site is located at the end of the Beaver Dam Mines Road and the Haul Road will span from the Beaver Dam Mine Site to he Touquoy Mine Site. The existing Touquoy mine will process ore and deposit tailings in a slurry sub-aqueously in exhausted pit and therefore dust is not expected.

The LAA encompasses the distance the 15 km zone in all directions form the PA (Figure 6.2-2).

The RAA encompasses a 35 km buffer from the PA, maximum zone of influence. The RAA covers the extent of the modelling domain (Figure 6.2-2).

As the Project has the potential to cause direct and indirect effects of air outside of the PA, the LAA is the most appropriate spatial boundary for air.

6.2.6.1.2 Temporal Boundaries

Effects to air quality and generation of fugitive have the potential to occur throughout project phases and from specific components of the Beaver Dam Mine Site. These include construction phase activities initially and during operational phase, the open pit, waste rock storage area, quarries, process plant, crushing operations and the service complex. The temporal boundaries used for the assessment of effects to Air are the Construction, Operational, and Active Closure phases.

Construction Phase (1 Year)

In the updated Project Description, the timeline for construction is now planned for one 1 year; and was previously anticipated to be up to 2 years (AMNS 2017). For construction activities lasting less than 1 year, Health Canada's "Guidance for Evaluating Human Health Impacts in Environmental Assessment: Air Quality" (Health Canada 2017) categorizes the air effects as 'short-term construction air exposure'.

Operations Phase (5 Years)

Ore from the Project will be transported by truck via the Haul Road to the existing and fully permitted Touquoy Mine. Processing of ore from the Beaver Dam gold deposit at the existing the Beaver Dam Mine Site is anticipated to begin construction in 2022, come into production in 2023, cease operations in 2027 and then be reclaimed. The timeline is subject to EIS and permitting approval.

Active Closure (2 Years)

The active closure phase will involve infrastructure demolition, earthworks, site reclamation and environmental monitoring activities. Monitoring will extend beyond 2 years of active closure until the reclamation performance measures indicate that the site is physical, chemical and biologically stable and self-sustaining.

6.2.6.1.3 Technical Boundaries

Since ambient air quality is a broad term, it is important to define technical boundaries as to select measurable parameters to assess the potential effects of the Project. For this assessment ambient air quality is characterized by the following indicators:

- TSP matter;
- PM_{10}; and
- $PM_{2.5}$;

It is recognized that the nitrogen oxide (NO_X as NO_2), SO_2, and CO are also important indicators of Air Quality. These are assessed separately, as part of the Greenhouse Gases Assessment (Section 6.4).

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FIGURE 6.2-2

Beaver Dam Mine Project

Spatial Boundaries: Air

Beaver Dam Mine Site

Touquoy Mine Site

Haul Road

- Project
- Air Local Assessment
- Air Regional Assessment Area



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 5 10 20 km

1:340,000 Scale when printed @ 11" x 17"

Drawn By: EP
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Document Name: BD_EIS_Figure6.3-1 Light Spatial Boundaries

6.2.6.1.4 Administrative Boundaries

Air quality is provincially regulated via the NSAQS (Table 6.2-2).

Air compounds that are of most concern from project operations include TSP and $PM_{2.5}$. PM_{10} has been included for reference, as a particulate size fraction between TSP and $PM_{2.5}$ but is limited in determining compliance or significance due to a lack of background monitoring data. Where Nova Scotia has air quality criteria, these have been used as the Assessment Criteria. If there were no Nova Scotia criteria for compounds of interest, then Canada-wide standards have been assumed to apply. PM_{10} is not regulated in either Nova Scotia or federally. Ontario has an Interim Ambient Air Quality Criteria (AAQC) for PM_{10}, but this value is not used to assess compliance for single facilities or operations and is generally applied at the regional level. This Interim criterion has been provided for context for this assessment but is not considered a guideline for the Project.

6.2.6.2 Thresholds for Determination of Significance

Residual effects are effects to VCs that are predicted to occur even after the implementation of mitigation measures (Section 6.2.8). Residual effects of the Project on Air Quantity VC identified are characterized using standard criteria, including magnitude, geographical extent, duration, frequency, reversibility, and context of the effect (Table 6.2-5). The residual effects assessment concludes with a determination of Significance. The screening of project effects, and mitigation measures, are assessed in aggregate to determine whether the residual impacts are "Not Significant" or "Significant" according to the following definitions:

Table 6.2-5: Air Quality Characterization Criteria for Residual Effects

Criteria	Groundwater Quality Impact Description
Magnitude	• **Negligible**: predicted change of air quality indicator is less than 10% of background conditions, (i.e., no measurable change of state of indicator from background conditions) and no exceedances of guidelines. • **Low**: indicator is predicted to be greater than guidelines and increase by greater than 10% over baseline levels but remains well within the observed range of natural variation (defined as 25th to 75th percentile baseline groundwater quality). • **Medium**: indicator is predicted to be greater than guidelines and differ substantially from baseline levels and approaches upper observed limits of natural variation (defined as 75thth to 95th percentile baseline groundwater quality). • **High**: indicator is predicted to be greater than guidelines and differ substantially from baseline water quality (outside of 75thth to 95th baseline water quality), resulting in a detectable change beyond the range of natural variation.
Geographical Extent	• **Discrete**: effect is limited to the immediate footprint or Project Area (PA). • **Local**: effect is limited to the near-field Local Assessment Area. • **Potential Regional**: effect persists to the far-field Local Assessment Area.
Timing	• Timing represents seasonal occurrence of the effect (e.g., winter, spring, summer and fall) and represents and the effect criteria for designated water users (aquatic resources, human health). The characterization of effect of changes to groundwater on designated water resources is assessed in their respective; for surface water quality timing is considered redundant to duration and frequency criteria and is not further considered here.
Duration	• **Short term**: effect is restricted to Construction and/or Operations Phases. • **Medium term**: effect occurs in Construction Phase and Operations. • **Long term**: Effect occurs in Construction Phase and EOM Phase and/or persists in PC.
Frequency	• **Intermittent**: VC interaction or effect will occur at irregular intervals throughout any Project Phase. • **Regular**: effect occurs on a regular basis but not continuous basis. • **Continuous**: effect occurs constantly (e.g., every model timestep in a given Project Phase).
Reversibility	• **Reversible**: effect can be reversed. • **Partially reversible**: effect can be partially reversed. • **Irreversible**: effect cannot be reversed, is of permanent duration.

Not Significant Residual Effect: to Surface Air Quality VC is defined as: negligible to moderate magnitude, are restricted to the LAA, are of intermittent or short-term duration, occur at any frequency and are reversible.

Significant Residual Effect: to Air Quality residual effects have high magnitude (i.e., an **exceedance** applicable criteria), be of potential regional geographic extent and of medium to long term duration, occur at any frequency and only be partially reversible to irreversible.

Significant residual effects for the Air VC would be defined as having high magnitude (i.e., an **exceedance** applicable criteria), occur beyond the LAA, be of long-term to permeant duration, occur at regular intervals or be continuous throughout the Project, and be only partially reversible to irreversible.

6.2.6.3 Air Effects Modelling, Summary

To support the effects assessment of the Air VC, air dispersion modelling was performed. The air dispersion modelling is provided in Appendix C.1 and contains further details on the modelling methodology, background air concentrations, and all modelling results. A summary is presented in this section.

Emission rates from the Project-related sources were calculated using USEPA AP-42 (5th Edition) emission factors for the Beaver Dam Mine Site and Haul Road dust emissions, and MOBILE6.2 (M6.2) for Haul Road vehicle emissions. There is currently no guidance on the use of models in Nova Scotia, and therefore the O.Reg. 419/05 requirements were used as a framework. The version of the air dispersion model used in this project is currently accepted in Ontario, and AERMOD is used across Canada and throughout the United States as a regulatory model of choice. AERMOD is an advanced steady state plume model that has the ability to incorporate building cavity downwash, actual source parameters, emission rates, terrain and historical meteorological information to predict ground level concentrations (GLCs) at specified locations.

Air compounds evaluated included TSP, PM_{10}, $PM_{2.5}$, NO_X, SO_2 and VOC.

As identified in Section 6.2.4, nitrogen oxide (NO_X as NO_2), SO_2, and CO are also important indicators of Air Quality and these are assessed separately, as part of the Greenhouse Gases Assessment (Section 6.4). Particle deposition was also modelled, and the results were provided to the human health risk component of this Environmental Assessment (Appendix C.2). Per default model setup, plume depletion was turned on, such that material that settled out of the plume (deposited on the ground) was removed from the airborne concentrations reported by the model. Deposition is typically reported in grams per square metre (g/m^2) and the results may be used further to estimate health risks based on biological intake (i.e., ingestion).

Haul Road emissions calculations assume that the roads are unpaved, and a dust management plan (targeting 80 to 90% dust suppression efficiency). This will be achieved through the implementation of a fugitive dust control plan that includes the use of dust suppressant (Section 6.2.8 and Appendix C.3).

The Beaver Dam Mine Site mining, crushing, and transfer operations will primarily operate from adjacent to the open pit. Although vehicle traffic is also expected, it was assumed that most of these operations also occur adjacent to the open pit. Therefore, the Beaver Dam Mine Site emissions were modelled using as an open pit source such that all emissions from mining operations were summed and attributed to the pit source. As discussed in Project Description (Section 2) the Beaver Dam Mine site may not rely on a primary crusher if the ore can be broken using jawbreaker and other mining equipment. For the purposes of this air assessment, a conservative assessment approach has been applied and assumed that a primary crusher would be in use.

The Touquoy Mine Site consists of crushers and mining sources as volume sources. These sources were previously modelled in AERMOD for an Emissions Summary and Dispersion Modelling Assessment (CRA 2007a). As the Beaver Dam Mine Site will use the Touquoy Mine Site for its refining capabilities, the crushing and mining operations remained unchanged.

A series of discrete receptor grids and discrete receptors located at ground level were used to identify the maximum point of impingement (MPOI) outside the two mine sites and along the connecting Haul Road.

Around the Touquoy Mine Site, the receptor grids were set up with the following grid spacing:

- 20 metres (m) spacing within 200 m of the edge of a bounding box that encompassed all onsite facility sources;
- 50 m spacing from 200 to 500 m;
- 100 m spacing from 500 to 1,000 m;
- 200 m spacing from 1,000 to 2,000 m; and
- 500 m spacing from 2,000 to 5,000 m.

A property line ground level receptor grid with 10 m spacing was used to evaluate the maximum property boundary concentration. No receptors were placed inside either Mine's property line.

Around Beaver Dam Mine, the receptors were set up with the following spacing:

- 20 metres (m) spacing within 200 m of the edge of a bounding box that encompassed all onsite facility sources;
- 50 m spacing from 200 to 500 m;
- 100 m spacing from 500 to 1,000 m;
- 200 m spacing from 1,000 to 2,000 m; and
- 300 m spacing from 2,000 to 3,000 m.

No receptors were placed inside Beaver Dam Mine's property line.

Along the four modelled road sections, receptors were spaced at 40 m parallel to the road and at the following distances perpendicular to the road:

- 30 m from road centerline;
- 45 m from road centerline;
- 55 m from road centerline;
- 65 m from road centerline; and
- 75 m from road centerline.

Modelling was also completed for selected sensitive receptors that are near the Haul Road or mine sites and have the potential to be impacted by air emissions. The sensitive receptors that were considered are included in Figure 6.2-3, and listed below:

- Sensitive Receptor 1 (R1) – 9 Beaver Dam Mines Road (Marlborough/Goodland Property);
- Sensitive Receptor 2 (R2) – 4112 Highway 224 (Beaver Lake IR 17);

- Sensitive Receptor 3 (R3) – 4115 Highway 224 (Cottage on Crown land);
- Sensitive Receptor 4 (R4) – 3492 Highway 224 (Hobbs Property);
- Sensitive Receptor 5 (R5) – 3379 Highway 224 (McLeod Property);
- Sensitive Receptor 6 (R6) – 3373 Highway 224 (Smith Property);
- Sensitive Receptor 7 (R7) – Tangier River (Deepwood Estates Property);
- Sensitive Receptor 8 (R8) – Tangier River (Musquodoboit Lumber Co Ltd. Property/John Dickson Lease); and
- Sensitive Receptor 9 (R9) – 5579 Mooseland Road (Lloy Property).

6.2.7 Project Activities/Interactions with Air Quality

The Project will result primarily in the generation and airborne transport of fugitive dust particles and exhaust emissions from equipment. Fugitive dust typically refers to small particles of geological or other origin that are moved into the atmosphere from non-ducted, open sources. Fugitive dust sources can originate from both stationary and mobile sources such as open fields, open burning, agricultural activity, construction sites, logging road traffic, vehicle traffic on paved and unpaved roads, aggregate pits and storage piles, as well as open pit mines. By contrast, non-fugitive sources are where emissions are discharged to the atmosphere in a confined flow stream, such as stacks, vents and vehicle exhausts. Stacks or vents at industrial or commercial facilities typically operate under some form of government authorization.

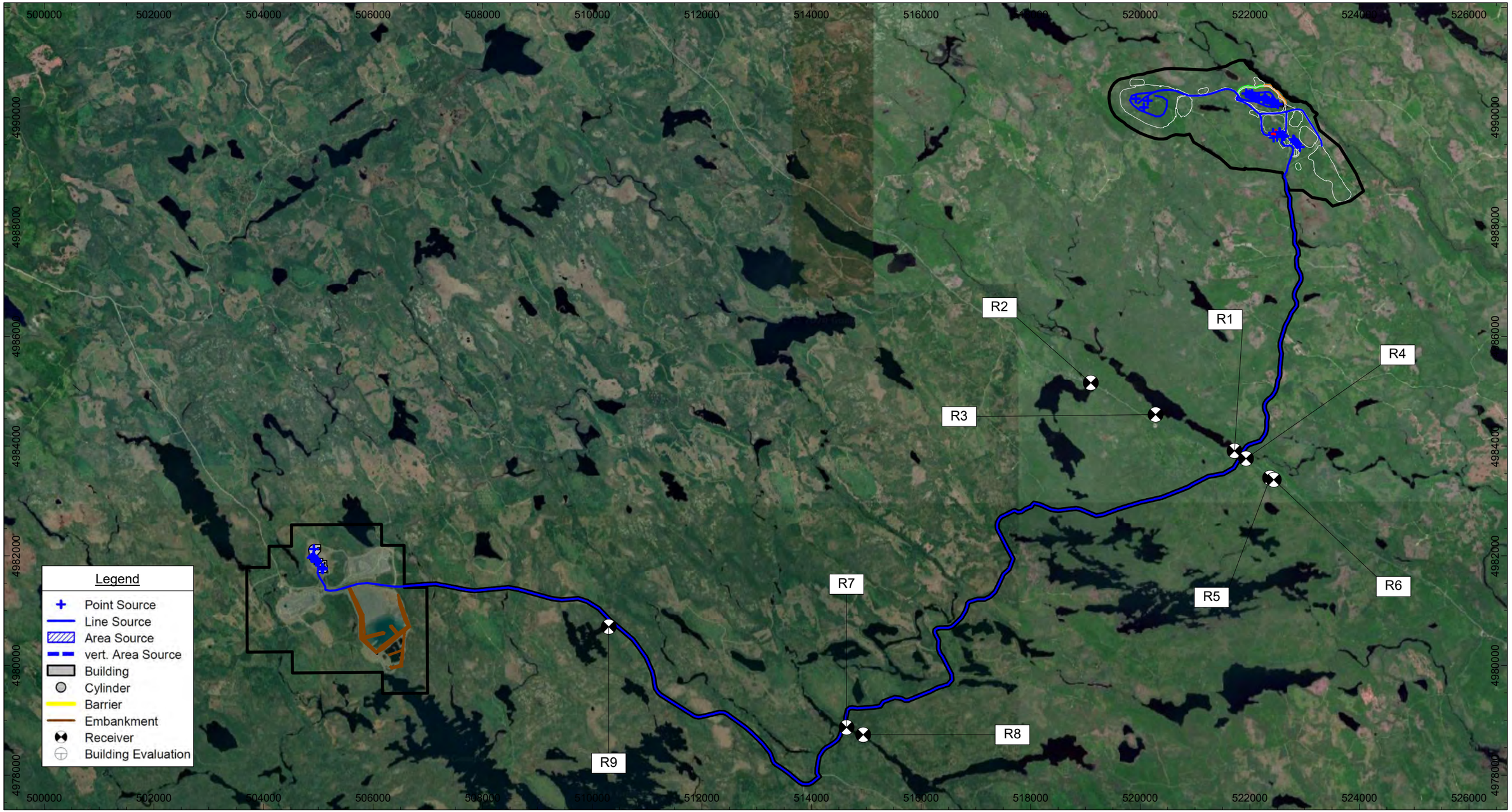
The potential interactions identified for the development and use of the proposed Haul Road between Beaver Dam Mine Site and the Touquoy Mine Site, and associated air dispersion modelling results are presented in the following sections. The evaluation of exposure potential related to potential dust deposition from Haul Road traffic on human health, including gathering and hunting of vegetation/country foods, which is assessed separately, in Appendix C.2.

Isopleths of the predicted concentrations from the dispersion modelling are shown in Figures 6.2-4 to 6.2-8, the individual results associated with each mine site, and the Haul Road, are described below. In all figures, where there is no colour, the predicted concentrations are below the lowest value provided in the colour scale on the figure; shades of green indicate areas where the predicted concentrations are times; yellow indicates areas where the mines and Haul Road operations meet the air quality standards on their own, but may exceed guideline values when background concentrations are added (cumulative effects); and red indicates where the mines and Haul Road operations exceed relevant air quality standards.

Note, Active Closure will involve infrastructure demolition, site reclamation and environmental monitoring activities. The dust generated by these activities will be substantially reduced relative to other Project phases. For these reasons, effects to Air during Active Closure are considered appropriately bounded by predictions for Construction and Operation phases, are not considered further.

6.2.7.1 Prediction of Air Effects, Beaver Dam Mine Site

The potential interactions identified for Beaver Dam Mine Site are presented in Table 6.2-6; emissions estimates for the operations phase (Haul Road traffic during mine operations) are provided in Table 6.2-7.



Source: Google Satellite

N

ATLANTIC GOLD
BEAVER DAM MINE, HALIFAX, NS

088664
07.01.2021

SENSITIVE RECEPTOR LOCATIONS

FIGURE 6.2-3

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Beaver Dam Mine Project Air Contour Total Suspended Particulate Matter 24-Hour Levels

17.1 ug/m3 TSP 24 hr Background Level Concentration

Mine Site concentrations reach background within boundary

TSP Ranges (ug/m3)

- 5
- 5 - 10
- 10 - 15
- 15 - 17.1
- 17.1 - 20
- 20 - 25
- 25 - 30
- 30 - 35
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65

Local Road

Dry Weather / Seasonal Road

Track

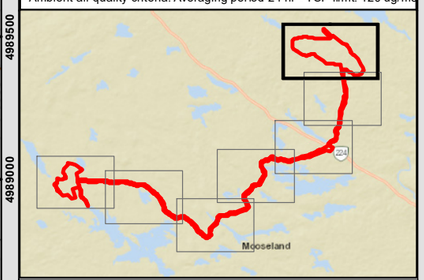
NSTDB Mapped Watercourses

Lakes

Planned Infrastructure

Proposed Property Boundary

Note: Based on 80% Road Dust Mitigation
Ambient air quality criteria: Averaging period 24 hr - TSP limit: 120 ug/m3



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 170 340 680 m

1:20,000 Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed By: LP

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Document Name: BD_EIS_Figure6-2-3Air 24hr TSP

Prepared For:

Atlantic Gold

FIGURE 6.2-4B

Beaver Dam Mine Project Air Contour Total Suspended Particulate Matter 24-Hour Levels

17.1 ug/m3 TSP 24 hr Background Level Concentration

Mine Site concentrations reach background within boundary

TSP Ranges (ug/m3)

- 5
- 5 - 10
- 10 - 15
- 15 - 17.1
- 17.1 - 20
- 20 - 25
- 25 - 30
- 30 - 35
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65

Local Road

Dry Weather / Seasonal Road

Track

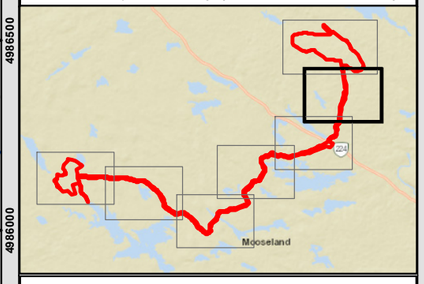
NSTDB Mapped Watercourses

Lakes

Planned Infrastructure

Proposed Property Boundary

Note: Based on 80% Road Dust Mitigation
Ambient air quality criteria: Averaging period 24 hr - TSP limit: 120 ug/m3



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 125 250 500 m

1:15,000 Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed By: LP

Date: 2021-05-24

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

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Document Name: BD_EIS_Figure6-2-3Air 24hr TSP

Prepared For:

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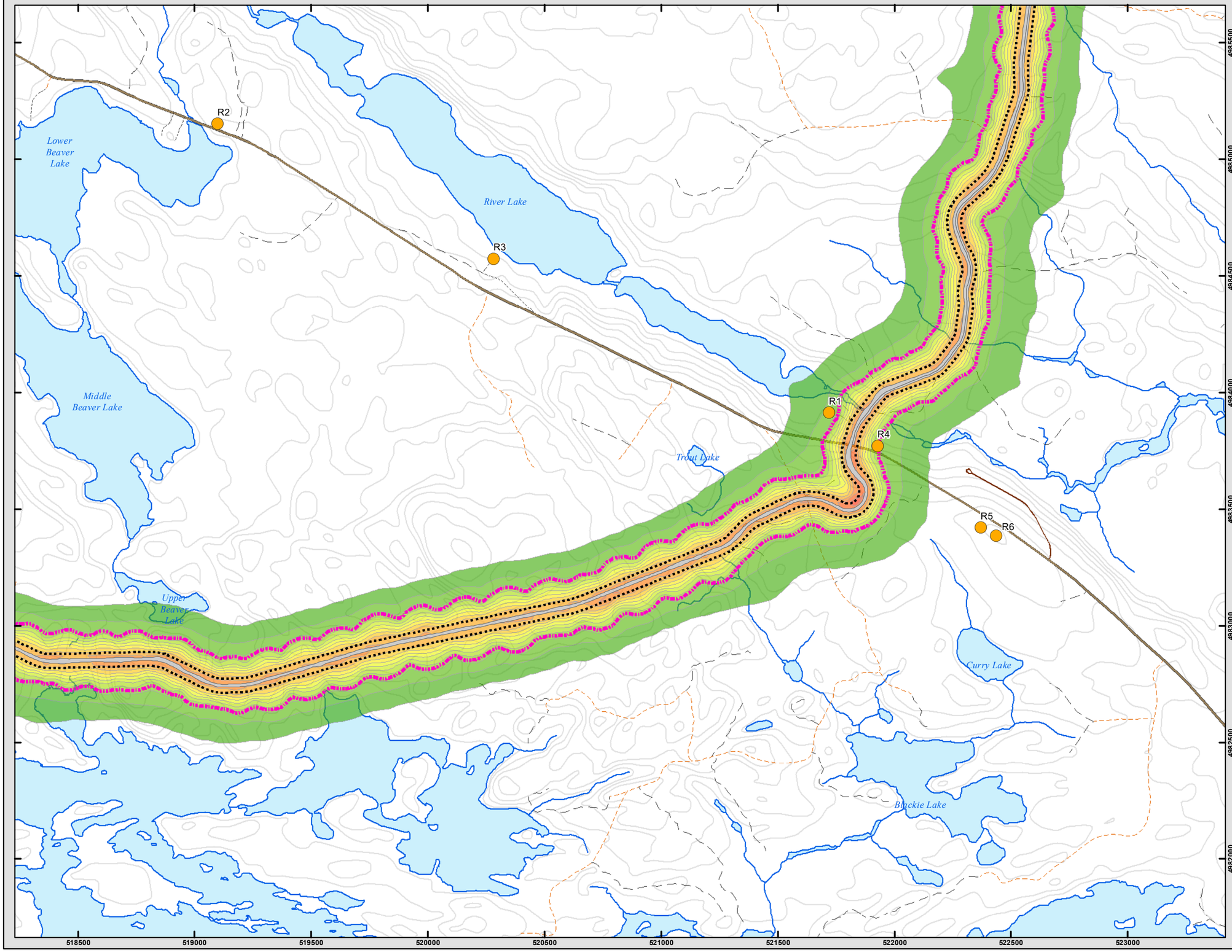
FIGURE 6.2-4C

Beaver Dam Mine Project Air Contour Total Suspended Particulate Matter 24-Hour Levels



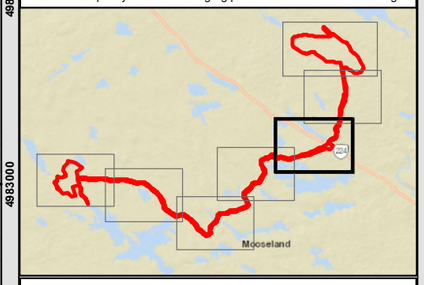
- Receptor
- 17.1 ug/m3 TSP 24 hr Background Level Concentration

TSP Ranges (ug/m3)

- 5
- 5 - 10
- 10 - 15
- 15 - 17.1
- 17.1 - 20
- 20 - 25
- 25 - 30
- 30 - 35
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60

- Collector Road
- Local Road
- Dry Weather / Seasonal Road
- Diveways (>300 m)
- Track
- NSTDB Mapped Watercourses
- Lakes
- Planned Infrastructure
- Proposed Property Boundary

Note: Based on 80% Road Dust Mitigation
Ambient air quality criteria: Averaging period 24 hr - TSP limit: 120 ug/m3



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 125 250 500 m

1:15,000 Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed By: LP

Date: 2021-05-24

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

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Document Name: BD_EIS_Figure6-2-3Air 24hr TSP

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FIGURE 6.2-4D

Beaver Dam Mine Project Air Contour Total Suspended Particulate Matter 24-Hour Levels

17.1 ug/m3 TSP 24 hr Background Level Concentration

TSP Ranges (ug/m3)

- 5
- 5 - 10
- 10 - 15
- 15 - 17.1
- 17.1 - 20
- 20 - 25
- 25 - 30
- 30 - 35
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55

Dry Weather / Seasonal Road

Track

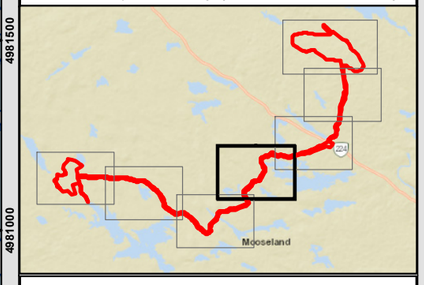
NSTDB Mapped Watercourses

Lakes

Planned Infrastructure

Proposed Property Boundary

Note: Based on 80% Road Dust Mitigation
Ambient air quality criteria: Averaging period 24 hr - TSP limit: 120 ug/m3



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 125 250 500 m

1:15,000 Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed By: LP

Date: 2021-05-24

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

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Document Name: BD_EIS_Figure6-2-3Air 24hr TSP

Upper Beaver Lake
Grassy Lake
Upper Kidney Lake
Lower Kidney Lake
Big Pond
Sandy Pond
Rum Lake

4983500
4983000
4982500
4982000
4981500
4981000
4980500
4980000

514500 515000 515500 516000 516500 517000 517500 518000 518500 519000 519500

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FIGURE 6.2-4E

Beaver Dam Mine Project Air Contour Total Suspended Particulate Matter 24-Hour Levels

Receptor

17.1 ug/m3 TSP 24 hr Background Level Concentration

TSP Ranges (ug/m3)

- 5
- 5 - 10
- 10 - 15
- 15 - 17.1
- 17.1 - 20
- 20 - 25
- 25 - 30
- 30 - 35
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60

Local Road

Dry Weather / Seasonal Road

Diveways (>300 m)

Track

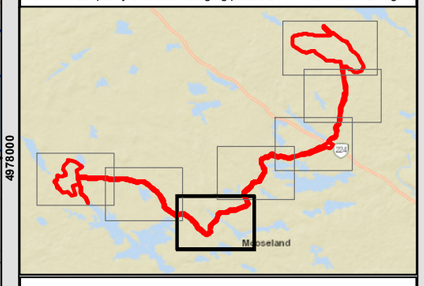
NSTDB Mapped Watercourses

Lakes

Planned Infrastructure

Proposed Property Boundary

Note: Based on 80% Road Dust Mitigation
Ambient air quality criteria: Averaging period 24 hr - TSP limit: 120 ug/m3



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 125 250 500 m

1:15,000 Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed By: LP

Date: 2021-05-24

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

McCallum Environmental Ltd.

Document Name: BD_EIS_Figure6-2-3Air 24hr TSP

Big Pond
Sandy Pond
Miller Lake
Mink Lake
Johns Pond
R7
R8
Jackson Lake
Grassy Lake
Bear Lake

4980500
4980000
4979500
4979000
4978500
4978000
4977500
4977000

512000 512500 513000 513500 514000 514500 515000 515500 516000 516500 517000

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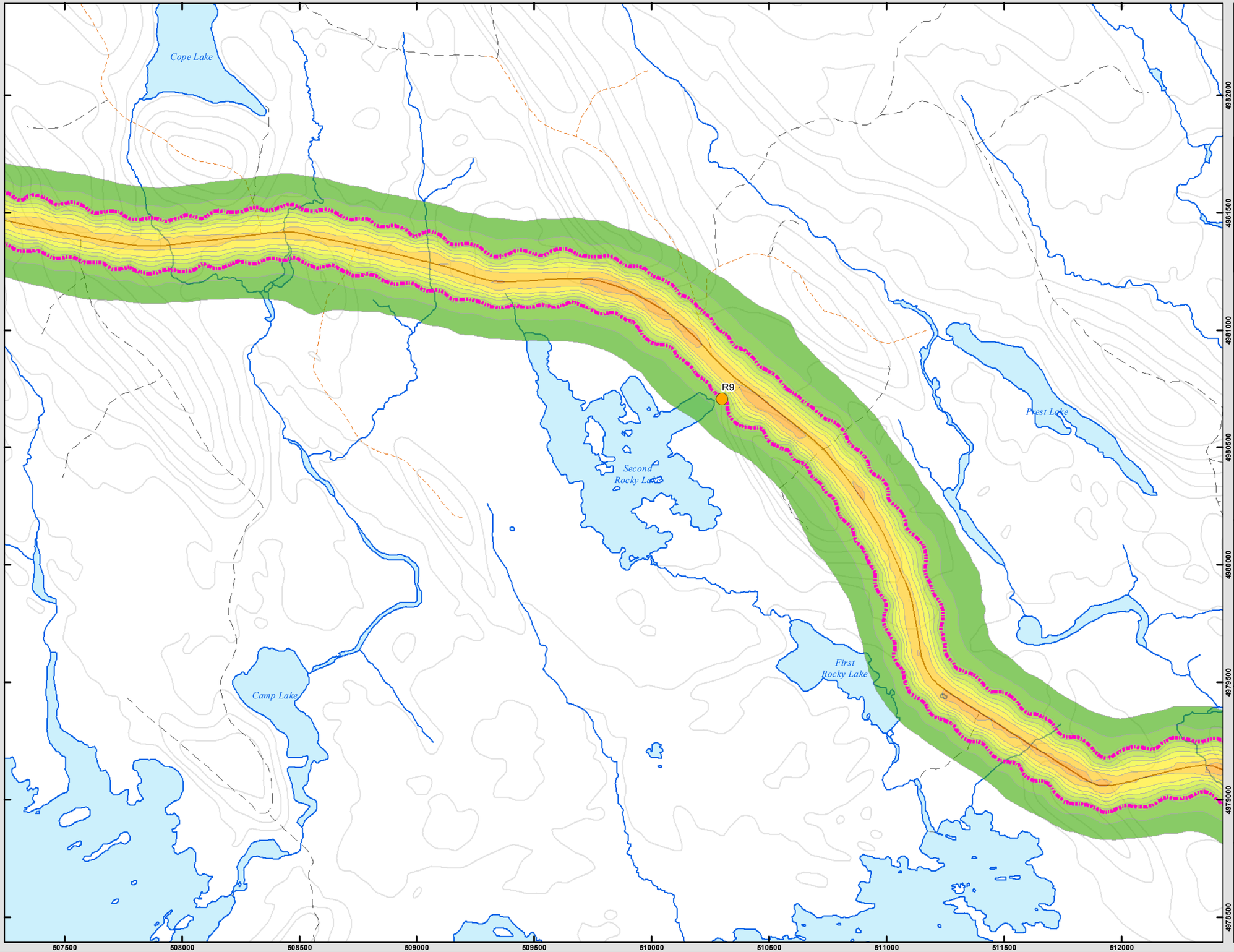
FIGURE 6.2-4F

Beaver Dam Mine Project Air Contour Total Suspended Particulate Matter 24-Hour Levels



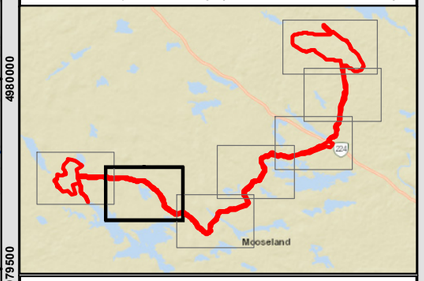
- Receptor
- 17.1 ug/m3 TSP 24 hr Background Level Concentration

TSP Ranges (ug/m3)

- 5
- 5 - 10
- 10 - 15
- 15 - 17.1
- 17.1 - 20
- 20 - 25
- 25 - 30
- 30 - 35
- 35 - 40
- 40 - 45

- Local Road
- Dry Weather / Seasonal Road
- Diveways (>300 m)
- Track
- NSTDB Mapped Watercourses
- Lakes
- Planned Infrastructure

Note: Based on 80% Road Dust Mitigation
Ambient air quality criteria: Averaging period 24 hr - TSP limit: 120 ug/m3



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 125 250 500 m

1:15,000 Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed By: LP

Date: 2021-05-24

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

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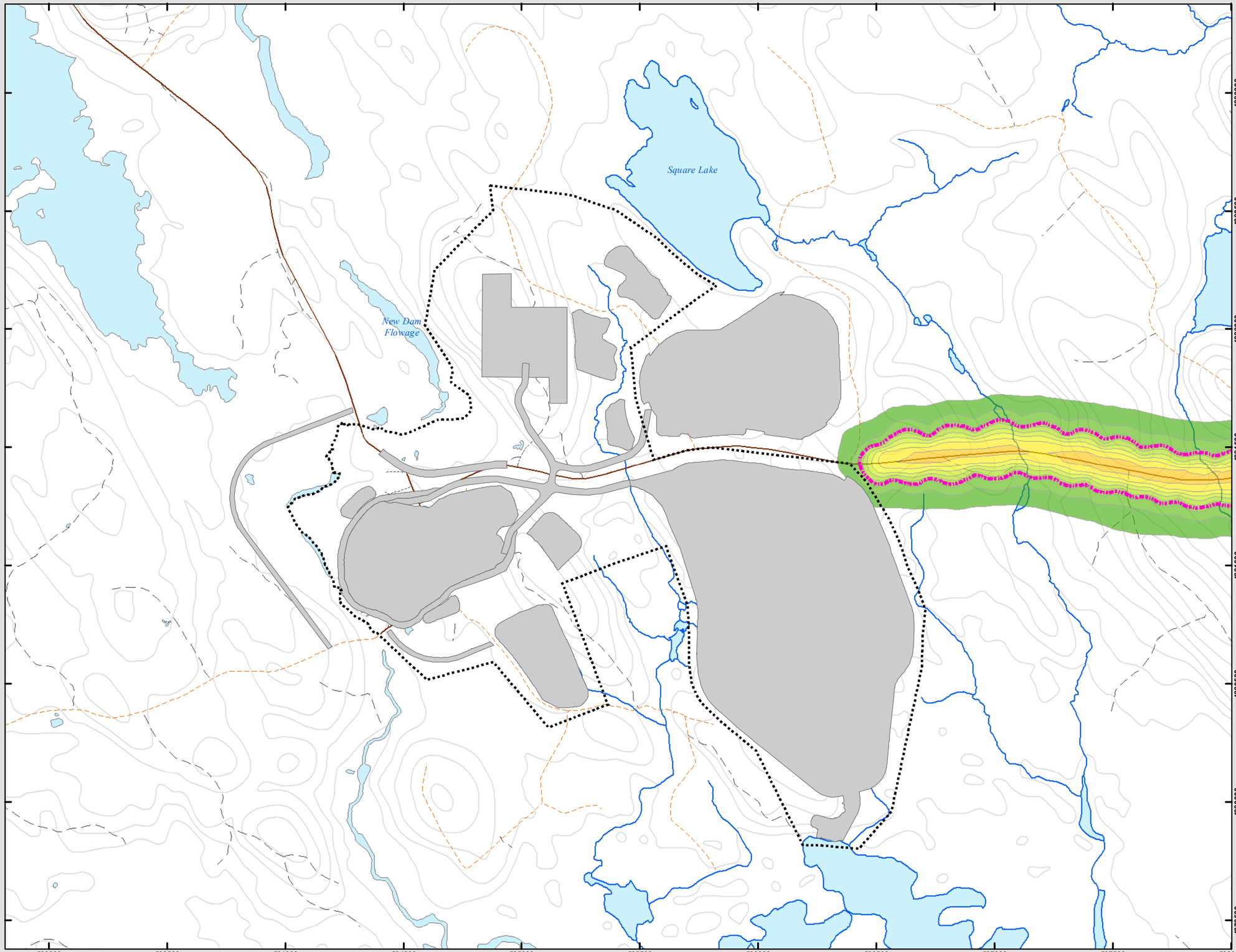
Document Name: BD_EIS_Figure6-2-3Air 24hr TSP

Prepared For:

Atlantic Gold

FIGURE 6.2-4G

Beaver Dam Mine Project Air Contour Total Suspended Particulate Matter 24-Hour Levels



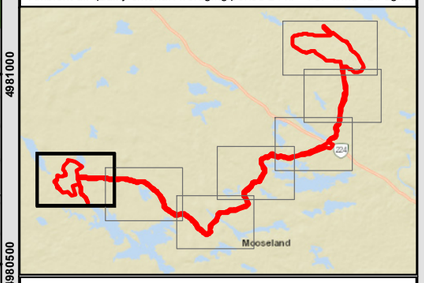
17.1 ug/m3 TSP 24 hr Background Level Concentration

TSP Ranges (ug/m3)

- 5
- 5 - 10
- 10 - 15
- 15 - 17.1
- 17.1 - 20
- 20 - 25
- 25 - 30
- 30 - 35
- 35 - 40

- Local Road
- Dry Weather / Seasonal Road
- Diveways (>300 m)
- Track
- NSTDB Mapped Watercourses
- Lakes
- Planned Infrastructure
- Touquoy Infrastructure Layout
- Proposed Property Boundary

Note: Based on 80% Road Dust Mitigation
Ambient air quality criteria: Averaging period 24 hr - TSP limit: 120 ug/m3



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 125 250 500 m

1:15,000 Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed By: LP

Date: 2021-05-24

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

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Document Name: BD_EIS_Figure6-2-3Air 24hr TSP

Prepared For:

Atlantic Gold

FIGURE 6.2-5A

Beaver Dam Mine Project Air Contour PM10 24-Hour Levels

13.1 ug/m3 PM10 24 hr Background Level Concentration

Mine Site concentrations reach background within boundary

PM10 Ranges (um/m3)

- 5
- 5 - 10
- 10 - 13.5
- 13.5 - 15
- 15 - 20
- 20 - 25

Local Road

Dry Weather / Seasonal Road

Track

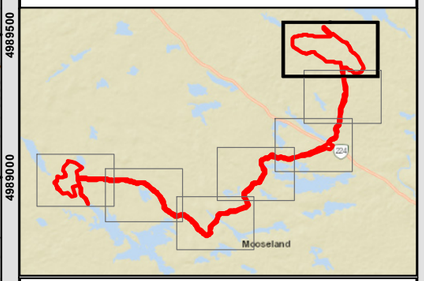
NSTDB Mapped Watercourses

Lakes

Planned Infrastructure

Proposed Property Boundary

Note: Based on 80% Road Dust Mitigation
Ambient air quality criteria: Averaging period 24 hr - PM10 limit: 50ug/m3



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 170 340 680 m

1:20,000 Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed By: LP

Date: 2021-05-24

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

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Document Name: BD_EIS_Figure6-2-4Air 24hr PM10

Prepared For:

Atlantic Gold

FIGURE 6.2-5B

Beaver Dam Mine Project Air Contour PM10 24-Hour Levels

13.1 ug/m3 PM10 24 hr Background Level Concentration

Mine Site concentrations reach background within boundary

PM10 Ranges (um/m3)

- 5
- 5 - 10
- 10 - 13.5
- 13.5 - 15
- 15 - 20
- 20 - 25

Local Road

Dry Weather / Seasonal Road

Track

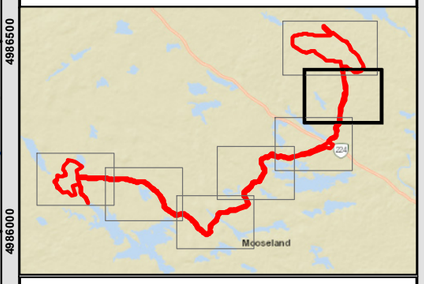
NSTDB Mapped Watercourses

Lakes

Planned Infrastructure

Proposed Property Boundary

Note: Based on 80% Road Dust Mitigation
Ambient air quality criteria: Averaging period 24 hr - PM10 limit: 50ug/m3



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 125 250 500 m

1:15,000 Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed By: LP

Date: 2021-05-24

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

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Document Name: BD_EIS_Figure6-2-4Air 24hr PM10

Prepared For:

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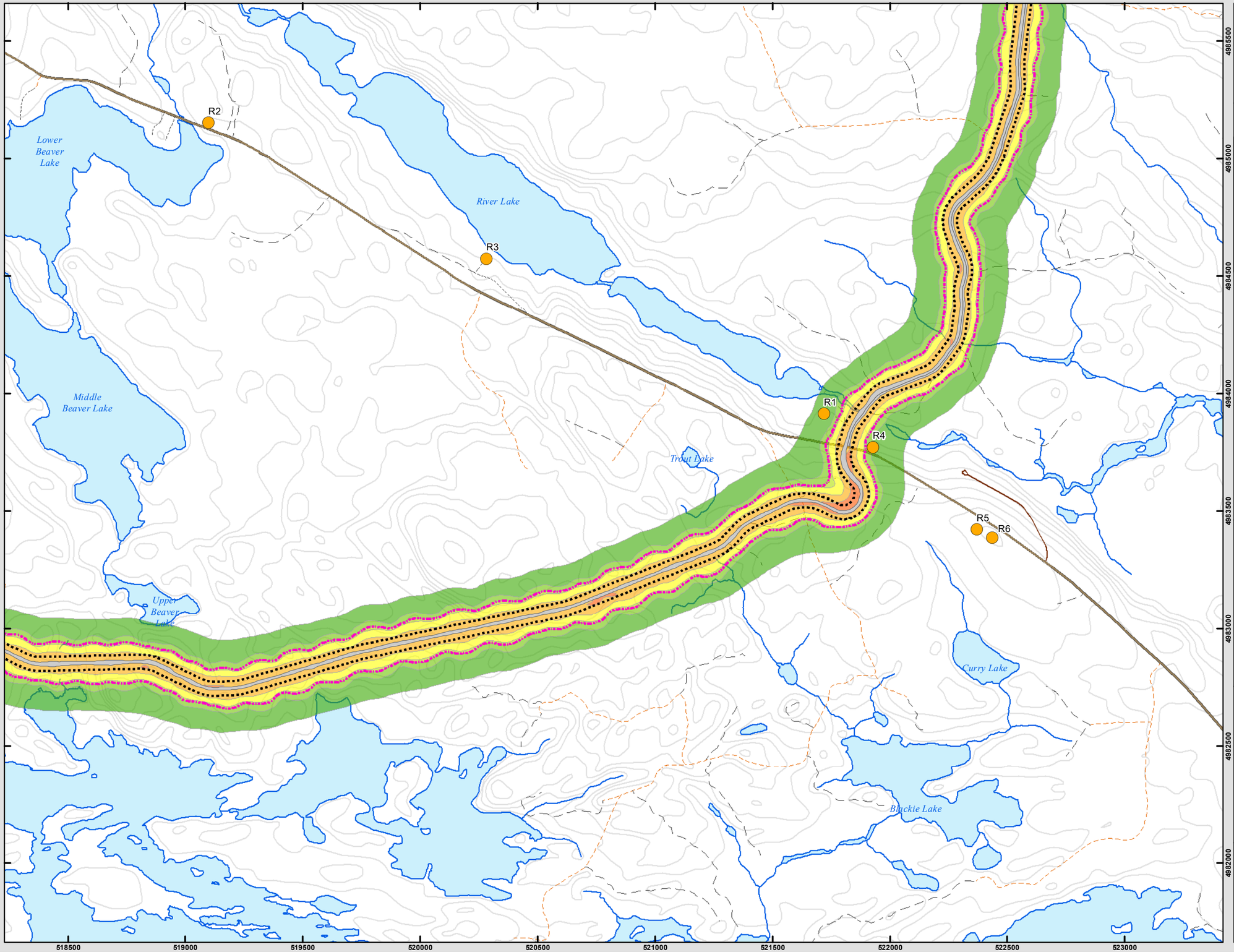
FIGURE 6.2-5C

Beaver Dam Mine Project Air Contour PM10 24-Hour Levels



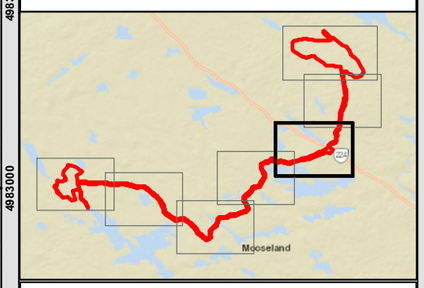
- Receptor
- 13.1 ug/m3 PM10 24 hr Background Level Concentration

PM10 Ranges (um/m3)

- 5
- 5 - 10
- 10 - 13.5
- 13.5 - 15
- 15 - 20
- 20 - 25

- Collector Road
- Local Road
- Dry Weather / Seasonal Road
- Diveways (>300 m)
- Track
- NSTDB Mapped Watercourses
- Lakes
- Planned Infrastructure
- Proposed Property Boundary

Note: Based on 80% Road Dust Mitigation
Ambient air quality criteria: Averaging period 24 hr - PM10 limit: 50ug/m3



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 125 250 500 m

1:15,000 Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed By: LP

Date: 2021-05-24

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

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Document Name: BD_EIS_Figure6-2-4Air 24hr PM10

Prepared For:

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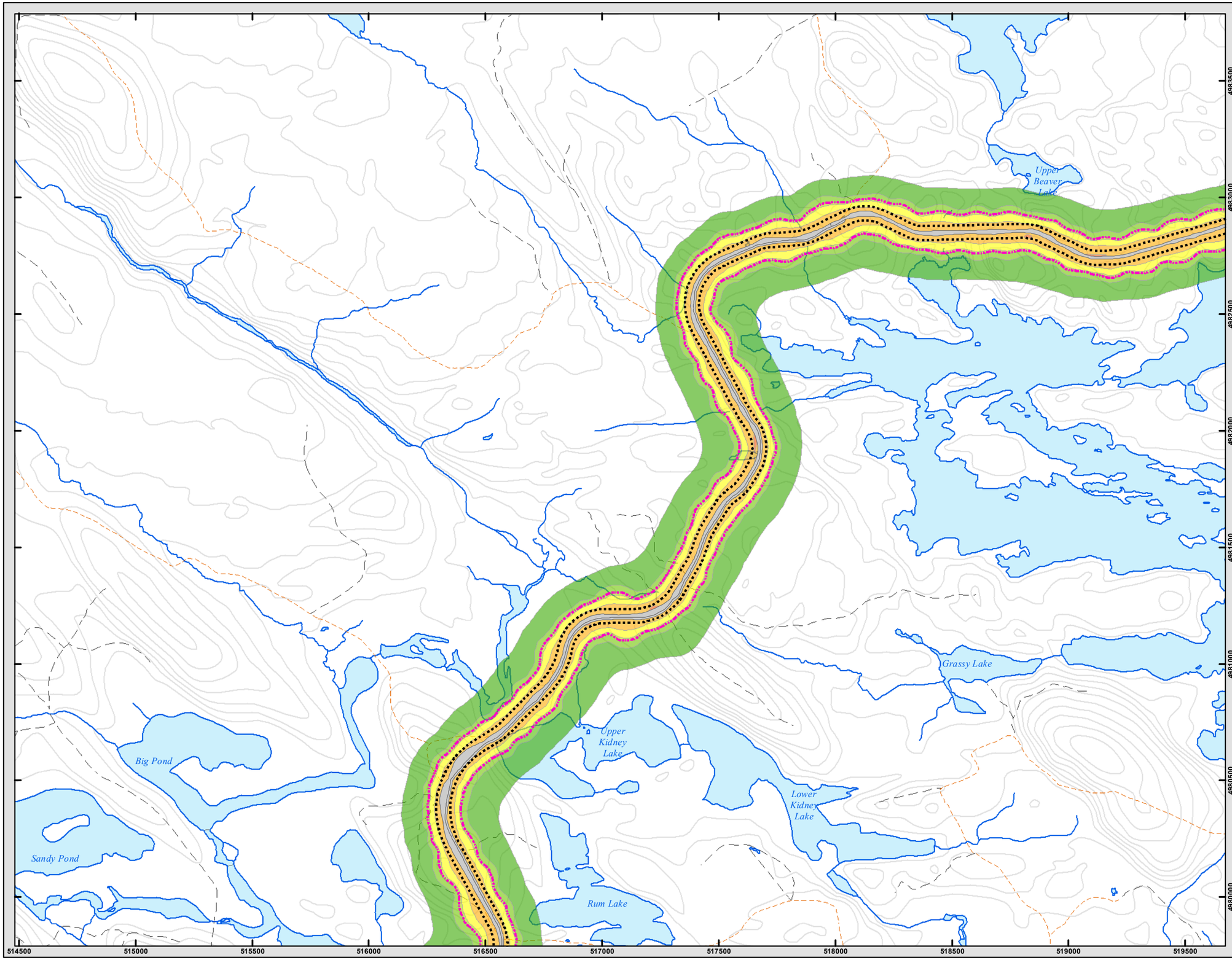
FIGURE 6.2-5D

Beaver Dam Mine Project Air Contour PM10 24-Hour Levels



13.1 ug/m3 PM10 24 hr Background Level Concentration

PM10 Ranges (um/m3)

- 5
- 5 - 10
- 10 - 13.5
- 13.5 - 15
- 15 - 20
- 20 - 25

Dry Weather / Seasonal Road

Track

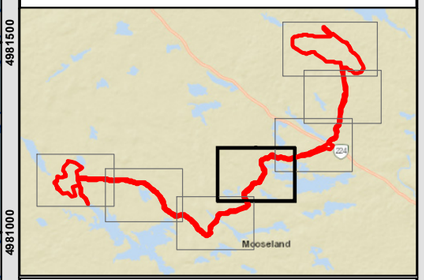
NSTDB Mapped Watercourses

Lakes

Planned Infrastructure

Proposed Property Boundary

Note: Based on 80% Road Dust Mitigation
Ambient air quality criteria: Averaging period 24 hr - PM10 limit: 50ug/m3



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 125 250 500 m

1:15,000 Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed By: LP

Date: 2021-05-24

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

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Document Name: BD_EIS_Figure6-2-4Air 24hr PM10

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FIGURE 6.2-5E

Beaver Dam Mine Project Air Contour PM10 24-Hour Levels

Big Pond
Sandy Pond
Miller Lake
Mink Lake
Johns Pond
R7
R8
Jackson Lake
Grassy Lake
Bear Lake

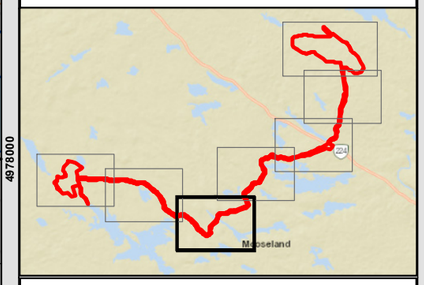
- Receptor
- 13.1 ug/m3 PM10 24 hr Background Level Concentration

PM10 Ranges (um/m3)

- 5
- 5 - 10
- 10 - 13.5
- 13.5 - 15
- 15 - 20
- 20 - 25
- 25 - 30

- Local Road
- Dry Weather / Seasonal Road
- Diveways (>300 m)
- Track
- NSTDB Mapped Watercourses
- Lakes
- Planned Infrastructure
- Proposed Property Boundary

Note: Based on 80% Road Dust Mitigation
Ambient air quality criteria: Averaging period 24 hr - PM10 limit: 50ug/m3



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 125 250 500 m

1:15,000 Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed By: LP

Date: 2021-05-24

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

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Document Name: BD_EIS_Figure6-2-4Air 24hr PM10

4980500
4980000
4979500
4979000
4978500
4978000
4977500
4977000

512000 512500 513000 513500 514000 514500 515000 515500 516000 516500 517000

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Atlantic Gold

FIGURE 6.2-5F

Beaver Dam Mine Project Air Contour PM10 24-Hour Levels

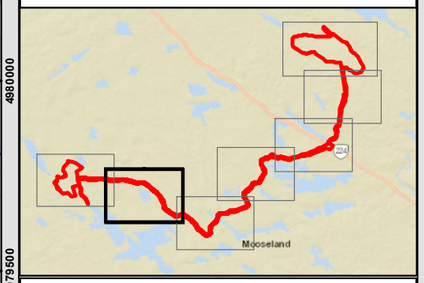
Cope Lake
Camp Lake
First Rocky Lake
Second Rocky Lake
Frest Lake
R9

Receptor
13.1 ug/m3 PM10 24 hr Background Level Concentration

PM10 Ranges (um/m3)
- 5
- 5 - 10
- 10 - 13.5
- 13.5 - 15
- 15 - 20

Local Road
Dry Weather / Seasonal Road
Diveways (>300 m)
Track
NSTDB Mapped Watercourses
Lakes
Planned Infrastructure

Note: Based on 80% Road Dust Mitigation
Ambient air quality criteria: Averaging period 24 hr - PM10 limit: 50ug/m3



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 125 250 500 m

1:15,000 Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed By: LP

Date: 2021-05-24

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

McCallum Environmental Ltd.

Document Name: BD_EIS_Figure6-2-4Air 24hr PM10

4982000
4981500
4981000
4980500
4980000
4979500
4979000
4978500

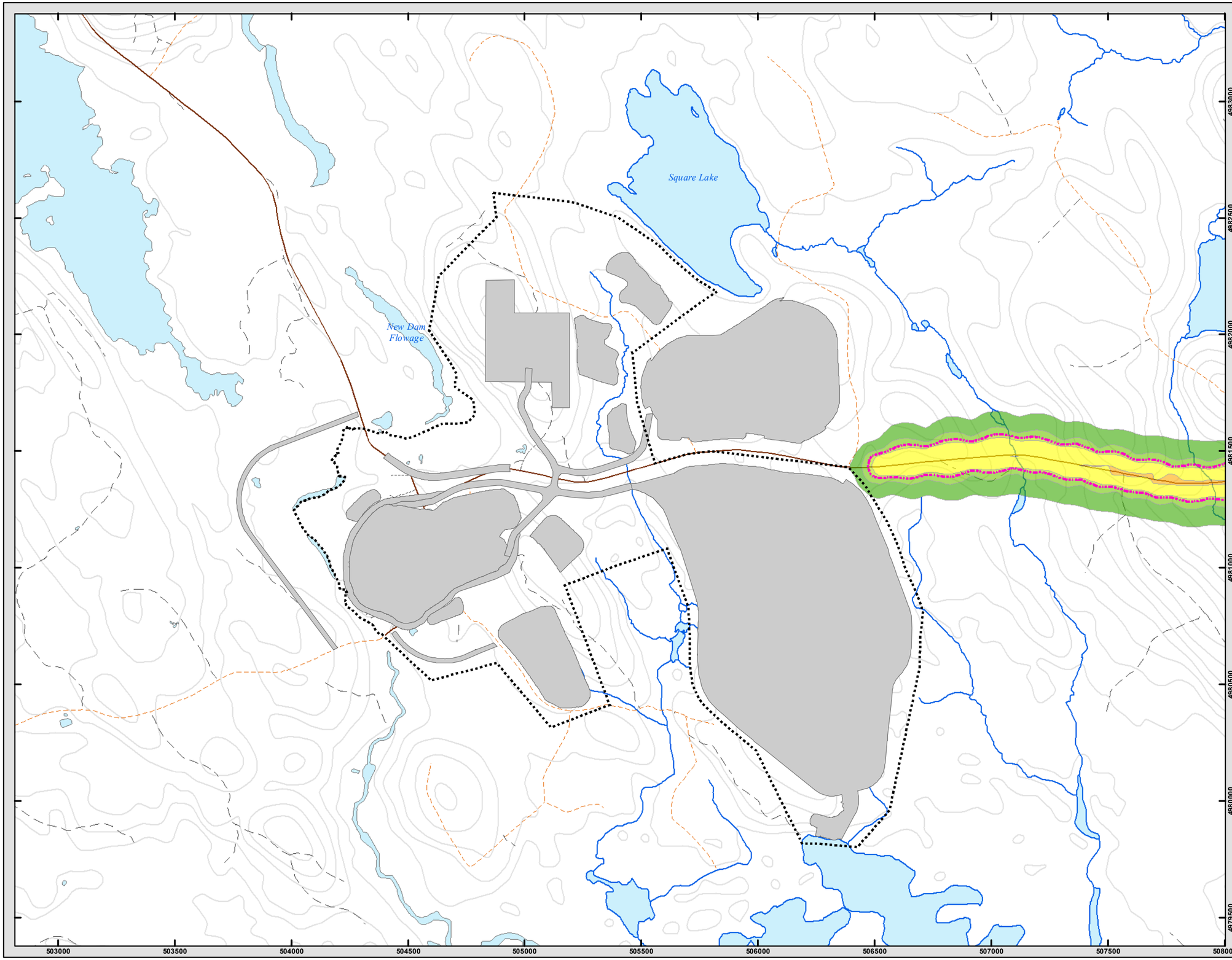
507500 508000 508500 509000 509500 510000 510500 511000 511500 512000

Prepared For:

Atlantic Gold

FIGURE 6.2-5G

Beaver Dam Mine Project Air Contour PM10 24-Hour Levels



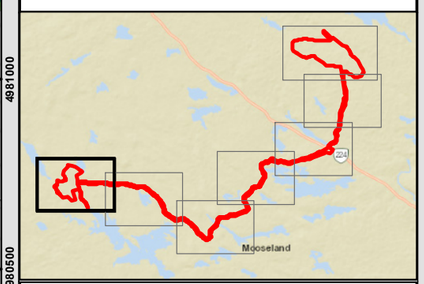
13.1 ug/m3 PM10 24 hr Background Level Concentration

PM10 Ranges (um/m3)

- 5
- 5 - 10
- 10 - 13.5
- 13.5 - 15
- 15 - 20

- Local Road
- Dry Weather / Seasonal Road
- Diveways (>300 m)
- Track
- NSTDB Mapped Watercourses
- Lakes
- Planned Infrastructure
- Proposed Property Boundary

Note: Based on 80% Road Dust Mitigation
Ambient air quality criteria: Averaging period 24 hr - PM10 limit: 50ug/m3



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 125 250 500 m

1:15,000 Scale when printed @ 11" x 17"

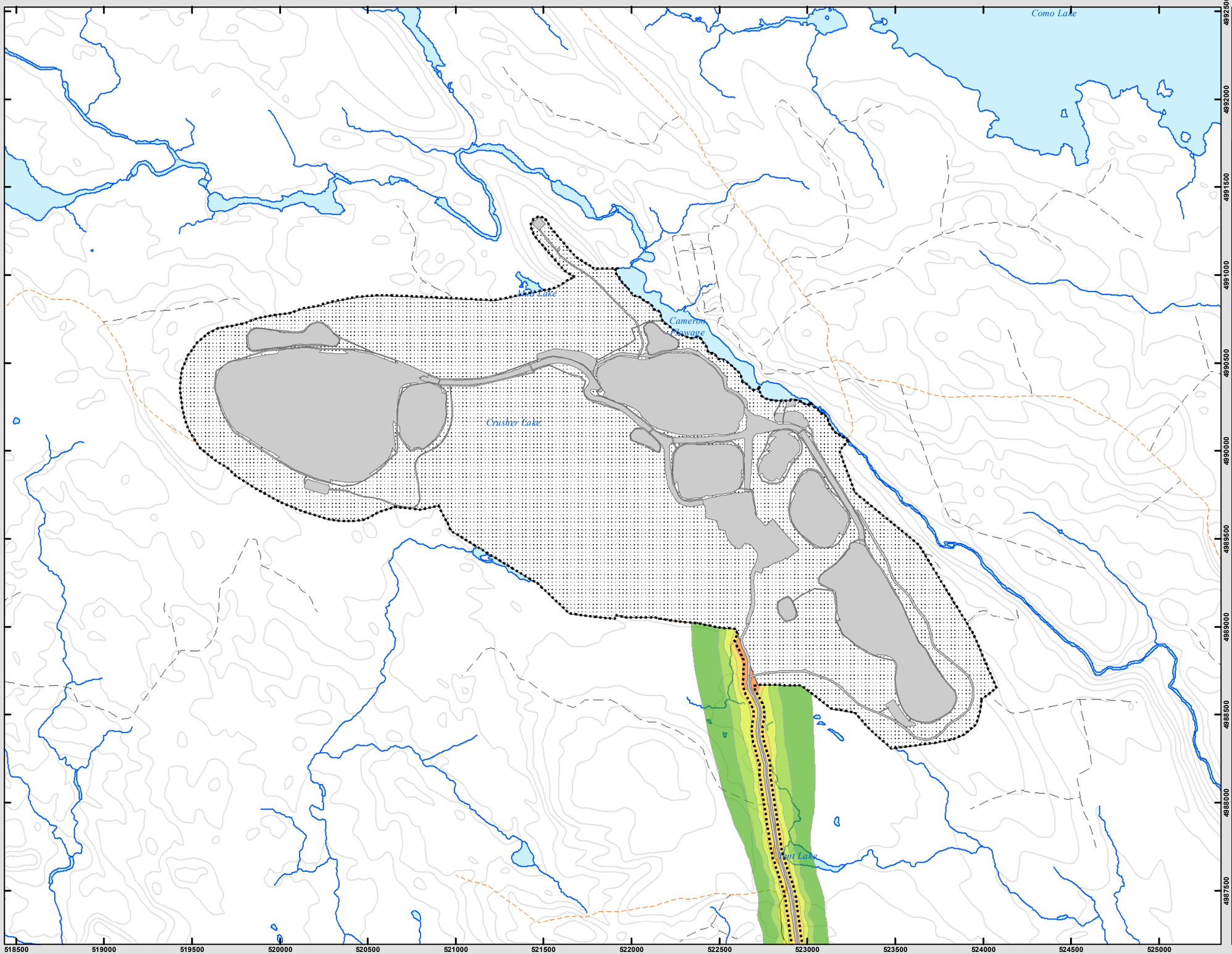
Drawn By: EP
Reviewed By: LP

Date: 2021-05-24

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

McCallum Environmental Ltd.

Document Name: BD_EIS_Figure6-2-4Air 24hr PM10



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Atlantic Gold

FIGURE 6.2-6A

Beaver Dam Mine Project Air Contour PM2.5 24-Hour Levels

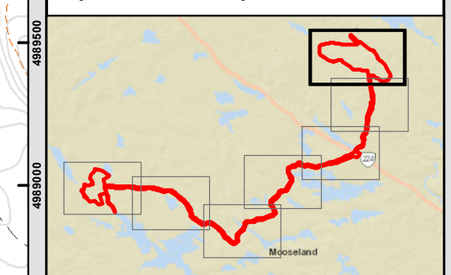
Mine Site concentrations reach background within boundary

PM 2.5 Ranges (ug/m3)

- 0.5
- 0.5 - 1
- 1- 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5 - 3

- Local Road
- Dry Weather / Seasonal Road
- Track
- NSTDB Mapped Watercourses
- Lakes
- Planned Infrastructure
- Proposed Property Boundary

Note: Based on 80% Road Dust mitigation
All contours shown well below limits or background values
Ambient air quality criteria: Averaging period 24 hr PM2.5 limit: 27 ug/m3
Background 24 hr PM 2.5 level: 9 ug/m3



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 170 340 680 m

1:20,000 Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed By: LP

Date: 2021-05-24

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

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Document Name: BD_EIS_Figure6-2-5Air 24hr PM2.5

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Atlantic Gold

FIGURE 6.2-6B

Beaver Dam Mine Project Air Contour PM2.5 24-Hour Levels

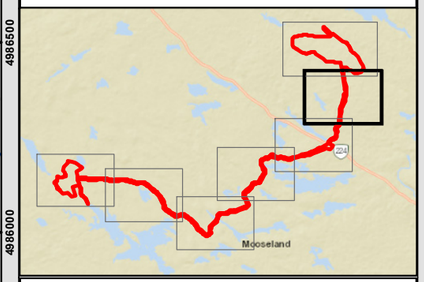
Mine Site concentrations reach background within boundary

PM 2.5 Ranges (ug/m3)

- 0.5
- 0.5 - 1
- 1- 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5 - 3

- Local Road
- Dry Weather / Seasonal Road
- Track
- NSTDB Mapped Watercourses
- Lakes
- Planned Infrastructure
- Proposed Property Boundary

Note: Based on 80% Road Dust mitigation
All contours shown well below limits or background values
Ambient air quality criteria: Averaging period 24 hr PM2.5 limit: 27 ug/m3
Background 24 hr PM 2.5 level: 9 ug/m3



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 125 250 500 m

1:15,000 Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed By: LP

Date: 2021-05-24

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

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Document Name: BD_EIS_Figure6-2-5Air 24hr PM2.5

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FIGURE 6.2-6C

Beaver Dam Mine Project Air Contour PM2.5 24-Hour Levels

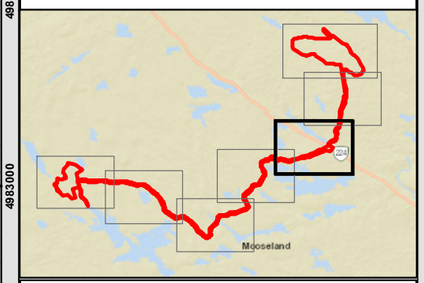
Receptor

PM 2.5 Ranges (ug/m3)

- 0.5
- 0.5 - 1
- 1- 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5 - 3

- Collector Road
- Local Road
- Dry Weather / Seasonal Road
- Diveways (>300 m)
- Track
- NSTDB Mapped Watercourses
- Lakes
- Planned Infrastructure
- Proposed Property Boundary

Note: Based on 80% Road Dust mitigation
All contours shown well below limits or background values
Ambient air quality criteria: Averaging period 24 hr PM2.5 limit: 27 ug/m3
Background 24 hr PM 2.5 level: 9 ug/m3



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 125 250 500 m

1:15,000 Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed By: LP

Date: 2021-05-24

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

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Document Name: BD_EIS_Figure6-2-5Air 24hr PM2.5

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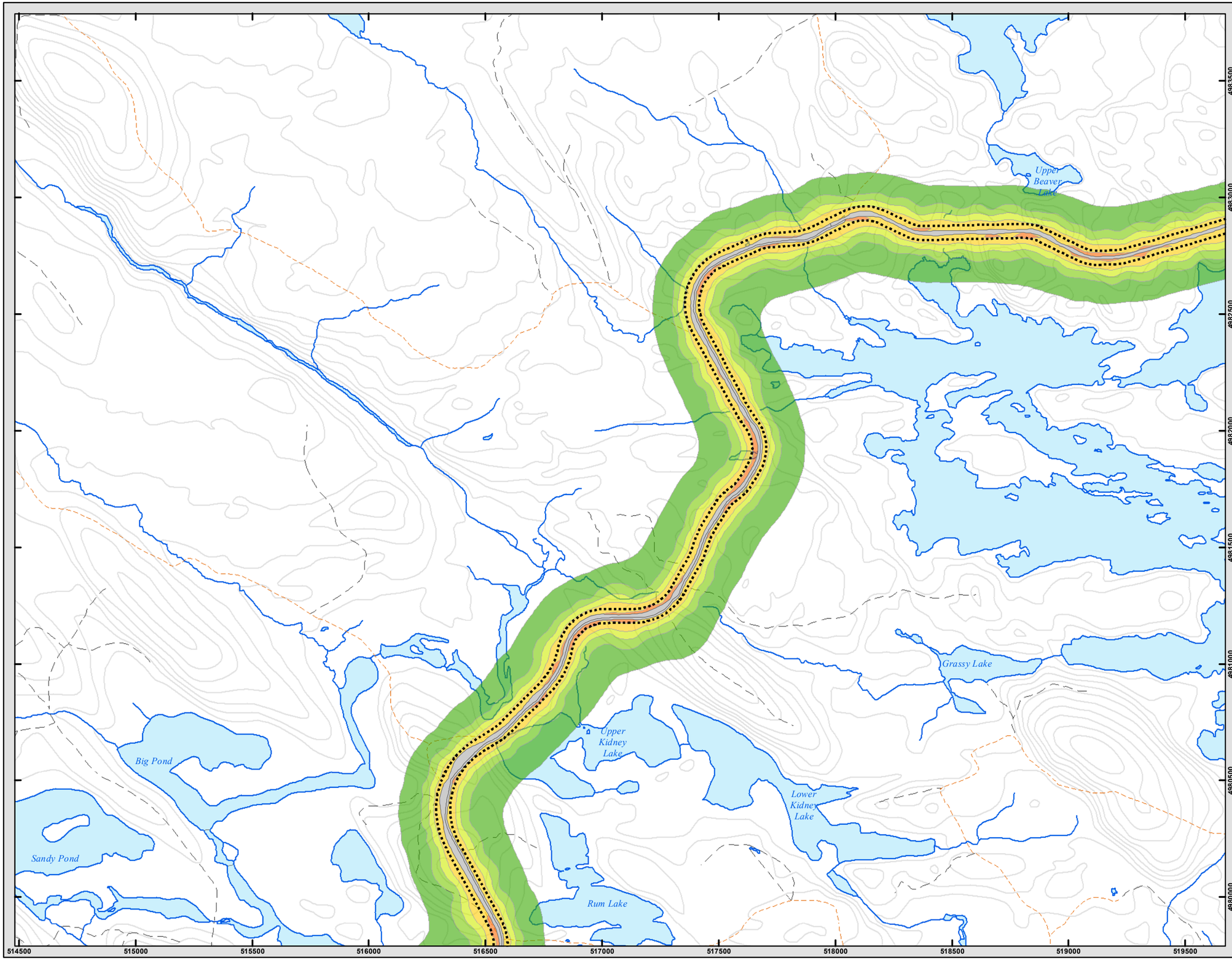
FIGURE 6.2-6D

Beaver Dam Mine Project Air Contour PM2.5 24-Hour Levels

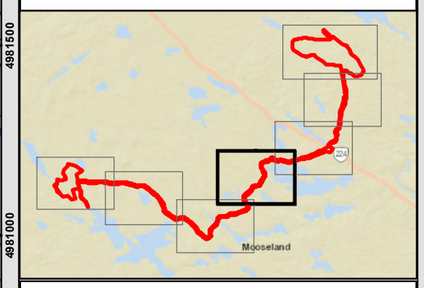


PM 2.5 Ranges (ug/m3)

- 0.5
- 0.5 - 1
- 1- 1.5
- 1.5 - 2
- 2 - 2.5

- Dry Weather / Seasonal Road
- Track
- NSTDB Mapped Watercourses
- Lakes
- Planned Infrastructure
- Proposed Property Boundary

Note: Based on 80% Road Dust mitigation
All contours shown well below limits or background values
Ambient air quality criteria: Averaging period 24 hr PM2.5 limit: 27 ug/m3
Background 24 hr PM 2.5 level: 9 ug/m3



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 125 250 500 m

1:15,000 Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed By: LP

Date: 2021-05-24

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

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Document Name: BD_EIS_Figure6-2-5Air 24hr PM2.5

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FIGURE 6.2-6E

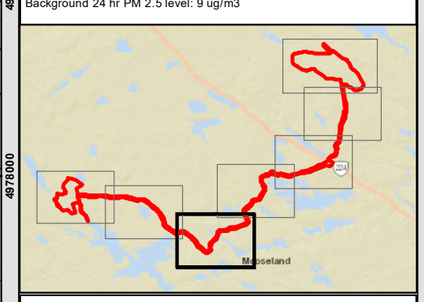
Beaver Dam Mine Project Air Contour PM2.5 24-Hour Levels

Receptor

PM 2.5 Ranges (ug/m3)
- 0.5
- 0.5 - 1
- 1- 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5 - 3

- Local Road
- Dry Weather / Seasonal Road
- Diveways (>300 m)
- Track
- NSTDB Mapped Watercourses
- Lakes
- Planned Infrastructure
- Proposed Property Boundary

Note: Based on 80% Road Dust mitigation
All contours shown well below limits or background values
Ambient air quality criteria: Averaging period 24 hr PM2.5 limit: 27 ug/m3
Background 24 hr PM 2.5 level: 9 ug/m3



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 125 250 500 m

1:15,000 Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed By: LP

Date: 2021-05-24

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

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Document Name: BD_EIS_Figure6-2-5Air 24hr PM2.5

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FIGURE 6.2-6F

Beaver Dam Mine Project Air Contour PM2.5 24-Hour Levels

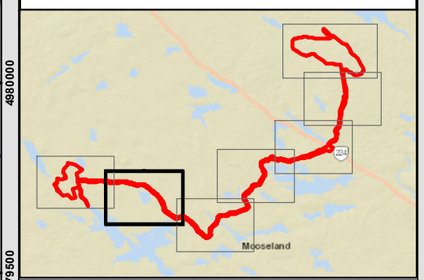
Cope Lake
Camp Lake
Second Rocky Lake
First Rocky Lake
Prest Lake
R9

Receptor

PM 2.5 Ranges (ug/m3)
- 0.5
- 0.5 - 1
- 1- 1.5
- 1.5 - 2

- Local Road
- Dry Weather / Seasonal Road
- Diveways (>300 m)
- Track
- NSTDB Mapped Watercourses
- Lakes
- Planned Infrastructure

Note: Based on 80% Road Dust mitigation
All contours shown well below limits or background values
Ambient air quality criteria: Averaging period 24 hr PM2.5 limit: 27 ug/m3
Background 24 hr PM 2.5 level: 9 ug/m3



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 125 250 500 m

1:15,000 Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed By: LP

Date: 2021-05-24

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

McCallum Environmental Ltd.

Document Name: BD_EIS_Figure6-2-5Air 24hr PM2.5

507500 508000 508500 509000 509500 510000 510500 511000 511500 512000

4982000 4981500 4981000 4980500 4980000 4979500 4979000 4978500

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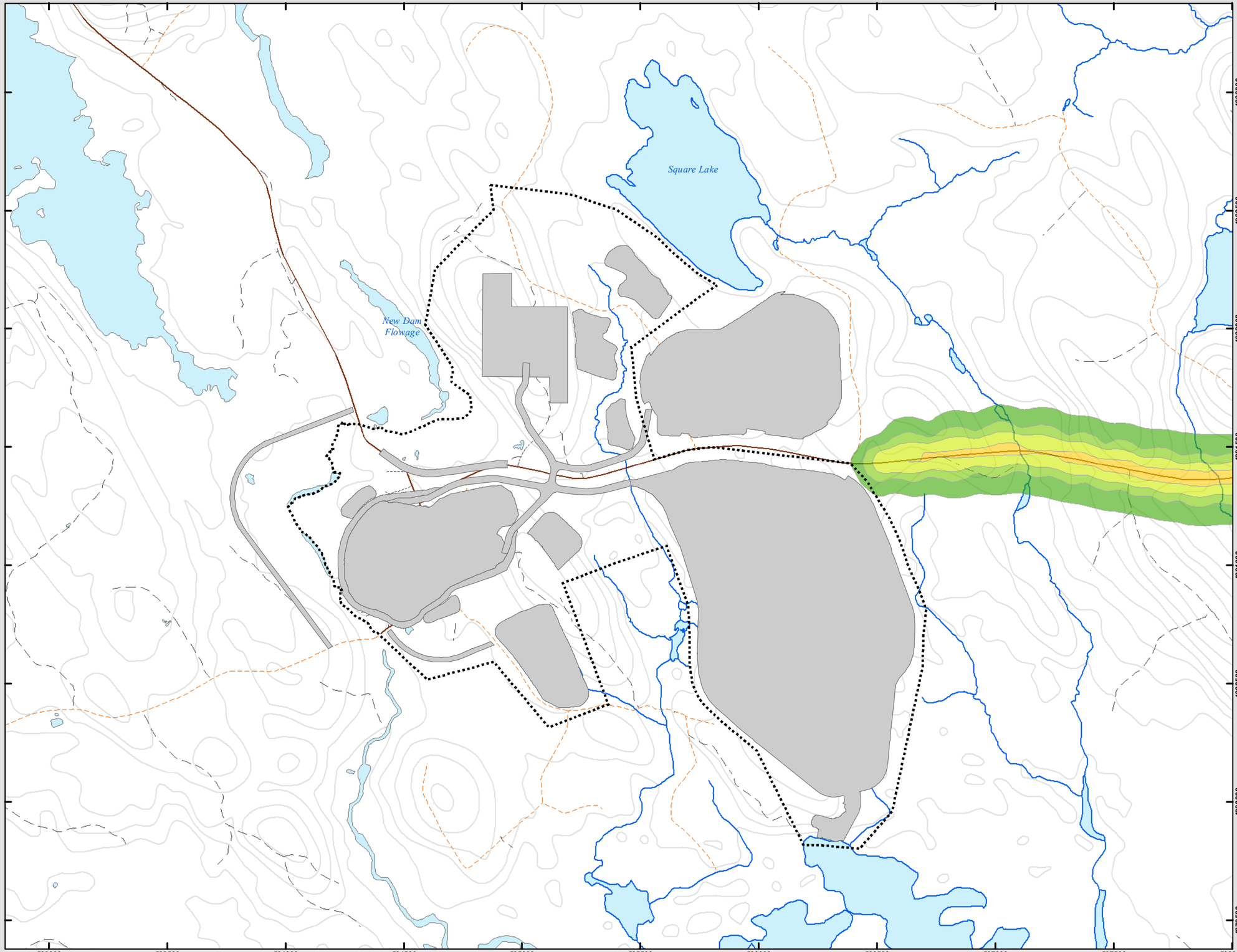
FIGURE 6.2-6G

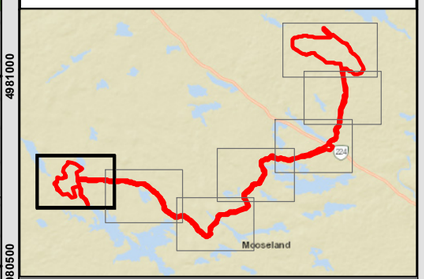
Beaver Dam Mine Project Air Contour PM2.5 24-Hour Levels



PM 2.5 Ranges (ug/m3)
- 0.5
- 0.5 - 1
- 1- 1.5
- 1.5 - 2

- Local Road
- Dry Weather / Seasonal Road
- Diveways (>300 m)
- Track
- NSTDB Mapped Watercourses
- Lakes
- Planned Infrastructure
- Proposed Property Boundary

Note: Based on 80% Road Dust mitigation
All contours shown well below limits or background values
Ambient air quality criteria: Averaging period 24 hr PM2.5 limit: 27 ug/m3
Background 24 hr PM 2.5 level: 9 ug/m3



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 125 250 500 m

1:15,000 Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed By: LP

Date: 2021-05-24

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

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Document Name: BD_EIS_Figure6-2-5Air 24hr PM2.5

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FIGURE 6.2-7A

Beaver Dam Mine Project Air Contour Annual Average Total Particulate Matter

12.1 ug/m3 TSP Annual Background Level Concentration

Mine Site concentrations reach background within boundary

TSP Ranges (ug/m3)

- 2
- 2 - 4
- 4 - 6
- 6 - 8
- 8 - 10
- 10 - 12
- 12 - 12.1
- 12.1 - 14
- 14 - 16
- 16 - 18
- 18 - 20

Local Road

Dry Weather / Seasonal Road

Track

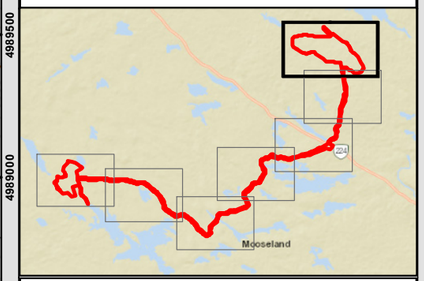
NSTDB Mapped Watercourses

Lakes

Planned Infrastructure

Proposed Property Boundary

Note: Based on 80% Road Dust Mitigation
Ambient air quality criteria: Averaging peroid Annual - TSP limit: 70ug/m3



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 170 340 680 m

1:20,000 Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed By: LP

Date: 2021-05-24

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

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Document Name: BD_EIS_Figure6-2-6Air Annual TSP

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FIGURE 6.2-7B

Beaver Dam Mine Project Air Contour Annual Average Total Particulate Matter

12.1 ug/m3 TSP Annual Background Level Concentration

Mine Site concentrations reach background within boundary

TSP Ranges (ug/m3)

- 2
- 2 - 4
- 4 - 6
- 6 - 8
- 8 - 10
- 10 - 12
- 12 - 12.1
- 12.1 - 14
- 14 - 16
- 16 - 18
- 18 - 20

Local Road

Dry Weather / Seasonal Road

Track

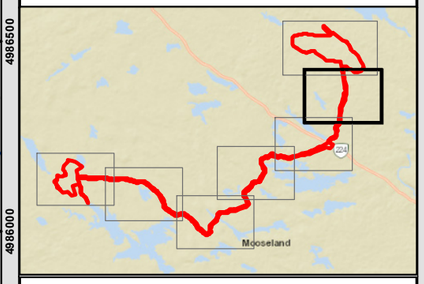
NSTDB Mapped Watercourses

Lakes

Planned Infrastructure

Proposed Property Boundary

Note: Based on 80% Road Dust Mitigation
Ambient air quality criteria: Averaging peroid Annual - TSP limit: 70ug/m3



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 125 250 500 m

1:15,000 Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed By: LP

Date: 2021-05-24

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

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Document Name: BD_EIS_Figure6-2-6Air Annual TSP

Prepared For:

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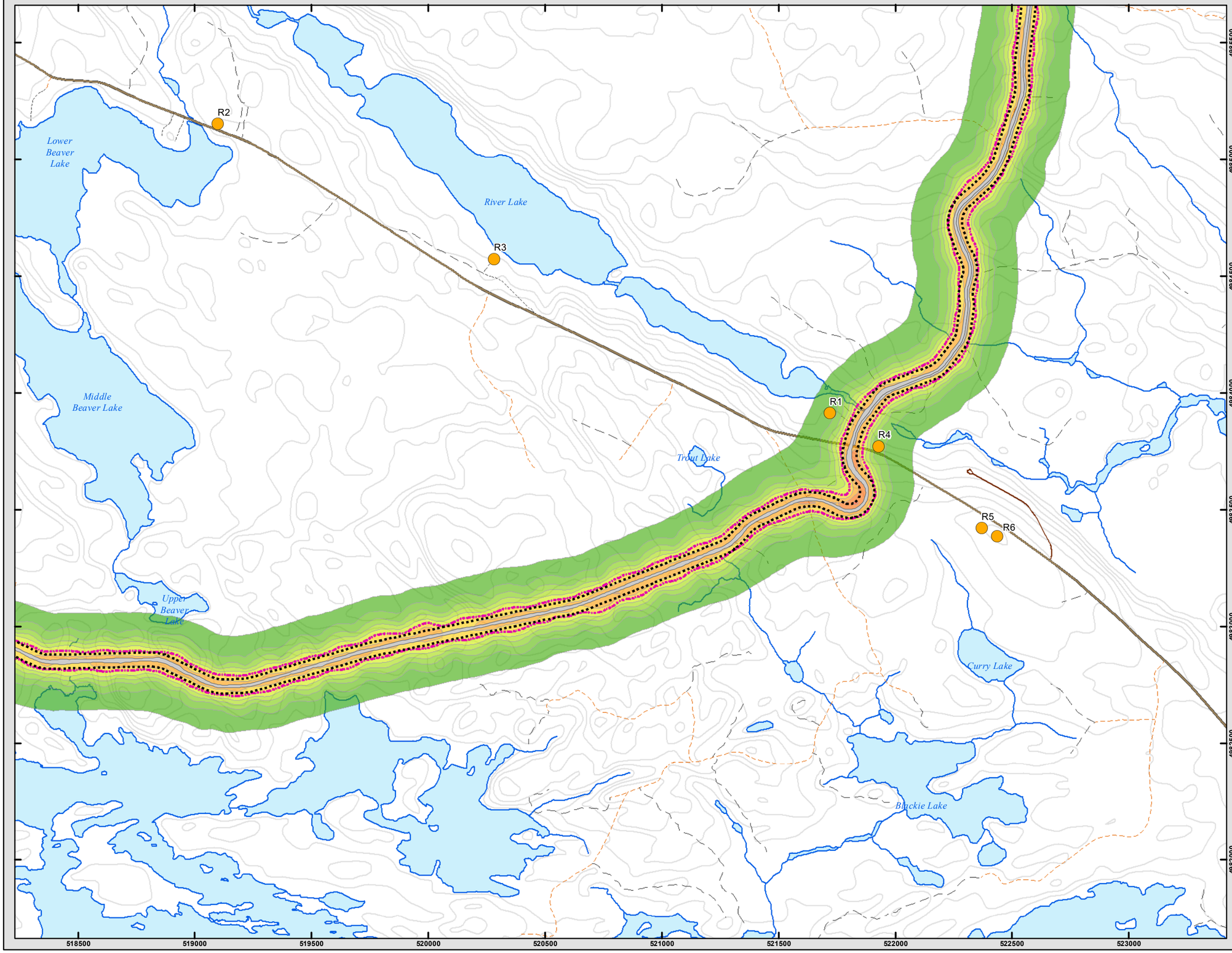
FIGURE 6.2-7C

Beaver Dam Mine Project Air Contour Annual Average Total Particulate Matter



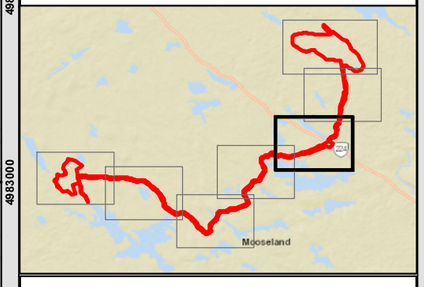
Receptor
12.1 ug/m3 TSP Annual Background Level Concentration

TSP Ranges (ug/m3)

- 2
- 2 - 4
- 4 - 6
- 6 - 8
- 8 - 10
- 10 - 12
- 12 - 12.1
- 12.1 - 14
- 14 - 16
- 16 - 18

Collector Road
Local Road
Dry Weather / Seasonal Road
Diveways (>300 m)
Track
NSTDB Mapped Watercourses
Lakes
Planned Infrastructure
Proposed Property Boundary

Note: Based on 80% Road Dust Mitigation
Ambient air quality criteria: Averaging peroid Annual - TSP limit: 70ug/m3



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 125 250 500 m

1:15,000 Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed By: LP

Date: 2021-05-24

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

McCallum Environmental Ltd.

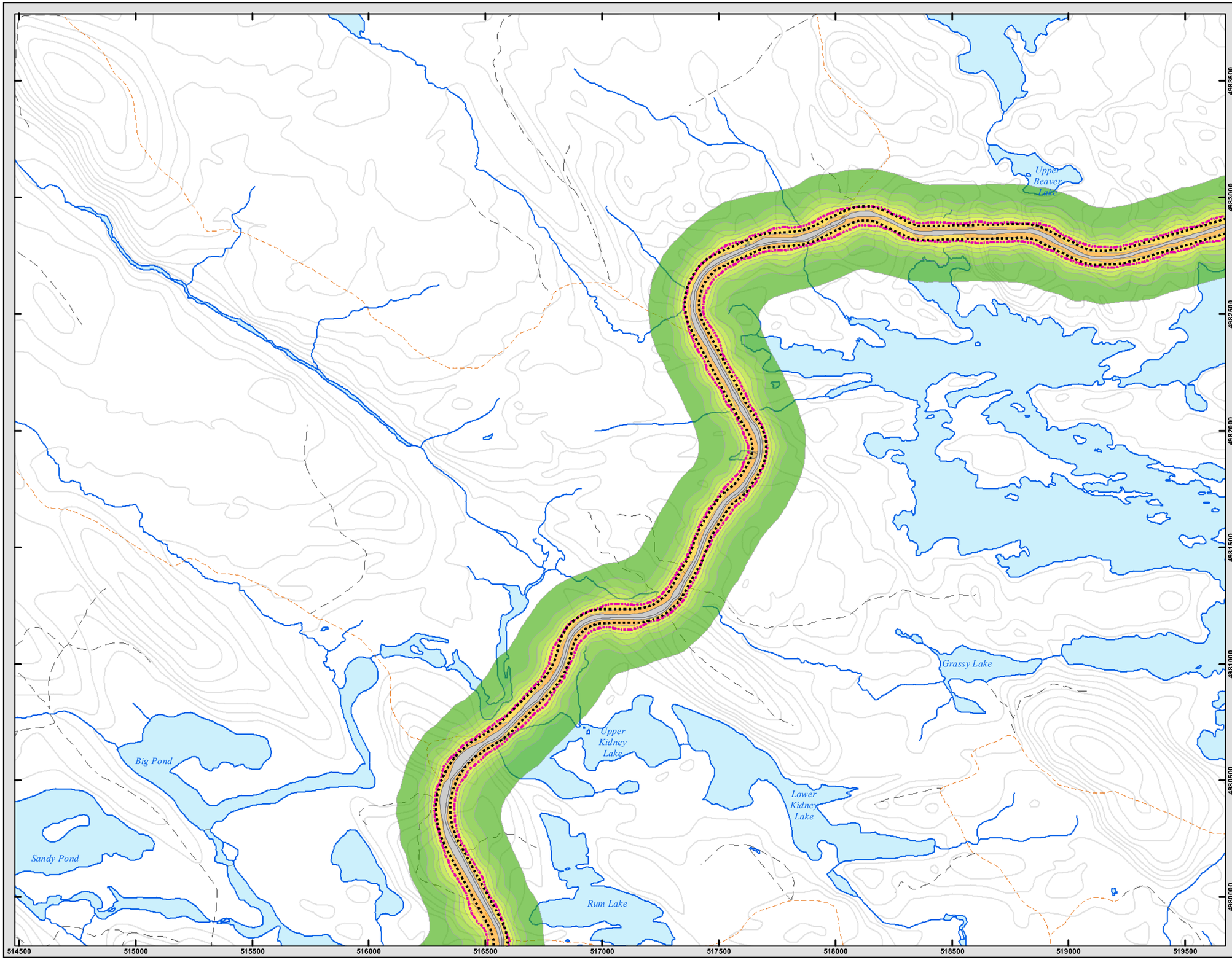
Document Name: BD_EIS_Figure6-2-6Air Annual TSP

Prepared For:

Atlantic Gold

FIGURE 6.2-7D

Beaver Dam Mine Project Air Contour Annual Average Total Particulate Matter



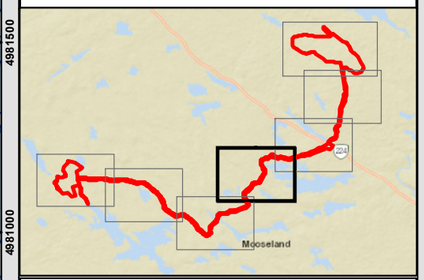
12.1 ug/m3 TSP Annual Background Level Concentration

TSP Ranges (ug/m3)

- 2
- 2 - 4
- 4 - 6
- 6 - 8
- 8 - 10
- 10 - 12
- 12 - 12.1
- 12.1 - 14
- 14 - 16

Dry Weather / Seasonal Road
Track
NSTDB Mapped Watercourses
Lakes
Planned Infrastructure
Proposed Property Boundary

Note: Based on 80% Road Dust Mitigation
Ambient air quality criteria: Averaging peroid Annual - TSP limit: 70ug/m3



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 125 250 500 m

1:15,000 Scale when printed @ 11" x 17"

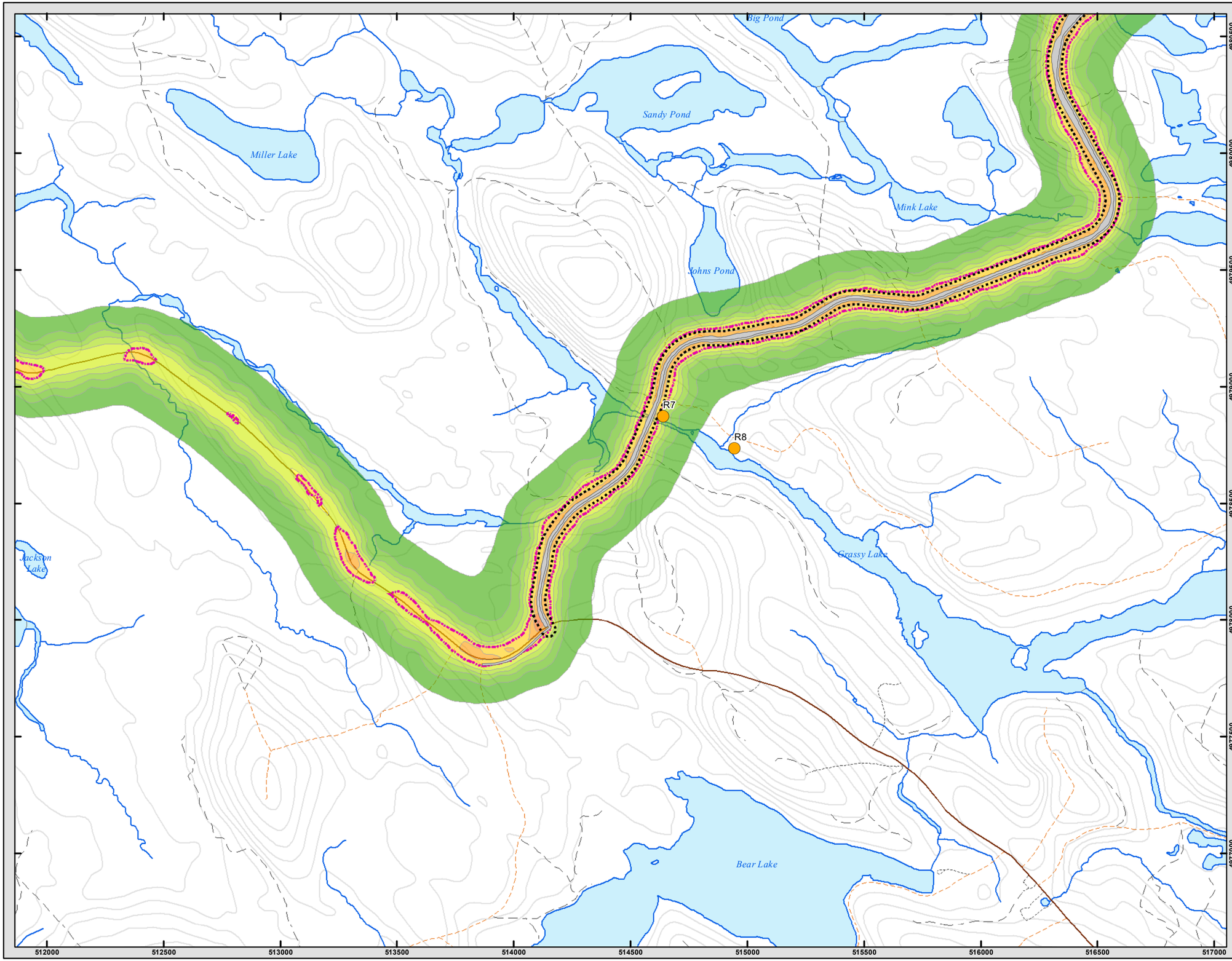
Drawn By: EP
Reviewed By: LP

Date: 2021-05-24

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

McCallum Environmental Ltd.

Document Name: BD_EIS_Figure6-2-6Air Annual TSP



Prepared For:

Atlantic Gold

FIGURE 6.2-7E

Beaver Dam Mine Project Air Contour Annual Average Total Particulate Matter

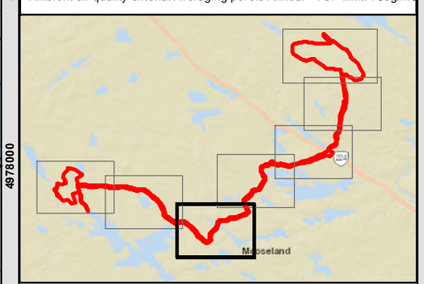
- Receptor
- 12.1 ug/m3 TSP Annual Background Level Concentration

TSP Ranges (ug/m3)

- 2
- 2 - 4
- 4 - 6
- 6 - 8
- 8 - 10
- 10 - 12
- 12 - 12.1
- 12.1 - 14
- 14 - 16
- 16 - 18

- Local Road
- Dry Weather / Seasonal Road
- Diveways (>300 m)
- Track
- NSTDB Mapped Watercourses
- Lakes
- Planned Infrastructure
- Proposed Property Boundary

Note: Based on 80% Road Dust Mitigation
Ambient air quality criteria: Averaging peroid Annual - TSP limit: 70ug/m3



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 125 250 500 m

1:15,000 Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed By: LP

Date: 2021-05-24

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

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Document Name: BD_EIS_Figure6-2-6Air Annual TSP

Prepared For:

Atlantic Gold

FIGURE 6.2-7F

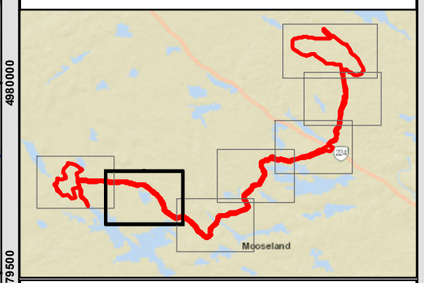
Beaver Dam Mine Project Air Contour Annual Average Total Particulate Matter

Receptor
12.1 ug/m3 TSP Annual Background Level Concentration

TSP Ranges (ug/m3)
- 2
- 2 - 4
- 4 - 6
- 6 - 8
- 8 - 10
- 10 - 12
- 12 - 12.1

Local Road
Dry Weather / Seasonal Road
Diveways (>300 m)
Track
NSTDB Mapped Watercourses
Lakes
Planned Infrastructure

Note: Based on 80% Road Dust Mitigation
Ambient air quality criteria: Averaging peroid Annual - TSP limit: 70ug/m3



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 125 250 500 m

1:15,000 Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed By: LP

Date: 2021-05-24

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

McCallum Environmental Ltd.

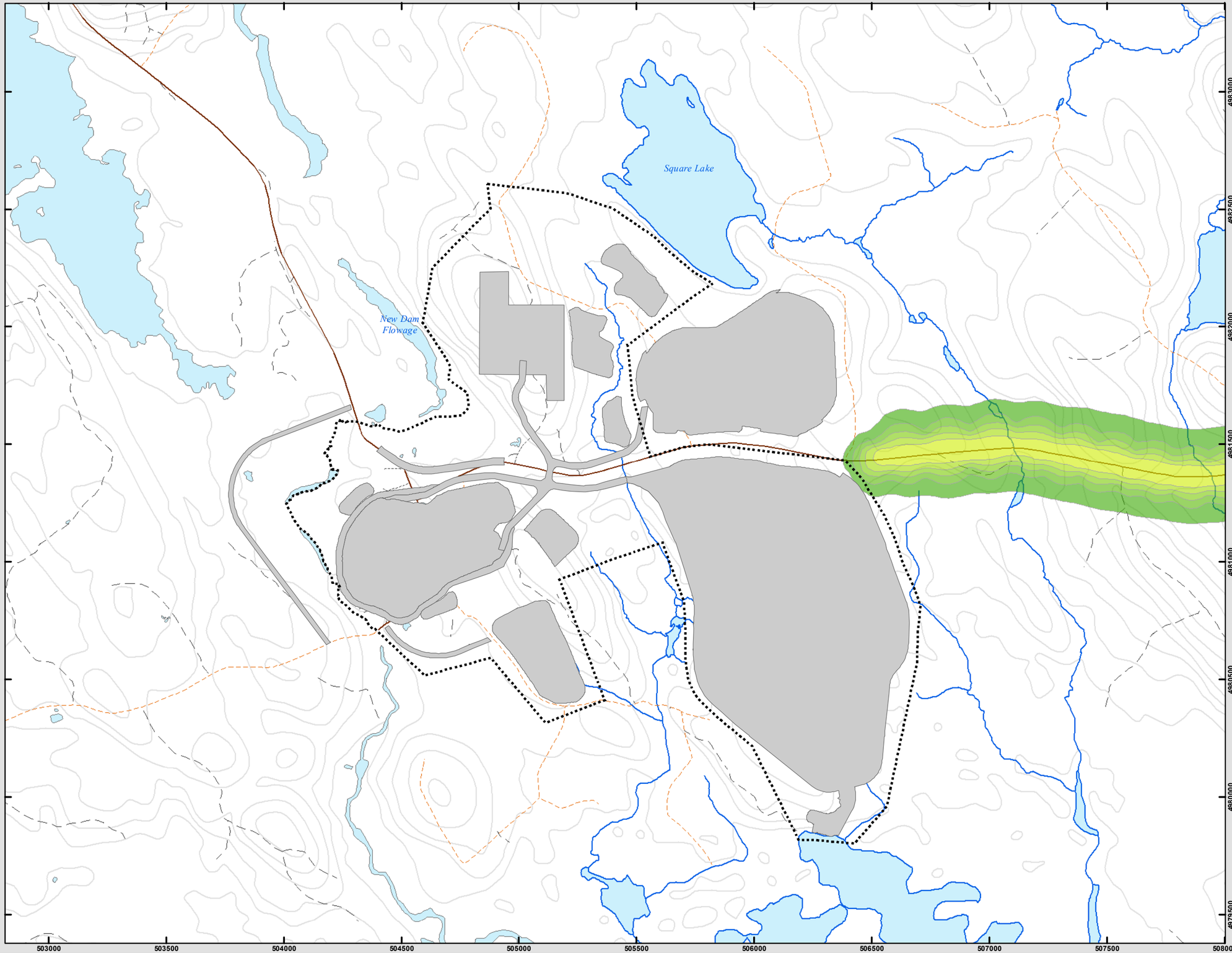
Document Name: BD_EIS_Figure6-2-6Air Annual TSP

Prepared For:

Atlantic Gold

FIGURE 6.2-7G

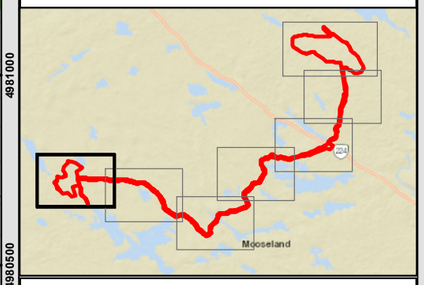
Beaver Dam Mine Project Air Contour Annual Average Total Particulate Matter



TSP Ranges (ug/m3)
- 2
- 2 - 4
- 4 - 6
- 6 - 8
- 8 - 10

- Local Road
- Dry Weather / Seasonal Road
- Diveways (>300 m)
- Track
- NSTDB Mapped Watercourses
- Lakes
- Planned Infrastructure
- Touquoy Infrastructure Layout
- Proposed Property Boundary

Note: Based on 80% Road Dust Mitigation
Ambient air quality criteria: Averaging peroid Annual - TSP limit: 70ug/m3



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Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

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1:15,000 Scale when printed @ 11" x 17"

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Date: 2021-05-24

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Document Name: BD_EIS_Figure6-2-6Air Annual TSP

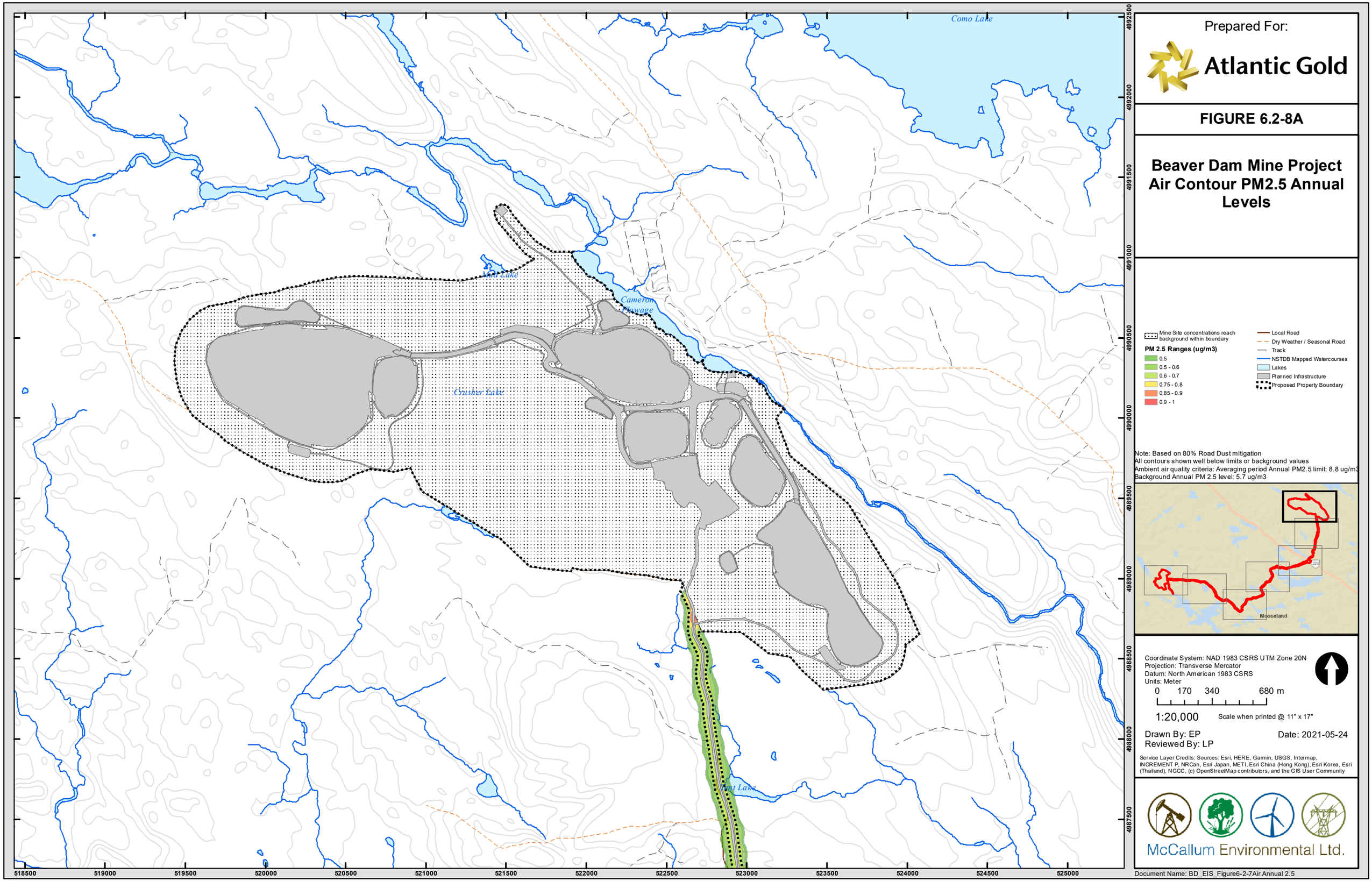

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FIGURE 6.2-8A

Beaver Dam Mine Project Air Contour PM2.5 Annual Levels

Mine Site concentrations reach background within boundary

PM 2.5 Ranges (ug/m3)

- 0.5
- 0.5 - 0.6
- 0.6 - 0.7
- 0.75 - 0.8
- 0.85 - 0.9
- 0.9 - 1

- Local Road
- Dry Weather / Seasonal Road
- Track
- NSTDB Mapped Watercourses
- Lakes
- Planned Infrastructure
- Proposed Property Boundary

Note: Based on 80% Road Dust mitigation
All contours shown well below limits or background values
Ambient air quality criteria: Averaging period Annual PM2.5 limit: 8.8 ug/m3
Background Annual PM 2.5 level: 5.7 ug/m3

Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 170 340 680 m

1:20,000 Scale when printed @ 11" x 17"

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Reviewed By: LP

Date: 2021-05-24

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Document Name: BD_EIS_Figure6-2-7Air Annual 2.5

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FIGURE 6.2-8B

Beaver Dam Mine Project Air Contour PM2.5 Annual Levels

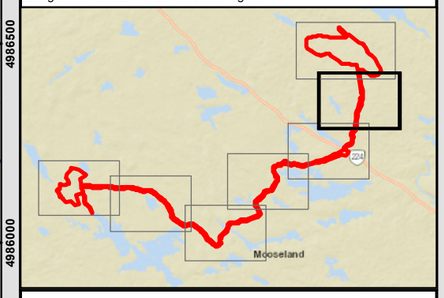
Mine Site concentrations reach background within boundary

PM 2.5 Ranges (ug/m3)

- 0.5
- 0.5 - 0.6
- 0.6 - 0.7
- 0.75 - 0.8
- 0.8 - 0.85
- 0.85 - 0.9
- 0.9 - 1

- Local Road
- Dry Weather / Seasonal Road
- Track
- NSTDB Mapped Watercourses
- Lakes
- Planned Infrastructure
- Proposed Property Boundary

Note: Based on 80% Road Dust mitigation
All contours shown well below limits or background values
Ambient air quality criteria: Averaging period Annual PM2.5 limit: 8.8 ug/m3
Background Annual PM 2.5 level: 5.7 ug/m3



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 125 250 500 m

1:15,000 Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed By: LP

Date: 2021-05-24

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Document Name: BD_EIS_Figure6-2-7Air Annual 2.5

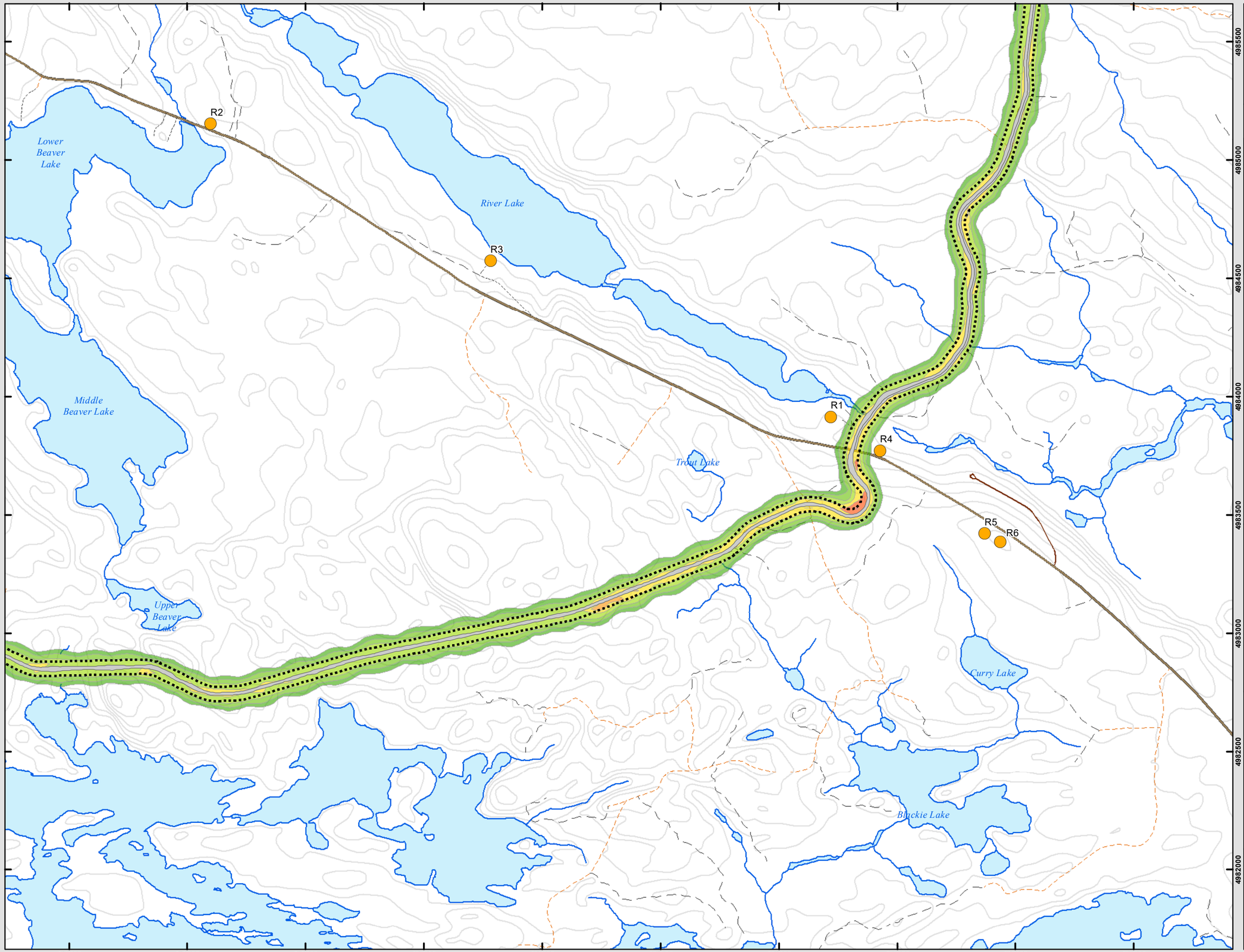

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FIGURE 6.2-8C

Beaver Dam Mine Project Air Contour PM2.5 Annual Levels

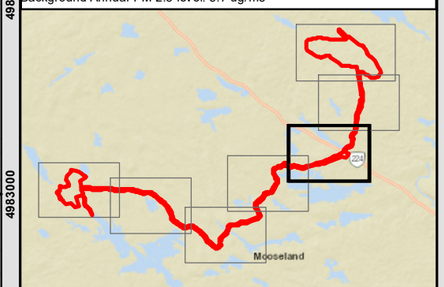
Receptor

PM 2.5 Ranges (ug/m3)

- 0.5
- 0.5 - 0.6
- 0.6 - 0.7
- 0.75 - 0.8
- 0.8 - 0.85
- 0.85 - 0.9
- 0.9 - 1

- Collector Road
- Local Road
- Dry Weather / Seasonal Road
- Diveways (>300 m)
- Track
- NSTDB Mapped Watercourses
- Lakes
- Planned Infrastructure
- Proposed Property Boundary

Note: Based on 80% Road Dust mitigation
All contours shown well below limits or background values
Ambient air quality criteria: Averaging period Annual PM2.5 limit: 8.8 ug/m3
Background Annual PM 2.5 level: 5.7 ug/m3



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Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 125 250 500 m

1:15,000 Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed By: LP

Date: 2021-05-24

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Document Name: BD_EIS_Figure6-2-7Air Annual 2.5

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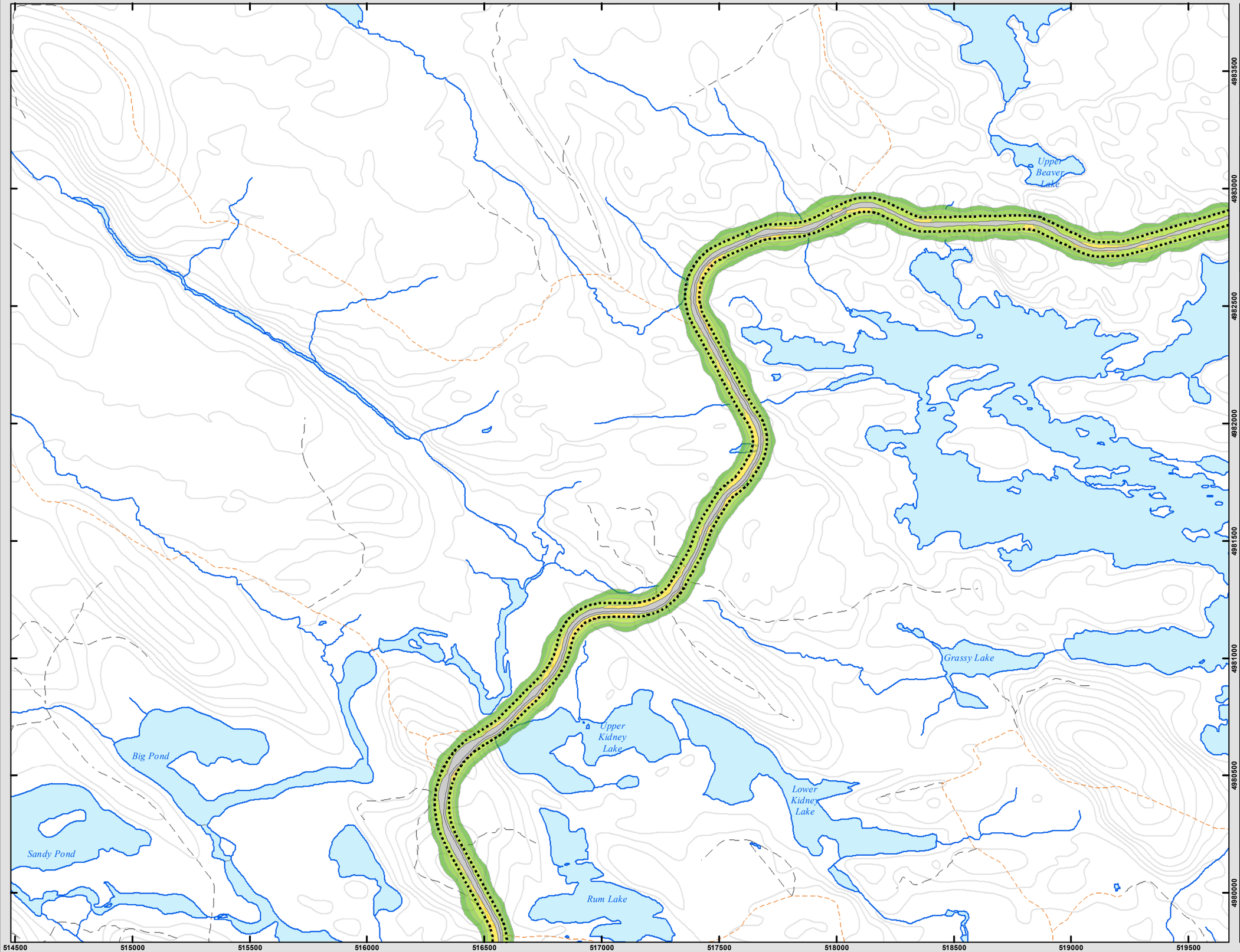
FIGURE 6.2-8D

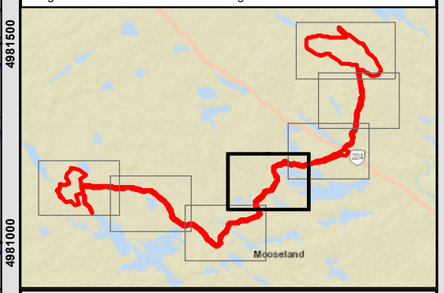
Beaver Dam Mine Project Air Contour PM2.5 Annual Levels



PM 2.5 Ranges (ug/m3)
- 0.5
- 0.5 - 0.6
- 0.6 - 0.7
- 0.75 - 0.8
- 0.8 - 0.85

- Dry Weather / Seasonal Road
- Track
- NSTDB Mapped Watercourses
- Lakes
- Planned Infrastructure
- Proposed Property Boundary

Note: Based on 80% Road Dust mitigation
All contours shown well below limits or background values
Ambient air quality criteria: Averaging period Annual PM2.5 limit: 8.8 ug/m3
Background Annual PM 2.5 level: 5.7 ug/m3



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Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 125 250 500 m

1:15,000 Scale when printed @ 11" x 17"

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Document Name: BD_EIS_Figure6-2-7Air Annual 2.5

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FIGURE 6.2-8E

Beaver Dam Mine Project Air Contour PM2.5 Annual Levels

Big Pond
Sandy Pond
Miller Lake
Mink Lake
Johns Pond
R7
R8
Jackson Lake
Grassy Lake
Bear Lake

4980500
4980000
4979500
4979000
4978500
4978000
4977500
4977000

512000 512500 513000 513500 514000 514500 515000 515500 516000 516500 517000

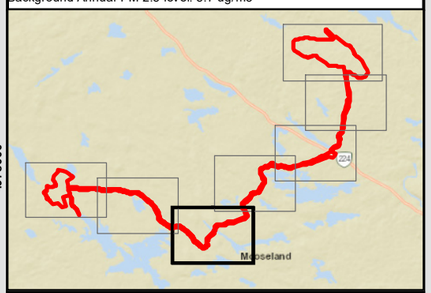
Receptor

PM 2.5 Ranges (ug/m3)

- 0.5
- 0.5 - 0.6
- 0.6 - 0.7
- 0.75 - 0.8
- 0.8 - 0.85
- 0.85 - 0.9
- 0.9 - 1

Local Road
Dry Weather / Seasonal Road
Diveways (>300 m)
Track
NSTDB Mapped Watercourses
Lakes
Planned Infrastructure
Proposed Property Boundary

Note: Based on 80% Road Dust mitigation
All contours shown well below limits or background values
Ambient air quality criteria: Averaging period Annual PM2.5 limit: 8.8 ug/m3
Background Annual PM 2.5 level: 5.7 ug/m3



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Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

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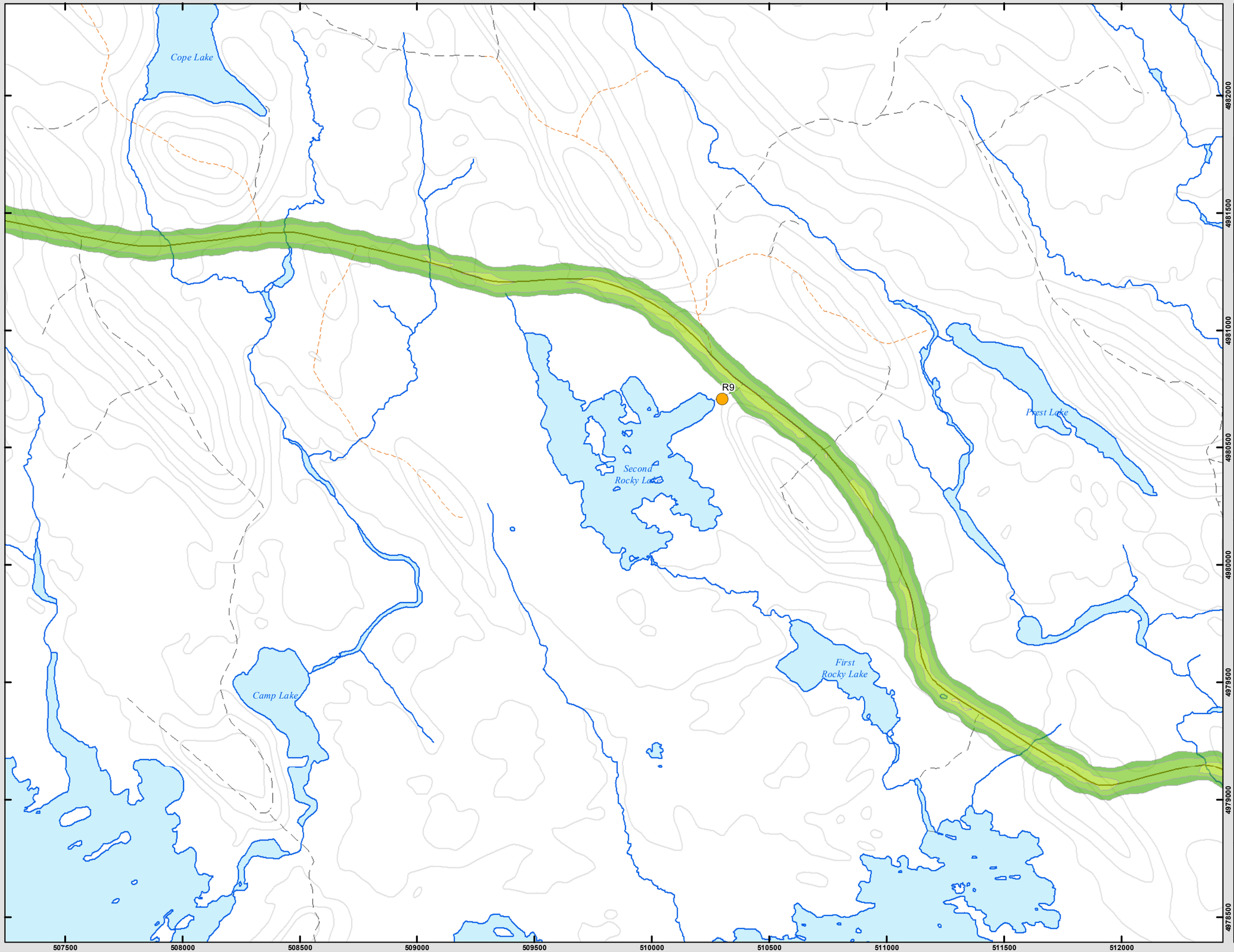

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FIGURE 6.2-8F

Beaver Dam Mine Project Air Contour PM2.5 Annual Levels

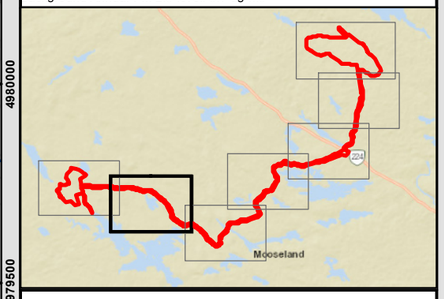
Receptor

PM 2.5 Ranges (ug/m3)

- 0.5
- 0.5 - 0.6
- 0.6 - 0.7
- 0.7 - 0.75

Local Road
Dry Weather / Seasonal Road
Diveways (>300 m)
Track
NSTDB Mapped Watercourses
Lakes
Planned Infrastructure

Note: Based on 80% Road Dust mitigation
All contours shown well below limits or background values
Ambient air quality criteria: Averaging period Annual PM2.5 limit: 8.8 ug/m3
Background Annual PM 2.5 level: 5.7 ug/m3



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Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 125 250 500 m

1:15,000 Scale when printed @ 11" x 17"

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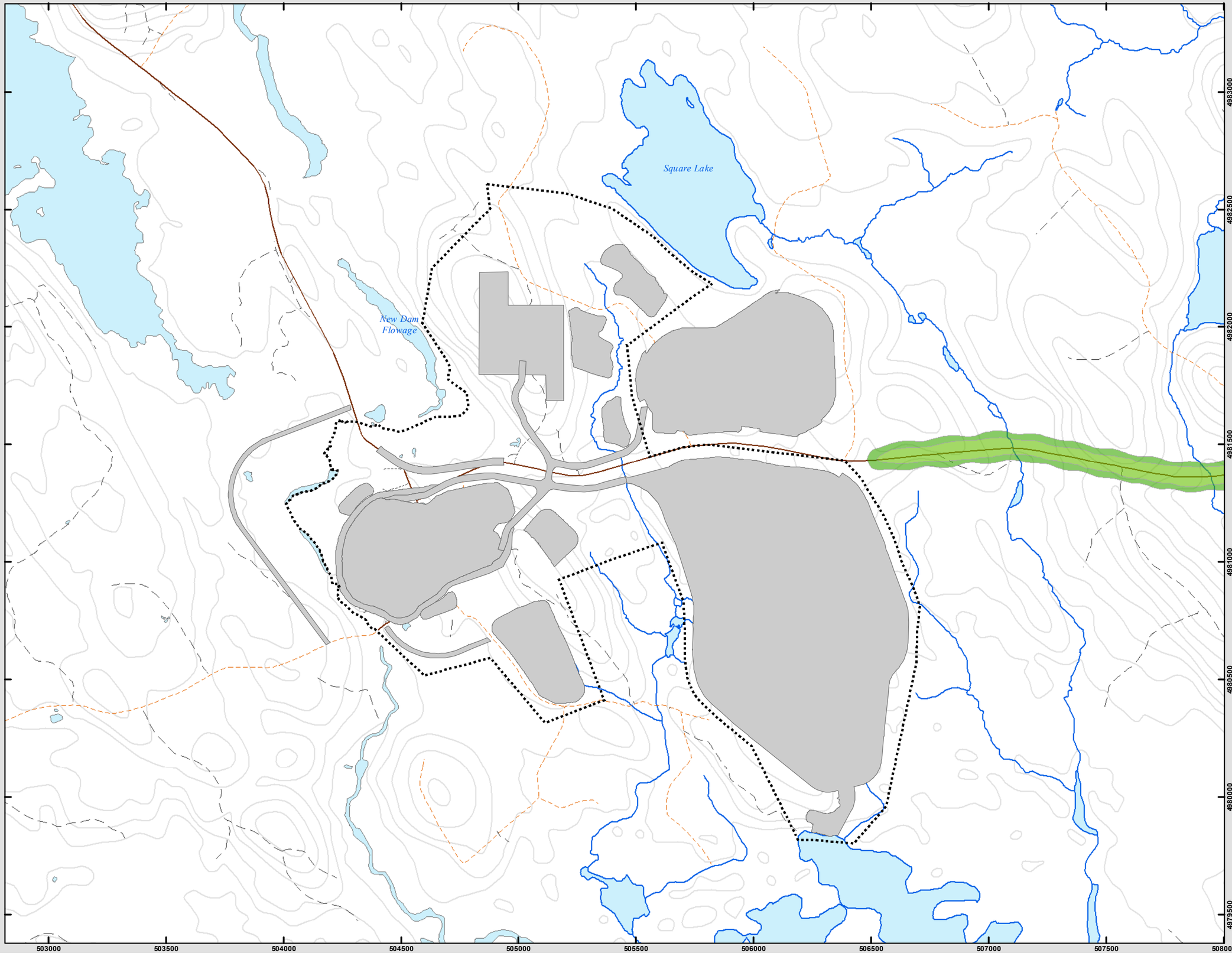
Document Name: BD_EIS_Figure6-2-7Air Annual 2.5

Prepared For:

Atlantic Gold

FIGURE 6.2-8G

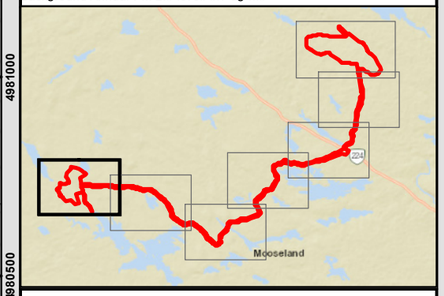
Beaver Dam Mine Project Air Contour PM2.5 Annual Levels



PM 2.5 Ranges (ug/m3)
- 0.5
- 0.5 - 0.6

- Local Road
- Dry Weather / Seasonal Road
- Diveways (>300 m)
- Track
- NSTDB Mapped Watercourses
- Lakes
- Planned Infrastructure
- Proposed Property Boundary

Note: Based on 80% Road Dust mitigation
All contours shown well below limits or background values
Ambient air quality criteria: Averaging period Annual PM2.5 limit: 8.8 ug/m3
Background Annual PM 2.5 level: 5.7 ug/m3



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Units: Meter

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Dust emissions are the primary atmospheric issue for the Beaver Dam Mine Site and airborne particulate matter will be generated during construction and operation phases of the Project. Sources of project-related particulate matter at the Beaver Dam Mine Site may include the following:

- overburden (e.g., topsoil, till and organic) removal;
- blasting;
- rock crushing option;
- onsite heavy truck traffic;
- material loading;
- wind erosion of material storage piles;
- construction of mine site roads; and
- operation of other heavy machinery.

During operation, most of the dust will be generated at the Beaver Dam Mine Site will be due to material handling and crushing processes and trucking operations. Estimated emissions for the Beaver Dam Mine Site are provided in Table 6.2-7. The total emissions (in grams per second or g/s) are provided as the sum of the emissions from all sources as this site was modelled as an open pit source.

Table 6.2-6: Potential Air Interactions with Project Activities at Beaver Dam Mine Site

Project Phase	Duration	Relevant Project Activity
Construction	1 year	• Clearing, grubbing, and grading in preparation of construction. • Drilling and rock blasting in preparation of construction. • Till and waste rock from site preparation transport and storage. • Watercourse and wetland alteration in preparation of construction. • Mine site road construction. • Surface infrastructure installation and construction. • Collection and settling pond construction. • General management of waste rock and soil derived from preparation and construction activities. • Accidents and malfunctions to include fuel and other spills, forest fires, slope failure, an unplanned explosive event, and mobile equipment accident.
Operations and Maintenance	5 years	• Rock blasting and ore extraction. • Management of waste rock produced from crushing and preparing ore for transport. • General management of waste rock derived from operation and maintenance activities.
Closure	2 years	• Infrastructure Demolition. • Site reclamation activities. • Accidents and malfunctions to include fuel and other spills, slope failure, and forest fires.
Post-closure	10+ years (monitoring)	• N/A

N/A = not applicable.

Table 6.2-7: Estimated Particulate Emissions from Beaver Dam Mine

Activity	Emission Rate (g/s)		
	TSP	PM_{10}	$PM_{2.5}$
Conveyors	2.87E-02	9.44E-03	2.67E-03
Crusher Option	2.46E-01	1.11E-01	2.05E-02
Truck Loading	6.57E-03	3.29E-03	1.64E-03
Total	**2.84E-01**	**1.24E-01**	**2.48E-02**

g/s = grams per second; PM_{10} = coarse particulate matter; $PM_{2.5}$ = fine particulate matter; TSP = total suspended particulate.

Results of air dispersion modelling for maximum predicted concentrations of emitted particulate species from the Beaver Dam Mine Site are presented in Table 6.2-8. This table summarizes the particulate size fraction considered, the averaging period, the assessment criteria against which the results are compared, the maximum predicted concentration from the modelling, the ambient background concentration, the combined effect (the modelled concentration from the site added to the assumed existing background concentration for that averaging period), and the percentage of the assessment criteria for the site modelling results alone and the cumulative effects.

For this site, maximum predicted concentrations occurred at the property boundary. Predicted concentrations for all indicator compounds and averaging periods were lower than existing background concentrations, and well below relevant assessment criteria. The cumulative effects were also found to be below the assessment criteria for all compounds and averaging periods.

Table 6.2-8: Maximum Predicted Concentrations due to Beaver Dam Mine Site Operations

Compound	Averaging Period	Assessment Criteria (Ambient Air Quality Standard) (µg/m³)	Maximum Predicted Concentration (µg/m³)	Percentage of Assessment Criteria (%)	Background Concentration (µg/m³)	Combined Effect (µg/m³)	Percentage of Assessment Criteria for Cumulative Effect (%)
TSP	24-hour	120	3.8	3	41.7	45.5	38
	Annual	70	0.8	1	12.4	13.2	19
PM_{10}	24-hour	50	3.7	7	31.0	34.7	69
$PM_{2.5}$	24-hour	27	1.4	5	9.0	10.4	39
	Annual	8.8	0.3	3	5.7	6.0	68

µg/m³ - micrograms per cubic metre; PM_{10} = coarse particulate matter; $PM_{2.5}$ = fine particulate matter; TSP = total suspended particulate.

6.2.7.2 Prediction of Air Effects, Haul Road

Airborne particulate matter will be generated during construction and operation of the proposed Haul Road. Sources of project-related particulate matter would include upgrading the existing road to be suitable for the mine traffic, and truck traffic hauling ore from Beaver Dam Mine to the Touquoy Mine Site for processing. Dust can be generated from mine haul truck tires interacting with gravel surfaced Mine Haul Roads and Beaver Dam Haul Roads. Dust is also generated during the truck loading and dumping activities. Dust is not expected from uncovered trucks because the ore material is of a size that is unlikely to generate dust. Dust can be tracked across asphalt roads and re-entrained by traffic or by the wind.

The potential interactions identified for the development and use of the proposed Haul Road between Beaver Dam Mine Site are presented in Table 6.2-9; the interactions are expected to be the same for the Haul Road as for the mine sites, except the construction phase will be shorter. Further, as the road is not currently anticipated to be decommissioned, there are no effects associated with the Active Closure. Emissions estimates for the operations phase (Haul Road traffic during mine operations) are provided in Table 6.2-10.

Table 6.2-9: Potential Air Interactions with Project Activities along the Haul Road

Project Phase	Duration	Relevant Project Activity
Construction	1 year	• Clearing, grubbing, and grading in preparation of construction • Drilling and rock blasting in preparation of construction • Till and waste rock from site preparation transport and storage • Watercourse and wetland alteration in preparation of construction • Haul road construction and upgrades • Accidents and malfunctions to include fuel and other spills, forest fires, and a haul truck accident
Operations	5 years	• Ore transport • Haul road maintenance and repairs • Accidents and malfunctions to include fuel and other spills, forest fires, and a haul truck accident
Active Closure	2 years	• N/A[(a)]
Post-closure	10+ years (monitoring)	• N/A

[(a)] Decommissioning and Reclamation of the Haul Road is not expected. The Haul Road will be returned to owner for forestry Industry.

N/A = not applicable.

Table 6.2-10: Estimated Particulate Emissions from the Haul Road

Activity	Emission Rate (g/s)		
	TSP	PM_{10}	$PM_{2.5}$
Haul Trucks	4.28E01	1.16E01	1.16E00

g/s = grams per second; PM_{10} = coarse particulate matter; $PM_{2.5}$ = fine particulate matter; TSP = total suspended particulate.

Results of air dispersion modelling for maximum predicted concentrations of emitted particulate species from the Haul Road are presented in Table 6.2-11. This table summarizes the particulate size fraction considered (i.e., TSP, PM_{10} and $PM_{2.5}$), the averaging period, the assessment criteria against which the results are compared, the maximum predicted concentration from the modelling, the ambient background concentration, the combined effect (the modelled concentration from the site added to the assumed existing background concentration for that averaging period), and the percentage of the assessment criteria for the site modelling results alone and the cumulative effects.

For this site, maximum predicted concentrations occurred within 30 m of the road, and predicted concentrations decreased, with increasing distance from the road. The maximum predicted concentrations for all compounds occurred in close proximity to the road, in areas that are not continuously occupied. Maximum predicted concentrations presented occur at 30 m from the road and decrease rapidly with distance. The TSP cumulative effects concentrations decline to values below assessment guidelines at all times within approximately 200 m of the road or less (Appendix C.1, Section 6.1) A cumulative effects assessment for the Project, including the Haul Road, is presented in Section 8.

Table 6.2-11: Maximum Predicted Concentrations due to Haul Road Operations

Compound	Averaging Period	Assessment Criteria Ambient Air Quality Standard) (µg/m³)	Maximum Predicted Concentration (µg/m³)	Percentage of Assessment Criteria (%)	Background Concentration (µg/m³)	Combined Effect (µg/m³)	Percentage of Assessment Criteria for Combined Effect (%)
TSP	24-hour	120	251.1	209	41.7	292.8	244
	Annual	70	84.4	121	12.4	96.7	138
PM_{10}	24-hour	50	146.3	293	31.0	177.3	355
$PM_{2.5}$	24-hour	27	16.2	60	9.0	25.2	93
	Annual	8.8	5.1	58	5.7	10.8	123

µg/m³ - micrograms per cubic metre; PM_{10} = coarse particulate matter; $PM_{2.5}$ = fine particulate matter; TSP = total suspended particulate.

For all the TSP size fraction, predicted concentrations decrease rapidly with distance and predicted cumulative effects are anticipated to be below guideline values at approximately 200 m distance from the road or less.

The PM_{10} cumulative effects concentrations are more strongly affected by the assumed background concentration (which is, itself, 62 percent of the assessment criteria). Using this highly conservative assessment, it is estimated that PM_{10} cumulative effects concentrations would decline to values below the assessment guideline at all times within 800 m of the road. If background PM_{10} were found to be half the current estimate, this distance would drop to approximately 350 m from the road, and in many areas less, demonstrating that accurate background data are needed to fully understand this issue.

Modelled $PM_{2.5}$ from road activities alone was predicted to meet 24-hour CAAQS even at the 30 m distance, possibly exceeding annual guidelines at this maximum location, but over half of the contribution to annual concentrations was found to be from background sources. The exceedance of the annual average $PM_{2.5}$ guideline in the combined effects assessment is limited to a very few individual roadside receptors (30 m from the road), and is not predicted to occur over a wide area or at any of the sensitive receptors.

6.2.7.3 Prediction of Air Effects, Touquoy Mine Site

The Touquoy Mine Site is currently in operation. The primary effect of the continued use of the Touquoy Mine Site is the continued generation of dust due to haul truck traffic on the site. There are no new or additional effects to air quality anticipated to be caused by the processing of ore and the management of tailings (exhausted pit) from the Project, as no new construction or disturbance is required at the Touquoy Mine Site related to the processing of Beaver Dam ore. Air emissions generated from the Touquoy Mine Site associated with the processing of Beaver Dam ore will include emissions generated from the processing plant, including the carbon reactivation furnace, the electrowinning cells, and the barring furnace (gold smelting), as well as mobile equipment sources (Table 6.2-12). Air emissions will occur from the processing plant, including CO_2, ammonia, off-gassing of hydrogen cyanide, and nitrogen oxides.

The Air Dispersion Modelling Assessment completed by GHD Ltd. (2019) considered the Touquoy processing facility as an input source, as the Beaver Dam Mine Site will use the Touquoy Mine Site for its refining capabilities. The crushing and mining emissions rates remained unchanged since being previously modelled for an Emissions Summary and Dispersion Modelling Assessment however emissions estimates have been updated using standard United States Environmental Protection Agency (US EPA) AP-42 emission factors and new dispersion modelling carried out. The emissions estimates are provided in Table 6.2-13. Emissions are shown from the two most significant sources at the Touquoy Mine Site: the crushing system (comprising primary, secondary,

and tertiary crushing) and the ROMTRANS, which comprise the transfer operations around the Raw Material Storage Pile, including material handling, transferring and conveying, loading the Run of Mine (ROM) stockpiles, and unloading from the ROM stockpiles.

Table 6.2-12: Potential Air Interactions with Project Activities at Touquoy Mine Site

Project Phase	Duration	Relevant Project Activity
Operations	5 years	• Ore management and processing. • Accidents and malfunctions to include fuel and other spills, forest fires, and mobile equipment accidents.
Active Closure	2 years	• Accidents and malfunctions to include fuel and other spills, forest fires, and mobile equipment accidents.

Table 6.2-13: Estimated Particulate Emissions from Touquoy Mine Site

Activity	Emission Rate (g/s)		
	TSP	PM_{10}	$PM_{2.5}$
Crushers	9.38E-02	4.22E-02	7.81E-03
ROMTRANS	8.42E-02	3.17E-02	1.58E-02

g/s = grams per second; PM10 = coarse particulate matter; PM2.5 = fine particulate matter; TSP = total suspended particulate.

Results of air dispersion modelling for maximum predicted concentrations of emitted particulate species from the Haul Road are presented in Table 6.2-11. Maximum predicted concentrations of emitted particulate species from the Touquoy Mine Site are presented in Table 6.2-14. This table summarizes the particulate size fraction considered, the averaging period, the assessment criteria against which the results are compared, the maximum predicted concentration from the modelling, the ambient background concentration, the cumulative effect (the modelled concentration from the site added to the assumed existing background concentration for that averaging period), and the percentage of the assessment criteria for the site modelling results alone and the cumulative effects.

For this site, maximum predicted concentrations occurred at the property boundary. Predicted concentrations for all indicator compounds and averaging periods were lower than existing background concentrations, and well below relevant assessment criteria. The cumulative effects were also found to be below the assessment criteria for all compounds and averaging periods.

Table 6.2-14: Maximum Predicted Concentrations due to Touquoy Mine Site Operations

Compound	Averaging Period	Assessment Criteria Ambient Air Quality Standard) (µg/m³)	Maximum Predicted Concentration (µg/m³)	Percentage of Assessment Criteria (%)	Background Concentration (µg/m³)	CombinedEffect (µg/m³)	Percentage of Assessment Criteria for CombinedEffect (%)
TSP	24-hour	120	3.1	3	41.7	44.8	37
	Annual	70	1.1	2	12.4	13.4	19
PM_{10}	24-hour	50	3.1	6	31.0	34.1	68
$PM_{2.5}$	24-hour	27	1.3	5	9.0	10.3	38
	Annual	8.8	0.4	5	5.7	6.1	70

µg/m³ - micrograms per cubic metre; PM_{10} = coarse particulate matter; $PM_{2.5}$ = fine particulate matter; TSP = total suspended particulate.

6.2.8 Mitigation

Mitigation measures used to reduce and control air pollutants during construction, operation, and decommissioning phases are outlined in Table 6.2-15. A draft Fugitive Dust Control Plan is provided in Appendix C.3. The overall goal of this Plan is to provide a framework for the control of fugitive dust which will enable protection of the health and safety for mine workers and the public, as well as to mitigate potential effects to the natural environment (e.g., impacts to flora and fauna). The draft Fugitive Dust Control Plan (Appendix C.3) will include procedures for inspection, monitoring, and reporting.

Table 6.2-15: Mitigation for Air

Project Phase	Mitigation Measure
C, O	• Use wet suppression controls on unpaved surfaces.
C, O	• Utilize paved surfaces where available.
C, O	• Speed reduction.
O	• Apply stabilized covers on inactive stockpiles.
O	• Use mechanical sweeper on paved surfaces to prevent dust from remobilizing.
O	• Apply dust suppressants, when and where practicable, to target 80% effectiveness.
O	• Size haul vehicles appropriately to minimize trip frequency.
O	• Implement appropriate dust suppression measures for crusher trains and associated activities/stockpiles.
O	• Implement Dust Suppression Plan as part of the Fugitive Dust Control Plan (Appendix C.3).
O	• A procedure, including a response plan, will be available for public to be able to register complaints regarding dust concerns.
CL	• Stabilize slopes on inactive stockpiles to a safe and long-term angle of repose.
CL	• Use soil and organics stockpiles for final capping and stabilization. Hydroseed as required.

Notes: C = construction; O = operations; CL = active closure (decommissioning and reclamation); VC = Valued Component.

The Plan has been developed based on:

- experience gained from the Touquoy Mine, which has been in operational since October 2017 and in the construction phase was in 2016 to 2017;
- industry best practice; and
- available guidance documents are also considered, including those provide by the Ontario Ministry of the Environment, Conservation and Parks (MECP).

The MECP guidance document is very useful because it is an overview that incorporates best management practices for industrial sources of fugitive dust emissions from a broad list of references collected from jurisdictions worldwide.

The control of dust from the mining operations will focus on provision of moisture control measures, such as spraying with water as required. In-pit operations will not generally have much direct off-site impact but could contribute to general dust levels at critical times if not controlled. The crushed ore stockpile at the Touquoy Mine Site will be covered to minimize wind and rain erosion; stockpiles will not be covered at the Beaver Dam Mine Site and may contribute to airborne dust. Dust control requires careful and consistently applied mitigation measures throughout the Project to ensure non-compliant or nuisance levels are avoided. The proposed mitigation measures for various process components are outlined below. These are similar to measures routinely used at most other Nova Scotia surface mine operations that allow for compliance with air quality guidelines at residential receptors.

Wind erosion from elevated waste rock piles containing finely divided material can be a major source of dust at mine sites. To prevent this occurrence, slopes on inactive stockpiles will be stabilized with mulching and/or vegetation, where appropriate. Waste rock piles will be sprayed with water as necessary to minimize fugitive dust.

Preventative measures to minimize dust produced on-site (Beaver Dam and Touquoy) and along the Haul Road include:

- wet suppression controls on unpaved surfaces;
- hardened surfaces where practical;
- speed reduction to keep dust levels at minimum;
- use of large haul vehicles so as to minimize trip frequency; and
- stabilized slopes and cover on inactive stockpiles.

The application of mitigation measures that are outlined in Table 6.2-15 to reduce airborne particulate matter will be determined by maintaining regulatory compliance with the NSE Maximum Permissible Ground Level Concentrations listed in the NSAQS and with the CAAQS for fine particulate matter and ozone. There are no federal or Nova Scotia provincial air quality criteria for PM_{10}.

Ongoing monitoring will determine compliance with these standards, and any exceedance or complaint by the general public or First Nations will be discussed with regulators and/or the Citizen Liaison Committee (CLC), and mitigation programs and operational practices will be reviewed to determine the appropriate course of action.

In the event that the monitoring program identifies the need for additional dust mitigation measures for the Haul Road, options exist for further reduction in particulates including:

- an enhanced dust suppression application schedule;
- use of other suppressants that are biodegradable;
- road re-surfacing or treatments to reduce silt content; and
- paving portions of the Haul Road.

A complaint from the public and/or First Nations will be a trigger to evaluate mitigation options. The Site Manager will be responsible for consideration of preventative mitigative actions listed in Table 6.2-15 and Table 6.2-16. Dust suppression on the Haul Road is a planned mitigation (targeting 80 to 90% effectiveness).

6.2.9 Residual Effects and Significance

Residual effects are effects to VCs that are predicted to occur even after the implementation of mitigation measures. Significant residual effects for the Air VC would be defined as having high magnitude (i.e., an exceedance applicable criteria), occur beyond the PA, be of long-term to permanent duration, occur at regular intervals or be continuous throughout the Project, and be only partially reversible to irreversible.

Modelling of sources at the Beaver Dam Mine Site and the Touquoy Mine Site showed maximum predicted concentrations at their respective fence lines well below applicable air quality criteria, which are unlikely to cause adverse effects. The Haul Road between the proposed Beaver Dam and the Touquoy Mine Sites is the source primarily responsible for the maximum predicted concentrations at both the gridded receptors and the sensitive receptors identified for this assessment.

Table 6.2-16: Residual Environmental Effects for Air

Project – Valued Component Interactions	Mitigation and Compensation Measures	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction – Beaver Dam Mine Site and Haul Road (Dust from haul trucks, Haul Road widening and construction)	Equipment maintenance, best management practices, minimize blasting events.	N Does not exceed guidelines or threshold	LAA Dust generated will likely extend beyond the PA	N/A VC is not expected to be affected by timing	MT Effects can occur beyond 12 months	R Effects occur regularly in the construction	R VC will recover to baseline conditions	Increased ambient dust	Not significant
Operations- Mine Site and Touquoy Mine Site at Property Lines and Points of Reception (Dust from onsite activities, vehicle travel, material handling and the crushing of ore)	Equipment maintenance, dust suppression, hardened surface where practical, vehicles to minimize trips, stabilization of stockpile slopes, cover of haul trucks, minimize blasts	N Does not exceed guidelines or threshold	LAA Dust generated will likely extend beyond the PA	N/A VC is not expected to be affected by timing	LT Effects may extend beyond 3 years	R Effects occur regularly during Operations	R VC will recover to baseline conditions	Increased ambient dust	Not significant
Operations- Haul Road at Property Lines (Dust from haul trucks)	Haul truck operations to minimize road surface disturbance during nighttime hours, implementation of Road Dust Best Management Practices Plan (with 80-90% or greater targeted dust suppression efficiency).	L Exceeds guidelines or threshold values by more than 20%	LAA Dust generated will likely extend beyond the PA	N/A VC is not expected to be affected by timing	LT Effects may extend beyond 3 years	S Exceedances are maximum values, sporadic to regular occurrence at Property Lines.	R VC will recover to baseline conditions	Increased ambient dust	Not Significant
Operations - Haul Road at Points of Reception (Dust from haul trucks)	Haul truck operations to minimize road surface disturbance during nighttime hours, implementation of Road Dust Best Management Practices Plan (with 80-90% or greater targeted dust suppression efficiency).	L Marginally exceeds guidelines or threshold values	LAA Dust generated will likely extend beyond the PA	N/A VC is not expected to be affected by timing	LT Effects may extend beyond 3 years	R Effects occur regularly in the operational phase of the Project	R VC will recover to baseline conditions	Increased ambient dust	Not Significant

Notes: See Table 6.2-5 and Section 5.11, Table 5.11-1 for definitions of the below characteristics.

Magnitude		Geographic Extent		Timing		Duration		Frequency		Reversibility	
N	Negligible	PA	Project Area	N/A	Not Applicable	ST	Short-Term	O	Once	R	Reversible
L	Low	LAA	Local Assessment Area	A	Applicable	MT	Medium-Term	S	Sporadic	IR	Irreversible
M	Moderate	RAA	Regional Assessment Area			LT	Long-Term	R	Regular	PR	Partially Reversible
H	High					P	Permanent	C	Continuous		

Maximum predicted $PM_{2.5}$ concentrations did not exceed the CAAQS for either the 24-hour or annual averaging periods at any of the sensitive receptor locations, based on Project alone predictions, or Project plus background. PM_{10} was predicted to exceed the Ontario Interim 24-hour guideline at Deepwood Estates up to 2% of the time without background) and up to 57% of the time with background concentration included. PM_{10} was also predicted to exceed the Ontario Interim 24-hour guideline at 9 Beaver Dam Mines Road up to 13% of the time with background concentration included but met the guideline without background. TSP was predicted to exceed the 24-hour Nova Scotia Air Quality Standard up to 0.3% of the time with background included at the Deepwood Estates receptor however once the dust mitigation is applied this will be reduced to negligible to low. There is uncertainty in the presented background concentrations of both PM10 and TSP. The Deepwood Estate property, the most impacted, has been acquired by AMNS so there will be no permanent or seasonal resident at this property. In addition, this property will likely be used as part of the monitoring to confirm impact predictions and assess the effectiveness of the mitigations.

The residual effects characterization for Air is presented in Table 6.2-16.

6.2.10 Proposed Follow-up and Monitoring Program

Prior to the start of construction, a baseline ambient air quality monitoring program will be undertaken at select locations on the Beaver Dam Mine Site and along the Haul Road. Air quality monitoring is currently ongoing at the Touquoy mine site and will continue throughout the construction and operations phase. The data collected will be used to better understand potential effects and refine mitigation and monitoring requirements prior to the processing of Beaver Dam ore.

Table 6.2-15 summarizes the mitigation activities that will be completed throughout the life of the Project. The details of the monitoring programs will be determined in consultation with regulatory agencies and will be described in the application for an Industrial Approval for the site operations following the EA process.

The objectives of the atmospheric environment monitoring programs are to:

- review predicted effects in the EIS;
- confirm the continuing effectiveness of mitigation measures;
- identify the need for any new mitigation measures; and
- confirm compliance with regulatory approvals and requirements.

Details of proposed dust monitoring for the Beaver Dam Project are included in Appendix C.3 draft Fugitive Dust Control Plan.

6.3 Light

6.3.1 Introduction

6.3.1.1 Summary of Light Before the Updates

This section describes the methods and results of baseline characterization as well as predictive studies that were undertaken to support characterization of potential project effects on the Light Valued Component (VC). Light level limits are not directly regulated through the provincial or federal regulatory regime. Changes (i.e., increases or changes to occurrence timing) to ambient light levels have the potential to adversely affect fauna and birds, as well as increase level of light pollution experienced by the general public or specific populations.

Light impact assessments were conducted for the Touquoy Gold Project in 2007 (CRA 2007a), and for the Beaver Dam Mine Project in 2017. The impacts of the proposed lighting installations were quantified and compared with guidelines published by the Institution of Lighting Professionals (ILP, previously known as Institution of Lighting Engineers [ILE]) in the document entitled "Guidance Note for the Reduction of Obtrusive Light" (ILE 2005). Limits recommended by the ILP guidelines were met at the identified receptors.

6.3.1.2 Summary of Updates to Light

The updates to this section are based on the update to the Project Description (Section 2, Project Area [PA] boundary change) as well as in response to Round 2, Information Requests (IR2s) submitted by Impact Assessment Agency of Canada (IAAC, formerly Canadian Environmental Assessment Agency [CEAA 2019]), Nova Scotia Environment (NSE 2019), and Eastern Shore Forest Watch Association (ESFWA 2019), light subsection updates are summarized in Table 6.3-1. Effects assessment methodology has been updated to include updated light modelling in response to comments from IR2s.

The calculated light levels at all receptors are below the limits recommended by the ILE guidelines during both pre- and post-curfew conditions (i.e., between 11 PM and 7 AM and before 11 PM; Section 6.3.7.1, Table 6.3-7 and Figure 6.3-2). The assessment considers worst-case operating conditions, for example, if all mobile equipment was in use at the same time and illuminating towards the receptors and the potential for light from both the Beaver Dam Mine Site and the Haul Road trucks to affect a receptor in a cumulative way. The calculated light levels from the Haul Road are also below the limits recommended by the ILP guidelines (Section 6.3.7.1, Table 6.3-7 and Figure 6.3-2).

Ambient night-time (i.e., post-curfew) light levels at the Beaver Dam Mine Site are predicted to meet the 1 lux guideline within 1.6 km from the site and as such not anticipated to affect the Beaver Lake IR 17 or other receptors. Detailed updated modelling results are presented in Appendix D.1 Light Impact Assessment.

The updated section includes a more thorough discussion of sky glow and a lightshed map (Figure 6.3-2) that shows that the light levels from the Beaver Dam Mine Site reach maximum 0.1 Lux (background level) at a distance of 5,082 m from the source. During pre-curfew conditions when the Haul Road is in operation, when two trucks pass the same point simultaneously, the ambient light may be above background (above 0.1 Lux) up to a distance of 279 m (Appendix D.1). The lightshed maps will inform the response to IR2 CEAA 2-05 in consideration of Beaver Lake IR 17 and areas identified for current use practices and shows light trespass from Beaver Dam Mine Site and Haul Road traffic to be discussed in Section 6.14.

The resulting area of illumination elevated above background conditions (sky glow) from the Beaver Dam Mine Site will be seen within 5,082 m. This encompasses receptors R1, R2, R3, and R4 (Section 6.3.7.1, Figure 6.3-2). The predicted illuminance levels

represent the worst-case operating conditions of the Beaver Dam Mine Site. The assessment considers when all of the mobile equipment at the mine would be in use at the same time, illuminating towards receptors. The areas surrounding the site are wooded with varying topography and inhibit the spread of light. It was conservatively assumed for screening purposes that 50% of the light will not reach the receptors due to directionality and line of sight obstructions. The amount of light blocked by the surrounding woodland and topographic changes, however, will likely be much greater than this (>90%), especially during the seasons when deciduous trees are leaf on (Appendix D.1). It is therefore not expected that the illumination will cause any significant visual impact, due to a combination of distance and the screening effects of topography and vegetative cover.

Table 6.3-1: Updated Subsections from the 2019 Revised Environmental Impact Statement – Light

2019 Revised EIS Submission (February 28, 2019)	Updated in 2021	Corresponding 2021 EIS Update Section Number	Reason for Update
-	-	6.3.1 Introduction	• New
6.3.1 Rationale for Valued Component Selection	No	6.3.2 Rationale for Valued Component Selection	• N/A
6.3.2 Baseline Program Methodology	Yes	6.3.3 Baseline Program Methodology	• Updated to clarify baseline methodology used for Touquoy and rationale for Environmental Zone classification
6.3.3 Baseline Conditions	Yes	6.3.4 Baseline Conditions	• Updated for clarity
6.3.4 Consideration of Consultation and Engagement Results	Yes	6.3.5 Consideration of Engagement Results	• This subsection has been updated to reflect recent public and the Mi'kmaq of Nova Scotia recent engagement.
6.3.5 Effects Assessment Methodology – **Boundaries**	Yes	6.3.6 Effects Assessment Methodology – **Boundaries**	• Updated PA, LAA, RAA based on changes in Project Infrastructure
6.3.5 Effects Assessment Methodology – **Thresholds for Determination of Significance**	Yes	6.3.6 Effects Assessment Methodology – **Thresholds for Determination of Significance**	• Updated in response to IR2 CEAA 2-02 and CEAA 2-04
6.3.6 Project Activities and Light Interactions and Effects	Yes	6.3.7 Project Activities and Light Interactions and Effects	• Updated to include Light Assessment Methodology, description of receptors and modelling completed, and discussion on skyglow for Beaver Dam Mine Site, Haul Road, and Touquoy
6.3.7 Preferred Alternative Haul Road	Yes	-	• The Preferred Alternative Haul Road is no longer being considered and has been removed from the Project Description and EIS
6.3.8 Mitigation and Monitoring	No	6.3.8 Mitigation	• N/A
6.3.9 Residual Effects and Significance	Yes	6.3.9 Residual Effects and Significance	• Updated to reflect updates from predictive modelling results
6.3.10 Proposed Compliance and Effects Monitoring Program	Yes	6.3.10 Proposed Compliance and Effects Monitoring Program	• Updated to reflect updated predictive modelling results

Notes: PA = Project Area; LAA = Local Assessment Area; RAA = Regional Assessment Area; - = no update; IR2 = Round 2, Information Requests; CEAA = Canadian Environmental Assessment Agency; EIS = environmental impact statement; N/A = not applicable.

6.3.2 Rationale for Valued Component Selection

Light level limits are not directly regulated through the provincial or federal regulatory regime. Changes (i.e., increases or changes to occurrence timing) to ambient light levels have the potential to adversely affect fauna and birds, as well as increase level of light pollution experienced by the general public or specific populations.

6.3.3 Baseline Program Methodology

A background light assessment for illuminance was conducted at the Touquoy Mine Site on the night of August 23, 2007 as part of the 2007 Touquoy Mine Project Focus Report (CRA 2007a). Post curfew measurements (after 11 pm) were conducted utilizing a Skeonic L-358 flash meter. Measurements were taken in the EV mode and converted into illuminance (lux) values. Illuminance refers to the amount of light that covers a surface and is quantified in terms of lux (i.e., one lux is the illuminance of 1 m^2 surface uniformly lit by one lumen (lm) of luminous flux – the quantity of energy emitted per second in all directions). One lux is the accepted equivalent to moonlight. Baseline sky glow, or sky brightness, conditions were not assessed for as part of the 2007 Focus Report (CRA 2007a).

The conditions around Beaver Dam Mine Site, Haul Road, and surrounding area are similar to that of the Touquoy Mine Site background conditions due to the proximity and remote, rural and mostly wooded, location. Ambient nighttime light conditions are minimal and typical of a rural area. The largest artificial light sources in the Beaver Dam Mine Site are from the nearest residences, the Beaver Lake IR 17, and the occasional all-terrain vehicle. The largest artificial light sources along the Haul Road are from Beaver Lake IR, 17 vehicles on Highway 224, the community of Mooseland, and other rural residences nearby. As such, additional on-site baseline light monitoring was not required to support the light impact assessment.

The ILP has developed an Environmental Zone classification system whereby the existing ambient light levels at a site are used to determine the recommended maximum amount of light trespass (i.e., the spilling of light beyond the boundary of the area being lit) to nearby receptors.

Light impact assessments were conducted for the Touquoy facility in 2007 (CRA 2007a), and for the Beaver Dam Mine Project in 2017 - updated in 2019. The impacts of the proposed lighting installations were quantified and compared with guidelines published by the ILP in the document entitled “Guidance Note for the Reduction of Obtrusive Light” (ILP 2020). Light assessment modelling methodology is detailed in the effects assessment methodology Section 6.3.6.2.

6.3.4 Baseline Conditions

The proposed Project is located in a historical mining area surrounded by forest, waterbodies, watercourses and wetlands. The nearest residential receptor to the Beaver Dam Mine Site is the Beaver Lake IR 17 located approximately 5 kilometres (km) southwest. A proposed haul route for transporting ore will connect the Beaver Dam Mine to the Touquoy Processing Plant, located approximately 30 km southwest.

The existing baseline light conditions around Beaver Dam Mine Site, Haul Road, and surrounding area are similar to that of the Touquoy Mine Site background conditions (CRA 2007a) due to the proximity, remote, rural, and mostly wooded location. Ambient nighttime light conditions are minimal and typical of a rural area. The largest artificial light sources near the proposed Project are from the closet residences, the Beaver Lake IR 17, and the occasional all-terrain vehicle. The largest artificial light sources along the Haul Road are from Beaver Lake IR 17, vehicles on Highway 224, the community of Mooseland, and other rural residences nearby. As such, additional on-site baseline light monitoring was not required to support the light impact assessment (Appendix D.1). The Beaver Dam Mine Site, Haul Road, background conditions for the Touquoy Mine Site (CRA 2007a), and

surrounding area also fall under the classification for rural areas, small villages, or relatively dark urban areas: "E2 Low District Brightness Areas" (ILP 2020).

6.3.5 Consideration of Engagement Results

Key concerns raised during public and Mi'kmaq of Nova Scotia engagement relating to ambient light include light from mining operations at the Beaver Dam Mine Site and trucking along the Haul Road. The change to the Haul Road reduced these concerns with respect to passing by existing residences, especially concerns of Millbrook First Nation regarding its residents in Beaver Lake.

The results of the public and Mi'kmaq of Nova Scotia engagement have been considered in the environmental effects assessment, including AMNS's commitments on mitigation and monitoring measures and proposed compliance and effects monitoring programs, as well as AMNS's broader commitment to ongoing public and Mi'kmaq of Nova Scotia engagement (Sections 3 and 4). Specific to evaluating the effect of ambient light, these are found within the following environmental effects assessment.

Engagement with Mi'kmaq communities, especially the Millbrook First Nation, has determined that community members living within close proximity to the Beaver Dam Mine Site are concerned with changes to the baseline sky conditions from the proposed Project.

6.3.6 Effects Assessment Methodology Update

6.3.6.1 Boundaries

6.3.6.1.1 Spatial Boundaries

The Regional Assessment Area (RAA) and Local Assessment Area (LAA) boundaries have been updated from the Revised 2019 EIS (AMNS 2019) to reflect the changes to the Project Description (Section 2) and the corresponding PA.

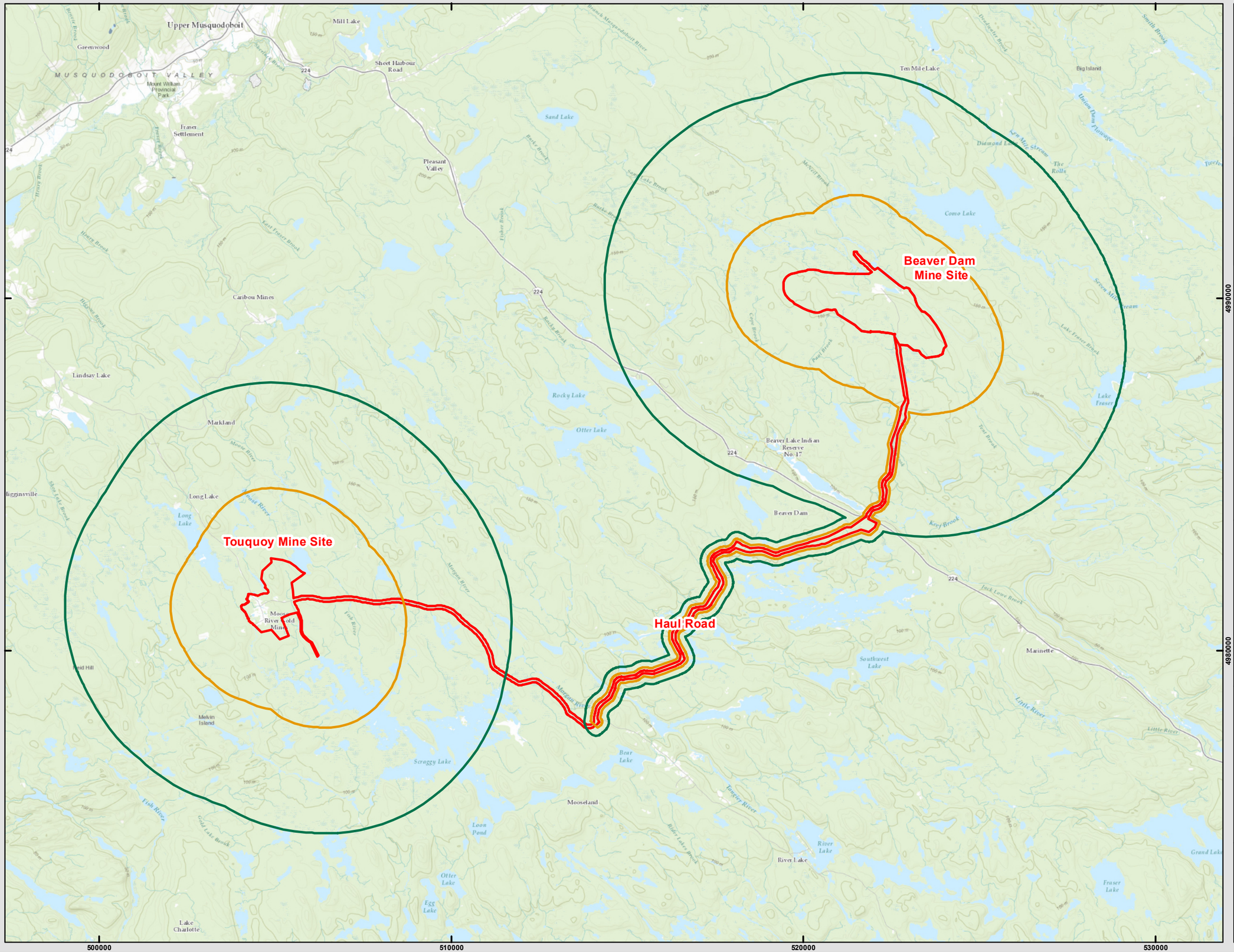
The spatial boundary used for the assessment of effects of ambient light are discussed below.

The PA consists of the three project components - Beaver Dam Mine Site, Haul Road, and Touquoy Mine Site and extends from Marinette to Moose River Gold Mines, Halifax County, NS. The Beaver Dam Mine Site is located at the eastern end of the Beaver Dam Mines Road and has been extended to the west and southeast to allow for micro-siting of the waste rock stockpile and organic material stockpile, respectively. The Haul Road spans from the Beaver Dam Mine Site to the Touquoy Mine Site.

The LAA is variable based on 1 lux threshold for light trespass into residential dwelling windows at sensitive receptor locations as determined by preliminary modelling and evaluation of light (Figure 6.3-1). At the Touquoy Mine Site, the boundary was defined based on the nearest modelled receptor (i.e., person canoeing on Scraggy Lake).

The RAA is based on the maximum extent of light propagation (measured by 0.1 lux) (Figure 6.3-1).

The RAA is the appropriate spatial boundary to evaluate potential effects from light on the Project due to the potential to cause direct and indirect effects of ambient light outside of the PA and LAA.



Prepared For:

Atlantic Gold

FIGURE 6.3-1

Beaver Dam Mine Project

Spatial Boundaries: Light

- Project Area
- Light Local Assessment
- Light Regional Assessment Area



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 1.25 2.5 5 km

1:100,000 Scale when printed @ 11" x 17"

Drawn By: EP
Date: 2021-05-09
Reviewed By: XX

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

McCallum Environmental Ltd.

Document Name: BD_EIS_Figure6.3-1 Light Spatial Boundaries

6.3.6.1.2 Temporal Boundaries

The temporal boundaries used for the assessment of effects of ambient light are the construction phase, operational phase, and decommissioning and reclamation phase.

6.3.6.1.3 Technical Boundaries

Canada Occupational Health and Safety Regulations (SOR/86-304) direct the minimum illumination levels required at various workplace locations.

6.3.6.1.4 Administrative Boundaries

No administrative boundaries were identified for the effects assessment of ambient light.

The ILP have produced suggested maximum guidelines on reduction of obtrusive light (ILP 2020), which were consulted in the assessment of the Project. The thresholds for light trespass (into windows post-curfew) for each Environmental Zone Classification is presented in Table 6.3-2.

Table 6.3-2: Maximum Values of Vertical Illuminance on Properties – Post-curfew

Environmental Zone Classification	Night-time Light Trespass Threshold into Windows Post-curfew (lux)
E1	1[(a)]
E2	1
E3	2
E4	5

Source: ILP 2020, Table 3.

Note: [(a)] From public road lighting installations only.

Classification results in an E2 classification for the Beaver Dam Mine Site and Touquoy Mine Site. As a result, a 1 lux threshold has been conservatively assigned for light trespass into windows (residential receptors). The Haul Road will not operate in post-curfew conditions (i.e., between 11 PM and 7 AM).

6.3.6.2 Light Assessment Modelling Methodology

6.3.6.2.1 Beaver Dam Mine Site and Haul Road Methodology

The light impact assessment was updated to reflect the current infrastructure for the Project as of 2020 (Appendix D.1). The impacts of the proposed lighting installations at the Beaver Dam Mine Site and lighting from haul trucks along the Haul Road on nearby sensitive receptors (Table 6.3-3) were compared with the guidelines published by the Institution of Lighting Professionals in the "Guidance Note for the Reduction of Obtrusive Light" (ILP 2020).

The Beaver Dam Mine Site, Haul Road and surrounding area falls under the Environmental Zone classification for rural areas, small villages, or relatively dark urban areas: "E2 Low District Brightness Areas" (ILP 2020). Based upon this classification, the light trespass limit at an off-site receptor after curfew (i.e., typically considered to be 11 PM) for the Beaver Dam Mine Site is 1 lux, which is the accepted equivalent to moonlight. The after curfew (i.e., post-curfew: between 11 PM and 7 AM) limit was used to

assess the impact of lighting from the proposed mine as mining operations under full-scale operation are scheduled to be 24 hours per day.

Table 6.3-3: Sensitive Receptors Used in Light Impact Assessment

Receptor	Location Description
R1	9 Beaver Dam Mine Road (Marlborough Property)
R2	4112 Highway 224 (Beaver Lake IR 17)
R3	4115 Highway 224 (Cottage on Crown Land)
R4	3492 Highway 224 (Hobbs Property)
R5	3379 Highway 224 (McLeod Property)
R6	3373 Highway 224 (Smith Property)
R7	Tangier River (Deepwood Estates Property)
R8	Tangier River (Musqudoboit Lumber Co. Ltd. Property/John Dickson Lease)
R9	5579 Mooseland Road (Lloy Property)

The ILP trespass limit at an off-site receptors before curfew (i.e., before 11 PM) is 5 lux (ILP 2020). AMNS has indicated that trucking transport along the Haul Road will occur approximately 16 hours a day, and not during post-curfew hours (i.e., not between the hours of 11 PM and 7 AM). No other proposed lighting will exist along the Haul Road. As such, the light trespass at receptors along the haul route was evaluated against the before curfew (pre-curfew) limit of 5 lux.

Luminous flux (i.e., the quantity of the energy of the light emitted per second in all directions) was calculated for a complete list of proposed light sources to be installed at the site and the haul trucks (complete list included in Appendix D.1). After determining luminous flux (lumens) estimates for each light source, the impacts of the incident light at the identified sensitive receptors can be determined. There are four main areas where lighting is to be located:

1. Open Pit
2. Operational Facilities
3. Waste Rock Storage
4. Haul Road

As a worst-case scenario, the illuminance for the Haul Road was considered from two trucks at the closest location on the haul route to each nearby individual sensitive receptor shining light towards each receptor were considered (Appendix D.1). Other than the hauling trucks, no other lighting sources will be present along the haul route (e.g., street lights, traffic lights). For simplicity, the two trucks were combined as a single stationary source (Appendix D.1). Lighting will not be installed along the Haul Road.

The illuminance level at a receptor is equal to the combined total from each light source. It has been conservatively assumed that 50 percent of the incident light will not reach the receptor due to the dense tree cover at the site and surrounding area. This was then compared to the applicable pre- and post-curfew light trespass thresholds.

In response to IR2 CEAA 2-05, and to determine the impact of potential elevated sky brightness, or sky glow, the total luminous flux (lumens) was calculated for the Beaver Dam Mine Site and Haul Road, the same 50% incidence considering directionality and

line of site obstructions was applied, and the distance to background light levels was modelled (Appendix D.1). Because there were no baseline light measurements taken, the most conservative 0.1 lux light level, which is considered the limit of possible impact, was used as background. For context, the 0.1 lux light level is also the maximum illuminance assessment criteria during post-curfew for the environmental zone E1 which is considered a natural, relatively uninhabited rural area such as national parks and areas of outstanding natural beauty.

Section 5 of Light Impact Assessment Report (Appendix D.1) provides details relating to the modelling methodology for the Project light effects as well as potential cumulative effects from the shared proposed usage of the Beaver Dam Haul Road by trucks from the Fifteen Mile Stream Gold Project, the Cochrane Hill Gold Project, and current baseline forestry activity. Conclusions relating to potential cumulative effect is described in the Cumulative Effects Section (Section 8).

Sensitive Receptors

Sensitive receptors were identified around the Beaver Dam Mine Site, and Haul Road (Table 6.3-3). The nearest permanent residential receptor to the mine is the Beaver Lake IR 17 (R2), at a distance of approximately 5 km southwest from the Beaver Dam Mine Site boundary. Five other residential receptors, farther away from the mine and located along Highway 224, are also considered; Marlborough property (R1), the cottage on crownland (R3), the Hobbs property (R4), the McLeod property (R5) and the Smith property (R6). These six residential receptors were mainly used in the analysis of the impacts of light trespass from the mine.

Sensitive receptors were also considered along the proposed Haul Road. Three seasonal residences located within 320 m of the haul route were assessed for light impacts from hauling trucks travelling along the route; the Deepwood Estates property (R7), the Musquodoboit Lumber Co property/John Dickson Lease (R8) and the Lloy property (R9) (Table 6.3-3). These three residential receptors were mainly used in the analysis of the impacts of light trespass from transport trucks travelling along the Haul Road. As previously mentioned, the illuminance from the haul route was evaluated against pre-curfew limits due to the hauling schedule.

Marlborough property (R1), the Hobbs property (R4), McLeod property (R5) and the Smith property (R6) were assessed for impacts of light trespass from both the transport trucks travelling along the haul route during pre-curfew conditions and light trespass from the mine during pre-curfew and post-curfew conditions.

Effects to wildlife, birds, and the Mi'kmaq of Nova Scotia from predicted light are further discussed in Sections 6.11, 6.12, and 6.14.

6.3.6.2.2 Touquoy Mine Site Methodology

In the 2007 Focus Report (CRA 2007a), the impacts of the proposed lighting installations at the Touquoy Mine Site were quantified and compared with guidelines published by the Institution of Lighting Professionals (ILP) in the document entitled "Guidance Note for the Reduction of Obtrusive Light" (ILE 2005). A threshold of 1 lux was determined to be the limit of noticeable impact from light. The extent of the 1 lux threshold was compared to nearby sensitive receptors to determine potential effects. Sensitive receptors included Camp Kidston (3 km to the north), the Scraggy Lake Area (2 km to the south) and the nearest residence (5 km to the northwest).

Effects to wildlife, birds, and the Mi'kmaq of Nova Scotia from predicted light are further discussed in Sections 6.11, 6.12, and 6.14.

6.3.6.3 Thresholds for Determination of Significance

The adverse effects of light trespass on human receptors are due both to an increase in general illuminance that may cause annoyance and may disrupt sleeping patterns, and from the direct view of the light source that can cause glare issues. The adverse effects of light trespass from exterior lighting are influenced by a number of factors:

- Light trespass is more likely to be perceived as obtrusive if the lighting installation is located above the observer. Lighting installations are usually directed towards the ground and an observer could hence have a direct view of the luminaire.
- The surrounding topography and site infrastructure, including distance, hills, trees, and buildings, generally have a positive effect by shielding the observer from the light source.
- Pre-existing lighting in the area. Light from a particular light source is seen as less obtrusive if it is located in, or perceived in, an area where the lighting levels are already high, e.g., along roads and near built up areas.
- The zoning of the area. A residential area is seen as more sensitive compared to commercial areas where high lighting levels are seen as more acceptable.
- Time of use. Clearly light will be seen as being more obtrusive during nighttime. This is generally considered to be between 11:00 pm and 7:00 am.

This section has been updated to reflect responses to IR2s CEAA 2-02 and CEAA 2-04 (AMNS 2021). For the purpose of this assessment, the threshold of determination of significant effects from light at the Beaver Dam Mine Site was determined to be 1 lux light trespass into windows at the nearest receptor location. This was determined as a result of the baseline environmental light classification of E2 at the Beaver Dam Mine Site.

For light, the following logic was applied to assess the magnitude of a predicted change in light levels:

- Negligible – background light levels (0.1 lux) are met at the property boundary.
- Low – increased light trespass above background levels beyond property boundaries, however, comply with relevant guidelines for light trespass into windows at the residential receptors.
- Moderate – increased light trespass above background levels beyond property boundaries, however, exceed relevant guidelines for light trespass (1 lux) into windows at the residential receptors up to 5 lux.
- High – increased light trespass above background levels beyond property boundaries, however, exceed guidelines for light trespass (1 lux) into windows at a residential receptor above 5 lux.

For light, the following logic was applied to assess the timing of a predicted change in light levels. Timing has been determined to not be applicable because the modelling was completed assuming that 50% of the light would not reach receptors due to directionality and line of sight obstructions. In reality the amount of light blocked by the surrounding woodland and topographic changes will likely be much greater than this (>90%) especially during seasons when trees are in full bloom, and thus results are conservatively high. Light trespass during daylight hours would be negligible and thus, this assessment focusses on dark or nighttime conditions.

6.3.7 Project Activities, Light Interactions, and Effects

The key sensitive receptors for light from the Beaver Dam Mine Site and Haul Road in the area is the Beaver Lake IR 17; a satellite community of the Millbrook First Nation located approximately 5 km south of the Beaver Dam Mine Site. Eight other receptors including a permanent resident, seasonal camps and cottages, are also located along the Beaver Dam Mines Road near Highway 224 and along the Haul Road as described in Table 6.3-3.

Camp Kidston, which operates only in the summer months, is located 3.5 km northeast of Touquoy. According to AMNS, the nearest permanent full-time occupied residences to the Touquoy Mine Site are located approximately 5.8 km to the north of the open pit along Caribou Road. The Touquoy facility is currently in operation. The primary effect of the continued use of the Touquoy Mine Site is the continued lighting of facilities and vehicular traffic during the processing of Beaver Dam ore. There are no new or additional effects from light anticipated to be caused by the processing of ore and the management of tailings (exhausted pit) from the Beaver Dam Mine Site, as no new construction or disturbance is required at the Touquoy Mine Site related to the processing of Beaver Dam ore. The effects of light previously described for the Touquoy Mine Site in the 2007 Focus Report (CRA 2007a) are presented in the Section 6.3.6.2.

The potential interactions identified for Beaver Dam Mine Site, the Haul Road, and the Touquoy Mine are presented in Tables 6.3-4 to 6.3-6.

Table 6.3-4: Potential Ambient Light Interactions with Project Activities at the Beaver Dam Mine Site

Project Phase	Duration	Relevant Project Activity
Construction	1 year	• Clearing, grubbing, and grading in preparation of construction • Drilling and rock blasting in preparation of construction • Till and waste rock removal from site preparation transport and storage • Existing settling pond dewatering in preparation of construction • Watercourse and wetland alteration in preparation of construction • Mine Site road construction • Lighting of construction areas • Surface infrastructure installation and construction • Collection and settling pond construction • General management of wastes derived from preparation and construction activities
Operations and Maintenance	5 years	• Rock blasting to access and extract ore • Management of waste rock produced from crushing and preparing ore for transport • Petroleum products management • Site maintenance and repairs • Lighting of facilities and Beaver Dam Mine Site roads • Environmental monitoring of atmospheric environment • General management of wastes derived from operation and maintenance activities
Active Closure	2 years	• Infrastructure demolition • Site reclamation activities
Post-closure	10+ years (monitoring)	N/A

Note: N/A = not applicable.

Table 6.3-5: Potential Light Interactions with Project Activities along Haul Road

Project Phase	Duration	Relevant Project Activity
Construction	1 year	• Clearing, grubbing, and grading in preparation of construction • Rock blasting in preparation of transport and storage • Till and waste rock from site preparation transport and storage • Watercourse and wetland alteration in preparation of construction • Haul Road upgrades
Operations and Maintenance	5 years	• Ore transport • Haul Road maintenance
Active Closure	2 years	• N/A[(a)]
Post-closure	10+ years (monitoring)	• N/A

Note: [(a)] Active Closure (i.e., decommissioning and reclamation) of the Haul Road is not expected. There is no plan to reclaim the Haul Road which is anticipated to conform with the existing and future land uses (i.e., forestry). N/A = not applicable.

Table 6.3-6: Potential Light Interactions with Project Activities at Touquoy Mine Site

Project Phase	Duration	Relevant Project Activity
Construction	1 year	• Tailings pipeline, make-up water pipeline alteration, and relocation of reclaim infrastructure
Operations and Maintenance	5 years	• Ore management and processing • Lighting of facilities and mine site roads
Active Closure	2 years	• N/A
Post-closure	10+ years (monitoring)	• N/A

Note: N/A = not applicable.

6.3.7.1 Beaver Dam Mine Site and Haul Road

A light impact assessment (Appendix D.1) was completed for the Project and included nine points of reception (Table 6.3-3 and Figure 6.3-2). For the purposes of this assessment, "pre-curfew" was assumed to be before 11 PM, and included road activity, and "post-curfew" was between 11 PM and 7 AM and included only overnight activities at the Beaver Dam Mine Site. The assessment of light impacts along the Haul Road was completed by considering a “worst case” scenario when two trucks are closest to each receptor and shining light towards the receptor. Because receptors along the Haul Road are not located on any road bends, with limited line of site to the travelling trucks, the assessed light impacts to these receptors were likely overestimated (Appendix D.1).

The calculated light levels at all receptors are below the limits recommended by the ILP guidelines during both pre- and post-curfew conditions (i.e., between 11 PM and 7 AM and before 11 PM; Table 6.3-7 and Figure 6.3-2). The assessment considers worst-case operating conditions, for example, if all mobile equipment was in use at the same time and illuminating towards the receptors and the potential for light from both the Beaver Dam Mine Site and the Haul Road trucks to affect a receptor in a cumulative way.

The calculated light levels from the Haul Road are also below the limits recommended by the ILP guidelines (Table 6.3-7 and Figure 6.3-2).

Table 6.3-7: Comparison of Light Levels at Receptors (2021)

Receptors	Illuminance (lux)		ILP Guidance Limit[a] (lux)		Percentage of Guidance Criteria	
	Pre-curfew[b]	Post-curfew	Pre-curfew[b]	Post-curfew	Pre-curfew[b]	Post-curfew
R1	8.49E-01	6.86E-02	5	1	16.97%	6.86%
R2	8.21E-02	8.21E-02	5	1	1.64%	8.21%
R3	7.88E-02	7.88E-02	5	1	1.58%	7.88%
R4	1.45E+00	6.57E-01	5	1	29.05%	6.57%
R5	8.06E-02	5.89E-02	5	1	1.61%	5.89%
R6	7.55E-02	5.84E-02	5	1	1.51%	5.84%
R7	4.88E+00	-	5	n/a[c]	97.5%	-[c]
R8	7.62E-02	-	5	n/a[c]	1.52%	-[c]
R9	1.39E+00	-	5	n/a[c]	23.73%	-[c]

Notes:

[a] Based on assumed classification of the area as Environmental Zone E2 – low district brightness areas (Guidance Note for the Reduction of Obtrusive Light [ILP 2020]).

[b] Curfew = the time after which stricter requirements for the control of obtrusive light will apply. If not defined by the local planning authority, the ILP suggest 11 PM (ILP 2020).

[c] Haul road operations will only occur between 7 AM and 11 PM (i.e., during pre-curfew hours).

Lights will be installed in active construction and operational areas and at the Beaver Dam Mine Site, including site roads. Lights will be operational at all times to provide for a safe working environment. Vehicle headlights moving around the site as well as entering and exiting the site will also be introduced. Temporary lighting systems (including portable lights) may be used during construction to illuminate specific areas and ensure the safety of staff.

Increased light may cause disturbance or displacement of species, while attracting other species, or general behavioral changes (DaSilva, Valcu and Kempenaers, 2015). For those species which may be attracted to lights, lights may increase potential for direct mortality of these species or may increase habitat suitability by supplementing their source of prey. Birds may become attracted to or disoriented by open pit lighting at night, particularly during periods of migration, which could lead to mortality (Jones and Francis, 2003). Light can also alter habitat quality and sleep/wake cycles for terrestrial fauna within the immediate vicinity of the PA. This may decrease efficiency of nocturnal hunters. Some opportunistic wild species may be attracted to the site as a result of increased access and available food sources (natural prey or anthropogenic food sources), potentially increasing interactions between site personnel and wildlife. Interactions of light with wildlife, birds, and the Mi'kmaq of Nova Scotia is further discussed in Sections 6.11, 6.12, and 6.14.

Ambient night-time (i.e., post-curfew) light levels at the Beaver Dam Mine Site are predicted to meet the 1 lux guideline within 1.6 km from the site and as such not anticipated to affect the Beaver Lake IR 17 or other receptors. The Beaver Lake IR 17 is located approximately 5 km southwest of the Beaver Dam Mine Site and is separated from the Beaver Dam Mine Site by forest and two topographic ridges. These ridges block direct views from the houses to all work areas. The pit is located in a topographic depression and therefore, the distance to any sensitive receptor location would mitigate light effects. The lighting effects would have a lower intensity, although it could be more diffuse, especially if moisture or particulate matter are present in the atmosphere.

Distance to Sky Glow dissipation is summarized in Table 6.3-8 along with total luminous flux from the Beaver Dam Mine and Haul Road, and distance to the 5.0 lux and 1.0 lux assessment criteria. Table 6.3-8 shows the distance to a maximum 0.1 lux illuminance level which is considered as background light level for this assessment. Figure 6.3-2 shows the lightshed map depicting these distances. The lightshed map (Figure 6.3-2) shows that the light levels from the Beaver Dam Mine Site reach maximum 5 lux at a distance of 719 m from the source, maximum 1 lux light level at distance of 1,607 m from the source and maximum 0.1 lux (background level) at a distance of 5,082 m from the source. Table 6.3-8 and Figure 6.3-2 also show that during pre-curfew conditions when the Haul Road is in operation, when two trucks pass the same point simultaneously, the ambient light may be 5 lux or more out to a maximum distance of 39 m from the Haul Road (on an instantaneous basis, this will not be a continuous light level, it will occur only where two trucks are passing each other, and only for the brief period they are both affecting the same receptor). At a distance of 279 m, the light under these same conditions will be less than 0.1 lux (or less than background) (Appendix D.1). This map will inform the response to IR2 CEAA 2-05 in consideration of Beaver Lake IR 17 and areas identified for current use practices and shows light trespass from Beaver Dam Mine Site and Haul Road traffic to be discussed in Section 6.14.

Table 6.3-8: Distance to Sky Glow Dissipation

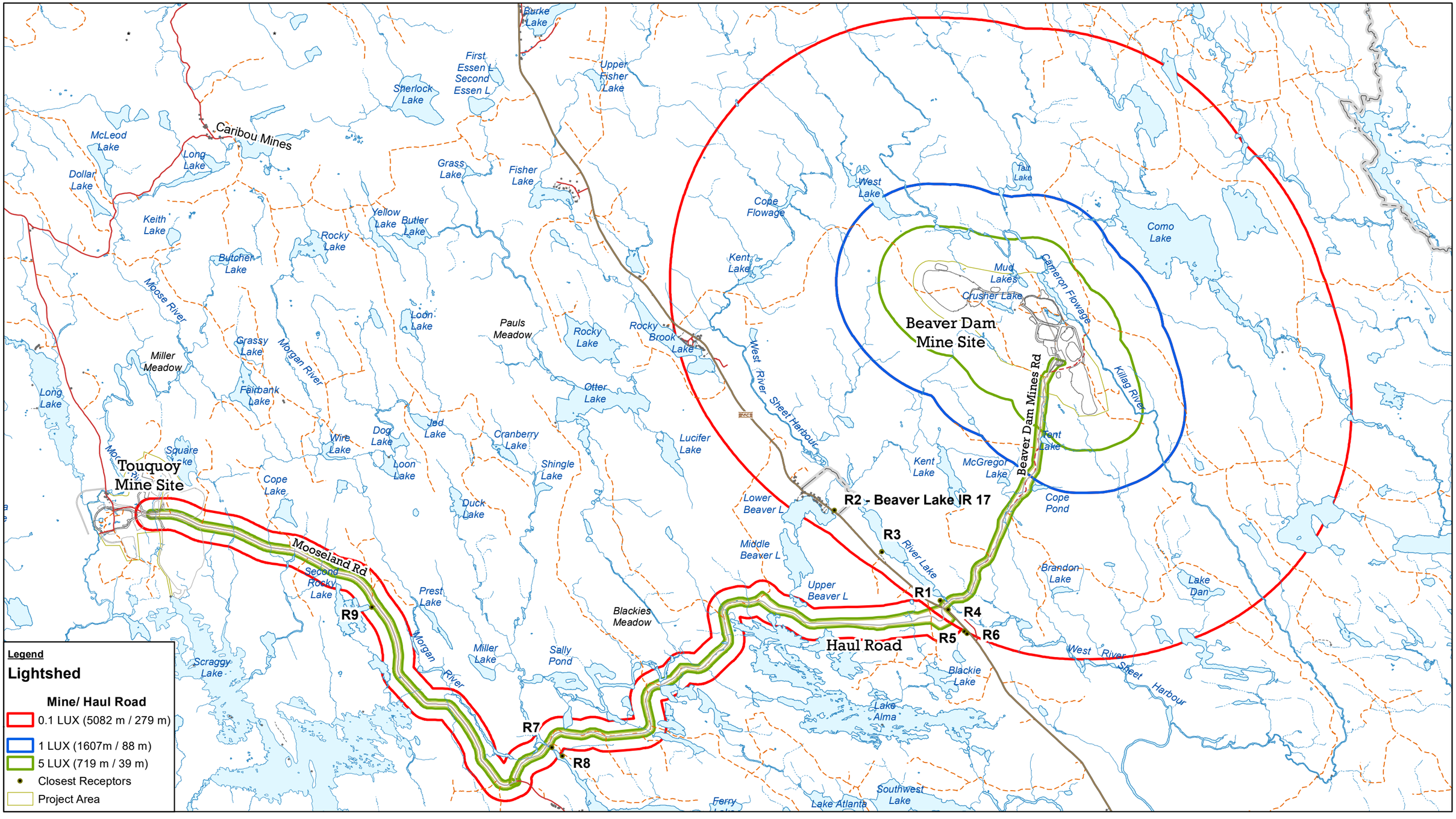
Component	Total Luminous Flux (Lumens)	Distance to Below 5.0 Lux (m)	Distance to Below 1.0 Lux (m)	Distance to Below 0.1 Lux (m)
Beaver Dam Mine Site (Based on 50% incident light)	5,165,700	719	1,607	5,082
Haul Road (Based on 50% incident light)	15,600	39	88	279

Source: ILP 2020.

Notes: 1.0 lux is approximately the brightness of a full moon under a clear sky.

0.1 lux is less bright than a full moon, but brighter than a moonless night.

On particularly overcast nights, sky glow may be visible farther due to reflection from low cloud cover.



Source: Service Nova Scotia, GHD

0 750 1,500 2,250
Meters

Coordinate System:
NAD 1983 CSRS UTM Zone 20N

Map shows light trespass from Beaver Dam Mine and Haul Road traffic only. Light trespass from (existing) Touquoy Mine is not presented.

ATLANTIC GOLD CORPORATION
MARINETTE, HALIFAX CO., NOVA SCOTIA
ENVIRONMENTAL IMPACT STATEMENT - BEAVER DAM MINE

LIGHT IMPACT FROM BEAVER DAM MINE AND HAUL ROAD

088664 (014)
Dec 3, 2020

FIGURE 6.3-2

GIS File: N:\CA\Halifax\Projects\661\088664\GIS\Maps\Deliverables\088664-REPORT\088664-RPT(017)\088664(017)GIS-HX011.mxd

The resulting area of illumination elevated above background conditions (sky glow) from the Beaver Dam Mine Site will be seen within 5,082 m. This encompasses receptors R1, R2, R3, and R4 (Figure 6.3-2). The predicted illuminance levels represent the worst-case operating conditions of the Beaver Dam Mine Site. The assessment considers when all of the mobile equipment at the mine would be in use at the same time, illuminating towards receptors. The areas surrounding the site are wooded with varying topography and inhibit the spread of light. It was conservatively assumed for screening purposes that 50% of the light will not reach the receptors due to directionality and line of sight obstructions. The amount of light blocked by the surrounding woodland and topographic changes, however, will likely be much greater than this (>90%), especially during the seasons when deciduous trees are leaf on (Appendix D.1). It is therefore, not expected that the illumination will cause any significant visual impact, due to a combination of distance and the screening effects of topography and vegetative cover.

Section 5 of Light Impact Assessment Report (Appendix D.1) provides details relating to the modelling methodology for the Project light effects as well as potential cumulative effects from the shared proposed usage of the Beaver Dam Haul Road by trucks from the Fifteen Mile Stream Gold Project, the Cochrane Hill Gold Project, and current baseline forestry activity. Conclusions relating to this potential cumulative effects are described in Section 8.

6.3.7.2 Touquoy Mine Site

The predicted light spill anticipated to occur at the identified points of reception (Camp Kidston, Scraggy Lake Area and the nearest residence) ranges between 0.0587 and 0.294 lux, well below the established 1 lux threshold used at the Touquoy Mine Site for the Touquoy Gold Project (CRA 2007a).

The primary effect of the continued use of the Touquoy Mine Site is the continued lighting of facilities and vehicular traffic during the processing of Beaver Dam ore. There are no new or additional effects from light anticipated to be caused by the processing of ore and the management of tailings from the Project that would affect the conclusions presented above for the Touquoy Mine Site based on the Touquoy Gold Project evaluation of light.

Effects to wildlife, birds, and Mi'kmaq of Nova Scotia from light are further discussed in Sections 6.11, 6.12, and 6.14.

Although the light impacts from the Touquoy Mine Site and Beaver Dam Mine Site were not evaluated in combination, it is expected that the ILP limits at nearby receptors will not be exceeded from light trespass at both facilities. This is expected due to the low illuminance levels assessed at each receptor in both assessments and due to the large distances from the receptors to the sources of light at the other facilities. For example, the Beaver Lake IR 17 sits on the edge of the potential sky glow dissipation to background point (approximately 5 km) from Beaver Dam Mine Site but over 13 km from Touquoy Mine Site so it would be well outside the sky glow of the Touquoy Mine so would not be impacted by both sites. Conclusions relating to potential cumulative effects are described in the Cumulative Effects Section (Section 8).

6.3.8 Mitigation

The use of lights will be limited to the amount necessary to ensure safe operation, with the recognition that excessive lighting can be disruptive to wild species. Light pollution will be reduced by installing downward- facing lights on site infrastructure and Mine Site roads, as well as at the Touquoy Mine Site. Wherever possible, motion-sensing lights will be installed to ensure lights are not turned on when they are not necessary. Only direct and focused light will be used for worker safety.

Bird collisions with Project lighting and subsequent mortality are expected to be rare, but if it occurs, it will not likely have significant effects on migratory birds (Section 6.12). Efforts will be made to reduce the effect of lighting on migrating birds. Practices will be reviewed on an annual basis for BAPs, including illumination. No additional monitoring is recommended for the Project related to night-time light levels.

Ore will be hauled to the Touquoy Mine Site for approximately 16 hours per day (i.e., 7 AM to 11 PM) during the operation phase. The Haul Road will not be used for ore transport during post-curfew period (i.e., 11 PM to 7 AM), although maintenance activities may occur.

Table 6.3-9: Mitigation for Light

Project Phase	Mitigation Measures
C	Temporary lighting will be directly focused on work areas and shielded where practicable to avoid light trespass
C, O, CL	Use of only downward-facing lights on site infrastructure and Mine Site roads
C, O, CL	Install motion-sensing lights, where practicable
C, O, CL	Only use direct and focused light when needed for worker safety
C, O, CL	All floodlights will employ full horizontal cutoff, as appropriate
C, O, CL	Lighting not in use will be turned off, whenever practicable
C, O, CL	Site perimeter lighting will be directed to minimize light offsite light trespass
C, O, CL	Utilize efficient sources of light to reduce overall magnitude of light, wherever practicable
C, O, CL	A procedure, including a response plan, will be available for public to be able to register complaints regarding light concerns

Note: C = construction; O = operations; CL = active closure.

6.3.9 Residual Effects and Significance

During the construction and operation of the Beaver Dam Mine Site and Haul Road, ambient lighting will increase, noticeably at first as an offset to the original undeveloped area. Increases in and the subsequent effects of light on potential receptors can be minimized through effective lighting design and operational schedule. Ongoing monitoring of site activity will inform on areas where light reductions are warranted.

Given the distance of the Beaver Dam Mine Site and Haul Road to surrounding properties/residences, the natural topography and vegetation, the modelling has shown no significant adverse effects due to light trespass into a receptor from the site or Haul Road will be experienced.

The predicted residual environmental effects of Project on ambient light are assessed to be adverse, but not significant. The overall residual effect of the Project on light is assessed as not likely to have significant adverse effects after proven mitigation measures have been implemented.

Table 6.3-10: Residual Effects for Light

Project - VC Interactions	Mitigation and Compensation Measures	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction and Active Closure – Beaver Dam Mine Site and Haul Road (Lights from haul trucks, site lighting)	Equipment maintenance, limited vegetation clearing.	L (qualitative assessment only – predicted to be less light propagation than operations phase described below)	RAA Lighting impacts may extend beyond the PA	A Seasonal aspects may affect VC (i.e., daylight hours)	MT Effects can occur beyond 12 months and up to 3 years	S Effects occur at regular intervals throughout the Project	R VC will return to baseline conditions	Increased ambient light	Not significant
Operational – Beaver Dam Mine Site, Haul Road, Touquoy Mine Site (Lights from haul trucks, site lighting)	Equipment maintenance, haul truck operation <24 hours per day, minimize lighting (downward facing lighting, motion sensor lights, light positioning away from property boundaries were practical).	L Less than or equal to appropriate guidelines or threshold values	RAA Lighting impacts may extend beyond the PA	A Seasonal aspects may affect VC (i.e., daylight hours)	LT Effects may extend beyond 3 years	R Effects occur at regular intervals throughout the Project	R VC will return to baseline conditions	Increased ambient light	Not significant

Notes: See Section 5.11, Table 5.11-1 for definitions of the below characteristics.

Magnitude		Geographic Extent		Timing		Duration		Frequency		Reversibility	
N	Negligible	PA	Project Area	N/A	Not Applicable	ST	Short-Term	O	Once	R	Reversible
L	Low	LAA	Local Assessment Area	A	Applicable	MT	Medium-Term	S	Sporadic	IR	Irreversible
M	Moderates	RAA	Regional Assessment Area			LT	Long-Term	R	Regular	PR	Partially Reversible
H	High					P	Permanent	C	Continuous		

A significant adverse environmental effect for light has not been predicted for the Project for the following reasons, with consideration of the ecological and social context of the RAA surrounding the Project:

- During Construction: Light will be elevated above baseline conditions potentially extending into the RAA. However, light spill will be limited by surrounding topography prior to reaching the nearest receptors. Given the remote location of the Project the likelihood of mobile receptors being regularly in close proximity to light generation sites is very low. Light trespass has been qualitatively assessed during construction and is predicted to be lower than during operations, which was modelled and is described below.
- During Operations: Light spill is predicted to extend a maximum of 5 km from the Beaver Dam Mine Site into the RAA for the Project. However, light levels will be limited by surrounding topography prior to reaching the nearest receptors and given the remote location of the Project the likelihood of mobile receptors being regularly in close proximity to light generation sites is very low.
- During Active Closure: Light levels will be elevated above baseline conditions potentially extending into the RAA during decommissioning activities, then drop to baseline conditions for the post closure period. Light trespass has been qualitatively assessed during Closure and is predicted to be lower than during operations, which was modelled and is described above.

6.3.10 Proposed Compliance and Effects Monitoring Program

The applicable thresholds for light are expected to be met within 1.6 km of the Beaver Dam Mine Site and 39 m of the Haul Road. Routine monitoring of the light levels at the Beaver Dam Mine Site, once constructed and operational, using a light meter will provide an opportunity to monitor light levels. More refined light level measurements could assist in further quantifying the effects of light sources on the sensitive receptors. A Complaints Protocol will be followed to provide a mechanism to register concerns and discuss them with Project representatives. Additional ambient light monitoring would occur if directed by regulators or as a result of a complaint.

Proposed follow-up and monitoring programs have been reviewed with the Mi'kmaq of Nova Scotia during engagement efforts including meetings, sharing of technical documents (Draft Impact Statement, Proposed Mitigation Measures, Plain Language Summary). On-going engagement with the Mi'kmaq will continue through the EA process and associated permitting relating to follow-up programs and monitoring.

6.4 Greenhouse Gases

6.4.1 Introduction

6.4.1.1 Summary of Greenhouse Gases Before the Updates

The Greenhouse gases (GHG) effects assessment outlines the project boundaries and thresholds for determination of significance. The effects assessment identifies the sources and GHG emission estimates for each phase, Project site and the projected contribution of Project GHG emissions to the total Nova Scotia GHG emissions. A summary is provided of the key issues raised during engagement related to atmospheric environment along with Atlantic Mining NS Inc. (AMNS) commitments on mitigations and monitoring measures. The predicted residual environmental effects of the Project on the atmospheric environment are assessed and the significance of these effects are determined. The proposed compliance and effects monitoring program is outlined.

6.4.1.2 Summary of Updates to Greenhouse Gases

The GHG effects assessment has been updated to identify the primary source of GHG emissions as diesel fuel use from diesel power generators and haul road trucks. Updated emulsion and GHG emission estimates have been provided for the Beaver Dam Mine Site, Haul Road and Touquoy Mine Site.

Table 6.4-1: Updated Subsections from the 2019 Revised Environmental Impact Assessment – Greenhouse Gases

2019 Revised EIS Submission (February 28, 2019)	Updated in 2021	Corresponding 2021 EIS Update Section Number	Reason for Update
-	-	6.4.1 Introduction	• new
6.4.1 Rationale for Valued Component Selection	No	6.4.2 Rationale for Valued Component Selection	• N/A
6.4.2 Baseline Program Methodology	No	6.4.3 Baseline Program Methodology	• N/A
6.4.3 Baseline Conditions	Yes	6.4.4 Baseline Conditions	• Addition of 2018 Nova Scotia GHG emission rate
6.4.4 Consideration of Consultation and Engagement Results	No	6.4.5 Consideration of Engagement Results	• N/A
6.4.5 Effects Assessment Methodology – **Boundaries**	No	6.4.6 Effects Assessment Methodology – **Boundaries**	• Included local and regional boundary figure.
6.4.5 Effects Assessment Methodology – **Thresholds for Determination of Significance**	No	6.4.6 Effects Assessment Methodology – **Thresholds for Determination of Significance**	• Added table describing criteria used to assess Thresholds for Determination of Significance
6.4.6 Project Activities and Greenhouse Gases Interactions and Effects	Yes	6.4.7 Project Activities/Interactions with Greenhouse Gases	• Changes to project timelines. • Updated emulsion rates. • Added Post-closure project activity phase. • Added primary source of project GHG emissions is diesel fuel use. • Updated Touquoy Mine Site projected GHG emission estimates.

Table 6.4-1: Updated Subsections from the 2019 Revised Environmental – Greenhouse Gases (continued)

2019 Revised EIS Submission (February 28, 2019)	Updated in 2021	Corresponding 2021 EIS Update Section Number	Reason for Update
6.4.7 Preferred Alternative Haul Road	Yes	Section removed	• The Preferred Alternative Haul Road is no longer being considered and has been removed from the Project Description.
6.4.8 Mitigation and Monitoring	No	6.4.8 Mitigation	• N/A
6.4.9 Residual Effects and Significance	No	6.4.9 Residual Effects and Significance	• N/A
6.4.10 Proposed Compliance and Effects Monitoring Program	No	6.4.10 Proposed Compliance and Effects Monitoring Program	• N/A

Notes: GHG = greenhouse gases; - = no update; EIS = environmental impact statement; N/A = not applicable.

6.4.2 Rationale for Valued Component Selection

GHGs are drivers of climate change, which are created through the combustion of fuel during equipment operation, blasting within the pit, and vehicle use associated with project activities. GHGs are the focus of provincial policies and regulations for the electricity sector; however, there exists no province-wide standard for greenhouse gas emissions.

6.4.3 Baseline Program Methodology

No additional preliminary baseline monitoring was completed for greenhouse gases, separate from air quality. See Section 6.2 Air, specifically Sections 6.2.3 and 6.2.4 for baseline air quality monitoring methodology and results, as well as local and regional air quality.

6.4.4 Baseline Conditions

6.4.4.1 Provincial and Federal Greenhouse Gas Limits

The National Pollutant Release Inventory (NPRI) is Canada's legislated and publicly accessible inventory of pollutant releases to air, water, and land. The NPRI is managed by Environment and Climate Change Canada (ECCC) and currently tracks over 300 substances and groups of substances (NPRI 2021). Under the authority of the *Canadian Environmental Protection Act* (CEPA), owners or operators of facilities that meet the NPRI reporting requirements published in the Canada Gazette, Part I are required to report to the NPRI.

Accurate tracking of GHG emissions is an important part of assessing Canada's overall environmental performance. In March 2004, the Government of Canada announced the introduction of the Greenhouse Gas Emissions Reporting Program. All facilities that emit the equivalent of 50 kilotonnes (kt) or more of GHGs in carbon dioxide equivalent units (CO_2e) per year are required to submit a report. Facilities with emissions falling below the reporting threshold of 50 kt per year can voluntarily report their GHG emissions. AMNS voluntarily reports GHG at the Touquoy Mine and will continue to do so should Beaver Dam Mine Project be approved.

In 2009, Nova Scotia Environment (NSE) released the Greenhouse Gas Emissions Regulations, made under Section 112 of the *Environment Act*, establishing GHG emission caps on the electricity sector. These regulations apply to any facility located in the

province of Nova Scotia that emits greater than 10 kt of CO_2e GHGs in a calendar year. The facility owner must submit an annual report no later than March 31 of the following year. AMNS reports on GHG at Touquoy as required in the Industrial Approval.

The Beaver Dam Mine Site is located in a relatively undeveloped rural region of Nova Scotia with infrequent industrial operations that would contribute to GHG emissions. Existing GHG emissions would be generated primarily through recreational vehicle usage, local traffic, and limited forestry operations.

The ECCC document, "National Inventory Report 1990-2018: Greenhouse Gas Sources and Sinks in Canada – Part 3" (ECCC 2020), the total GHG emissions from Nova Scotia were identified to be 17,000 kt CO_2e during 2018.

6.4.5 Consideration of Engagement Results

Key issues raised during public consultation and Mi'kmaq engagement relating to atmospheric environment include potential dust and noise from mining operations at the Project and trucking along the Haul Road. The change to the Haul Road, through the construction of 4 km of new road to bypass the residence include those from the Millbrook First Nation Beaver Dam IR 17 was undertaken in to address concerns. Concerns about GHG emissions specifically associated with the trucking/hauling ore were also noted.

The results of the public and Mi'kmaq engagement have been considered in the environmental effects assessment, including AMNS commitments on mitigation and monitoring measures and proposed compliance and effects monitoring programs, as well as AMNS's broader commitment to ongoing public and Mi'kmaq engagement. AMNS will continue to evaluate opportunities to reduce GHGs at their existing and proposed operations. Additional information on climate change and GHG is provided in the Project Description (Section 2.1).

6.4.6 Effects Assessment Methodology

6.4.6.1 Boundaries

6.4.6.1.1 Spatial Boundaries

The spatial boundary used for GHGs are described below:

- The Project Area (PA) encompasses three primary components from Marinette to Moose River Gold Mines, Halifax County, NS. The Beaver Dam Mine Site will be located at the end of the Beaver Dam Mines Road, and the Haul Road will span from the Beaver Dam Mine Site to Moose River Gold Mines, where the Touquoy Mine (processing and exhausted pit [to be used to dispose Beaver Dam Mine tailings]) is located.
- The Local Assessment Area (LAA) encompass a 15 kilometre (km) zone in all directions from the PA, based on the expected maximum extent of potential ground level emissions (Figure 6.4-1).
- The Regional Assessment Area (RAA) encompasses the province of Nova Scotia. GHG emissions will be compared to Nova Scotia targets and totals (Figure 6.4-1).

As the Project has the potential to cause direct and indirect effects of GHGs, as well as cumulative effects compounded spatially and temporally from other Projects, the RAA is the most appropriate spatial boundary.

6.4.6.1.2 Temporal Boundaries

The temporal boundaries used for the assessment of effects to GHGs are the construction phase, operational phase, and active closure phase.

6.4.6.1.3 Technical Boundaries

No technical boundaries were identified for the effects assessment of GHGs.

6.4.6.1.4 Administrative Boundaries

In 2009, NSE released the Greenhouse Gas Emissions Regulations, made under Section 112 of the *Environment Act*, establishing GHG emission caps on the electricity sector. These regulations apply to any facility located in the province of Nova Scotia that emits greater than 10 kt of CO_2e GHGs in a calendar year. The facility may be required to report to the NPRI an inventory of pollutant releases to air, water, and land. There exists no province-wide standard for GHG emissions.

There may be other requirements for monitoring of the atmospheric environment through provincial approvals to be obtained prior to the start of the Project, specifically the Industrial Approval.

Prepared For:

Atlantic Gold

FIGURE 6.4-1

Beaver Dam Mine Project

Spatial Boundaries: Green House Gases

Beaver Dam Mine Site

Touquoy Mine Site

- Project Area
- GHG Local Assessment Area
- GHG Regional Assessment Area



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 25 50 100 km

1:1,700,000 Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed By: XX

Date: 2021-04-30

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

McCallum Environmental Ltd.

Document Name: BD_EIS_Figure6.4-1 GHG Spatial Boundaries

6.4.6.2 Thresholds for Determination of Significance

The *Nova Scotia Environmental Goals and Sustainable Prosperity Act*, requires a reduction in provincial GHGs of at least 10 percent (%) below 1990 levels by the year 2020 (NS 2019). The *Environmental Goals and Sustainable Prosperity Act* 2017–19 Progress Report (NS 2019) indicated that NS achieved the goal for reducing greenhouse gas emissions four years early (2016), which is approximately 18% below 1990 levels. The electricity sector is responsible for about half of the province's GHG emissions. Guidance for targets to that industry are specific in regulation both provincially and federally. To achieve these reductions, Nova Scotia has imposed emissions caps on electricity generation sector for 2025 and 2030 and is working to increase efficiency in the transportation sector. Reduction of the use of electricity from fossil fuels helps to meet these targets through use of energy efficient LED lighting and low-emission sourced renewable power (e.g., solar, wind, water).

The transportation sector generates about a quarter of the province's GHG emissions. Reductions in GHG from onsite mining activity can be achieved implementing no idling policies, burning low-sulphur fuels, and regular equipment maintenance.

Table 6.4-2 provides a summary of the characterization criteria used to assess residual impacts. Although there is no province or national wide standard for GHGs it is important to select a range of criteria for monitoring impact predictions. As a result, in the absence of standards relative change from 2018 levels provide a suitable alternative to determine magnitudes.

Table 6.4-2: Greenhouse Gas Characterization Criteria for Residual Effects

Criteria	Greenhouse Gases Impact Description
Magnitude[(a)]	• **Negligible:** GHGs are predicted to be less than 0.1% of NS 2018 (CO_2e) levels. • **Low:** GHGs are predicted to be greater than 0.1% but less than 0.2% of NS 2018 (CO_2e) levels. • **Medium:** GHGs are predicted to be greater than 0.2% but less than 0.3% of NS 2018 (CO_2e) levels. • **High:** GHG's are predicted to greater than 0.3% of NS 2018 (CO_2e) levels.
Geographical Extent	• **Discrete:** effect is limited to the immediate footprint or Project Area (PA). • **Local:** effect is limited to the near-field Local Assessment Area. • **Regional/Provincial/National**: effect persists to regional, provincial and national scale.
Timing	• N/A
Duration	• **Short term:** effect does not extend beyond 1 year of the Project. • **Medium term:** greater than 1 year and over the life of the project (1 year construction, 5 years operation and 2 years active closure). • **Long term:** Effects persist to post-closure 10+ years. • **Permanent:** Effects represent a permanent change.
Frequency	• **Intermittent:** VC interaction or effect will occur at intermittent intervals throughout any Project Phase. • **Regular:** effect occurs on a regular basis but not continuous basis. • **Continuous:** effect occurs constantly.
Reversibility	• **Reversible:** effect can be reversed. • **Partially reversible:** effect can be partially reversed. • **Irreversible:** effect cannot be reversed, is of permanent duration.

Notes: [(a)] GHGs predications are based on Nova Scotia's GHG emissions submitted in 2018 (ECCC 2020) and emissions rates provided in Table 6.4-5 and 6.4-6.
GHG = greenhouse gases; % = percent; NS = Nova Scotia; CO_2e = carbon dioxide equivalents; N/A = not applicable.

Residual effects of the Project on from GHGs are described using standard criteria, including magnitude, geographical extent, duration, frequency, reversibility, and context of the effect (Table 6.4-2). The residual effects assessment concludes with a determination of Significance. Residual effects after mitigations determines "Not Significant" or "Significant" according to the following definitions:

- **Not Significant Residual Effect:** GHG VC is defined as, negligible to low magnitude, a regional, provincial, and national scale and of short to medium term duration, occurring continuously and are reversible.
- **Significant Residual Effect:** GHG is defined as residual effects have medium to high magnitude, a regional, provincial and national scale and of long-term duration, occur at continuous frequency and only be partially reversible to irreversible.

6.4.7 Project Activities/Interactions with Greenhouse Gas

The key sensitive receptor in the area is the Beaver Lake Indian Reserve (IR) 17; a satellite community of the Millbrook First Nation located approximately 5 km south of the Beaver Dam Mine Site. A permanent resident, seasonal camps and cottages are also located along the Beaver Dam Mines Road near Highway 224. Camp Kidston, which operates only in the summer months, is approximately 3.5 km northeast of the site. According to AMNS, the nearest permanent full-time occupied residences are located approximately 5.8 km to the north of the Touquoy Mine Site open pit along Caribou Road.

The Touquoy Mine Site is currently in operation. The primary effect of the continued use of the Touquoy Mine Site is the continued generation of GHG emissions during the processing of Beaver Dam Mine ore. There are no new or additional effects to GHGs anticipated to be caused by the processing of ore and the management of tailings (exhausted pit) from the Project, as no new construction or disturbance is required at the Touquoy Mine Site related to the processing of Beaver Dam Mine ore. The effects to GHGs previously described for the Touquoy Mine Site in the Environmental Assessment Registration Document (EARD) (CRA 2007a) and Focus Report (CRA 2007b) are presented in Table 6.4-5.

Table 6.4-3: Potential Project Activities/Interactions with Greenhouse Gas at Beaver Dam Mine Site

Project Phase	Duration	Project Interaction
Construction	1 year	• Clearing, grubbing, and grading in preparation of construction • Drilling and rock blasting in preparation of construction • Till and waste rock from site preparation transport and storage • Watercourse and wetland alteration in preparation of construction • Mine Site road construction • Haul road construction • Lighting of construction areas • Surface infrastructure installation and construction • Collection and settling pond construction • General management of wastes derived from preparation and construction activities
Operation and Maintenance	5 years	• Rock blasting to access and extract ore • Management of waste rock produced from crushing and preparing ore for transport • Petroleum products management • Site maintenance and repairs • Lighting of facilities and Mine Site roads • General management of wastes derived from operation and maintenance activities
Active Closure	2 years	• Infrastructure Demolition • Site reclamation activities
Post-closure	10+ years (monitoring)	• N/A

Note: N/A = not applicable.

Table 6.4-4: Potential Project Activities/Interactions with Greenhouse Gas along Haul Road

Project Phase	Duration	Project Interaction
Construction	1 year	• Clearing, grubbing, and grading in preparation of construction • Drilling and rock blasting in preparation of construction • Till and waste rock from site preparation transport and storage • Watercourse and wetland alteration in preparation of construction • Haul Road construction and upgrades
Operation and Maintenance	5 years	• Ore transport • Road lighting • Haul Road maintenance and repairs
Active Closure	2 years	• N/A[(a)]
Post-closure	10+ years (monitoring)	• N/A

Note: [(a)] Decommissioning and Reclamation of the Haul Road is not expected. The Haul Road will be returned to owner for forestry industry.
N/A = not applicable.

Table 6.4-5: Potential Project Activities/Interactions with Greenhouse Gas at Touquoy Mine Site

Project Phase	Duration	Project Interaction
Construction	1 year	• Tailings pipeline, make-up water pipeline alteration, and relocation of reclaim infrastructures
Operation and Maintenance	5 years	• Ore management and processing • Lighting of facilities and Mine Site roads
Active Closure	2 years	• Decommissioning and reclamation activities
Post-closure	10+ years (monitoring)	• N/A

Note: N/A = not applicable.

The primary sources of GHG emissions were considered for each phase of the Project (construction, operation, and active closure). The primary sources of emissions from each work phase are stationary and mobile fuel combustion sources. These fuel combustion GHG-specific emissions include carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). During the construction and operation phase of the Beaver Dam Mine Site, GHG emissions that would be generated from explosives used in rock blasting were also considered. For rock blasting, the explosive considered is emulsion (30% Ammonium Nitrate Fuel Oil [ANFO] and 70% emulsion), which is an explosive used by AMNS at other project sites. Under ideal conditions, the sole GHG emission from this explosive is CO_2, though small amounts of CH_4 and N_2O may also form as a result of the combustion. For the purposes of these emission estimates, it has been assumed the emulsion will be combusting under ideal conditions, with the primary CO_2 emissions being included only.

Other key assumptions used as part of the GHG emission estimates include:

- Sources of stationary and mobile combustion are operational 24 hours a day during the mine operation phase and during the construction and decommissioning phases would be limited to 16 hours. Down-time for equipment is assumed to occur up to 10 days out of a year due to weather conditions. This is a conservative estimate as additional downtime would be required for equipment maintenance/repair during this period.
- The primary source of GHG emissions is diesel fuel use. Estimates for diesel fuel use have been made for the construction, operation and active closure phases. Diesel emissions occur from mine diesel power generators and from the haul road trucks.

- The emulsion use during the operation phases has been estimated by AMNS based on prior mining experience at similar sites to be approximately 3,744 tonnes/year.

6.4.7.1 Beaver Dam Mine Site and Haul Road

The projected GHG emission estimates for the life of the Project, based on the available information, are presented in Table 6.4-6. It is expected that as the phase milestone activities approach, the information driving the emissions estimates below can be refined based on known rather than projected data.

Table 6.4-6: Predicted Greenhouse Gas Emissions (Beaver Dam Mine Site and Haul Road)

Phase	Period	Greenhouse Gas	Phase Emissions	
			(tonnes)	Tonnes CO_2e
Primary Haul Road and Mine Construction	2022	CO_2	2,408.16	2,426.19
		CH_4	0.05	-
		N_2O	0.05	-
Operation	2023 to 2027	CO_2	39,928.46	40,638.55
		CH_4	1.01	-
		N_2O	2.30	-
Active Closure	2028 to 2029	CO_2	8,970.17	9,114.01
		CH_4	0.21	-
		N_2O	0.47	-

Note: CH_4 = Methane; CO_2 = Carbon dioxide; CO_2e = Carbon dioxide equivalents; N_2O= Nitrous Oxide; - = not applicable.

GHG emissions from Nova Scotia reported in 2018 were 17,000 kt CO2e (ECCC 2020). Based on the Project GHG assessment, in an average full year of operation of the Project (most GHG-intensive phase), the site would emit 8.13 kt CO2e - approximately 0.05% of the reported 2018 GHG total for Nova Scotia.

6.4.7.2 Touquoy Mine Site

At the Touquoy Mine Site, GHG emissions will be generated from light and mobile fuel combustion sources, as well as emissions from the processing plant during the period of full-scale operations (2022 to 2029). The projected annual GHG emission estimates for the Touquoy Mine Site, based on the 2019 GHG emissions reported to the NPRI, is presented in Table 6.4-7.

Table 6.4-7: Estimated Greenhouse Gas Emissions (Touquoy Mine Site)

Phase	Period	Greenhouse Gas	Phase Emissions	
			(tonnes)	Tonnes CO2e
Maximum Annual Emissions	2022 to 2029	CO_2	13,183.2	13,560.8
		CH_4	1.3	-
		N_2O	0.2	-

Note: CH_4 = Methane; CO_2 = Carbon dioxide; CO_2e = Carbon dioxide equivalents; N_2O= Nitrous Oxide; - = not applicable.

GHG emissions from Nova Scotia reported in 2018 were 17,000 kt CO_2e (ECCC 2020). The 2019 GHG emissions for the Touquoy Mine Site was 13.56 kt CO_2e - approximately 0.08% of the reported 2018 GHG total for Nova Scotia.

6.4.7.3 Overall Project

In an average full year of operation of the Project (most GHG-intensive phase), including operation of the Beaver Dam Mine Site, hauling of ore, and the processing of ore at the Touquoy facility, the Project facilities would emit 21.69 kt CO_2e - approximately 0.128% of the reported 2018 GHG total for Nova Scotia (ECCC 2020).

6.4.8 Mitigation

AMNS will take steps to minimize GHG emissions associated with the Project, through activities such as reducing engine idling, where possible, and considering the use of more fuel-efficient vehicles and equipment. GHG emissions will also be minimized through the adoption of good maintenance practices, including undertaking regular maintenance as specified by suppliers. A review of emissions will be completed on an annual basis. AMNS will seek to use Best Available Practices (BAP) that will evolve over time.

Mitigation measures at the Touquoy Mine processing facility are also described in the Air Quality Management Plan that was completed as part of the Industrial Approval application for this facility. These mitigation measures include regular equipment maintenance, choosing more efficient equipment and vehicles, and reduction of vehicle travel distances and idling where possible. These mitigation measures are anticipated to continue throughout the life of the Project.

Table 6.4-8: Mitigation for Greenhouse Gases

Project Phase	Mitigation Measure
C, O, CL	Limit engine idling, where practicable
C, O, CL	Implement fuel efficiencies, where practicable
C, O, CL	Implement preventative maintenance plans for all mobile and stationary equipment.
C, O, CL	Use renewable energy where reasonable (e.g., solar-powered lights)

Notes: C = Construction; O = Operations; CL = Active Closure.

6.4.9 Residual Effect and Significance

The predicted residual environmental effects of Project development and production on the atmospheric environment are assessed to be adverse, but not significant. The overall residual effect of the Project on GHGs is assessed as not likely to have significant adverse effects after mitigation measures have been implemented.

Table 6.4-9: Residual Environmental Effects for Greenhouse Gases

Project - VC Interactions	Mitigation and Compensation Measures	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction – Beaver Dam Mine Site and Haul Road (Haul Road widening and construction, use of heavy machinery, haul trucks and site vehicle emissions)	Equipment maintenance, implementing fuel efficiencies, limited engine idling, use of more fuel efficient vehicles.	L	RAA	N/A	ST	C	R	Increased greenhouse gas emissions during operations	Not Significant
Operation – Beaver Dam Mine Site, Haul Road and Touquoy Mine Site (Emissions from haul trucks, site vehicles, heavy machinery, blasting and drilling of in-situ rocks)	Equipment maintenance, implementing fuel efficiencies, minimizing blasts, limited engine idling, use of more fuel efficient vehicles.	L	RAA	N/A	MT	C	R	Increased greenhouse gas emissions	Not Significant
Active Closure – Beaver Dam Mine Site (Emissions from haul trucks, site vehicles, heavy machinery)	Equipment maintenance, implementing fuel efficiencies, limited engine idling, use of more fuel efficient vehicles.	N-L	RAA	N/A	MT	I	R	Increased greenhouse gas emissions	Not Significant

Notes: See Table 6.4-2 for definitions of the below characteristics and Section 5.11, Table 5.11-1.

Magnitude		Geographic Extent		Timing		Duration		Frequency		Reversibility	
N	Negligible	PA	Project Area	N/A	Not Applicable	ST	Short-Term	O	Once	R	Reversible
L	Low	LAA	Local Assessment Area	A	Applicable	MT	Medium-Term	I	Intermittent	IR	Irreversible
M	Moderate	RAA	Regional Assessment Area			LT	Long-Term	R	Regular	PR	Partially Reversible
H	High					P	Permanent	C	Continuous		

A significant adverse environmental effect for GHG has not been predicted for the Project for the following reasons, with consideration of the ecological and social context of the LAA surrounding the Project:

- **During Construction:** GHG will be elevated above baseline but not a significant contributor with a low magnitude (above 1% NS 2018 levels) that will be intermittent and short-term in duration and reversible.
- **During Operations:** GHG will be elevated above baseline during this period but not a significant contributor with a low magnitude (i.e., combined 21.69 kt CO_2e 21.69 kt CO_2e - approximately 0.128% above NS 2018 levels) that will be continuous but mid-term in duration and reversible.
- **During Active closure:** GHG will be elevated above baseline but expected to be negligible in magnitude (i.e., less that 0.1% above NS 2018 Levels) intermittent to allow for earthworks and reclamation activities and medium-term duration (i.e., 2 years in duration) and reversible.

Mitigations presented in Table 6.4-8 will be established to reduce the impact to GHGs from Project activities.

6.4.10 Proposed Compliance and Effects Monitoring Program

GHG monitoring reporting will be completed to verify the predicted environmental effects and the effectiveness of the mitigation measures outlined in Table 6.4-8. An Air Quality Management Plan will be developed as part of the Industrial Approval application for the Beaver Dam Mine Project. In addition, GHG emissions will be reviewed on an annual basis throughout the construction, operation and closure.

6.5 Geology, Soils, and Sediment Quality

6.5.1 Introduction

6.5.1.1 Summary of Geology, Soils, and Sediment Quality Before the Updates

Prior to updates, Section 6.5 described the methods and results of baseline characterization as well as predictive studies that were undertaken to support characterization of potential Project effects on the Geology, Soils, and Sediment Quality Value Component (VCs). Geology, Soils, and Sediment Quality represent physical components of the natural environment.

Prior to updates, the Geology, Soils, and Sediment Quality assessment was developed to incorporate quantitative data from baseline reports as well as geochemical test-work and prediction of the potential for metal leaching and acid mine drainage (ML/ARD). The subsequent assessment of residual effects incorporated mitigation and management plans for Project effects and, although residual effects were identified, they were characterized as Not Significant.

Changes related to Geology, Soils and Sediment Quality VC s provided in Section 6.5 were used to support the Effects Assessment on water quality, fish and fish habitat, and wetlands.

6.5.1.2 Summary of Updates to Geology, Soils, and Sediment Quality

The Geology, Soils, and Sediment Quality EA for the Project has been updated to reflect updates of the Project Description (Section 2) and to address Round 2, Information Requests (IR2) issued by the Impact Assessment Agency of Canada (IAAC, formerly the Canadian Environmental Assessment Agency [CEAA 2019]) and Nova Scotia Environment (NSE 2019). This includes:

- Compilation of soil sediment quality results, including results from 2019 (Stantec 2019a) and 2020 (Stantec 2020) field surveys for the Beaver Dam Mine Site and are included in Appendix E.7 and E.8, respectively;
- Updated metal leaching and acid rock drainage assessment (ML/ARD) and description of the geochemical baseline based on ongoing test-work for the Project (Appendix E.2);
- Updated kinetic test-work results and geochemical source terms for the Project, including predictions of drainage quality (Appendix E.3 and Appendix E.4);
- Updated ML/ARD Management Plan (Appendix E.5);
- Nitrogen Monitoring Plan (Appendix P.3) and
- Beaver Dam Mine Project Geotechnical Investigation (Appendix A.2c).

Table 6.5-1: Updated Subsections from the 2019 Revised Environmental Impact Assessment - Geology, Soils, and Sediment Quality

2019 Revised EIS Submission (February 28, 2019)	Updated in 2021	Corresponding 2021 EIS Update Section Number	Reason for Update
-	-	6.5.1 Introduction	• New
6.5.1 Rationale for Valued Component Selection	No	6.5.2 Rationale for Valued Component Selection	• N/A

Table 6.5-1: Updated Subsections from the 2019 Revised Environmental Impact Assessment - Geology, Soils, and Sediment Quality (continued)

2019 Revised EIS Submission (February 28, 2019)	Updated in 2021	Corresponding 2021 EIS Update Section Number	Reason for Update
6.5.2 Baseline Program Methodology	Yes	6.5.3 Baseline Program Methodology	• Addition of soil and sediment methodologies from 2019 to 2020 field surveys for Beaver Dam mine site (Appendix E.7 and E.8). • Additional survey areas as a result of PA modification for infrastructure micro-sitting.
6.5.3 Baseline Conditions	Yes	6.5.4 Baseline Conditions	• Present soil and sediment results from 2019 to 2020 field surveys for Beaver Dam mine site. • Additional survey areas as a result of PA modification for infrastructure micro-sitting.
6.5.4 Consideration of Consultation and Engagement Results	No	6.5.5 Consideration of Consultation and Engagement Results	• N/A
6.5.5 Effects Assessment Methodology – **Boundaries**	Yes	6.5.6 Effects Assessment Methodology – **Boundaries**	• Adjusted PA description. • LAA was enlarged due to the modified PA. • RAA was enlarged where necessary due to the modified PA. Fauna assessment area changed to the RAA. • PA modification for infrastructure micro-sitting.
6.5.5 Effects Assessment Methodology – **Thresholds for Determination of Significance**	Yes	6.5.6 Effects Assessment Methodology – **Thresholds for Determination of Significance**	• Updated significance threshold and magnitude assessment. • Reflect changes in VC baseline conditions and improve significance assessment criteria. • Updated in response to IR2 CEAA-2-02.
6.5.6 Project Activities and Geology, Soils, and Sediment Quality Interactions and Effects	Yes	6.5.7 Project Activities and Geology, Soils, and Sediment Quality Interactions and Effects	• Updated based on revised noise and light impact assessments. • Updated discussion of direct and indirect impacts to fauna. Incorporated changes to assessment level and RAA. • Changes to project timelines.
6.5.7 Preferred Alternative Haul Road	Yes	-	• Preferred Alternative Haul Road sections and references are removed from the EIS. • Removed as a result of the updated Project Description – IR2 responses CEAA-2-22, NSE-2-48.
6.5.8 Mitigation	Yes	6.5.8 Mitigation	• Bolstered and clarified mitigation measures. • Reflects improved understanding of impacts.
6.5.9 Residual Effects and Significance	Yes	6.5.9 Residual Effects and Significance	• Updated based on field survey results and changes to significance threshold determination. • Change to magnitude determination. • Reflect changes to significance threshold and magnitude assessment. • Updated in response to IR2 CEAA-2-02.
6.5.10 Proposed Compliance and Effects Monitoring Program	No	6.5.10 Proposed Compliance and Effects Monitoring Program	• N/A

Notes: PA = Project Area; LAA = Local Assessment Area; RAA = Regional Assessment Area- = no update; CEAA = Canadian Environmental Assessment Agency; EIS = Environmental Impact Statement; IR2 = Round 2. Information Requests; NSE = Nova Scotia Environment; CEAA = Canadian Environmental Assessment Area.

6.5.2 Rationale for Valued Component Selection

A component, to be considered for assessment, must be of recognized as important to a society, the local community, or the environment, and there must be a perceived likelihood that the component will be affected by the proposed Project. Geology, Soils, and Sediment Quality represent physical attributes of the environment that, if affected (i.e., there is a positive or negative change in the baseline condition), act as a pathway to pass on those changes to biological components of the environment and/or other receptors (such as surface water quality, wetlands, and fish and fish habitat) thereby having the potential to also affect or change the baseline condition of those VCs.

Geology, Soils, and Sediment Quality as a VC is centered on the potential for Metal Leaching and Acid Rock Drainage (ML/ARD). Metal leaching (ML) refers to the process by which metals that are bound to minerals are mobilized in an aqueous solution. Acid Rock Drainage (ARD) occurs when sulphide minerals are exposed to oxygen and water and naturally oxidize without the presence of sufficient quantities of neutralizing minerals. Acidic drainage accelerates the rate of ML, although neutral ML may also occur. There is the potential for ML/ARD to be produced during exposure of Halifax Group or sulphide-bearing bedrock to oxygen and surface water runoff; and the potential for impacts to soil and sediment from the Project. ARD is provincially regulated through the Sulphide Bearing Material Disposal Regulations.

Soil and sediment quality may facilitate exposure of birds, fauna, and fish to contaminants through ingestion. Exposure of soil from Project activities may increase the potential for siltation of watercourses from surface water runoff. Contaminated soil and sediment are provincially regulated via the Contaminated Sites Regulations.

6.5.3 Baseline Program Methodology for Soil and Sediments

Baseline studies have been conducted at various intervals since 2014 to support the effects assessment (EA) for the Project. Baseline programs characterized the Geology, Soils, and Sediment Quality that could potentially be affected either directly or indirectly by the Project. The main objectives of the baseline studies program were to:

- identify soil characteristics that may be sensitive Project related disturbances;
- provide sufficient information to develop an effects assessment, mitigations, management and monitoring plans (e.g., reclamation and closure); and
- determine soil and sediment baseline metal concentrations.

The information collected during the baseline program was used to carry out the effects assessments, develop management and mitigation plans, and guide the reclamation and closure plan.

For sediment quality investigations, detailed results including, and sediment descriptions are provided in Appendix H (Fish and Fish Habitat 2015-2017 Baseline) of Appendix J.2 (Baseline Fish and Fish Habitat 2019-2020 Technical Report) and Appendix E.1 (Tabulated Sediment Quality Data). Additional sediment sampling conducted in 2019 and 2020 at the Beaver Dam Mine is presented in E.6 to E.8, which includes laboratory results. This was undertaken to better define historic tailings on site, which is presented in Table 6.5-4.

Geotechnical Investigations for the Project are detailed in Appendix A.2a and A.2c.

The baseline program methodology is summarized below, including delineation of the baseline study area and identification of monitoring locations; results of baseline characterization studies most salient to the EA presented in Section 6.5.4.

6.5.3.1.1 Beaver Dam Mine Site and Haul Road, Geological and Geochemical Baseline

Geochemical studies for the Project are referenced in Appendix E.2, Appendix E.3, and Appendix E.5. The objective of these studies was to characterize local geology and geochemistry at the Beaver Dam Mine site, including assessment of potential for ML/ARD (Section 6.5.6.3). Samples collected as part of these efforts were evaluated for acid base accounting (ABA) characteristics, kinetic test-work, mineralogy and particle size distribution. The Beaver Dam geological units and sample descriptions are provided in Table 6.5-2.

Table 6.5-2: Beaver Dam Mine Geological Units and Sample Descriptions

Geologic Unit	Description	Code	No. Samples
Argillite	argillite with <5% greywacke interbeds	AR	10
Argillite-Greywacke	argillite with 5 to 49% greywacke interbeds	AG	11
Greywake-Agillite	greywacke with 20 to 50% argillite interbeds	GA	14
Greqacke	greywacke with <20% argillite interbeds	GW	24
Quartx Vein	quartz vein	QTZV	3
Unknown	core logs were not available	-	8

Source. Appendix E.2 Beaver Dam Project ML/ARD Assessment Report (Lorax 2020).

6.5.3.1.2 Beaver Dam Mine Site Soil and Sediment Baseline

As part of quantifying baseline soil and sediment quality at the proposed Beaver Dam Mine Site, two Environmental Site Assessments (ESAs) were conducted. An initial Phase II ESA was conducted between July 10 to 11, 2019 and an Extended Phase II ESA was conducted between July 20 to 28, 2020 (Appendix E.7 and E.8).

During these periods, a total of 94 test pits and 13 sediment locations were sampled for available (acid extractible) metals, including mercury within the proposed Beaver Dam Mine Project Area (PA) and the nearby Killag River (Appendix E.8, Drawing A-2 and A-3).

As outlined in the Beaver Dam ESA Phase I report, the proposed Beaver Dam Mine site was previously subject to gold mining activities (Stantec 2019b). Gold mining and exploration activities had intermittently occurred at the site between 1867 and 1989 and resulted in the production of tailings and waste rock. In addition to quantifying baseline conditions at site, test pit locations were chosen based on areas of concerns (tailings and waste rock) identified during the review of historical records, digital elevation model (DEM) data and the location of proposed mine infrastructure.

Test pits were manually excavated using a hand-held shovel and metal bar or a Dutch auger. Test pit excavations were monitored, where detailed logs and photographic records of sub-surface conditions encountered and obtained representative soil samples. Test pits were advanced to depths generally ranging between 0.2 metres below ground surface (mbgs) to approximately 1 mbgs, at which point refusal of the hand-held shovel, bar or Dutch auger was encountered. Representative bulk soil samples were then collected from the test pits. The soil samples were examined in the field for evidence of impacts (visual or olfactory), placed in laboratory supplied glass jars, placed on ice, and submitted to an accredited laboratory for analysis.

Sediment sample location were limited: the bottoms of Site waterbodies were often too rocky, vegetated, or loose to permit sample collection. Sediment samples were collected at depths ranging from 0.3 to 1.8 m below the waterbody floor, at which point refusal of the hand-held sampling equipment was generally encountered, and/or the water depth was too great to continue with the hand-held sampling equipment. The majority of samples were collected using a hand-held shovel, Dutch auger, or sludge judge from

either a boat or the shoreline. A Petit Ponar was also used in deep water locations but proved to be ineffective due to the presence of a thick organic layer inhibiting the penetration of the Ponar grab in the underlying substrate. The sediment samples were examined in the field for evidence of impacts (visual or olfactory) and placed in jar, placed on ice and submitted to an accredited laboratory for analysis.

The Beaver Dam site having previously been subject to mining activities, analytical results for soil have been compared to the applicable Nova Scotia Tier 1 Environmental Quality Standards (EQS) for an industrial site with non-potable groundwater use and coarse-grained soil (standards for coarse-grained soil are more conservative than standards for fine-grained soil). For metals, the Tier 1 EQS for a potable and non-potable site are equivalent.

Analytical results for sediment have been compared to the Tier 1 EQS as well as to the Canadian Sediment Quality Guidelines. Tier 1 EQS for sediment are largely identical to the Canadian probable effect levels with the exception of antimony, iron, manganese, nickel, and strontium, for which Tier 1 EQS exist but federal guidelines do not.

The Canadian Council of Ministers of the Environment (CCME) have developed interim sediment quality guidelines (ISQG) for the protection of aquatic life (CCME 1999). They have also developed or compiled probable effect levels (PEL) above which adverse biological effects are usually or always observed. The PEL is less stringent than the ISQG for all metals.

Analytical results for sediment have been compared to the applicable ISQG and PEL for a freshwater environment. For metals, ISQG and PEL are only available for arsenic, cadmium, chromium, copper, lead, mercury, and zinc.

Soil and sediment quality results for Beaver Dam are summarized in Section 6.5.4.

6.5.3.1.3 Haul Road Baseline

Eleven soil samples were collected along the Haul Road during the Human Health Risk Assessment (Appendix C.2). Where Project components/activities are not expected to interact with the VC, these components and activities are considered to have no potential effects and are not considered in the assessment. That is, interactions between the Project and soils and sediment quality along the Haul Road are restricted to accidents and malfunctions during Haul Road use and potential spills; these are related to occurrences of low likelihood outside of normal operating conditions and associated potential effects are addressed in Section 6.18 Accidents and Malfunctions, as well as the draft Spill Contingency Plan (Appendix A of Appendix P.1).

As such, soil and sediment quality was not systematically assessed along the Haul Road as background sediment quality is not required when remediating contamination resulting from accidents and malfunctions. In the event of an accident such as a hydrocarbon spill or haul truck upset, contaminated sediment and/or soil would be remediated to federal and provincial sediment and soil quality guidelines rather than to background values. In this context, AGNS understands that a generalized understanding of probable sediment quality, based on regional results, is sufficient for the purposes of environmental assessment; no additional sediment sampling is proposed before construction. Note that road salts and magnesium chloride will not be used regularly on the Haul Road and the trucks will be covered to prevent metal concentrate and dust from impacting nearby soils and sediments.

Further note, the water features along the Haul Road are not expected to have been impacted by past industrial activity. Background sediment quality can be estimated using the regional sediment quality.

Assessment of soils and sediment quality along the Haul Road is not considered further in this assessment.

Additional baseline soil sampling was completed along the Haul Road as part of the Human Health Risk Assessment is included in Appendix C.2.

6.5.3.1.4 Touquoy Mine Site Baseline

The Touquoy Mine Site was previously subjected to a sediment quality investigation that consisted of the collection of sediment samples from ten locations on the Touquoy site and surrounding area watercourses in January 2007. Three of these locations had organic substrate not suitable for chemical analysis for soils (CRA 2007a).

Historical till and soil geochemical regional data is available from the DNR. The documents entitled Compilation of Seabright Resources Inc. Till and Soil Geochemical Data over the Meguma Terrane (NSDNR 2006) and Till Geochemical Survey over Mainland Nova Scotia (NSDNR 2006a) were reviewed. Till samples were collected from 1986 to 1989 by Seabright Resources Inc. and Seabright Explorations Inc., and from 1977 to 1982 by the Department of Regional Economic Expansion and Nova Scotia Department of Mines, respectively. Samples were submitted for chemical analysis of select metals. The results of the historical till investigations are summarized below.

6.5.4 Baseline Conditions

6.5.4.1 Regional Overview

6.5.4.1.1 Regional Geology and Geohazards

Nova Scotia can be divided into two distinct metallogenic terranes; the Avalon Terrane to the north and the Meguma Terrane to the south (Keppie et al., 2000). These two terranes developed independently until they were juxtaposed along the Cobequid-Chedabucto Fault Zone during the mid-Devonian Acadian Orogeny.

The Beaver Dam site and existing Touquoy Mine site is within the southern Meguma Terrane, while the Avalon Terrane is located to the north of the fault zone. The Meguma Terrane includes the Cambrian to Ordovician Meguma Group and Late Ordovician to Early Devonian volcanic and sedimentary rocks (FSSI, 2015). After the collision of the Meguma and Avalon terranes in the mid-Devonian period, sedimentary material was deposited over both terranes during the Carboniferous to Early Cretaceous period. The sedimentary units include siliciclastic rocks, calcareous rocks, evaporites, coal, kaolinitic clay and silica sand (FSSI, 2015). The majority of the gold mineralization occurs within the units of the Meguma Group. The Meguma Group is divided into the Goldenville Formation and the overlying Halifax Formation (Figure 6.5-1).

The metamorphic facies in both Meguma Group units vary from greenschist to amphibolite facies. The Goldenville Formation is a greywacke unit that is >5,600m thick, while the Halifax Formation is primarily argillite with an average thickness of approximately 4,400 m. Both the Goldenville Formation and the Halifax Formation are made up of deep marine turbidite deposits.

Isostatic Uplift and Subsidence

During the most recent major advance of the North American ice sheet complex, known as the Wisconsinan Glaciation, the Appalachian Glacier Complex covered the Maritimes. These glaciers formed and grew locally, independent of the Laurentide Ice Sheet due to a combination of increased snowfall, cold temperatures, and isolation from continental glaciers by deep ocean channels and the Appalachian mountain range. The glaciers were centred in the Maritimes, and advanced and retreated at least four times. During each of these cycles, glaciers were centered on land masses and flowed towards the Scotian Shelf and Laurentian Channel or radiated from central Nova Scotia and New Brunswick (NSDNR 2012).

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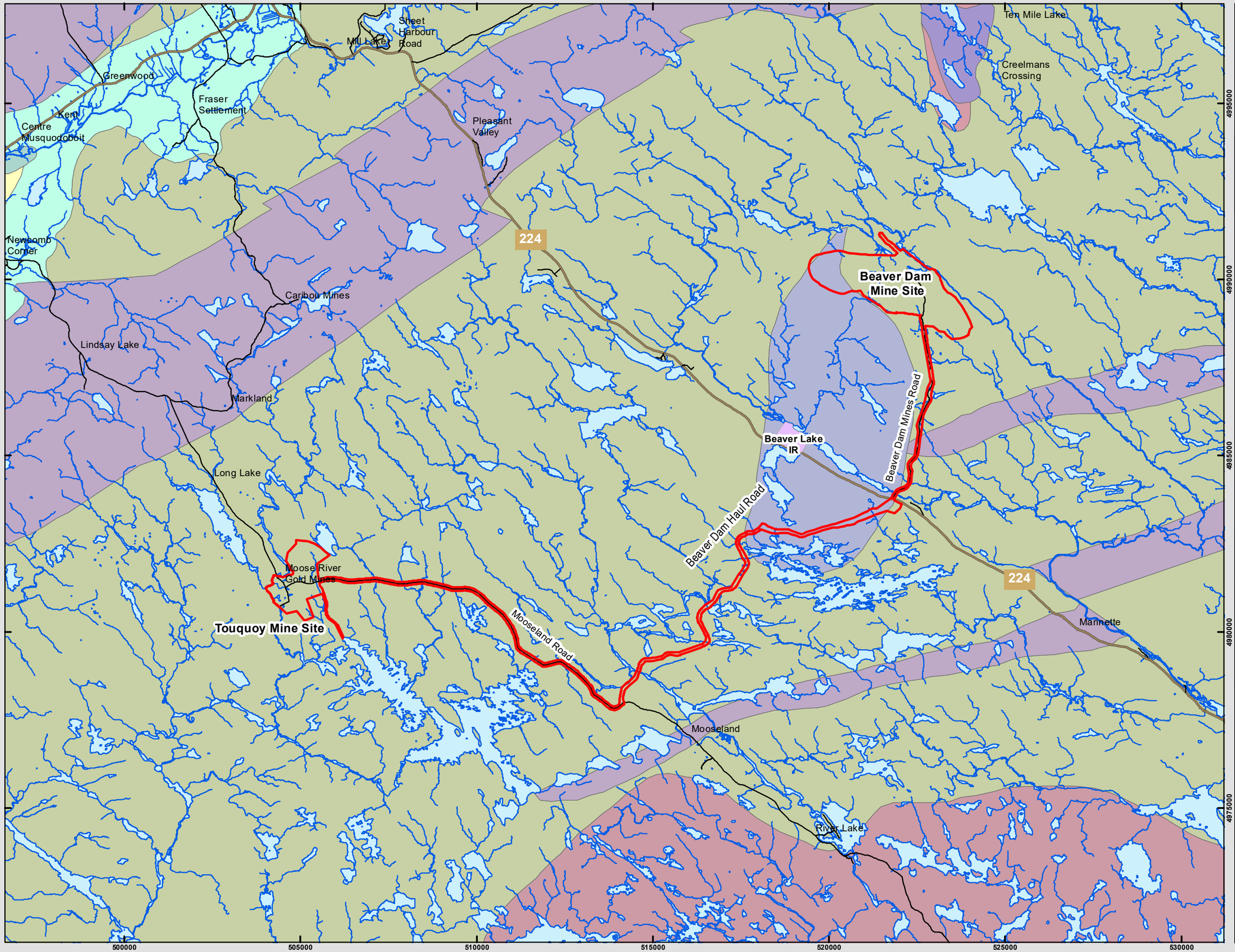
FIGURE 6.5-1

Regional Bedrock Geology



- Streams
- Collector Road
- Local Road
- Lakes
- Beaver Lake Indian Reserve
- Project Area
- Early Cretaceous units
- Goldenville Group
- Halifax Group
- Liscomb Complex: Paragneiss
- Middle - Late Devonian diorite - grabbro
- Middle - Late Devonian granitoid
- Middle - Late Devonian muscovite biotite monzogranite
- Windsor Group (Middle)
- Windsor Group (Lower)



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 1.25 2.5 5 km

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The enormous weight of the Appalachian Glacier Complex caused the surface of the Earth's crust to deform and warp downward, forcing the viscoelastic mantle material beneath to flow away from the central loading region. This caused the central land masses in Nova Scotia and New Brunswick to depress and the outer regions at the limits of the glacier complex to flux upward. Following retreat of the glacier complex, the central land masses in Nova Scotia began to rise to their pre-glaciation position, while the outer regions began to subside. This concept is called isostatic rebound and exacerbates the effects of global sea level rise.

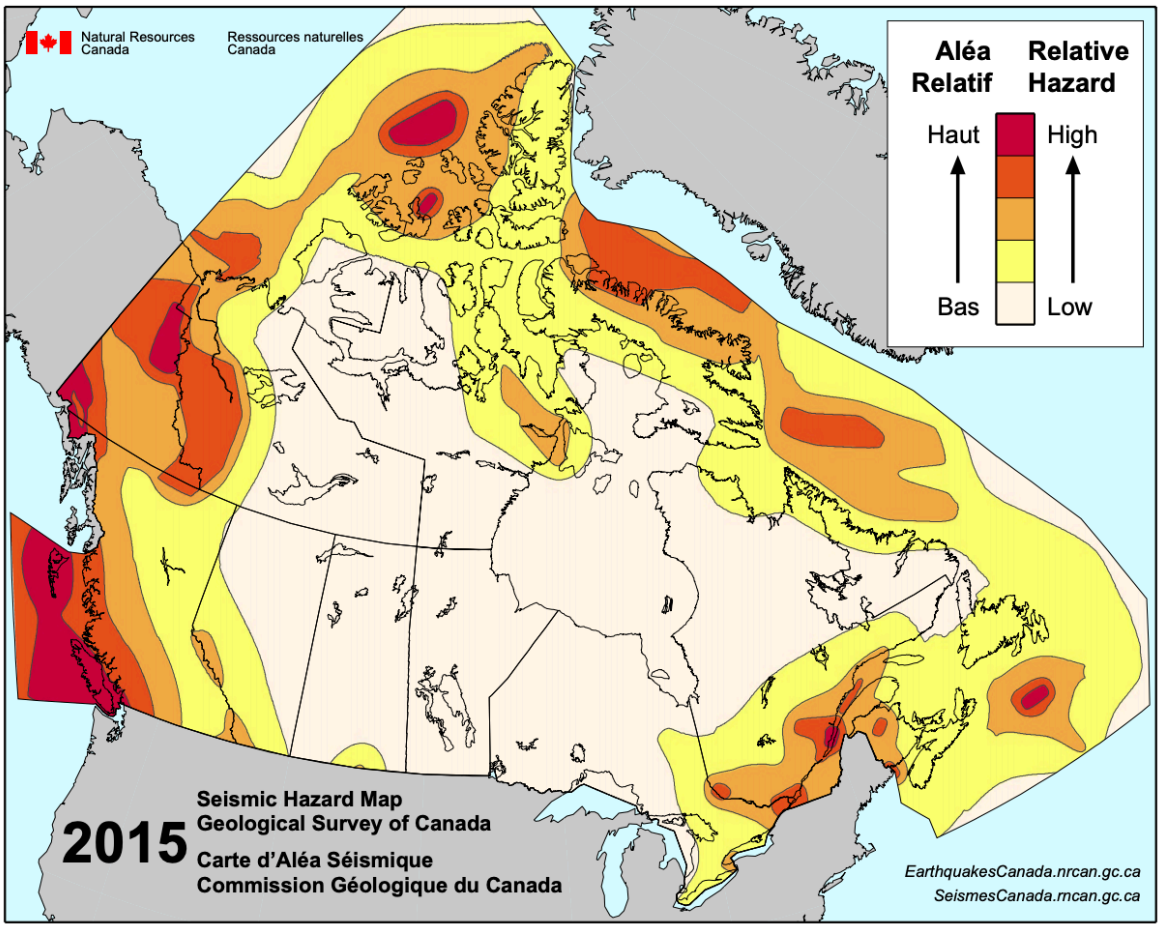
Given the Project is located approximately 30 km from the coast and average elevation is 140 masl, it is unlikely the effects of isostatic rebound will impact the Project, nor will the Project impact isostatic rebound.

Seismic Activity

The North American Plate has a stable interior but along the edges more seismic activity is likely to occur. Eastern Canada is part of the stable interior; however; unlike the subduction zone on the west coast of North American where plates are colliding, crustal stresses on the east coast are more difficult to explain and likely depend on their local tectonic context.

Although seismic activity is unpredictable, all of Nova Scotia is in a moderately low hazard zone. The southern Bay of Fundy is a moderate hazard zone. The Laurentian Slope is a moderate to high hazard zone (NRCAN 2015). Figure 6.5-2 displays the relative earthquake hazards across Canada as determined by the Geological Survey of Canada (NRCAN 2015).

Figure 6.5-2: Relative Earthquake Hazard Map of Canada



Each year, approximately 450 earthquakes occur in eastern Canada, of which four will exceed magnitude 4, 30 will exceed magnitude 3, and 25 events will be reported as felt. A decade will likely include three events greater than magnitude 5. Nova Scotia, in particular, has low seismic activity with records (since 1925) showing a max magnitude of 3.5 (Yarmouth - 2015) and most of the activity occurring in SW Nova Scotia (Figure 6.5-3).

The Northern Appalachians Seismic Zone is located in southwest Nova Scotia. The Project is located east of this zone. The nearest earthquake to Marinette, NS was recorded with a magnitude of 2.7 in 1999 and was located northeast approximately 20 km north of the PA. Magnitudes of intensity less than 3.0 are not felt by people except under especially favourable conditions and cause no damage to buildings. The global frequency of earthquakes with magnitude 2.0 to 2.9 is over one million per year.

If an earthquake occurs, seismic activity may affect the Project through primary impacts such as infrastructure damage facilitated by ground vibrations and secondary impacts such as fires facilitated by damaged infrastructure. Tsunami's, should they be created by offshore earthquakes, are unlikely to impact the Project. The Project is located approximately 30 km from the coast and at an elevation of 140 masl.

Given that Nova Scotia is located in a low hazard zone and the limited extent and duration of the Project, the potential risk of seismic activity affecting the Project is very low and not significant.

A geotechnical stability assessment was undertaken for the waste rock and soil stockpiles (Golder 2021; Appendix A2.C), which included an assessment of potential seismic activities on design. The assessment concluded that the overall stability of the stockpiles is within acceptable safety factors. A geotechnical stability assessment is also being undertaken by Golder (In Progress) on the open pit design. Recommendations from this assessment will be applied to final open pit design.

Landslides, Slope Erosion, and Subsidence Following Project Activities

Geotechnical work has been completed at the Touquoy site and the expertise gained from working with these materials will be applied to the final design of the Beaver Dam disturbed areas using actual geotechnical data collected at Beaver Dam to supplement the abundant public information available. Features constructed from site materials such as waste rock stockpiles and overburden stockpiles will use the collected data for final design to produce features with appropriate safety factors to reduce the possibility of landslides, slope erosion and subsidence. With many stockpiles it is common to have subsidence in the short-term creating a landscape that is varied in topography. This is in line with NSL&F objectives for reclamation to have surfaces that are not uniform but offer safe long-term landscapes with a variety of features. General reclamation goals to have heterogeneous landscapes that offer habitat features greater than simply a hydro seeded mat are important and can be assisted by some variation in the topography through subsidence.

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FIGURE 6.5-3

Distribution and Magnitude of Earthquakes Recorded in Eastern Canada (1985-2021)

Earthquake Magnitude

- 0 - 1.0
- 1.0 - 2.0
- 2.0 - 3.0
- 3.0 - 4.0
- 4.0 - 5.4

Source: Natural Resources Canada, arthquake Database (2021)



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 25 50 100 km

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Miramichi
Fredericton
Moncton
Saint John
Maine
Bay of Fundy
Digby
Yarmouth
Kentville
Nova Scotia
Truro
Minas Basin
Northumberland Strait
Summerside
Prince Edward Island
Charlottetown
New Glasgow
Sydney
Cabot Strait
Bridgewater
Halifax
Project Area

150000 200000 250000 300000 350000 400000 450000 500000 550000 600000 650000 700000 750000 800000

5250000 5200000 5150000 5100000 5050000 5000000 4950000 4900000 4850000 4800000 4750000

6.5.4.1.2 Regional Soil Quality

Soil quality, at a regional scale, is influenced by physiographic, geomorphological and topographic conditions. The Beaver Dam Mine Project is located in the Eastern Ecoregion of the Acadian Ecozone. Ecoregions express macroclimate as a distinctive ecological response to climate through soils and vegetation (Neily et al. 2005). The ecoregion has extensive wetland and rock barrens, which support stunted black spruce, larch, and heath.

Ecoregions are further subdivided into Ecodistricts, which reflect macro elements of the physical and biological attributes of ecosystems which will ultimately influence biodiversity. The three primary Project locations are spread across the further subdivided Eastern Interior and Eastern Drumlin Ecodistricts (Figure 6.5-4). The Eastern Interior Ecodistrict is generally characterized by highly visibly bedrock where glacial till is very thin, exposing the ridge topography. Where till is thicker, ridged topography is masked and thick softwood forests occur. There are a few drumlins and hills scattered throughout the Ecodistrict and fine textured soils are derived from slates. The Eastern Drumlin Ecodistrict is underlain by Meguma Group greywacke and slate, blanketed by fine-textured till derived from these underlying and adjacent rocks. Drumlins are derived from carboniferous rocks from the north, as well as material from the Cobequid Hills and Pictou Antigonish Highlands.

The Beaver Dam Mine Site is in an area of low topographic relief at 140 masl with scattered drumlins reaching 165 to 175 masl and Cameron Flowage channeling through a topographic low of 130 masl. Drainage is to the southeast along a number of poorly drained streams, shallow lakes, and wetlands.

A variety of landforms are found in this ecoregion, including rolling till plains, drumlin fields, extensive rockland, and wetlands. The bedrock is highly visible in those areas where the glacial till is very thin, exposing the ridge topography.

At a regional scale, local area soils are composed of a variety of soil types, but is dominated by the Danesville, Halifax, and Gibraltar series. Surface soil and subsoils of the Danesville series are typically dark grayish brown sandy loam over yellowish-brown sandy loam with parent material consisting of dark brown sandy loam till derived from quartzite. Surface and subsoils of the Gibraltar series are typically brown sandy loam over strong brown sandy loam with parent material consisting of pale brown coarse sandy loam till derived from granite.

The Project is in a highly mineralized region and the geology contributes to naturally elevated concentrations of metals in soils and sediments, including iron, arsenic and aluminum. The occurrence of naturally elevated concentrations in surface waters is commonly observed in regions of planned/proposed mining activities, all over the world (e.g., “Golden Triangle“ of northwestern British Columbia, Canada). In such regions, naturally elevated concentrations of certain parameters generally occur where exposure of rock or other geologic materials to oxygen and water results in natural weathering processes, including chemical oxidation and leaching of solid-phase constituents (e.g., metals), which are then transported to soils and sediments, Historical studies completed by Nova Scotia Department of Natural Resources (DNR) show areas sampled around Beaver Dam Mine Site are below CCME Soil Quality Guideline for Inorganic Arsenic. The Killag Historic Gold Mining area is located approximately 9 km to the southeast of the project site. Studies show areas with elevated arsenic values over the CCME SQG (12 mg/kg) despite no known historic mining activity or mineral occurrences, and therefore, it can be assumed that elevated values are attributed to background levels. Regional studies of till samples show high levels of arsenic that have no mineral occurrences, and therefore it can be concluded that the elevated arsenic levels are attributed to natural background levels, or higher areas of mineral enrichment.

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FIGURE 6.5-4

Ecodistricts of Eastern Nova Scotia

- Streams
- Collector Road
- Local Road
- Beaver Lake Indian Reserve
- Lakes
- Project Area

Ecodistrict

- Rawdon/Wittenburg Hills
- Eastern Drumlins
- Eastern Granite Uplands
- Eastern Interior
- Governor Lake
- Central Lowlands



Coordinate System: NAD 1983 CSRS UTM Zone 20N
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Units: Meter

0 1.25 2.5 5 km

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6.5.4.1.3 Regional Sediment Quality

The soils of Halifax County have developed almost entirely from glacial drift and, in most cases, mirror the distribution of underlying rock formations. This is particularly true for coarse-textured materials derived from granite and quartzite. Finer-textured materials were transported more readily by glaciers and typically accumulated in drumlin or drumlin-like mound deposits (Hilchey et al. 1963).

Sediment is derived from the movement of soils and in some instances bedrock materials being transported by water to areas frequented by water. Soil and bedrock quality is therefore a good indicator of what sediment quality is in the absence of anthropogenic activities that could affect sediment directly. Sediment quality for the Beaver Dam Mine Site and Touquoy Mine Site are discussed below.

6.5.4.2 Local Baseline Study Results

6.5.4.2.1 Local Geology

The Meguma Group is the dominant unit occurring in the area near the Beaver Dam site and at the existing Touquoy mine site (located 19 km to the southwest of the Beaver Dam Mine Site); both sites are located within the Goldenville Formation of the Meguma Group.

The Goldenville Formation is further subdivided, from oldest to youngest, into the Moose River Member, the Tangier Member and the Taylors Head Member. Claystone and siltstone are present in the Moose River and Tangier Members but are minor in the Taylors Head Member. Overall here is a decrease in the proportion of fine-grained sediments from the oldest to the youngest units within the Goldenville Formation. Both the Beaver Dam Mine Site and the Touquoy Mine Site are located within the Moose River Member (FSSI, 2015). The Moose River Member is at its widest in the Beaver Dam Mine Site vicinity and is folded into three sub-parallel anticlines.

Mineralization at the Beaver Dam Property occurs in the north-dipping southern limb of an overturned anticline with gold hosted both within quartz veins and disseminated through the intervening inter-bedded argillite and greywacke. The Moose River-Beaver Dam Anticline is sinisterly offset into segments by two northwest trending faults:

- the Mud Lake Fault; and
- the Cameron Flowage Fault .

The Mud Lake Fault has been described as a 2 to 3 m wide zone of gouge within a 10 to 20 m wide brecciated zone (PCA, 2015). Duncan (1987) stated an average thickness of 12 m, ranging from 5 to 26 m, for the Mud Lake Fault and that the Mud Lake Fault usually can be sub-divided into three zones consisting of:

- Hanging Wall Breccia (2 to 10 m) consisting of greywacke and minor argillite orthobreccia and minor parabreccia;
- Gouge Zone (2 to 10 m) consisting of graphitic argillite gouge and minor greywacke; and
- Footwall Breccia (1 to 5 m) consisting of greywacke and argillite ortho-and parabreccia.

While these many unique lithologies and geologic structures are tracked during core logging, argillite and greywacke along with two interbedded intermediates (argillite- and greywacke-dominated) represent the four major rock types by volume identified on site. In an effort to be consistent with the geological observations from site while simultaneously allowing for a representative and simplified geo-environmental model, these four major rock types are being carried forward in this ML/ARD assessment. Description of the Beaver Dam geologic units and sample descriptions are provided in Table 6.5-2.

The overburden at the Beaver Dam Mine Site consists of glacial till deposits of varying thickness and occasional shallow peat bogs. Stea and Fowler (1979) describe the overburden as a blue-greenish-grey, loose, cobbly silt-sand till that will grade into a sandier, coarser till, sometimes with red clay inclusions. A typical composition of the glacial till matrix is 80 percent sand, 15 percent silt and 5 percent clay. Surficial geology in the area is described on geology maps (Stea et al. 1992) as consisting of stony till plains and drumlins with minor organic deposits. Till is typically 2 to 20 m thick and primarily comprised of a stony and sandy matrix material derived from local bedrock sources, while drumlin facies are typically 430 m thick and siltier due to erosion and incorporation of older till units by glaciers. Figure 6.5-5 displays regional surficial geology.

Hydrostratigraphy

Description of local study area hydrostratigprahy was performed by Conestoga-Rovers & Associates (CRA 2007a,b) and Peter Clifton & Associates (PCA 2007). These results supported development of a 3D geological model for the Beaver Dam Mine Site as well as the hydrogeological modelling and solute transport modelling (Appendix F.5 and F.6). Three hydrostratigraphic units based on lithology and hydraulic properties were identified:

- glacial till;
- weathered fractured bedrock; and
- competent fractured bedrock.

These hydrostratigraphic units were further subdivided into zones based on the surficial geology in the overburden (Appendix F.6).

The overburden hydrostratigraphic units include:

- Stony Till;
- Silt Till;
- Organics; and
- Silty Drumlin.

Bedrock stratigraphic units identify include Cunard, Beaverbank, Taylor's Head, Tangier and Moose River, and Moose River

6.5.4.2.2 Local Soil Quality

Beaver Dam Mine Site

The Beaver Dam Mine Site is primarily composed of soils belonging to the Bridgewater and Halifax series. Surface soil and subsoils of the Bridgewater series are typically medium-textured brown shaley loam over yellowish-brown shaley loam with parent material consisting of olive shaley loam till derived from Precambrian slates. Surface soil and subsoils of the Halifax series are typically brown sandy loam over yellowish sandy loam with parent material consisting of olive to yellowish-brown stony sandy loam till derived from quartzite (Figure 6.5-6). These soils correlate to the NS Forest Soil Type – ST2, common in upland forests throughout the province. Soil depths to sea horizon are typically up to 18 inches. No mapping currently exists to depict soil depth by horizon.

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FIGURE 6.5-5

Regional Surficial Geology

- Streams
- Collector Road
- Local Road
- Lakes
- Beaver Lake Indian Reserve
- Project Area
- Alluvial Deposits
- Organic Deposits
- Glaciofluvial Deposits (Kames and Eskers)
- Glaciofluvial Deposits (Outwash Fans)
- Hummocky Ground Morraine
- Stony Till Plain (Ground Moraine)
- Silty Till Plain (Ground Moraine)
- Silty Drumlin (Drumlin Facies)
- Bedrock



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
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0 1.25 2.5 5 km

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The area of the proposed open pit is largely reworked soils associated with an historical settling pond (Appendix E.9 draft Historic Tailings Management Plan). Suspected tailings were observed within the proposed open pit area near the historical settling pond, north of Crusher Lake between the lake and the proposed road, and to the north of the proposed road near the historical Mill Shaft Pit area (proposed topsoil/sub-soil stockpile [TSSP] area). Several trenches and pits with nearby suspected waste rock were located within the proposed pit area, to the south and east of the pit area, north of Crusher Lake between the lake and the proposed road, and to the north of the proposed road near the historical Mill Shaft Pit area (proposed TSSP area). These trenches and pits are suspected to be historical mine workings (Appendix E.8 Beaver Dam Mine Project Extended Phase II Environmental Site Assessment).

Soil sampling conducted in 2019 and 2020 at the Beaver Dam Mine Site showed that arsenic exceeded the Tier 1 EQS at several locations. Levels of arsenic ranged from non-detected to 3,900 mg/kg. Lead and mercury which have been associated with historical mining activities in Nova Scotia, were relatively elevated but did not exceed applicable Tier 1 EQS. The maximum identified lead concentration was 200 mg/kg versus a Tier 1 EQS of 740 mg/kg, and the maximum identified mercury concentration was 40 mg/kg versus a Tier 1 EQS of 99 mg/kg (Table 6.5-3 and Appendix E.8, Drawing A-5).

Table 6.5-3: Summary of Soil Contamination (2019 and 2020)

Standard Exceedances	Tier 1 EQS	Exceeding (Samples)	Exceeding (Test Pits)
Arsenic	31 mg/kg	73 of 96 samples[(a)]	72 of 94 test pits[(a)]
Other Metals	Various	None	None

Source: Appendix E.7 (Limited Phase II - Environmental Site Assessment [Beaver Dam Property]) and Appendix E.8 (Extended Phase II Environmental Site Assessment [Beaver Dam Project Property]).

Notes: Numbers of exceedances do not include field duplicate samples.

(a) There are more soil samples than test pit locations as two soil samples, rather than one, were collected from two of the test pits.

mg/kg = milligram per kilogram; PEL = Canadian Council of Ministers of the Environment (CCME) probable effects level; Tier 1 EQS = Nova Scotia Tier 1 Environmental Quality Standards for Contaminated Sites.

The existing topsoil and overburden are considered suitable for use in reclamation. Topsoil will be stockpiled in two locations during construction and used for revegetation at the end of the mine life and, when practical, during operation. Plant material and vegetation that was able to grow on the overburden and topsoil prior to disturbance is assumed to be able to grow on the area post reclamation. Organic debris (roots, stumps, brush) will also be stockpiled and mulched to provide biomass for reclamation. All disturbed areas, most notably the waste rock and till storage piles, will be reclaimed with topsoil and growing medium to a depth matching the native surroundings.

Touquoy Mine Site

The Touquoy Mine Site can be used as a surrogate to understand how to manage historic tailings at the Beaver Dam Mine Site. The soils are primarily composed of the Danesville series (CRA 2007a,b), whereas, the soils at the Beaver Dam Mine Site are primarily composed of Halifax and Bridgewater series (Figure 6.5-6). Lessons learned from water treatment and historic tailings disposal have been applied to the Beaver Dam Mine. Water Management during construction to address metals associated with historic tailings is described in Appendix F.1 of Water Management Plan Appendix P.4. A draft Beaver Dam Historic Tailings Waste Rock Management Plan is provided in Appendix E.9

Regional till and soil data was reviewed and compared to CCME Soil Quality Guidelines (SQG) for the Protection of Environmental and Human Health for industrial property use. A review of the regional till samples collected by Seabright Resources Inc. and Seabright Exploration Inc. in the Compilation of Seabright Resources Inc. Till and Soil Geochemical Data over the Meguma Terrane identified that 98 samples were located in the vicinity of the PA. Results available for review included samples analyzed for arsenic, tungsten, gold, and antimony. Data was not provided for additional metals that may have been analyzed. The results indicate that

arsenic concentrations were identified to be above the CCME soil quality guidelines of 12 mg/kg in 29 of the 98 samples, and antimony concentrations were identified to be below the CCME SQG of 40 mg/kg in all samples collected. Tungsten results were presented with negative concentrations; therefore, they are not included in the discussion. There are no applicable guidelines for gold.

A review of the till samples collected by the Department of Regional Economic Expansion and Nova Scotia Department of Mines in the Till Geochemical Survey over Mainland Nova Scotia identified three soil samples in the vicinity of the PA. Samples were identified to have been collected from Lake Alma, MacGreggor Lake, and River Lake, located adjacent to the Haul Road. Results available for review included samples analyzed for silver, copper, lead, zinc, cadmium, nickel, cobalt, iron, manganese, calcium, magnesium, mercury, arsenic, molybdenum, uranium, tin, tungsten, and barium. Based on a review of the analytical results, copper was identified to exceed the CCME SQG of 91 mg/kg in one of three samples collected. No other parameters were identified to exceed the CCME SQGs, where they exist.

6.5.4.2.3 Local Sediment Quality

Beaver Dam Mine Site

Sediment sampling conducted in 2020 within Crusher Lake, a historical settling pond (within the proposed pit footprint) and the Killag River showed that levels of arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, selenium, strontium, and zinc exceeded the Tier 1 EQS guidelines at one or more sample locations.

Arsenic in sediment ranged from 3.1 to 2,800 mg/kg, with the highest concentration located upstream within the Killag River approximately 800 m north-northwest of the proposed open pit, which also had cadmium, iron, lead, and manganese above applicable criteria. Arsenic exceeded ISQG at all locations other than at the east end of Crusher Lake (Table 6.5-4 and Appendix E.8, Drawing A-6).

Table 6.5-4: Summary of Sediment Contamination (2020)

Criteria Exceedances	Criteria (mg/kg)			Exceeds ISQG	Exceeds PEL	Exceeds Tier 1 EQS
	ISQG	PEL	Tier 1 EQS			
Arsenic	5.90	17.00	17	10 of 13	9 of 13	9 of 13
Cadmium	0.60	3.50	3.5	3 of 13	1 of 13	1 of 13
Chromium	37.30	90.00	90	2 of 13	0 of 13	0 of 13
Copper	35.70	197.00	197	3 of 13	0 of 13	0 of 13
Iron	-	-	43,766	-	-	2 of 13
Lead	35.00	91.30	91.3	4 of 13	2 of 13	2 of 13
Manganese	-	-	1,100	-	-	1 of 13
Mercury	0.17	0.486	0.486	4 of 13	2 of 13	2 of 13
Selenium	-	-	2	-	-	1 of 13
Strontium	-	-	1	-	-	11 of 13[(a)]
Zinc	123.00	315.00	315	3 of 13	1 of 13	1 of 13
Antimony and nickel	-	-	25 and 75	-	-	0 of 13

Notes: [(a)] Strontium exceedances of Tier 1 EQS exclude concentrations below the laboratory's reportable detection limits (RDL) where the RDL exceeds the EQS.

Numbers of exceedances do not include field duplicate samples.

ISQG = Canadian Council of Ministers of the Environment (CCME) interim sediment quality guideline; mg/kg = milligram per kilogram; PEL = CCME probable effects level; Tier 1 EQS = Nova Scotia Tier 1 Environmental Quality Standards for Contaminated Sites.

Prepared For:

Atlantic Gold

FIGURE 6.5-6

Regional Soils

Streams
Collector Road
Local Road
Beaver Lake Indian Reserve
Lakes
Project Area

Soil Series

Aspotogan
Bayswater
Bridgeville
Bridgewater
Chaswood
Cumberland
Danesville
Falmouth
Gibraltar
Halifax
Hebert
Kirkhill
Mahone
Middlewood
Peat
Queens
Riverport
Rock
Torbrook
Wolfville



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 1.25 2.5 5 km

1:100,000 Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed by: LP

Date: 2021-05-24

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

McCallum Environmental Ltd.

Sheet Harbour Road
Mill Lake
Ten Mile Lake
Creelmans Crossing
Greenwood
Fraser Settlement
Kent
Centre Musquodoboit
Pleasant Valley
224
Newcomb Corner
Caribou Mines
Beaver Dam Mine Site
Lindsay Lake
Markland
Beaver Lake IR
Beaver Dam Mines Road
Beaver Dam Haul Road
Long Lake
Moose River Gold Mines
Touquoy Mine Site
Mooseland Road
Marinette
Mooseland
River Lake

4995000
4990000
4985000
4980000
4975000

500000 505000 510000 515000 520000 525000 530000

Further information on analytical results for soils and sediments at the Beaver Dam mine site can be found in the Beaver Dam Extended Phase II ESA (Appendix E.8).

Touquoy Site

The following is provided to show how information from historic tailings information the Beaver Dam Mine site assessment, planning and mitigation measures.

A sediment quality investigation at the Touquoy site consisted of the collection of ten sediment samples from the site and surrounding area watercourses in January 2007. Three of these locations had organic substrate not suitable for chemical analysis for soils. A summary of the analytical results from the Touquoy site is presented below. Arsenic levels above the CCME probable effects level (PEL) and Tier 1 NSE EQS were found at Sediment Sites 1, 2, 3, 5, 6, 7 and 8. Sites 1, 6, 7 and 8 are above the existing open pit or in a different catchment. All the locations exceed the CCME interim sediment quality guideline (ISQG).

Only Station 5 (0.81 mg/kg) exceeds the ISGQ (0.6 mg/kg) but not the PEL (3.5 mg/kg) limits for cadmium. Station 9 along the shore of Scraggy Lake is close to the ISGQ at 0.58 mg/kg.

Sediment at Site 3, 5, 6 and 10 exceed the ISQG limit (35 mg/kg Pb) for lead but not the PEL limit (91.3 mg/kg Pb). Sediment from the shore at Scraggy Lake far exceeded both limits at 1,100 mg/kg Pb. Such a high concentration in a relatively pristine area appears to be anomalous and suggests that the lake requires further investigation.

Mercury was found at Sites 3 and 9 at concentrations above the ISQG limit (0.17 mg/kg), and at Site 2 (0.52 mg/kg) above the PEL (0.48 mg/kg). It was detected at all sites between concentrations of 0.02 to 0.16 mg/kg.

The concentration of zinc was relatively consistent across all sites. Site 9 at 150 mg/kg was elevated above the ISQG limit of 123.0 mg/kg, but well below the PEL of 315.0 mg/kg.

Cyanide was included in the analysis to monitor for its presence once the mine is operating. Cyanide is naturally present in some foods and in certain plants and seeds such as peach pits. Cyanide is contained in over 800 plant species, some foods and a great number of microorganisms, cigarette smoke and the combustion products of synthetic materials such as plastics. In manufacturing, cyanide is used to make paper, textiles, and plastics. It is present in the chemicals used to develop photographs. Cyanide salts are used in metallurgy for electroplating, metal cleaning, and removing gold from its ore. Cyanide gas is used to exterminate pests and vermin in ships and buildings. If accidentally ingested (swallowed), chemicals found in acetonitrile-based products that are used to remove artificial nails can produce cyanide. Cyanide was not used in the previous milling operations.

Cyanide was detected at low levels in Sites 5, 9 and 10, all sites that are well removed from the open pit. It was below the detection limit of 0.5 mg/kg at all other sites (CRA 2007a,b).

6.5.5 Consideration of Consultation and Engagement Results

Key issues raised during public consultation and Mi'kmaq engagement relating to geology, soil and sediment include potential ARD, suspended solids and leaching of metals from the rock at the Beaver Dam Mine Site which may affect receiving water and its fish habitat, specifically Cameron Flowage, the closest watercourse to the Site.

The results of the public consultation and Mi'kmaq engagement have been considered in the environmental effects assessment, including AMNS's commitments on mitigation and monitoring measures and proposed compliance and effects monitoring programs, as well as AMNS's broader commitment to ongoing public and Mi'kmaq engagement. Specific to evaluating the effect on geology, soil and sediment, these are found within the following environmental effects assessment.

Engagement updates undertaken in 2019 to 2021 with the Public and Mi'kmaq of Nova Scotia including Millbrook First Nation is provided in Section 3 and Section 4, respectively.

6.5.6 Effects Assessment Methodology

6.5.6.1 Boundaries

6.5.6.1.1 Spatial Boundaries

The spatial boundary used for the assessment of effects to geology, soil, and sediment is the PA. As the Project has the potential to cause direct and indirect effects to Geology, Soil, and Sediment Quality within and immediately adjacent to but not outside the Project Area, the PA is the most appropriate spatial boundary.

The PA encompasses three primary components from Marinette to Moose River Gold Mines, Halifax County, NS. The Beaver Dam Mine Site will be located at the end of the Beaver Dam Mines Road and the Haul Road will span from the Beaver Dam Mine Site to Moose River Gold Mines, where the Touquoy Mine [processing and exhausted pit (to be used to dispose Beaver Dam tailings)] is located.

The evaluation of effects was completed at the PA level, as direct and indirect impacts to Geology, Soil, and Sediment Quality are expected only within the PA boundaries (Figure 6.5-1 shows the PA boundary).

No RAA was necessary for geology, soil, and sediment as a footprint analysis was completed on this VC, and impacts were only expected within the PA.

6.5.6.1.2 Temporal Boundaries

Temporal boundaries reflect those periods during which planned Project activities are reasonably expected to potentially affect a VC. The temporal boundaries used for the assessment of effects to Surface Water are the Construction, Operations, Active Closure and Post-closure phases.

The temporal boundaries used for the assessment of effects to geology, soil, and sediment are the construction, operations, active closure, and post-closure phases.

6.5.6.1.3 Technical Boundaries

The Geology, Soils, and Sediment Quality assessment was developed to incorporate quantitative data from baseline reports as well as geochemical characterizations studies. Geology, Soils, and Sediment Quality represent physical components of the natural environment; changes related to Geology, Soils and Sediment Quality VCs provided in the subsequent sections are to support the Effects Assessment on Surface Water, Wetlands, and Fish and Fish habitat (Sections 6.7, 6.8, and 6.9).

Project effects to Geology are here constrained by the ML/ARD assessment and geochemical characterizations programs; these results (Section 6.5.6.3) informed predictive water quality modelling and the Surface Water Quality and Quantity Effects Assessment (Section 6.7). The goals were to remove as much subjectivity as possible from the assessment and to increase certainty in the predictions of alteration of the Surface Water VC, residual effects, and the determination of significance to ensure a robust, transparent, and defensible approach to the effects assessment.

Changes to soil and sediment quality may have negative, neutral, or beneficial effects on soil or sediment characteristics. Examples of this include increases in productivity (such as mixing of organic material with surface horizons or addition of nutrients through dust deposition) or degradation of soil and sediment quality, caused by ML/ARD processes. Soil and Sediment Quality degradation

may result from Project Activities causing increases in surface runoff and siltation, local soil erosion, or loss of soil structure due to disturbances such as excavation, soil transport.

6.5.6.1.4 Administrative Boundaries

A number of legislated requirements exist to guide mining proponents on the development of a mine site and on the management of bedrock geology and surface soil disturbance; these were used to support the effects assessment as well as for the planning and implementation of proposed mitigate measures (Table 6.5-5).

ARD is provincially regulated through the Sulphide Bearing Material Disposal Regulations. Contaminated soil and sediment are provincially regulated via the Contaminated Sites Regulations. Sediment quality is compared to the CCME ISQGs and PELs, and the NSEQSs for freshwater sediment.

Table 6.5-5: Relevant Guidelines and Standards informing Effects Assessment for Geology, Soils, and Sediment Quality

Legislation and/or Standard	Applicability to Geology, Soils and Sediment Valued Component	Related Valued Components and Sections
Federal *Fisheries Act* (1985)	Relevant information requirements set under the Fish Habitat Protection and Pollution Prevention provisions of the *Fisheries Act* (1985) include descriptions of measures that will be taken to avoid or minimize any effects on the aquatic environment, shoreline, or riparian areas during Project development or its subsequent operation (Section 37). The *Fisheries Act* (1985a) also regulates the discharge of harmful substances, including sediment (Section 34), into the fish habitat. Consideration of the above legislation is particularly important in cases when Project development takes place near shorelines, or riparian areas where migration of chemical contaminants and sediment into the aquatic environment could occur.	Potentially contaminated soils is assessed in Section 6.18 Accidents and Malfunctions. Management and monitoring plans are provided in Appendix E.5, E.9, J.3, P.1 and P.4 .
Canadian Soil Quality Guidelines for the Protection of Environment and Human Health (CCME 2007)	These guidelines provide Canada-wide standards that suggest maximum limits of various toxic substances (e.g., metals, hydrocarbons, pesticides, etc.) in the soil.	The assessment of effects of the Project on human health, as well as biological components of the environment (i.e., wetlands and fish and fish habitat) are assessed separately in Appendix C.2, Section 6.8, and 6.9.
Sulphide Bearing Material Disposal Regulations pursuant to Section 66 of the Nova Scotia *Environment Act*	In Nova Scotia, the potential for ML/ARD is regulated by the Environment Act administered by NSE.	N/A
Contaminated Sites Regulations.	Exposure of soil from Project activities may increase the potential for siltation of watercourses from surface water runoff. Contaminated soil and sediment is provincially regulated via the Contaminated Sites Regulations.	N/A
Manual for prediction of Drainage chemistry from Sulphidic Geologic Material (Price1997, 2009) and Guidelines and Recommended Methods for the Prediction of Metal Leaching and Acid Rock Drainage at mine sites in British Columbia Price (Price et al. 1998)	Characterization of geology and baseline geochemical studies, including ML/ARD assessment, followed industry best practices and available guidance documents for determining and obtaining geochemical data to be used as inputs for mitigation and management plans as well as ML/ARD assessment	Geological and geochemical baseline studies results informed predictive water quality modelling (Appendix D of Appendix P.4), and mine site water management for the Project (Appendix P.4).

6.5.6.2 Thresholds for Determination of Significance

There are no regulated or proposed thresholds for geology. Sediment and soil have regulated thresholds that are well understood by the proponent and can be quantified through the monitoring program proposed. Tier 1 NSE and CCME Soil and Sediment Criteria in conjunction with background considerations and percent change, in context with NSE policy and guidance documents are the thresholds.

Sediment and soils that become mobilized have a linkage with surface water quality that have regulated thresholds and can are assessed through predictive efforts for the Surface Water Quality and Quantity and Fish and Fish Habitat VCs (Section 6.7 and 6.9) or through the monitoring program proposed.

6.5.6.3 Metal Leaching and Acid Rock Drainage Assessment

The Project is in a highly mineralized region and the geology contributes to naturally elevated concentrations of metals. The occurrence of naturally elevated concentrations in soils, sediments and surface waters is commonly observed in regions of planned/proposed mining activities, all over the world (e.g., "Golden Triangle" of northwestern British Columbia, Canada). In such regions, naturally elevated concentrations of certain parameters generally occur where exposure of rock or other geologic materials to oxygen and water results in natural weathering processes, including chemical oxidation and leaching of solid-phase constituents (e.g., metals), which are then transported to soils and sediments.

The Project has the potential to increase concentrations of metals, and other parameters, in soils, sediment and surface water by excavating and disturbing overburden and bedrock, i.e., mining activities. To support the Project, geochemical characterization studies and ML/ARD assessment were completed to characterize and predict potential of for metal leaching (ML) and acid rock drainage (ARD). ML/ARD is typically associated with the weathering of sulphide-bearing geologic materials. While this is a natural process, the exposure of fresh particle surfaces produced by mining activity enhances the reaction rates associated with ML/ARD. Results of the ML/ARD assessment were accessed to predict drainage chemistry and contact water quality from various Beaver Dam facilities including waste rock storage areas, temporary stockpiles (i.e., topsoil, till, and organics), and pit walls.

Detailed results of geochemical studies are presented in Appendix E.2, Appendix E.3 and Appendix E.5 and are summarized in the underlying sections. ML/ARD results further informed the Surface Water Quality and Quantity (Section 6.7), where effects on indicators of Surface Water Quality and Quantity (total and dissolved metals, anions, and nutrients; mg/L) were either assessed quantitatively by predictive water modelling or qualitatively based on geochemical characterization studies and professional judgement and experience (e.g., pH, TSS). Appendix E.3 (Geochemical Source Term Update, Table 1-1) provides an overview of the facilities where geochemical source terms were produced. Appendix E.3 also describes the sources terms uses the Surface Water Quality predictions (Section 6.7).

Summary of Assessment

The ML/ARD assessment of the Beaver Dam mine rock includes static testing for a dataset of 70 samples from the main geologic units encountered at the project (Appendix E.5). Acid-base accounting (ABA) was completed for all samples, while 30 samples were analyzed for solid phase elements. The main purpose of ABA characterization is to identify acid-producing and acid-neutralizing phases as ARD will only result from the weathering of sulphide-bearing rocks if there is insufficient alkalinity produced to buffer the acidity generated by the sulphide oxidation process. The ABA results were used to calculate the acid generating potential and the neutralization potential of the samples (Table 6.5-6). These parameters are then used to calculate the net potential ratio (NPR) which can be used as an indicator for the likelihood of a given sample to generate net acid upon exposure to the atmosphere. ABA results indicate that approximately 40% of the Beaver Dam samples were classified as potentially acid generating

(PAG) based on having an NPR-threshold of 2, where samples with an NPR of <2 are considered PAG, while samples with a NPR of ≥2 are non-acid generating (NAG). This NPR value is consistent with the criteria proposed in Price (2009). Generally, argillitic samples have a higher proportion of PAG samples than the greywacke sample population. The full set of ABA analyses for all mine rock samples is presented in Appendix E.2 (Metal Leaching and Acid Rock Drainage Assessment).

Table 6.5-6: Acid-base Accounting Summary

Sample ID	Paste pH	Total S (%)	Sulphate S (%)	Sulphide S (%)	Total C (%)	CaNP (kg $CaCO_3$/t)	Modified NP (kg $CaCO_3$/t)	NPR (ModNP/AP)
ARGILLITE (AR) n = 10								
Min	8.2	0.020	0.010	0.020	*<0.05*	*<4.5*	6.0	0.27
Median	9.0	0.44	0.20	0.44	*<0.05*	*<4.5*	8.5	0.64
Max	9.5	1.0	0.060	0.94	*<0.05*	*<4.5*	37	17
ARGILLITE-GREYWACKE (AG) n = 11								
Min	7.9	0.010	*<0.01*	0.010	*<0.05*	*<4.5*	7.0	0.23
Median	9.1	0.12	0.020	0.12	*<0.05*	*<4.5*	8.0	8.0
Max	9.5	1.1	0.060	1.1	0.17	14	177	47
GREYWACKE-ARGILLITE (GA) n = 14								
Min	7.9	0.010	0.010	0.010	*<0.05*	*<4.5*	5.0	0.40
Median	9.0	0.16	0.020	0.14	0.11	9.1	9.0	2.5
Max	9.5	1.7	0.060	1.5	0.57	48	58	46
GREYWACKE (GW) n = 24								
Min	8.9	*<0.01*	*<0.01*	*<0.01*	*<0.05*	*<4.5*	6.0	0.16
Median	9.2	0.025	0.020	0.030	0.10	9.1	14	22
Max	9.5	1.2	0.060	1.2	0.60	50	160	512
QUARTZ VEIN (QTZV) n = 3								
BD157-070	9.2	0.160	0.020	0.140	-	-	145	33
BD156-108	9.3	0.060	0.010	0.050	-	-	10	6.4
BD160-089	8.9	0.040	0.010	0.040	-	-	30	24

Source: Appendix E.2 Metal Leaching and Acid Rock Drainage Assessment, Appendix 4-2.

Notes: n = number of samples used in statistical distribution

A hyphen indicates the parameter was not analyzed.

Values in grey italics are below the analytical detection limit. Values were set at the detection limit for calculation of NP, AP and NPR values.

Sulphate S is calculated using the HCl method.

AP (acid potential) calculated using sulphide sulphur (% non-sulphate sulphur x 31.25); CaNP (carbonate neutralization potential) calculated using total inorganic carbon (% TIC x (100.09/12.01) x 10); Modified NP is obtained by the modified Sobek method.

NPR = neutralization potential ratio; calculated as Modified NP / AP.

During construction and operations, regular testing of rock will be conducted for acid generating potential. A sampling frequency of 8 to 10 samples per 100,000 tonnes of rock generated is recommended based on the guidelines in Price (2009). Parameters of potential concern identified by the solid phase elemental analysis include As, Cu, Mn and Pb. Of these, As is considered the species with the greatest potential for deleterious effects on mine contact water.

To understand sulphide oxidation and metal leaching rates from Beaver dam mine-specific materials, eight humidity cells (one PAG cells and one NAG cell four each of the four major waste rock types) were initiated using representative samples from this

dataset to represent a range of sulphur values from the main geologic units. Ex-ray diffraction and petrographic analyses were completed on the humidity cell samples. The main sulphide mineral identified by petrography was pyrrhotite (<1 to 3%). Humidity cell testing are currently underway. After 24 weeks of testing, the leachates from all humidity cells show neutral pH (Appendix E.3). To support updated EA. Updated kinetic test-work results are included in Appendix E.4.

Two humidity cells with PAG materials (HC4 and HC6) have been running for 107 weeks; while the remaining six humidity cells were terminated after 39 weeks. The leachate pH from all humidity cells that were terminated after 39 weeks of operation has remained circum-neutral falling between 7.1 and 8.6. HC4 and HC6 show a decreasing trend in pH as per the purpose of their continued operation. HC4 leachate, initially producing pH of approximately 7.5, has decreased to pH stabilizing just above 3.0 in the most recent weeks of testing. HC6 has decreased from pH 7.6 to values just below 4.0. The majority of PAG samples are expected to take several years to become acid producing, which will be confirmed through additional source term monitoring (ML/ARD) Monitoring Plan and Water Management Plan (P.4). As noted is the conceptual reclamation plan, post closure monitoring will be may be extended based on information gathered during construction, operations and active closure.

Metal leaching analyses from the kinetic test-work results indicate that As is the main parameter of concern (Appendix E.3 and Appendix E.4). Results indicate the six terminated humidity cells show a decrease in As loading rates over the duration of the experiments to values in the range of approximately 0.005 to 0.01 mg/kg/wk in the later test cycles and, further, the major effect of pH on As mobility which appears to be at a minimum within a pH range of 6.5 to 7.5.

In addition to the ML/ARD assessment (Appendix E.5) of the mine rock, five overburden samples and five Haul Road samples were also analyzed. The overburden samples were collected from within the proposed Beaver Dam pit. These samples have low sulphur content; however, they lack any significant neutralization potential. The samples along the Haul Road were collected from bedrock outcrops. The results indicate that the bedrock along the Haul Road is not potentially acid generating; however, additional samples may be required depending on the Haul Road design and blast depth (Section 2 Project Description). Source materials for the Haul Road will require physical and chemical testing to determine suitability for construction of the Haul Road. Materials may be sourced from small quarries (<4 ha) along the Haul Road, Touquoy Mine, Beaver Dam Mine or a commercial quarry.

Appendix E.2 and Appendix E.3 detail the ML/ARD Assessment Report and the Geochemical Source Term Predictions for waste rock, low-grade ore, tailings and overburden.

Possible Onset of Acid Rock Drainage from Waste Rock: Beaver Dam Mine Site

Lorax Environmental has provided predictions relating to ARD potential from the waste rock pile at the Beaver Dam Mine Site. Initial predictions indicate the range may be approximately 10 to 30 years for half of the Beaver Dam PAG waste rock to generate acidic leachate. However, in response to IR2 NSE-2-44, the PAG humidity cells that are expected to become acidic, the time to NP depletion theoretically corresponds to the time to onset of acid generating conditions, although the grain liberation is an important factor. Note that for the purposes of calculating NP depletion rates and the time for complete depletion of NP, the initial sulphate production rates, which reflect the flushing of non-acid generating surface oxidation products such as gypsum, were not incorporated in the calculation. Rather the relatively stable NP depletion rates in later cycles of the tests more appropriately reflect depletion based on sulphate produced by sulphide oxidation. This will prevent underestimating the amount of available NP and the lag time to the onset of acidic conditions. The model results suggest that will be depleted between around 7 to 10 years for the PAG humidity cells.

To provide a more realistic estimate that considers the slowing of sulphide oxidation at the Beaver Dam Mine Site in response to colder temperatures and/or freezing of parts of the waste rock, the sulphate leaching rate was corrected by a factor of 0.3. This value is consistent with the temperature-dependent sulphide oxidation rate and sulphate release rate observed around 10°C

(Dockrey and Mattson, 2016), which is somewhat higher than the mean annual temperature measured at the Beaver Dam site. Note that this approximation is only applicable for waste rock exposed to ambient air temperatures such as pit walls, since waste rock piles may have a different temperature profile. As discussed in NSE 2-44, Plotting humidity cell total sulphur (ST) contents against the respective temperature-corrected NP depletion rates shows a positive correlation (Figure 4-11a of Appendix E.2 ML/ARD Assessment Report) that can be written as:

$$\text{NP depletion rate} = 0.0013 \times \ln [ST] + 0.0064$$

This function was then applied to the PAG samples within the Beaver Dam static test population to quantify a range of lag times that can be expected until these PAG samples release net acidic drainage. The results of this exercise are shown in Figure 4-11b within Appendix E.2 and show that it will take around 20 years for 10% of all PAG samples and 28 years for 50% of all PAG samples to turn acidic. For additional details refer to ML/ARD Assessment Report included in Appendix E.2.

There is no expectation for acidic conditions during Beaver Dam Mine operations based on an assessment of the geochemical characteristics of the mine rock (refer to Appendices E.3 Geochemical Source Term Update). However, during the closure phase, current studies suggest that acidic conditions may occur. The proposed ML/ARD Management Plan will inform the scope of the ML/ARD monitoring and mitigation measures to be adopted during the operational and closure phases of the Project. The Plan will outline geochemical test work to be conducted during the construction and the operational mining phases.

The scope of the ML/ARD Management Plan for the pre-mining phase will fill in gaps and reduce uncertainties identified in the initial geochemical characterization work as presented in Appendix E.3. The results from this ML/ARD Management Plan will further be used to inform the submission of the NSE Industrial Approval Application. The scope of work addressed in this Plan will comprise, but not limited to, the following:

- Tailings testing consisting of static characterization of Beaver Dam tailings samples as part of an overall metallurgical testing program when undertaken. This work will be used to assess whether the use of Touquoy tailings as a geochemical surrogate for Beaver Dam tailings is valid.
- Based on the results of the above, kinetic testwork including humidity cells and/or saturated columns may be conducted on Beaver Dam tailings.
- Confirmation sampling and additional static testing of samples collected from deeper till horizons.
- Collection of additional (non-surface) haul road samples to increase spatial coverage and confidence in material geology and geochemistry.
- Collection of naturally oxidized, high-sulphide sample(s) for kinetic testwork and assessment of pH and metal leaching potential of this material under acidic conditions.
- Incorporation of available static test results into geological/geochemical block model that can be used to refine the PAG versus NPAG waste rock tonnages for the deposit.

The results of the pre-mining geochemical characterization will also be used to inform the operations phase ML/ARD Management Plan (Appendix E.5), which consists of the following:

- Definition of geochemical analyses required for the classification or environmental rock types.
- Derivation of proxies and criteria to classify PAG versus NPAG materials rapidly on site.

- Definition of optimum sampling frequency of waste rock, ore, tailings and overburden throughout the life of mine based on the observed geochemical variability.
- Definition of criteria distinguishing construction from non-construction materials.
- Development of material handling and ARD prevention/mitigation strategies.

The implementation of the above ML/ARD Management Plan (Appendix E.5) will confirm whether acidic conditions can be anticipated during the active closure phase as well as the timeframe when this will occur. Moreover, this plan will inform the adoption of appropriate mitigation to be applied (refer to Section 6.5.8 for mitigation measures).

6.5.7 Project Activities Interactions and Effects

6.5.7.1 Overview of Potential Project Interactions

The purpose of this section is to identify how the Geology, Soil and Sediment Quality VCs may be affected by with the Project's components and activities (Tables 6.5-7 to 6.5-9). The Project is part of the Moose River Consolidated (MRC) Project, which includes the existing and fully permitted Touquoy Gold Project, located in Moose River Gold Mines, Nova Scotia. The Project will operate as a satellite surface mine to the MRC Project, and crushed ore from the will be transported by truck via the Haul Road to the existing and fully permitted Touquoy Mine.

Geology, Soils, and Sediment Quality represent physical components of the natural environment; changes related to Geology, Soils and Sediment Quality VCs provided in the subsequent sections are to support the Effects Assessment on water quality, wetlands, and fish and fish habitat (Sections 6.7, 6.8, and 6.9).

Project effects to Geology are here constrained by the ML/ARD assessment and geochemical characterizations programs; these results (Section 6.5.6.3) informed predictive water quality modelling and the Surface Water Quality and Quantity Effects Assessment (Section 6.7). The goals were to remove as much subjectivity as possible from the assessment and to increase certainty in the predictions of alteration of the Surface Water VC, residual effects, and the determination of significance to ensure a robust, transparent, and defensible approach to the effects assessment.

Changes to soil and sediment quality that have neutral or beneficial effects on soil or sediment characteristics. Examples of this include increases in productivity (such as mixing of organic material with surface horizons or addition of nutrients through dust deposition) or degradation of soil and sediment quality, caused by ML/ARD processes. Soil and Sediment Quality degradation may result from Project Activities causing increases in surface runoff and siltation, local soil erosion, or loss of soil structure due to disturbances such as excavation, transport.

6.5.7.2 Potential Project Interactions, Beaver Dam Mine Site

The Beaver Dam Mine Site is currently an advanced exploration site with existing conditions as described in other sections. Effects to geology, soil, and sediment caused by project activities will include the blasting in geology, materials movement of soil and geology, and changing sediment. Any anticipated effects are outlined and further discussed in related VC Sections including, groundwater, surface water, and wetlands, with further residual effects from Project activities on geology, soil, and sediment described in Section 6.5.9. All site areas used for storage of natural materials such as the Till Stockpile, Waste Rock stockpiles, LGO would be monitored throughout the life of the Beaver Dam facility as per any approval relative to operation and any approval relative to closure and reclamation plan for the Project. Surface water and groundwater monitoring programs would include

locations in proximity to areas where soils, sediment and geology (rock materials) would be disturbed so these programs would outline effects and compare them to applicable guidelines.

Table 6.5-7: Potential Soils and Sediment Interactions with Project Activities at the Beaver Dam Mine Site

Project Phase	Duration	Relevant Project Activity
Construction	1 year	• Clearing, grubbing, and grading in preparation of construction • Rock blasting in preparation of transport and storage • Till, historical tailings and waste rock from site preparation transport and storage • Existing settling pond dewatering in preparation of construction • Watercourse and wetland alteration in preparation of construction • Mine Site road construction • Surface infrastructure installation and construction • Collection and settling pond construction
Operations and Maintenance	5 years	• Rock blasting to access and extract ore • Mine dewatering of facilitate access to and extraction of ore • Management of waste rock produced from crushing and preparing ore for transport • Surface Water Management
Active Closure	2 years	• Infrastructure demolition • Site reclamation activities
Post-closure	10+ years (monitoring)	N/A

Note: N/A = not applicable.

6.5.7.3 Potential Project Interactions, Haul Road

The baseline conditions along the Haul Road have been previously described and consist of existing forestry type roads of varying widths, surfaces and conditions. With the upgrades of the Haul Road, there are anticipated activities that have the potential to affect geology, soil, and sediment anticipated to be caused through activities as outlined on the table above. Surface water and sediment monitoring programs would include locations in proximity to areas where geology (rock materials), soils, and sediment quality would be disturbed as part of road upgrades so these programs would outline effects and compare them to applicable guidelines. During Active Closure of the Haul Road it is not expected as either option would be returned to the owner(s) for forestry industry activities.

Table 6.5-8: Potential Soils and Sediment Interactions with Project Activities along Haul Road

Project Phase	Duration	Relevant Project Activity
Construction	1 year	• Clearing, grubbing, and grading in preparation of construction • Rock blasting in preparation of transport and storage • Till and waste rock from site preparation transport and storage • Watercourse and wetland alteration in preparation of construction • Haul Road upgrades
Operations and Maintenance	5 years	• Ore transport • Haul Rock maintenance
Active Closure	2 years	• N/A[(a)]
Post-closure	10+ years (monitoring)	• N/A

Note: [(a)] Decommissioning and Reclamation of the Haul Road is not expected. The Haul Road will be returned to owner for forestry Industry. N/A = not applicable.

6.5.7.4 Potential Project Interactions, Touquoy Mine Site

The Touquoy facility is currently in operation. There are no effects to geology, soil, and sediment anticipated to be caused by the processing of ore and the management of tailings (exhausted pit) from the Project at the Touquoy Mine Site. The use of the Touquoy facility for the processing of Beaver Dam ore will not involve construction or operation at the Touquoy Mine Site or use of the Tailings Management Facility; therefore, no effects are anticipated at the Touquoy facility related to the processing of Beaver Dam ore, with the exception of the continued potential for accidents and malfunctions and continued environmental monitoring. The waste rock stockpile will continue to be monitored throughout the life of the Touquoy Mine Site as per the approved closure and reclamation plan for the Touquoy Mine; this facility will not be used as part of the Project.

Table 6.5-9: Potential Soils and Sediment Interactions with Project Activities at Touquoy Mine Site

Project Phase	Duration	Relevant Project Activity
Construction	1 year	• Tailings pipeline, make-up water pipeline alteration, and relocation of reclaim infrastructure
Operations and Maintenance	5 years	• N/A
Active Closure	2 years	• Decommissioning and reclamation activities
Post-closure	10+ years (monitoring)	• N/A

Note: N/A = not applicable.

6.5.8 Mitigation

Design and operation of sedimentation and erosion controls, as well as waste and water management infrastructure, represents a key aspect of planned mitigation and management activities for the Project to mitigate potential effects to Geology, Soils, and Sediment Quality VC. Geology, Soils, and Sediment Quality represent physical components of the natural environment; changes related to Geology, Soils and Sediment Quality VCs described here informed the Effects Assessment on Surface Water, Wetlands, and Fish and Fish habitat (Sections 6.7, 6.8, and 6.9). As such, fulsome discussion of proposed mitigation and management measures are presented Surface Water (Section 6.7.9), Wetlands (Section 6.8.8), and Fish and Fish Habitat (Section 6.9.8). A summary of the most salient aspects specific to Geology, Soils and Sediment Quality VCs are presented in this section and summarized in Table 6.5-10.

Table 6.5-10: Summary of Mitigation for Geology, Soils, and Sediment Quality

Project Phase	Mitigation Measure
C, O, CL	Use of the following routine controls, as needed: • Silt fences • Silt curtains • Riprap • Check dams • Settling ponds
C, O, CL	Segregate and manage waste rock with the potential for acid generation
C, O	Implement Erosion and Sediment Control Plan
C, O	Secure overburden stockpiles using a combination of mulching, hydroseeding, and slope stabilization
C, O, CL	Limit exposed soil
CL	Use soil and organics stockpiles for final capping and stabilization. Hydroseed as required

Note: C = construction; O = operations; CL = active closure.

Geology and Soils

Geology and soils outside the disturbed areas at the sites have no potential for generating impacts and are therefore not part of any mitigation or monitoring program. Soils, excluding historic tailings will be stored in temporary stockpiles and at active closure used for reclamation. Historic tailings will be transported off site and disposed of in the Touquoy mined out pit. Therefore, there is no need for mitigation or compensation measures, or for monitoring of site soils.

Soil Erosion and Sedimentation

A draft Erosion and Sediment Control Plan (Appendix C of Appendix P.4 Mine Water Management Plan) will be implemented during construction and operation to mitigate the release of sediment from the mine site to the receiving surface water systems. A draft Erosion and Sediment Plan is included in Appendix C of Appendix P.4.

General strategies for erosion prevention are:

- minimizing clearing and grubbing dimensions during construction activities;
- controlling and directing runoff from disturbed areas by grading slopes and ditching;
- re-vegetating disturbed areas;
- limiting the length and steepness of bare, exposed slopes to minimize runoff energy;
- applying appropriate surface drainage techniques (e.g., ditch blocks, ditch surface lining, and rip-rap);
- stabilizing water diversion channels and ditches and protecting channel banks with rocks, gabions, or fibre mats; and
- protecting disturbed areas from water erosion and collecting surface water from disturbed areas for treatment, if required, to meet discharge standards prior to release.

Where soil erosion may still occur despite preventative measures, sediment control strategies may be implemented to capture sediments before they are released to the receiving environment. Sediment control measures may include installation of, for example:

- silt fences;
- weed-free straw bales;
- check dams;
- fabric-covered triangular dikes;
- gravel or sand-filled burlap bags;
- sedimentation ponds; and
- rip-rap along channels and ditches.

Sediment Quality

Sediment is a valued part of aquatic habitats and needs to be afforded the protection from new inputs of potential impacts (suspended solids, elevated metals) that can affect invertebrates and other aspects of the aquatic environments dependent on invertebrates such as fish species for example. Fulsome discussion of mitigation specific to aquatic habitats (i.e., wetlands and fish and fish habitat) are provided in Sections 6.8 and 6.9.

6.5.9 Residual Effects and Significance

Table 6.5-11 presents a summary of the assessment of potential environmental effects on Geology, Soil and Sediment Quality VC. The assessment of residual effects incorporated mitigation and management plans for Project effects as described in Appendix P.4. However, the proposed mitigation cannot eliminate the Project-related residual effects, and the following residual effects were identified:

- change in soil and sediment quality via migration of contaminants via dust deposition and runoff events, including ML/ARD interactions; and
- change soil and sediment quality as a result of slope destabilization and road widening activities associated with Haul Road construction.

Significant residual effects for Geology, Soils and Sediment Quality are not anticipated at any of the PA components (Beaver Dam Mine Site, Touquoy Mine Site [Beaver Dam Mine Site ore processing], or Haul Road) for the following reasons, with consideration of the ecological and social context of the LAA surrounding the Project:

- During Construction: Changes are restricted to a small footprint in the broader ecological and social context of the LAA.
- During Operations: Changes are restricted to a small footprint in the broader ecological and social context of the LAA.
- During Closure: Changes are limited in footprint and the landscape returns to near baseline conditions.

Project effects to Geology are here constrained by the ML/ARD assessment and geochemical characterizations programs; these results (Section 6.5.6.3) informed predictive water quality modelling and the Surface Water Quantity and Quality Effects Assessment (Section 6.7); residual effects relevant to Geology VC are thus described in Section 6.7.9 (Residual Effects to Surface Water).

The soils and sediments in the Beaver Dam Mine Site, some areas of the Haul Road and the soils are currently disturbed in many areas as well. Overburden and soils will be stored temporarily for future reclamation use and some overburden will be reclaimed in its stored location at the Beaver Dam Mine Site. Soils and materials not used in construction along any Haul Road option would be stored and remediated, as necessary, in a manner that is permanent with no residual impacts predicted.

Sediment has the potential for changes that have possible effects in the short-term mitigation and monitoring programs have been designed to outline (if they actually occur) and avoid and monitor any identified long-term residual impacts.

Table 6.5-11: Residual Effects for Geology, Soils, and Sediment Quality

Project - VC Interactions	Mitigation and Compensation Measures	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction and Operation – Beaver Dam Mine Site (exposure of acid generating material, impacted soil/sediment through migration of contaminants via dust deposition and runoff events.)	Select removal of impacted materials, wet dust suppression controls, hardened surfaces where practical, covering of haul trucks to reduce dust during transportation, vehicle speed reduction to minimize dust, spill preparedness. reclaiming/spreading stockpiles, soil/sediment quality,	L Minor changes from baseline conditions	LAA Potential adverse effects to soil/sediment quality and quantity outside the PA	A Seasonal aspects may affect VC (i.e., wind)	LT Effects may extend beyond 3 years	S Effects occur at irregular intervals throughout the Project	IR VC will not recover to baseline conditions	Soil and sediment quality, increased dust impact (i.e., flora and fauna/habitat, human health, etc.)	Not significant
Construction and Operational – Haul Road (Haul Road widening and construction, trucking activity, and sediment quality impacts through migration of contaminants via dust deposition and runoff events.	Slope stabilization, sediment and erosion control, best management practices, spill preparedness. reclaiming/spreading stockpiles, soil/sediment quality	L Minor changes from baseline conditions	PA Potential adverse effects confined to the PA	N/A VC is not expected to be affected by timing	MT Effects can occur beyond 12 months and up to 3 years	O Potential effects to occur once during the construction phase	R Sediment Quality will recover to baseline conditions after cessation of activities/ closure of the mine IR Soil under the footprint of the road will be lost.	Erosion, soil and sediment quality	Not significant
Operational – Touquoy Mine Site (soil/sediment quality)	Covering of haul trucks to reduce dust during transportation onsite, vehicle speed reduction to minimize dust onsite. reclaiming/spreading stockpiles, soil/sediment quality	L Minor changes from baseline conditions	LAA Potential adverse effects to soil/sediment quality and quantity outside the PA	A Seasonal aspects may affect VC (i.e., wind)	LT Effects may extend beyond 3 years	S Effects occur at irregular intervals throughout the Project	R Soil Sediment Quality will recover to existing conditions after cessation of activities/ closure of the mine	Soil and sediment quality, increased dust impact (i.e., flora and fauna/habitat, human health, etc.)	Not significant

Notes: See Section 5.11, Table 5.11-1 for definitions of the below characteristics.

Magnitude		Geographic Extent		Timing		Duration		Frequency		Reversibility	
N	Negligible	PA	Project Area	N/A	Not Applicable	ST	Short-Term	O	Once	R	Reversible
L	Low	LAA	Local Assessment Area	A	Applicable	MT	Medium-Term	S	Sporadic	IR	Irreversible
M	Moderate	RAA	Regional Assessment Area			LT	Long-Term	R	Regular	PR	Partially Reversible
H	High					P	Permanent	C	Continuous		

6.5.10 Proposed Compliance and Effects Monitoring Program

Monitoring will be completed to verify the predicted environmental effects and the effectiveness of the mitigation measures for Geology, Soils and Sediment Quality VC. Monitoring will occur outlined in the following plans:

- Erosion and Sediment Control Plan (Appendix C of the Appendix P.4 Mine Water Management Plan);
- ML/ARD Mitigation and Monitoring Plan (Appendix E.5); and
- Mine Water Management Plan (Appendix P.4).

Management and monitoring plans represent living documents and will be developed through regulatory permitting, as well as public and Mi'kmaw engagement.

6.6 Groundwater Quality and Quantity

6.6.1 Introduction

6.6.1.1 Summary of Groundwater Quality and Quantity Before the Updates

The Beaver Dam Mine hydrogeology consists of a fractured rock aquifer system which is overlain by a thin aquifer in the till. Based on previous studies of the hydrogeology of this deposit and others in the area, the degree of hydraulic connection amongst the smaller bedrock fracture systems is likely poor to moderate, and the main zones that are capable of storing and transmitting relatively large amounts of groundwater are the larger scale faults. The water table is close to the surface across the mine site, reflecting flat lying terrain, low permeability bedrock and the excess of annual rainfall over evaporation. The bedrock sequence and part of the overlying tills will be saturated with groundwater under ambient conditions.

The historic and recent data (collected up to 2018) from the site describes physical hydrogeology of the site and interactions that were examined as part of the groundwater Valued Component (VC). Modeling results contributed to an assessment of surface water quantities (i.e., baseflow and water levels) and potential impacts to wetlands. An evaluation of impacts to potable water in the vicinity of the mine site was undertaken and determined to be not significant.

Groundwater at the Touquoy Mine was assessed to evaluation potential impacts from the deposition of tailings in the mined-out pit. A series of geotechnical/hydrogeological drill holes were sampled at the Touquoy Mine Site for groundwater quality). Samples were analyzed for general chemistry and metals at this time. Since 2016, groundwater monitoring has been ongoing at the Touquoy Mine Site as per regulatory requirements (32 pairs of wells). Results indicate that the groundwater is slightly basic with an elevated hardness. Certain metals such as aluminum, arsenic, manganese, strontium and zinc are elevated relative to guidelines for drinking water in Canada but within ranges found in groundwater in Nova Scotia. The groundwater assessment concluded that there would be no impact to the Moose River resulting from tailings deposition.

6.6.1.2 Summary of Updates to Groundwater Quality and Quantity

The groundwater assessment for the Beaver Dam Mine Site has been updated to reflect additional hydrogeologic data collected since the Revised 2019 EIS (AMNS 2019), updates to Project layout, additional Contaminant of Concern (COC) source terms and comparison of predicted COC concentrations in groundwater to NSE Tier 1 EQS for potable groundwater, GCDWQ or NSE Tier 2 PSS for groundwater discharge to surface water (>10 m) (Section 6.6.7.1) and in response to Round 2, Information Requests (IR2s) from the Impact Agency of Canada (IAAC; formerly the Canadian Environmental Assessment Agency [CEAA 2019]) and Nova Scotia Environment (NSE 2019). Responses to theses IR2s include: CEAA-2-35, NSE-2-2, NSE-2-35, NSE-2-135, NSE-2-145, NSE-2-150, NSE-2-166.

The hydrogeological model has been updated to address IR2s and provide additional details on groundwater predictions. The maximum, not average, simulated concentrations in groundwater discharge are used to evaluate potential health risks from the consumption of surface and/or groundwater that may be impacted by mining activities. In response to IR2 CEAA-2-41, only advection and dispersion were considered for contaminant transport to provide a conservative bias for predicted COC concentrations, which is discussed in Sections 7.1.5.1 and 7.1.5.2 of Appendix F.5 (Hydrogeologic Modelling Report). The Post-closure (PC) transport simulations were run for 500 years to approximate a steady-state condition thereby simulating the maximum extent and concentration of potential COCs. For End-of-Mine (EOM), it is assumed the EOM COC sources will persist for approximately double the predicted duration to provide a further conservative bias towards simulating the maximum extent and concentration of potential COCs.

Groundwater drawdown predictions were updated to include cross-sections through the Beaver Dam open pit showing simulated drawdown (Figures 7.4a through 7.6b in Appendix F.5 [Hydrogeologic Modelling Report]). Updates in predicted drawdown from 2019 is attributed to changes in proposed site infrastructure. In general, there was a greater amount of simulated drawdown south of the pit in the 2019 that related to the proposed unlined surface water management ditches surrounding an eastern waste rock pile. The eastern waste rock pile had been removed therefore, the simulated drawdown south of the proposed pit decreased as there was no proposed infrastructure in that area. The simulated drawdown north of the proposed pit is similar between the 2019 and 2021 EIS. During PC, a greater amount of drawdown is simulated in the vicinity of the PAG waste rock stockpile due to the proposed engineer cover that will limit infiltration over the PAG waste rock stockpile.

A seepage face is also simulated along the pit walls at depth and porosity assessment are provided to evaluate potential impacts to overall water balance including inputs to changes in baseflow in the Cameron Flowage/Killag River at EOM and PC (i.e., responses to IR2s CEAA-2-14, CEAA-2-41, CEAA-2-42, NSE-2-162, NSE-2-163, NSE-2-190). The estimated total average annual flow in Cameron Flowage is 103,881 cubic metres per day (m^3/d). The estimated average annual baseflow for Cameron Flowage is 23,426 m^3/d, which is approximately 23% of the total average annual flow (Section 6.6.4.2.1). The estimated average annual baseflow in Cameron Flowage provides a baseline condition to compare predicted baseflow at the end of mine life and post-closure (Appendix F.5). The simulated change in baseflow throughout the Cameron Flowage watershed is presented in Table 7.4 of Appendix F.5 (Hydrogeologic Modelling Report). The simulated baseflow reduction ranges from 677 to 754 m^3/d at EOM and from 446 to 620 m^3/d at PC. The range in baseflow reduction represents 2 to 3% of total baseflow in the Cameron Flowage watershed and is under 1% of the total average annual flow in Cameron Flowage (Section 6.6.4.2.1).

An updated assessment at Touquoy has been undertaken based on additional sampling as well as comparisons with NSE Tier 1 EQS for potable groundwater GCDWQ or NSE Tier 2 PSS for groundwater discharge to surface water (NSE-2-145). The updated Groundwater Flow Solute Transport Model (Appendix F.6) has been updated to included additional monitoring data (NSE-2-146) along with Moose River Accumulation Study (Appendix F.8) to assess potential impacts to Moose River from disposal of Beaver Dam Mine Tailings. The calculated mean annual baseflow in Moose River is 28,814 m^3/d, and the mean summer baseflow for 2019 and 2020 are 9,848 and 9,143 m^3/d, respectively (Section 6.6.4.2.2). As discussed, in Section 6.6.7.1, in the summer months, the dewatering of the Touquoy open pit occurs at a rate of 444 m^3/d, which is anticipated to reduce the flow in Moose River by 339 m^3/d. This accounts for approximately 1.7% of the mean summer flow at Moose River of 18,938 m^3/d at SW-2.

Table 6.6-1: Updated Subsections from the 2019 Revised Environmental Impact Statement – Groundwater Quality and Quantity

2019 Revised EIS Submission (February 28, 2019)	Updated in 2021	Corresponding 2021 EIS Update Section Number	Reason for Update
-	-	6.6.1 Introduction	• new
6.6.1 Rationale for Valued Component Selection	no	6.6.2 Rationale for Valued Component Selection	-
6.6.2 Baseline Program Methodology	yes	6.6.3 Baseline Program Methodology	• Addition of 2019 field surveys (NSE-2-33 and NSE-2-146) • Additional survey areas as a result of PA modification for infrastructure micro-sitting.
6.6.3 Baseline Conditions	Yes	6.6.4 Baseline Conditions	• Present results from 2019 field surveys: • Additional survey areas as a result of PA modification for infrastructure micro-sitting. • Response to IR2s NSE-2-33 and NSE-2-146
6.6.4 Consideration of Consultation and Engagement Results	No	6.6.5 Consideration of Engagement Results	-

Table 6.6-1: Updated Subsections from the 2019 Revised Environmental Impact Statement – Groundwater Quality and Quantity (continued)

2019 Revised EIS Submission (February 28, 2019)	Updated in 2021	Corresponding 2021 EIS Update Section Number	Reason for Update
6.6.5 Effects Assessment Methodology – **Boundaries**	Yes	6.6.6 Effects Assessment Methodology – **Boundaries**	• Adjusted PA description. • LAA was enlarged due to the modified PA. • RAA was enlarged where necessary due to the modified PA. Fauna assessment area changed to the RAA. • PA modification for infrastructure micro-sitting. • Response to IR2 CEAA-2-14
6.6.5 Effects Assessment Methodology – **Thresholds for Determination of Significance**	Yes	6.6.6 Effects Assessment Methodology – **Thresholds for Determination of Significance**	• Updated significance threshold and magnitude assessment: • Reflect changes in VC baseline conditions and improve significance assessment criteria • Response to IR2 CEAA-2-02
6.6.6 Project Activities and Groundwater Quality and Quantity Interactions and Effects	Yes	6.6.7 Project Activities/Interactions with Groundwater Quality and Quantity	• Updated based on updates to hydrogeology modelling • Comparisons with NSE Tier 1 EQS for potable groundwater GCDWQ or NSE Tier 2 PSS for groundwater discharge to surface water (NSE-2-145). • Changes to project timelines.
6.6.7 Preferred Alternative Haul Road	Yes	Section removed	• Preferred Alternative Haul Road sections and references are removed from the EIS. • Reflect changes to sensory disturbances and updates to project infrastructure and operations.
6.6.8 Mitigation and Monitoring	Yes	6.6.8 Mitigation	• Bolstered and clarified mitigation measures. • Reflects improved understanding of impacts.
6.6.9 Residual Effects and Significance	Yes	6.6.9 Residual Effects and Significance	• Updated based on field survey results and changes to significance threshold determination. • Change to magnitude determination • Reflect changes to significance threshold and magnitude assessment.
6.6.10 Proposed Compliance and Effects Monitoring Program	No	6.6.11 Proposed Compliance and Effects Monitoring Program	-

Notes: PA = Project Area; LAA = Local Assessment Area; RAA = Regional Assessment Area- = no update; IR2 = Round 2, Information Requests; CEAA = Canadian Environmental Assessment Agency; EIS = environmental impact statement. NSE Tier 1 = Nova Scotia Environment Tier 1 Environmental Quality Standard (EQS) for potable groundwater; NSE Teir 2 = Nova Scotia Environment Tier 2 Pathway Specific Standard (PSS); GCDWQ = Guidelines for Canadian Drinking Water Quality.

6.6.2 Rationale for Valued Component Selection

Groundwater quality and quantity is provincially regulated via many legislative avenues within the *Nova Scotia Environment Act* and protects ecological components, as well as the health of the general public.

Groundwater quality and quantity as a VC is centered on its potential ecological value in recharging surface water and wetlands. From a hydrological and hydrogeological perspective, the potential disconnection between bedrock aquifers and surface water in the project area may limit groundwater recharging, or being recharged, by surface water. In a mine dewatering scenario at the Beaver Dam mine site, groundwater drawdown will affect surface water quantity in Cameron Flowage/Killag or adjacent watercourses or wetlands. This groundwater drawdown is considered in base flow predictions used to assess impacts to Wetlands (Section 6.8) and Fish and Fish Habitat (Section 6.9). Groundwater quality as a component of the surface water quality is assessed in the Surface Water Quality and Quantity (Section 6.7), Wetlands (Section 6.8) and the Fish and Fish Habitat (Section 6.9) Groundwater is also assessed for the Touquoy Mine Site operation as that pit is being used for Beaver Dam Mine Site tailings deposition in the exhausted or mined-out pit. The groundwater assessment at Touquoy is focused on changes to groundwater quality and quantity as inputs to Surface Water (Section 6.7), Wetlands (Section 6.8) and Fish and Fish Habitat (Section 6.9) Groundwater quality and quantity also has a socio-economic importance due to its potential to provide potable water through drilled and dug wells. The nearest potable well is approximately 5 kilometres (km) southwest of the Beaver Dam Mine Site. Camp Kidston, that operates only in the summer months, is located 3.5 km northeast of the Touquoy Mine Site and the nearest permanent full-time residences are located approximately 5.8 km to the north of the Touquoy Mine Site along Caribou Road.

6.6.3 Baseline Program Methodology

Baseline conditions at the Beaver Dam Mine and Touquoy Mine Sites were assessed and developed as follows:

- publicly available data including well records, reports and groundwater quality and quantity data were reviewed and compiled;
- site-specific reports, and geologic cross-sections and maps developed from past drilling programs were reviewed and compiled;
- a groundwater monitoring network was installed at both Beaver Dam Mine and the Touquoy Mine to collect groundwater quality/quantity information to establish baseline conditions and to provide ongoing monitoring; and
- a numerical groundwater flow model was developed for both Beaver Dam Mine Sites and the Touquoy Mine. The numerical models were applied to simulate current baseline groundwater quantity conditions, which form the basis of comparison for predicted groundwater quantity conditions under future mining conditions.

The assembled data and groundwater monitoring networks installed at Beaver Dam and Touquoy Mine Sites are described in Section 6.6.3.1 and Section 6.6.3.2, respectively.

Baseline conditions at the Beaver Dam Mine Site have been updated in the Hydrogeologic Modelling Beaver Dam Mine Site Report (Appendix F.5) to include additional baseline sampling (Appendix F.4). A combination of changes in Project Description (Section 2) and specifically the mine layout (Section 2, Figure 2.3-2) along with additional baseline sampling have resulted to updates to the groundwater modelling predictions (Section 6.6.6.2) from the Revised 2019 EIS. The specific appendices that support the Beaver Dam Mine Groundwater Assessment include:

- Appendix F.1 Assessment of Potential Open Pit Groundwater inflows at the Beaver Dam Mine Gold Project, Nova Scotia (Peter Clifton and Associates April 2015);

- Appendix F.2 Hydrogeologic Investigation - Beaver Dam Mine, July 30, 1986 (Jacques Whitford and Associates Ltd. 1986);
- Appendix F.3 Field Activity Report Beaver Dam Mine Project – (November 8, 2018);
- Appendix F.4 Baseline Groundwater Program (Beaver Dam) Memo – (March 20, 2021);
- Appendix F.5 Hydrogeologic Modelling Beaver Dam Mine Site Report – updated modelling – (April 15, 2021); and
- Appendix F.9 Response to Information Request Nos. CEAA-2-36, CEAA-2-37, and NSE-2-130 Evaluation of Potential Impacts from Metals COCs to Groundwater and Surface Water from Dust Deposition along the Haul Road Beaver Dam Mine Project Marinette, Nova Scotia – (April 14, 2021).

Touquoy modelling has been updated based on updates to Beaver Dam Mine Project Description, production schedule and tailings. In addition, the following Touquoy supporting appendices include:

- Appendix F.6 Groundwater Flow and Solute Transport Modelling to Evaluate Disposal of Beaver Dam Tailings in Touquoy Open Pit - Beaver Dam Gold Project – (April 12, 2021);
- Appendix F.7 Touquoy Integrated Water and Tailings Management Plan - Beaver Dam Gold Project – (April 15, 2021);
- Appendix F.8 Beaver Dam Gold Project Assimilative Capacity Study of Moose River – Touquoy Pit Discharge – (April 12, 2021); and
- Appendix F.10 Simulating the Cumulative Effects of Deposition of Tailings to the Touquoy Pit – (April 8, 2021).

6.6.3.1 Beaver Dam Mine Site Baseline Program Methodology Update

The Beaver Dam Mine Site is in an area of Nova Scotia that has been well studied from a geologic and hydrogeologic perspective. Publicly available information is abundant including important studies such as Lin (1970). The Nova Scotia Well Log Database (NS Well Log Database) that contains thousands of records of wells drilled and dug in Nova Scotia was reviewed to determine the proximity and construction details for potable wells in the area of the Beaver Dam Mine Site. Data was reviewed for applicability to the Beaver Dam Mine Site geology and hydrogeology and was used in the assessment of this VC. Hydrogeological maps and cross-sections for the mine area are well characterized from past drilling programs. The stratigraphy and general hydrogeological conditions have been described in Appendix F.5 (Hydrogeologic Modelling Report).

Peter Clifton & Associates (PCA) completed a hydrogeological assessment of the Beaver Dam Mine Site (PCA, 2015). The report provides an assessment of potential groundwater inflows to the proposed open pit at the Beaver Dam Mine Site and includes a review of previous hydrogeological investigations completed at the Mine Site by Jacques Whitford and Associates Ltd. (JWA) in 1986 (JWA, 1986a) and Stantec Consulting Ltd. (Stantec) in 2014 (Stantec, 2015). The PCA (2015) and JWA (1986a) reports are included in Appendix F.1 and Appendix F.2, respectively. Additional reports reviewed for background information such as fault mapping, previous hydrogeologic evaluations, and geologic interpretations include *Assessment Report on 1987 Exploration Programme on Development License 0078* (Duncan, 1987) and *Environmental Assessment of Gold Mining Exploration, Beaver Dam, Nova Scotia* - (JWA, 1986b).

To further define baseline conditions at the Beaver Dam Mine Site, a monitoring well drilling, installation and hydrogeologic investigation program was conducted from March 29, 2018 to May 7, 2018 (Appendix F.3). In total, 49 nested monitoring wells were installed (Figure 6.6-1). At each nested location, one shallow well was drilled to intercept the water table, or the first occurrence of saturated conditions, typically encountered within the overburden above bedrock. A second monitoring well was also installed at every monitoring well nest, typically screened within shallow competent bedrock. A series of deeper bedrock wells (approximately 30 metres [m] below ground surface [bgs]) were installed at 12 locations, designed to assess more regional

groundwater flow patterns in the deeper bedrock and determine the relationship between shallow and deep bedrock groundwater flow conditions. Finally, three additional wells were installed at depths of approximately 60 m bgs to evaluate bedrock groundwater flow conditions at this greater depth near the proposed open pit mine. The drilling program is documented in the Field Activities Report for the Beaver Dam Mine Project (Appendix F.3) including the location of wells, boreholes logs, and associated hydraulic testing conducted to assess the hydraulic properties of the overburden and bedrock.

Following drilling, packer and slug tests were conducted at selected well locations to determine the hydraulic conductivity of the overburden and bedrock. Biweekly synoptic monitoring of groundwater and surface water elevations began July 5, 2018. Following the installation of transducers in monitoring well for automated recording of water levels, the manual monitoring frequency was reduced to quarterly, weather permitting. Nine quarterly rounds of water quality sampling from all newly installed monitoring wells have been completed from June 2018 to November 2020 (Section 6.7.5.2). Measured groundwater elevations and groundwater quality sample results are presented in Appendix F.4 Baseline Groundwater Program. Groundwater quality data is compared to Nova Scotia Environment (NSE) Tier 1 Environmental Quality Standard (EQS) for potable groundwater, the NSE Tier 2 Pathway Specific Standard (PSS) for groundwater discharge to surface water (>10 m) and the Guidelines for Canadian Drinking Water Quality (GCDWQ) maximum acceptable concentration. Hydraulic conductivity testing, groundwater elevation measurements, and water quality sampling results are discussed in Section 6.7.5.2.

Previous drilling programs and recent monitoring support that the Beaver Dam Mine Site hydrogeologic conditions are very similar in nature to those at the Touquoy Mine Site. This is expected as the Touquoy Mine Site is located in the same geologic formation as the Beaver Dam Mine Site. The understanding of the groundwater system at Beaver Dam Mine Site will therefore grow with the collection and analysis of data from the compliance monitoring program at the Touquoy Mine Site that has been ongoing since the spring of 2016. Data collected at the Touquoy Mine Site will be used to supplement the ongoing data collection at the Beaver Dam Mine Site. Relationships between surface water and groundwater systems at the Touquoy Mine Site will be better understood in these intervening years and this knowledge will be applied to the monitoring and data collection programs for the Beaver Dam Mine Site throughout the construction, operation, and reclamation phases. Empirical data has significant value in this situation and will be used to the fullest extent, and preferentially over modelling.

The historic and recent data from the Beaver Dam Mine Site, supplemented by data collected at the Touquoy Mine Site provides thorough picture of the physical hydrogeology of the Beaver Dam Mine Site as well as possible interactions that were examined as part of the groundwater VC. Based on the observed hydrogeologic conditions at the Beaver Dam Mine Site, a hydrogeologic conceptual site model (CSM) was developed to describe observed geologic, hydrogeologic, and hydraulic condition, including groundwater and surface water interactions. The Beaver Dam Mine Site CSM is presented in Appendix F.5 Hydrogeologic Modelling Report.

Based on the CSM, a three-dimensional (3D) numerical groundwater flow model was developed for the Beaver Dam Mine Site in accordance with British Columbia Ministry of the Environment guidelines (Wels et al., 2012). The Beaver Dam Mine Site 3D numerical groundwater flow model (Beaver Dam Model) was applied to simulated baseline groundwater quantity conditions, which provides a basis of comparison for predicted groundwater quantity conditions at end of mine life and post-closure. The Beaver Dam Model is also applied to improve understanding of hydrogeologic interactions and to simulate transport of constituents of concern (COCs) at the Beaver Dam Mine Site. Detailed documentation of the Beaver Dam Model, including background information, CSM development, model construction, model calibration, and model application is included in Appendix F.5 Hydrogeologic Modelling Report.



Paper Size ANSI B

0 180 360 540

Metres

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983 CSRS
Grid: NAD 1983 CSRS UTM Zone 20N

N

GHD

ATLANTIC MINING NS INC
BEAVER DAM GOLD PROJECT
GROUNDWATER MONITORING

MONITORING WELL LOCATIONS PRE-CONSTRUCTION (CURRENT)

Project No. **088664-60**
Revision No. **-**
Date **09/03/2021**

FIGURE 6.6-1

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Print date: 26 May 2021 - 14:09

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6.6.3.2 Touquoy Mine Site Baseline Program Methodology

PCA also completed a hydrogeological assessment of the Touquoy Mine Site (PCA, 2007). The report provides an assessment of potential groundwater inflows to the proposed open pit at the Touquoy Mine Site. The assessment used a series of geotechnical/hydrogeological drill holes that were also sampled for groundwater quality. The holes were purged using an airlift method and then sampled after fully developing and purging the wells to obtain a representative groundwater sample. The water obtained from the drill holes represents groundwater from bedrock at the site. Samples were analyzed for general chemistry and metals. Test pits were also excavated in June 2006 to evaluate groundwater flow in the till between the open pit and Moose River. Additional assessment work completed in September 2006 included a temperature survey of surface water to determine possible areas of upwelling groundwater.

JWA (2008) prepared a Groundwater Monitoring Plan as part of the Industrial Approval application for the Touquoy Mine Site. The series of 32 multi-level well pairs, proposed in the plan were installed by GHD at the Touquoy Mine Site (GHD 2016a,b), and groundwater monitoring has been ongoing at the Touquoy Mine Site to characterize the groundwater conditions in the overburden and bedrock (water levels and chemistry). The baseline groundwater conditions are described in the 2017 Annual Report of Surface Water and Groundwater Monitoring (Stantec 2018).

The historical and recent data from the site provided a thorough picture of the physical hydrogeology of the Touquoy Mine Site as well as possible interactions that were examined as part of the groundwater VC. Based on the observed hydrogeologic conditions at the Touquoy Mine Site, a hydrogeologic CSM was developed to describe groundwater and surface water interactions at the site. The CSM for the Touquoy Mine Site is presented in Appendix F.6 Groundwater Flow and Solute Transport Modelling to Evaluate Disposal of Beaver Dam Tailings in Touquoy Open Pit – Beaver Dam Gold Project.

A three-dimensional (3D) groundwater flow model was developed based on the CSM in accordance with the BC Guidelines for Groundwater Modelling to Assess Impacts of Proposed Resource Development Activities (Wels et al. 2012). The Touquoy Mine Site numerical groundwater flow model (Touquoy Model) was applied to simulate baseline groundwater quantity conditions for the disposal of the Beaver Dam tailings into the Touquoy pit. Baseline conditions correspond to the fully dewatered conditions at the end of mine life, which provide a basis of comparison for predicted groundwater quantity conditions during closure (i.e., as the Touquoy pit is filling) and post closure (i.e., after the groundwater conditions have stabilized following the filling of the Touquoy pit). The Touquoy Model is also applied to improve understanding of hydrogeologic interactions and to simulate transport of constituents of concern at the Touquoy Mine Site. Detailed documentation of the Touquoy Model, including background information, CSM development, model construction, model calibration and model application is included in Appendix F.6 Groundwater Flow and Solute Transport Modelling to Evaluate Disposal of Beaver Dam Tailings in Touquoy Open Pit – Beaver Dam Gold Project.

6.6.4 Baseline Conditions

Baseline conditions in terms of geology, hydrogeology, and groundwater quality are described in this section on a regional basis, for the PAs surrounding the Beaver Dam Mine, Haul Road and Touquoy Mine. The Beaver Dam Mine Site, Haul Road, and Touquoy Mine Site are assessed at the local scale.

6.6.4.1 Regional Baseline Conditions

The Beaver Dam Mine Site is located in a rural, sparsely populated area of Halifax County. The nearest potable well is approximately 5 km southwest from and up gradient of the Beaver Dam Mine Site. Potable wells located along Hwy 224 are a mix of drilled and dug wells based on a review of the NS Well Log Database. Some of the drilled wells in the NS Well Log Database are reported as completed in granite. Granite was encountered at one well location during the monitoring well drilling program at

the Beaver Dam Mine Site, consistent with the location of granite mapped by Nova Scotia Department of Natural Resources (NSDNR). Based on this mapping, the granite intrusion is expected to terminate approximately 100 m southwest of the proposed west waste rock pile location and granite bedrock is not anticipated beneath mine features. Therefore, regional wells completed in granite may not be representative of the hydrogeologic conditions in the fractured slates and quartzite bedrock present beneath the Beaver Dam Mine Site. Drilled wells over 60 m bgs typically intersect only one or two sets of discrete water-bearing fractures and have relatively low yields, (typically 5 to 10 litres per minute [L/min]). Static groundwater levels measured at the Beaver Dam Mine Site range from 3 to 12 m bgs.

Potable groundwater resources in the area are typically vulnerable to surface water entry and associated coliform bacteria issues, and have elevated iron and manganese concentrations (Lin, 1970). A response to IR2 CEAA-2-35 provides an assessment of groundwater discharges to surface water that has the potential to effect human health (Appendix C.2). Potable water is also addressed in IR2 NSE-2-35. Both responses are addressed in detail in Section 7.4.5 of the Hydrogeologic Modelling Report (Appendix F.5) and in Section 6.6.7. Tables 6.6-2 and 6.6-3 below summarize the water quality identified in nearby drilled and dug wells.

Table 6.6-2: Till Groundwater Analysis for Dug Well in area of Beaver Dam Mine Site

Parameter	NSE Tier 1 EQS	CDWQ Guidelines	CDWQ Source	Units	Dug Well
Sodium		200	AO	mg/L	2.0
Potassium				mg/L	0.3
Calcium				mg/L	21.0
Magnesium				mg/L	3.5
Hardness ($CaCO_3$)				mg/L	67.0
Alkalinity ($CaCO_3$)				mg/L	40.7
Sulfate		500	AO	mg/L	22.0
Chloride		250	AO	mg/L	6.4
Silica				mg/L	3.9
Orthophosphate				mg/L	<0.01
Nitrate + Nitrite				mg/L	0.12
Ammonia				mg/L	<0.5
Arsenic	0.01	0.01	MAC	mg/L	**0.04**
Iron		0.3	AO	mg/L	2.3
Manganese		0.05	AO	mg/L	0.25
Lead	0.01	0.01	MAC	mg/L	0.009
Copper		1	AO	mg/L	0.01
Zinc	5	5	AO	mg/L	0.03
Total Dissolved Solids		500	AO	mg/L	84.0
Suspended Solids				mg/L	382
Colour		15	AO	TCU	12.5
Turbidity				NTU	87
Conductivity				µmho/cm	149.0
pH		7.0 to 10.5	AO	S.U.	6.8

Notes: The Dug well was partially constructed of waste rock and the sample was turbid so it may not be representative of metals in the overburden groundwater.

NSE Tier 1 EQS = Nova Scotia Environment Tier 1 Environmental Quality Standards for Potable Groundwater (Coarse Grained Soil), Agricultural/Residential; CDWQ = Health Canada's Guidelines for Canadian Drinking Water Quality, October 2014; AO = Aesthetic Objective; MAC = Maximum Acceptable Concentration; m = metre; < = less than; mg/L = milligrams per litre; µmho/cm = micromhos per centimetre; TCU = true colour units; NTU = nephelometric turbidity units.

Red = Denotes guideline exceedance of CDWQG.

Bold = Denotes guideline exceedance of NSE Tier1 EQS.

Table 6.6-3: Bedrock Groundwater Analysis for Drilled Wells in area of Beaver Dam Mine Site

Parameter	NSE Tier 1 EQS	CDWQ Guidelines	CDWQ Source	Units	Austin Shaft 7m	Austin Shaft 17m	DDH86- 47 (flowing)[a]
Sodium		200	AO	mg/L	2.1	2.3	4.4
Potassium				mg/L	0.9	0.8	1.4
Calcium				mg/L	8.3	9.5	24.3
Magnesium				mg/L	1.0	1.1	2.0
Hardness ($CaCO_3$)				mg/L	25.0	28.3	69.0
Alkalinity ($CaCO_3$)				mg/L	20.3	23.5	69.0
Sulfate		500	AO	mg/L	8.0	8.0	7.5
Chloride	250	250	AO	mg/L	3.3	3.1	4.6
Silica				mg/L	4.8	5.2	12.0
Orthophosphate				mg/L	0.02	<0.01	0.01
Nitrate + Nitrite				mg/L	0.18	0.13	<0.5
Ammonia				mg/L	<0.05	<0.05	<0.5
Arsenic	0.01	0.01	MAC	mg/L	**0.04**	**0.04**	**0.04**
Iron		0.3	AO	mg/L	0.3	0.32	0.5
Manganese		0.05	AO	mg/L	<0.01	0.03	0.31
Lead	0.01	0.010	MAC	mg/L	<0.002	<0.002	<0.002
Copper		1	AO	mg/L	<0.01	<0.01	<0.01
Zinc	5	5	AO	mg/L	<0.01	<0.01	<0.01
Total Dissolved Solids		500	AO	mg/L	35.0	43.0	94.0
Suspended Solids				mg/L	<0.3	<0.3	0.8
Colour		15	AO	TCU	5.0	5.0	20
Turbidity				NTU	1.5	2.3	0.4
Conductivity				µmho/cm	69.00	76.00	161.0
pH		7.0 - 10.5	AO	S.U.	6.30	6.40	7.4
Aluminum		0.1	AO	mg/L	<0.05	<0.05	-
Boron	5	5	MAC	mg/L	<0.02	<0.02	-
Barium	1	1	MAC	mg/L	<0.005	<0.005	-
Beryllium	0.004			mg/L	<0.005	<0.005	-
Chromium	0.05	0.05	MAC	mg/L	<0.01	<0.01	-
Cobalt	0.01			mg/L	<0.01	<0.01	-
Nickel	0.1			mg/L	<0.02	<0.02	-
Antimony	0.006	0.006	MAC	mg/L	<0.05	<0.05	-
Selenium	0.01	0.05	MAC	mg/L	<0.1	<0.1	-
Tin	4.4			mg/L	<0.03	<0.03	-
Vanadium	0.0062			mg/L	<0.01	<0.01	-
Mercury	0.001	0.001	MAC	mg/L	<0.05	<0.05	-
Cadmium	0.005	0.005	MAC	mg/L	<0.01	<0.01	-

Notes: [a] Sample taken from exploration borehole but representative of typical bedrock groundwater of site area.

NSE Tier 1 EQS NSE Tier 1 EQS = Nova Scotia Environment Tier 1 Environmental Quality Standards for Potable Groundwater (Coarse Grained Soil), Agricultural/Residential; CDWQ = Health Canada's Guidelines for Canadian Drinking Water Quality, October 2014; AO = Aesthetic Objective; MAC = Maximum Acceptable Concentration; < = less than; m = metre; mg/L = milligrams per litre; µmho/cm = micromhos per centimetre; TCU = true colour units; NTU = nephelometric turbidity units.

Red Denotes guideline exceedance.

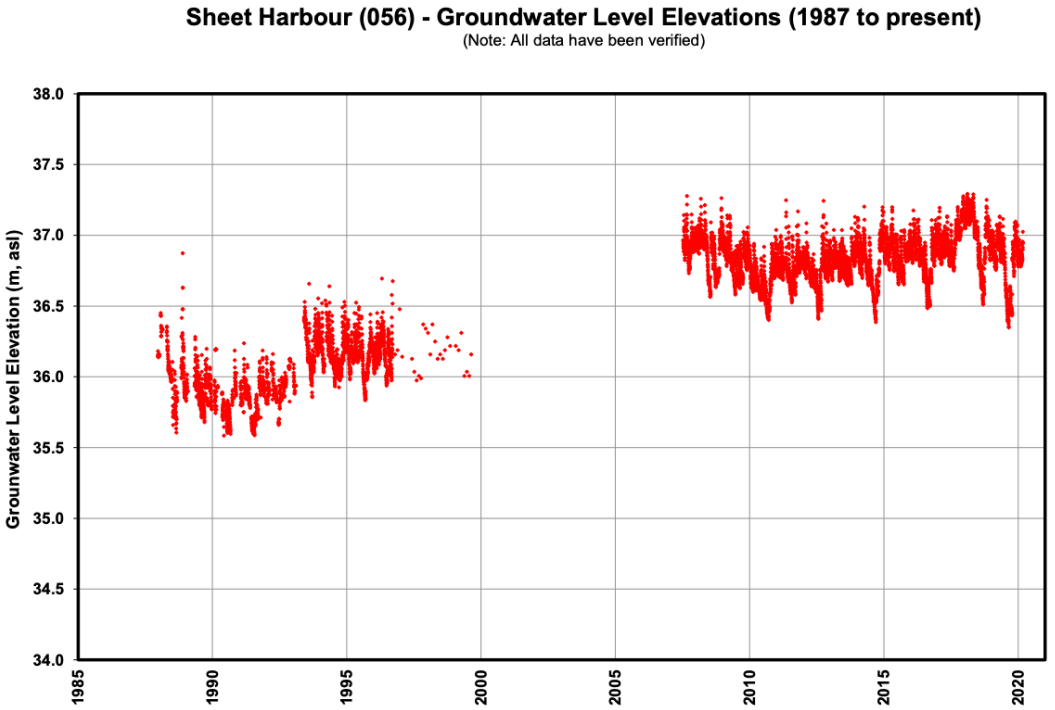
Bold Denotes guideline exceedance of NSE Tier1 EQS.

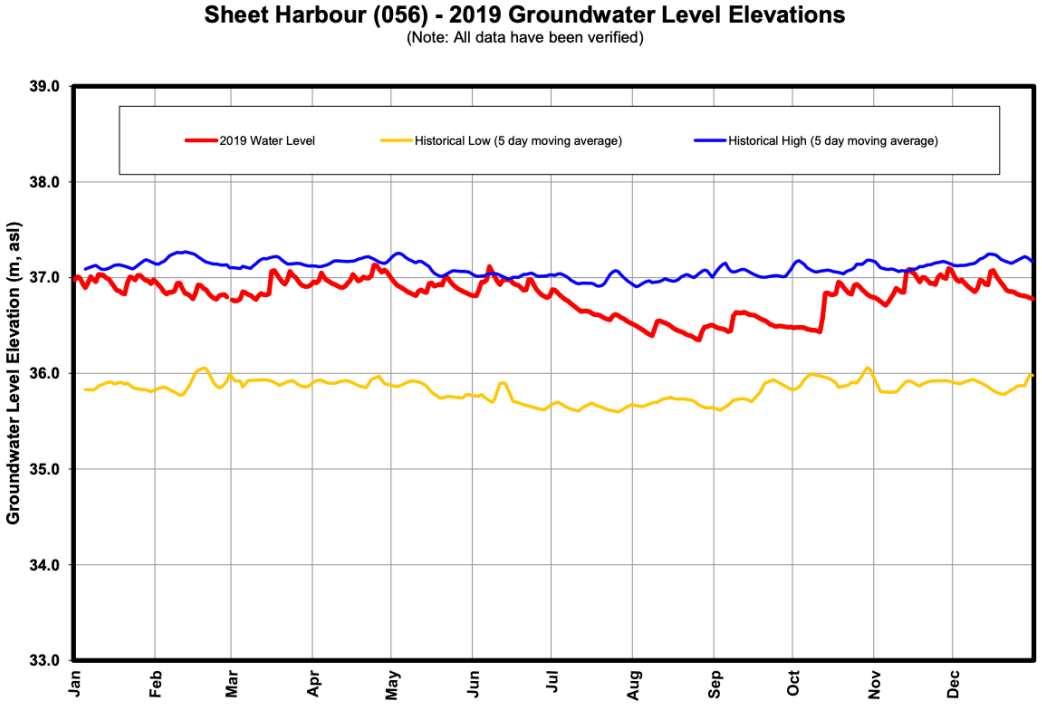
In relation to the Touquoy Mine Site, Camp Kidston, that operates only in the summer months, is located 3.5 km northeast of the Touquoy Mine Site. According to Atlantic Mining NS Inc. (AMNS), the nearest permanent full-time occupied residences are located approximately 5.8 km to the north of the Touquoy Mine Site along Caribou Road. The next closest permanent residences to the Touquoy Mine Site are approximately 7.4 km to the northwest and 11.7 km to the southeast.

A review of the Nova Scotia Groundwater Observation Well Network 2015 report (NSE 2015c) identifies that there are two regional observation wells located near the PA: one, in Sheet Harbour, and the other in Musquodoboit Harbour. This is the most recent report completed under this program. The report identifies that in general across the Province, aquifers have higher groundwater levels in the spring months and lower levels in the summer months. The typical seasonal variation in groundwater levels in Nova Scotia aquifers is usually less than 3 m. Lower groundwater levels may also be observed in February, depending on winter conditions including snowfall amounts and frost, which can limit recharge. Similar seasonal changes in groundwater levels have been observed at the Touquoy Mine Site where groundwater elevation monitoring has been ongoing since 2016. Trend analysis has not been conducted on the two nearest regional observation wells in this network due to insufficient data collected to date (less than 10 years of usable data). In general, groundwater levels have remained relatively consistent at the Musquodoboit Harbour observation well since its installation in 2008, and groundwater levels have increased by approximately 1 m in the Sheet Harbour observation well since its installation in 1987.

Figures 6.6-2 and 6.6-3 below provide a summary of the groundwater elevations observed (NSE 2020) in these two regional observation wells.

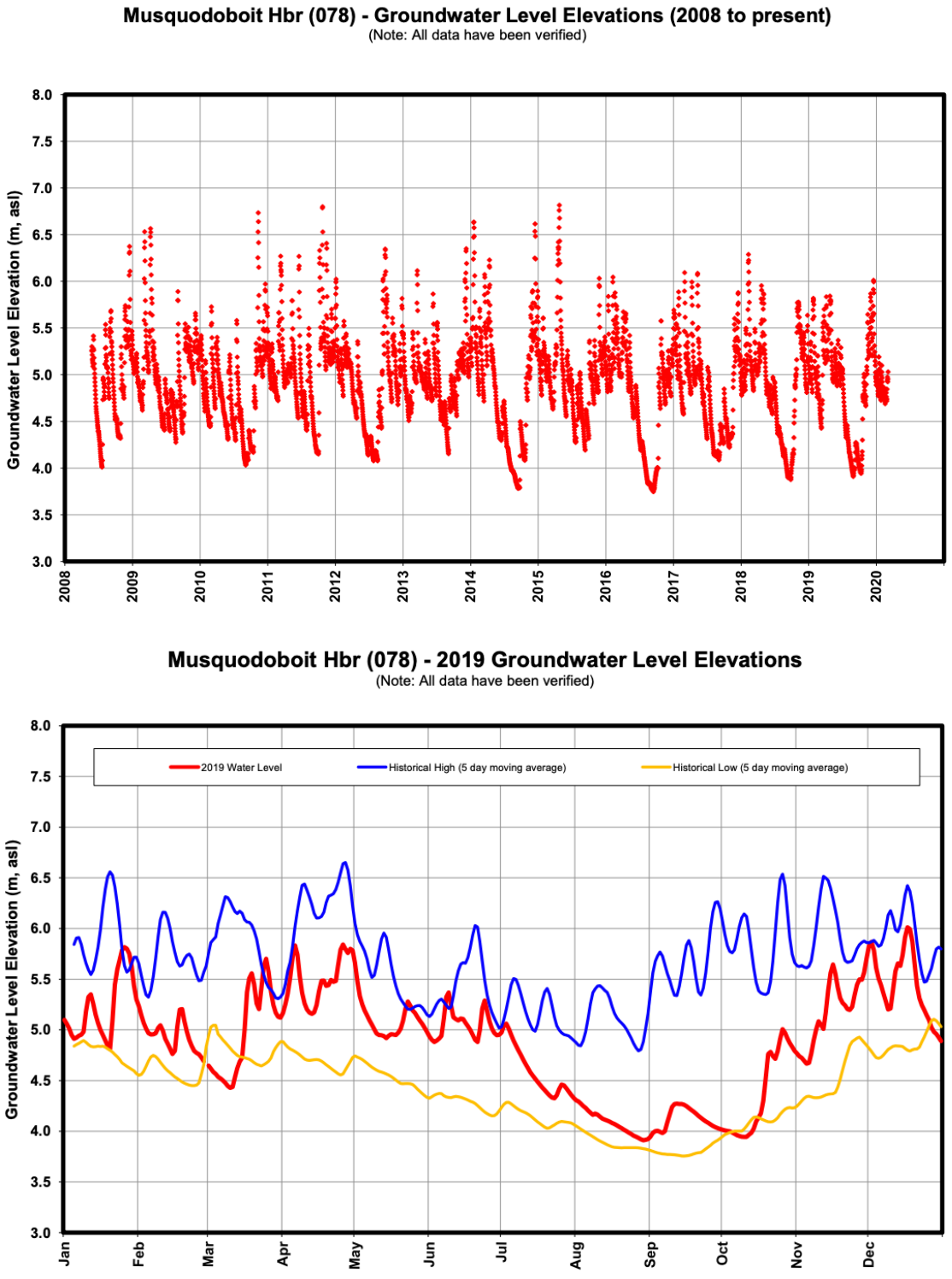
Figure 6.6-2: Summary of Groundwater Elevations Observed in Sheet Harbour Observation Well





Source: NSE (2020).

Figure 6.6-3: Summary of Groundwater Elevations Observed in Musquodoboit Harbour Observation Well



Source: NSE (2020).

6.6.4.2 Project Area Baseline Conditions

In general, the hydrogeology for the PA surrounding the Beaver Dam and Touquoy Mine Sites consists of a fractured rock aquifer system that is overlain by a thin till overburden layer. These two hydrogeologic units are present on a regional scale and extend beyond the limits of the Mine Sites. The bedrock can be subdivided into a shallow weathered fractured zone and deep fractured zone. Prior to 2018, most of the site-specific hydrogeologic data collected were focused on determining the rate of groundwater flow in bedrock for the purpose of determining pit dewatering requirements.

The till within the PA is orange brown to olive brown silty sand and gravel. It contains quartzite and slate cobbles and boulders up to 1 m in diameter. Grain size analysis indicates the till averages approximately 60% gravel, 25% sand, 15% silt, and 1% clay. Topography throughout the PA is relatively flat. Till thickness is controlled by the depth to the undulating bedrock surface and the glacial depositional environment which has left scattered drumlins located throughout the region. Till thickness ranges from 0.5 to 22 m, but typically ranges from 3 to 5 m thick.

The degree of groundwater saturation within the till varies. A series of test pits installed at the Beaver Dam Mine Site encountered groundwater at a depth of 0.6 m bgs but this was close to a bog area and may have indicated a perched water table condition. The water table was encountered at depths of 1.5 to 1.8 m bgs in several test pits, while others were terminated at bedrock at depths of up to 4 m bgs without encountering groundwater. Groundwater levels observed for the Beaver Dam Mine Site monitoring network typically vary between 2 and 5 m bgs. Groundwater flow in the till mimics the topography, with recharge occurring in elevated areas and groundwater flowing towards and discharging into surface water bodies in low-lying areas.

The till, as well as bedrock, have temporal variations in flow and static groundwater levels based on the amount of rainfall and infiltration. Groundwater levels in monitoring well locations are observed to respond quickly to precipitation events, consistent with what would be expected for systems consisting of shallow till overburden overlaying fractured bedrock. Rainfall and infiltration can be highly variable due to the local and regional weather patterns. Infiltration can be limited by both periods of frozen ground conditions and dry periods. Seepage discharge rates from the till are expected to be greatest following the spring thaw and during the early summer months.

6.6.4.2.1 Beaver Dam Mine Site Baseline Conditions

Results from the ongoing groundwater monitoring program at the Beaver Dam Mine Site indicate that the groundwater has an approximately neutral acidity (pH ranges from 5.15 to 8.31, average of 7.0) and has an elevated hardness (2.2 to 270 milligrams per litre [mg/L], average of 37 mg/L as Calcium Carbonate [$CaCO_3$]). Metals including aluminum, arsenic, total copper, iron, total lead, manganese, total silver, and zinc are naturally elevated relative to NSE PSS for GW and NSE Tier 1 EQS for potable groundwater, NSE Tier 2 PSS for groundwater discharge to surface water (>10 m) and/or GCDWQ MAC. However, these metals are within ranges typically found in groundwater throughout Nova Scotia. Groundwater analytical results for the Beaver Dam Mine Site are presented in the Baseline Groundwater Program Memo (Appendix F.4). The actual volume of groundwater stored in the bedrock aquifer is relatively small, which is reflective of relatively small primary porosity of these rocks.

JWA conducted a hydrogeological investigation at the Beaver Dam Mine Site in 1986 (JWA, 1986a) and Stantec conducted a hydrogeological investigation in 2014 (Stantec 2015). Based on the results of pumping tests and packer tests, the geometric mean (approximate median) of the hydraulic conductivity values obtained by JWA (1986a) and Stantec (2015) is relatively low at 4.5 x 10^{-8} metres per second (m/s). The results of extensive packer testing within bedrock drill holes at the Beaver Dam Mine Site did not identify any large-scale permeable zones from which high rates of groundwater seepage into an open pit could be expected. As discussed further in this section, the packer tests specifically targeted the Mud Lake Fault Zone and results indicate that the Mud Lake Fault has a hydraulic conductivity similar to the surrounding bedrock.

GHD (2018) (included as Appendix F.3 Field Activities Report) conducted further packer testing in summer 2018 at three deep drill holes installed surrounding the proposed pit location. These packer tests were conducted to better define hydraulic conductivity values surrounding the pit and better support pit inflow calculations. Each deep drill hole was tested at 10 depth intervals for a total of 30 packer tests. Hydraulic conductivity results from the packer tests range from 2.1×10^{-6} to 7.2×10^{-10} m/s with a geometric mean of 3.2×10^{-8} m/s, consistent with the previous packer test results summarized by PCA (2015). The packer test results indicate the bedrock has a low hydraulic conductivity, which is consistent with the lithology observed in diamond drillhole cores drilled at the Beaver Dam Mine Site.

The bedrock hydraulic conductivity at the Beaver Dam Mine Site generally decreases with depth. The shallow bedrock zone (referred to as the top 22 m of bedrock by JWA, 1986a) has a geometric mean hydraulic conductivity (across all packer and slug tests) of 5.6×10^{-7} m/s, while the geometric mean hydraulic conductivity of bedrock below 22 m is 2.9×10^{-8} m/s. Therefore, the amount of groundwater flow is expected to be greater in the shallow bedrock relative to the deep less permeable bedrock.

JWA (1986a) reported that during drilling completed in the 1980s at the Beaver Dam Mine Site, most of the diamond drill holes had static groundwater levels within 0.3 m of ground surface. Drill holes that penetrated the Mud Lake Fault Zone were often flowing, albeit at very low rates (less than 5 litres per minute [L/min]). This indicates an area where bedrock groundwater is discharging upward into the overlying wetland systems near the proposed open pit mine. The same observation was made by GHD (2018) (Appendix F.3 Field Activities Report) during recent fieldwork completed to evaluate groundwater/surface water interaction (Table 6.6-4), which included the installation of well points at select locations where groundwater discharge was suspected.

Based on previous studies of the hydrogeology of the bedrock formation at the Beaver Dam Mine Site and surrounding the area, the degree of hydraulic connection between smaller bedrock fracture zones is likely poor to moderate. The water table is close to the surface (typically within 2 to 5 m of ground surface) across the Beaver Dam Mine Site, reflecting flat lying terrain, low permeability bedrock, and an excess of annual rainfall beyond evapotranspiration rates. Thus, a portion of the overlying tills will be saturated with groundwater under ambient conditions.

The bedrock at the Beaver Dam Mine Site consists of three sub-parallel anticlines. The gold deposit is associated with beds that dip to the north at between 75° and 90°. The Mud Lake Fault and the Cameron Flowage Fault trend northwest near the Beaver Dam Mine Site. The Mud Lake Fault is described from drill cores as a 2 to 3 m zone of gouge within a 10 to 20 m wide brecciated zone. Locally, bedrock groundwater flows predominantly southeast along the fault trends, with flows to the northeast and east directions caused by secondary structural features. The fractures that were encountered displayed evidence of groundwater flow (iron staining) but were infrequently spaced with variable orientations.

Fracture orientation depended on location relative to the anticline (i.e., which side of the anticline) and proximity to the Mud Lake Fault.

Considering all packer testes conducted in bedrock drill holes at the Beaver Dam Mine Site (JWA 1986; Stantec 2015 and Appendix F3 Field Activities Report), bedrock hydraulic conductivity values ranged from 1.0 × 10-10 m/s to 2.1 × 10-6 m/s with a geometric mean of 3.4 × 10-8 m/s. Six packer tests were conducted at drill hole intervals that intersected the Mud Lake Fault. Hydraulic conductivity results determined from these tests ranged from 1.2 × 10-9 m/s to 1.9 × 10-6 m/s with a geometric mean of 1.2 × 10-8 m/s, which is only slightly less than the geometric mean hydraulic conductivity calculated for all packer test results. This indicates that the Mud Lake Fault is likely of similar permeability or lower permeability than the surrounding bedrock. This is consistent with the observation by JWA (1986a) that the Mud Lake Fault is infilled with clay-like gouge. Additional work undertaken by Golder Associates to assess the overall pit design is described in the Project Description (Section 2). This assessment evaluated the geotechnical stability of the pit design including potential for faults (Golder *In Progress*).

Table 6.6-4: Groundwater-Surface Water Interactions

Location ID	Description	GPS Coordinates	Rationale for Location	Results Summary	Notes
Location #1 Wellpoint and SED1	Downstream of site on Cameron Flowage	523247 4990039	To assess interaction between Cameron Flowage and local groundwater system down gradient of site	Delta of 4 cm indicates slight downward gradient from stream to groundwater system. Cameron Flowage has minor contribution to local groundwater system at this location	Inspection completed of stream bank to 100 m from well point site up-gradient and down-gradient with no seepage points noted or up-welling in stream bed obvious. Stream has bedrock exposed and cobbles with coarse sand bottom
Location #2 Wellpoint and SED2	Upstream of site, west bank of Cameron Flowage	521989 4990921	To assess interaction between Cameron Flowage and groundwater system at this location up-stream of mine area	No delta in levels inside and outside well point at this location indicating no groundwater and surface water interaction	Inspection completed of stream bank to 100 m from well point site up-gradient and down-gradient with no seepage points noted or up-welling in stream bed obvious. Stream has coarse sand and cobble substrate with minor sands
Location #3 Wellpoint and SED3	Down-gradient from planned Waste Rock Pile	521560 4990242	To assess interaction between groundwater and surface water at this location	No delta in levels inside and outside well point at this location indicating no groundwater and surface water interaction	No visible areas of discharge noted within 50 m of site up-gradient and down-gradient. Stream has gravelly cobble substrate with some silt and boulders
Location #4 Wellpoint and SED4	Down-gradient from planned Waste Rock Pile	521941 4990172	To assess interaction between groundwater and surface water at this location	Delta of 6 cm indicates slight downward gradient from stream to groundwater at this location	No visible areas of discharge noted within 40 m of site up-gradient and down-gradient. Stream has an organic substrate underlain by silty sand with some cobbles
Location #5 Wellpoint and SED5	Down-gradient from planned Waste Rock Pile	521829 4990207	To assess interaction between groundwater and surface water at this location	No delta in levels inside and outside well point at this location indicating no groundwater and surface water interaction	No visible areas of discharge noted within 50 m of site up-gradient and down-gradient. Stream has an organic substrate underlain by silty sand with some cobbles
Location #6 Wellpoint and SED6	Down-gradient from Cameron Flowage	522960 4990277	To assess interaction between groundwater and surface water at this location	Delta of 3 cm indicates slight downward gradient from stream to groundwater at this location.	No visible areas of discharge noted within 50 m of site up-gradient and down-gradient. Stream has a silt substrate with organics and some boulders
Location #7 Wellpoint and SED7	Downstream of planned facilities, ore storage, and crushing facilities	522730 4990130	To assess interaction between groundwater and surface water at this location	No delta in levels inside and outside well point at this location indicating no groundwater and surface water interaction	No visible areas of discharge noted within 60 m of site up-gradient and down-gradient. Stream has a silt substrate with minor organics and some boulders and cobbles
Location #8 Wellpoint and SED8	Downstream of planned Waste Rock Pile	522658 4989053	To assess interaction between groundwater and surface water at this location	No delta in levels inside and outside well point at this location indicating no groundwater and surface water interaction	No visible areas of discharge noted within 40 m of site up-gradient and down-gradient. Stream has a silt substrate with heavy organics and boulders, minor cobbles
Location #9 Wellpoint and SED9	Downstream of planned Waste Rock Pile	521841 4989133	To assess interaction between groundwater and surface water at this location	No delta in levels inside and outside well point at this location indicating no groundwater and surface water interaction	No visible areas of discharge noted within 50 m of site up-gradient and down-gradient. Stream has a silt substrate with organics

Notes: GPS = Global Positioning System; cm = centimetre; m = metre.

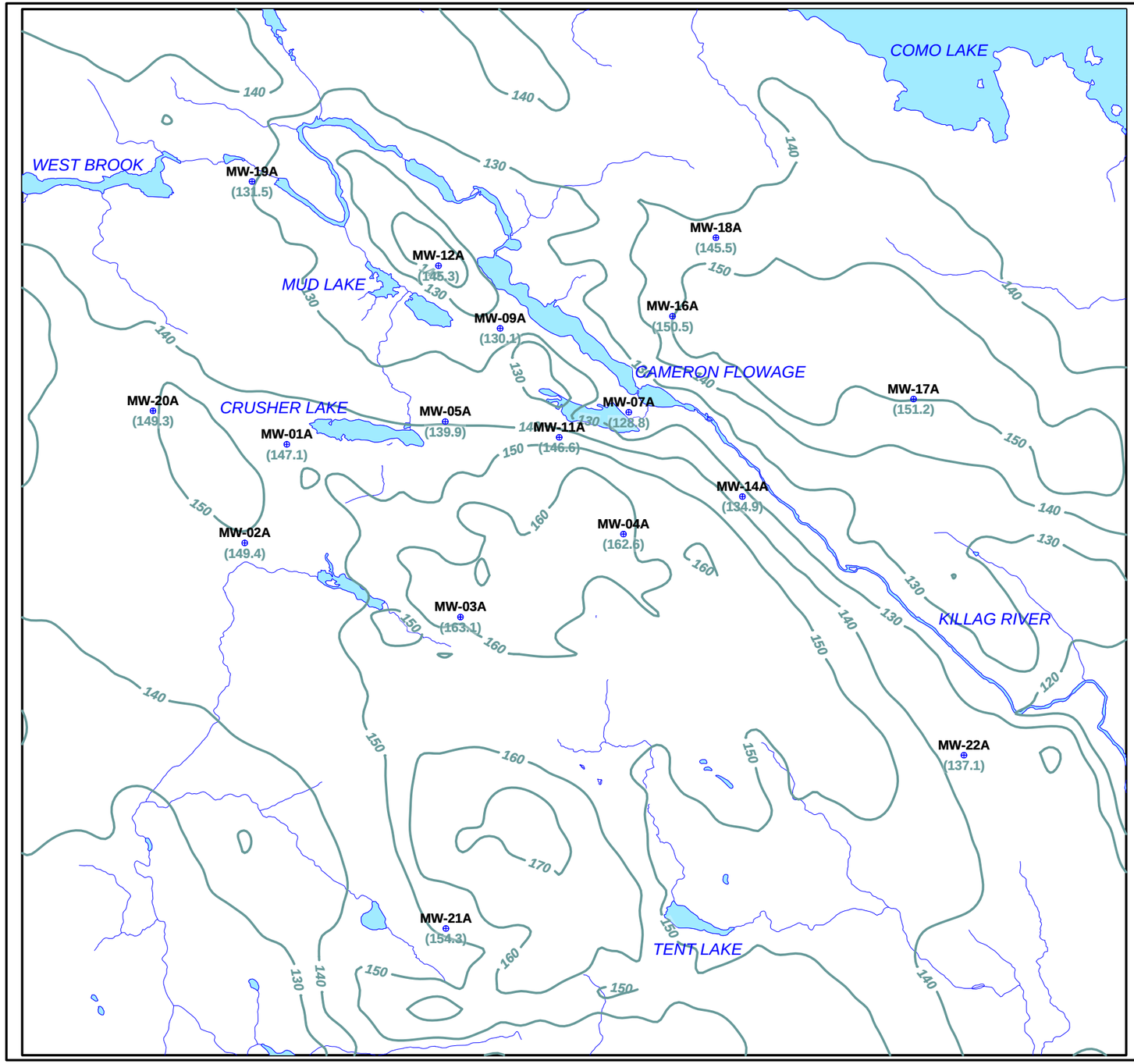
The vertical and horizontal extents of the Mud Lake Fault, defined based on exploratory drill hole records and regional fault mapping, were incorporated into the Beaver Dam Model. Through model calibration, it was determined that the best match to observed groundwater elevations was obtained by assigning a hydraulic conductivity value to the Mud Lake Fault that was lower than, or similar to, that of the surrounding bedrock. This further supports that the Mud Lake Fault has a similar hydraulic conductivity value to that of the surrounding bedrock and does not act as preferential flow path at the Beaver Dam Mine Site.

Groundwater flow at the Beaver Dam Mine Site occurs primarily in the till overburden and the shallow bedrock zone, with less flow expected within the deeper less permeable bedrock. Groundwater flow in the till overburden typically follows topographic relief, and is expected to mirror the topographic surface, with recharge occurring on the basin boundaries and uplands and discharge occurring to low-lying areas containing wetland areas and tributaries of the Killag River Watershed. Figure 6.6-4 in shows a groundwater elevation contour map based on groundwater elevations measured in the overburden on July 18, 2018. Figure 6.6-4 further demonstrates that shallow groundwater flow mirrors topographic relief and that groundwater recharge in areas of topographic highs and discharges to low-lying surface waterbodies. **PCA (2015) further states that groundwater occurs at shallow depths at the Beaver Dam Mine Site and that Cameron Flowage is a likely area of groundwater discharg**e.

Groundwater flow in the shallow weathered bedrock is controlled by secondary permeability caused by fracturing. Locally, groundwater flow in shallow bedrock is directed predominantly to the south-east along the direction of dominant fault trends, with a smaller component of groundwater flow towards the northeast and east.

The degree of hydraulic connection amongst the shallow bedrock fractures is likely poor to moderate. The volume of groundwater stored in the shallow bedrock aquifer is probably small, and this reflects the relatively small primary porosity of these rocks. Some of the larger bedrock fractures may be hydraulically connected to surface waterbodies, which may become sources of aquifer recharge under a mine dewatering scenario.

Groundwater can be expected to seep into the open pit developed at the Beaver Dam Mine Site largely through the surficial glacial till, and through fractures in the shallow bedrock. The more competent deep bedrock is not expected to contribute significant groundwater inflow to the open pit. As the pit dewatering progresses and groundwater levels in the near the open pit are lowered, a reduction in baseflow (i.e., the groundwater contribution to stream flow) may be observed in nearby water bodies (i.e., some surface water bodies ,which are presently groundwater discharge areas, may receive reduced groundwater discharge or become areas of groundwater recharge).



LEGEND

- SURFACE WATER BODY
- MW-17A ⊕ — WATER LEVEL MONITORING LOCATION
- (154.5) — OVERBURDEN GROUNDWATER ELEVATION MEASURED ON JULY 18, 2018 (m AMSL)
- — 140 — OBSERVED OVERBURDEN GROUNDWATER ELEVATION CONTOURS - JULY 18, 2018 (m AMSL)

0 200 400 600m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

OBSERVED OVERBURDEN GROUNDWATER ELEVATION CONTOURS - JULY 18, 2018

088664-031

March 18, 2021

FIGURE 6.6-4

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\RPTFigures\Figure 2.7 - Observed Overburden Groundwater Elevation Contours - July 18, 2018.srf

Both total stream flow and baseflow were estimated for Cameron Flowage through analysis and review of stream flow data collected at nearby hydrometric stations. The nearest four hydrometric stations are Pembroke River at Glenbervie, Musquodoboit River Near Upper Musquodoboit, Musquodoboit River Near Middle Musquodoboit, and Musquodoboit River at Crawford Falls, which have drainage areas of 7,330 hectares (ha), 14,100 ha, 33,400 ha, and 65,000 ha, respectively. A baseflow value was estimated for each drainage area using a recursive digital filter (Eckhardt, 2005) and scaled to the total drainage area of approximately 3,871 ha for Cameron Flowage. The estimated total average annual flow in Cameron Flowage is 103,881 cubic metres per day (m^3/d). The estimated average annual baseflow for Cameron Flowage is 23,426 m^3/d, which is approximately 23% of the total average annual flow. The estimated average annual baseflow in Cameron Flowage provides a baseline condition against which to compare predicted baseflow at the end of mine life and post-closure (Appendix F.5).

To confirm the average annual baseflow estimates, preliminary stage-discharge relationships were developed for six gauging locations using available flow monitoring measurement events and corresponding surface water elevations measured at the gauging locations. The preliminary stage-discharge relationships will be further refined as additional flow monitoring measurement events are conducted. The preliminary stage-discharge relationships were applied to estimate stream discharge (flow) at each of the six gauging locations. Two gauging locations, SW2A and SW1A, are located immediately upstream and downstream of Cameron Flowage, respectively, and were selected to verify the total flow and baseflow estimates calculated using the nearest four hydrometric stations. Consistent with the method applied for the nearest four hydrometric stations, a recursive digital filter (Eckhardt, 2005) as implemented in WHAT: Web-based Hydrograph Analysis Tool (Lim et al. 2005) was applied to the average daily discharge data for SW2A and SW1A to estimate baseflow at those gauge locations. The average annual baseflow estimated for SW2A and SW1A is 24,686 m^3/d, with an average annual total flow of 112,420 m^3/d. Based on these values, the average annual baseflow to at SW2A and SW1A represents approximately 22% of the total average annual flow at those gauge locations. **The estimated average annual baseflow at SW2A and SW1A is within approximately 5% of the estimated average annual baseflow estimated from the nearest four hydrometric station for Cameron Flowage**. This comparison verifies that the estimated average annual baseflow from the nearest four hydrometric stations is reasonable and provides an appropriate baseline conditions against which to compare the relative predicted baseflow at end of mine life and post-closure.

6.6.4.2.2 Touquoy Gold Mine Site Baseline Conditions

As identified in the Touquoy Gold Project Focus Report (CRA 2007a), the Touquoy Mine Site is located within a metamorphic bedrock hydrostratigraphic unit, cross cut by structural features (faults, anticlinal axes) that may represent separate hydrostratigraphic units. Groundwater inflows and outflows will be controlled by these relatively low permeability and fracture-controlled bedrock units. Given the high water table in the study area and combined with the high water surplus and general low permeability of the area, the groundwater flow system can be characterized as a "local" system, with topographic highs representing recharge zones that would discharge into the adjacent topographic lows. The till overburden hydrostratigraphic unit acts as a confining unit that creates non-flowing artesian conditions within the bedrock, Groundwater-surface water interaction is limited by the presence of this confining till, with flow rates controlled by the thickness, continuity and permeability of the till.

Single-well response tests conducted on wells across the Touquoy Mine Site including all of the monitoring wells installed as part of the groundwater monitoring plan (GHD, 2017a,b). The hydraulic conductivity estimates were fairly consistent across the site, in both the silty-sand till overburden (geometric mean of 1.8 × 10 -6 m/s), and in the relatively shallow bedrock (geometric mean of 1.0 × 10 -6 m/s). No differentiation of hydraulic conductivity in the bedrock was observed in wells constructed in the two dominant rock lithologies: argillite; and greywacke.

Seepage into the open pit at Touquoy from the till and bedrock was expected to range from 550 cubic metres per day (m^3/d) to 1,450 m^3/d (PCA, 2006). An additional assessment completed as part of the Touquoy Gold Project Focus Report (CRA 2007a) to

determine the potential linkage between Moose River and the local groundwater system identified that groundwater upwelling was not measured from temperature profiling conducted through the portion of Moose River that lies adjacent to the proposed Touquoy open pit. The limited linkage between the Moose River and Touquoy Pit has been confirmed to date (Appendix F.6 Groundwater Flow and Solute Transport Modelling to Evaluate Disposal of Tailings in Touquoy Open Pit) by ongoing flow monitoring at the site during operations under the Touquoy Gold Project Industrial Approval.

The presence of faults in the vicinity of the Touquoy pit have been characterized by AMNS, including water bearing faults. Water bearing faults were identified on the pit wall in the vicinity of monitoring well OPM-2A/B. The faults are typically to be saturated relative to the rock mass surrounding the faults, significant volumes of flow to the Touquoy open pit have not been observed. The hydraulic conductivity of the shallow bedrock at OPM-2B based on single-well response testing was within the range of other bedrock wells installed at the Touquoy mine site.

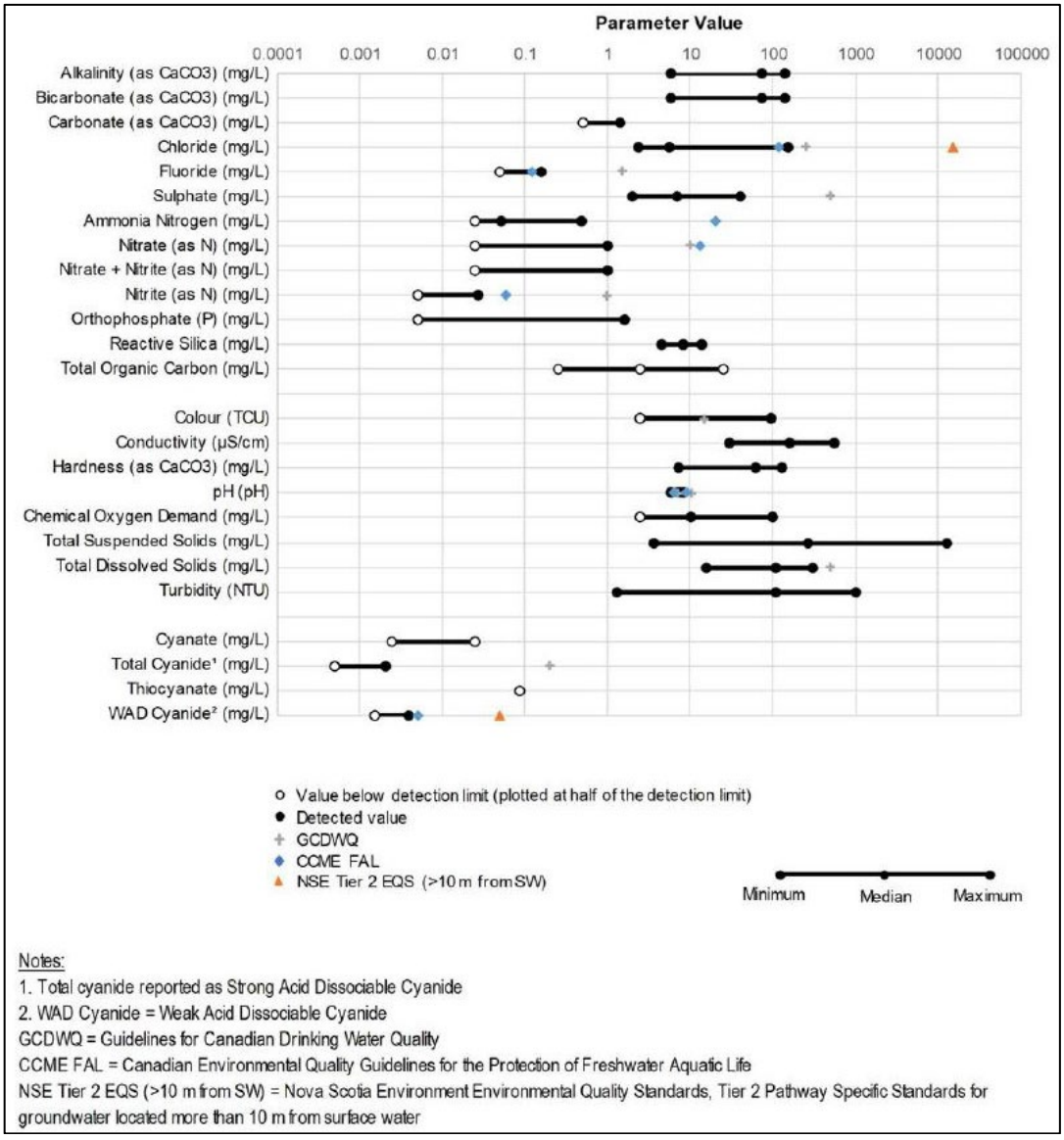
Groundwater seepage into the Touquoy open pit is largely through the surficial glacial till, and through fractures in the shallow bedrock. The more competent deep bedrock is not expected to contribute significant groundwater inflow to the open pit. As the pit dewatering progresses and groundwater levels in the vicinity of the open pit are lowered, a reduction in baseflow (i.e., the groundwater contribution to stream flow) is inferred in Moose River, although uncertainty in stream flow measurements in Moose River upstream and downstream the Touquoy site appear to overestimate the reduction in baseflow compared to the observed pit inflow rates.

Both total stream flow and baseflow were estimated for Moose River at SW-2 through analysis and review of stream flow data collected at nearby hydrometric stations. Mean annual flow in Moose River is estimated to be 1.15 m^3/s. Baseflow indices were calculated using a recursive baseflow filter implemented in the BFLOW software code (Arnold et al., 1995) for annual and monthly streamflow rates observed in Moose River at SW-2. **The mean annual baseflow index for Moose River is estimated to be 0.29, with summer baseflow indices 0.52 in 2019 and 0.34 in 2020. The calculated mean annual baseflow in Moose River is 28,814 m^3/d, and the mean summer baseflow for 2019 and 2020 are 9,848 and 9,143 m^3/d, respectively**.

6.6.4.2.3 Groundwater Quality at the Touquoy Mine Site

Baseline groundwater quality at the Touquoy Mine Site indicates that the groundwater is slightly basic (pH range 7.02 to 8.08) and an elevated hardness (45 to 160 mg/L). Groundwater quality results from samples collected near the open pit at the Touquoy Mine Site (i.e., the OPM-series wells) are summarized on Figures 6.6-5 and 6.6-6. As shown on these figures, the groundwater quality generally meets the NSE Tier 2 PSS for groundwater greater than 10 m from surface water criteria. The GCDWQ and the CCME FAL guidelines are also presented on Figures 6.6-5 and 6.6-6 for illustrative purposes, but are no discussed, as groundwater at the Touquoy Mine Site is not used as a potable water supply, and the NSE Tier 2 PSS already account for groundwater discharging to surface water bodies. The Touquoy groundwater monitoring program results (for OPM-series wells) are reported annually to NSE based on the requirements of the Industrial Approval which regulates operational activities and monitoring at the Touquoy Mine Site (Stantec 2020).

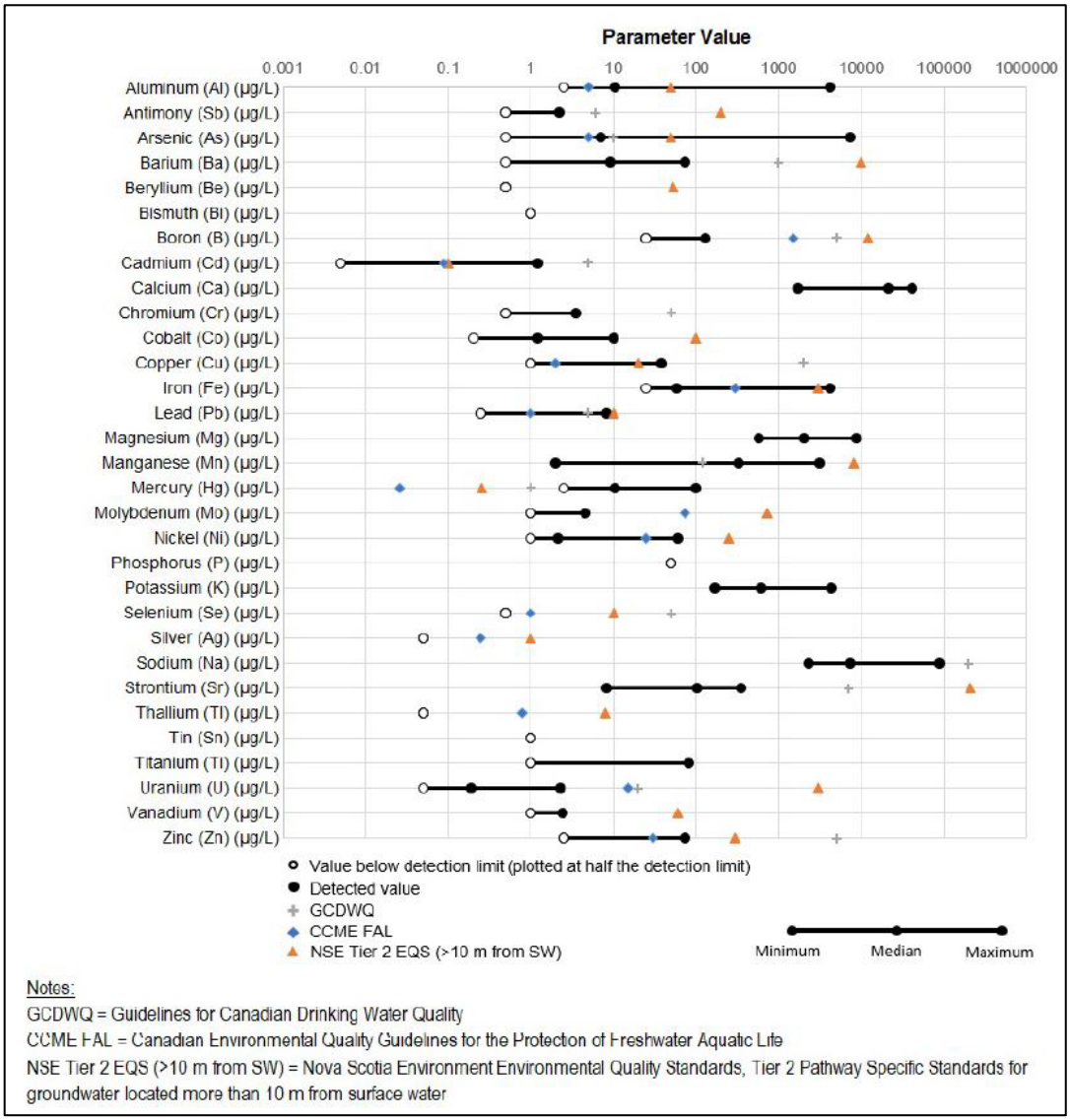
Figure 6.6-5: Summary of Groundwater Quality near the Open Pit at Touquoy Mine Site – General Chemistry and Cyanide-Related Parameters



Notes:
1. Total cyanide reported as Strong Acid Dissociable Cyanide
2. WAD Cyanide = Weak Acid Dissociable Cyanide
GCDWQ = Guidelines for Canadian Drinking Water Quality
CCME FAL = Canadian Environmental Quality Guidelines for the Protection of Freshwater Aquatic Life
NSE Tier 2 EQS (>10 m from SW) = Nova Scotia Environment Environmental Quality Standards, Tier 2 Pathway Specific Standards for groundwater located more than 10 m from surface water

Source: Stantec (2019).

Figure 6.6-6: Summary of Groundwater Quality near the Open Pit at Touquoy Mine Site – Dissolved Metals



Source: Stantec (2019).

Groundwater quality exceedances of the NSE Tier 2 PSS were noted in 2017 for aluminum, arsenic, cadmium, copper, iron, mercury, silver, and organics that were common in the 2016 baseline period, and therefore were not attributed to the operation of the mine. The development of site-specific criteria for the Mine Site should be considered to determine thresholds for water quality that consider the elevated concentrations of parameters under baseline conditions. Until such time as site-specific criteria are developed, the evaluation of potential water quality effects from the operation of the mine is based on long-term upward or downward trends in comparison to the baseline levels, and not exclusively on any exceedances of NSE EQS or PSS criteria. The current monitoring record representing operation is too short to distinguish any potential effects of the mine water quality compared to the natural variability, as operation only began in October 2017.

Arsenic was noted to consistently exceed the Tier 2 PSS at OPM-1A/B in both 2016 and 2017. These elevated arsenic concentrations are not attributed to operation and may be from historical tailings and/or the Touquoy ore body itself. A remedial action plan was completed by AMNS in 2018 that involved the delineation, removal, and management of these historical tailing piles around the open pit area.

The Groundwater Contingency Plan (Stantec 2017b) presents contingency action levels for groundwater quality around the mine for indicators of operation-related effluent impacts to groundwater compared to the baseline water quality record. However, the monitoring record for the baseline period is relatively short, therefore, as observed for the upstream surface water quality, the natural variability of groundwater quality may not have been captured in the baseline period, and therefore the action levels defined in the groundwater contingency plan may be overly conservative for evaluating potential mine effects on groundwater quality.

Single, discontinuous groundwater quality results above action levels were identified in the 2016 baseline and 2017 operating data, however, these were not attributed to mine operations, but may be the result of natural variability not captured during the baseline period. Groundwater quality will continue to be monitored closely in 2018 and will be ongoing to identify potential indicators of groundwater seepage from mine operations.

6.6.5 Consideration of Engagement Results

Key concerns raised during public and Mi'kmaq engagement relating to groundwater included potential effects on groundwater levels from open pit mining at the Beaver Dam Mine Site and potential groundwater quality impacts associated with Project activities at the both the Beaver Dam and the Touquoy Mine Sites. Concerns were specifically expressed by the Millbrook First Nation regarding effects on groundwater quality and quantity in terms of potable water wells and the health of its residents in Beaver Lake IR 17. These concerns were identified in relation to potential effects on groundwater quality from unplanned releases due to accidents and malfunctions, specifically during mine operations.

The results of the public and Mi'kmaq engagement have been considered in the environmental effects assessment, including AMNS's commitments to mitigation and monitoring measures and proposed compliance and effects monitoring programs, as well as AMNS's broader commitment to ongoing public and Mi'kmaq of Nova Scotia engagement. Specific evaluations of the potential effects on groundwater quality and quantity are presented within the following environmental effects assessment.

AMNS continued to engage with the public and Mi'Kmaq on the Beaver Dam Mine Project. The most recent engagement undertaken since the February 2021 revised EIS is provided in Section 3 and Section 4.

6.6.6 Effects Assessment Methodology Update

6.6.6.1 Boundaries

6.6.6.1.1 Spatial Boundaries

The spatial boundaries used for the assessment of effects to groundwater quality and quantity are defined below:

- The PA encompasses three primary component the Beaver Dam Mine Site, located at the end of the Beaver Dam Mines Road, the Haul Road, spans from the Beaver Dam Mine Site to Moose River Gold Mines and Touquoy Mine Site, where the Beaver Dam ore will be processed and disposed sub-aqueously in the mined out pit (Figure 6.6-7).
- The Local Assessment Area (LAA) encompasses an 800 m buffer around the PA, 800 m buffer along a portion of the Haul Road that are up-gradient of receptors, and down-gradient from the Touquoy Mine Site. The LAA is the maximum extent of direct and indirect impacts on groundwater (Figure 6.6-8).
- The Regional Assessment Area (RAA) encompasses a 6 km that includes the Tertiary Watersheds intersecting the PA and represents the maximum cumulative zone of influence and corresponds with the groundwater flow model domains (Figure 6.6-8).

As the Project has the potential to cause direct and indirect effects to groundwater outside of the PA, the LAA is the appropriate boundary for evaluation of this VC.

6.6.6.1.2 Temporal Boundaries

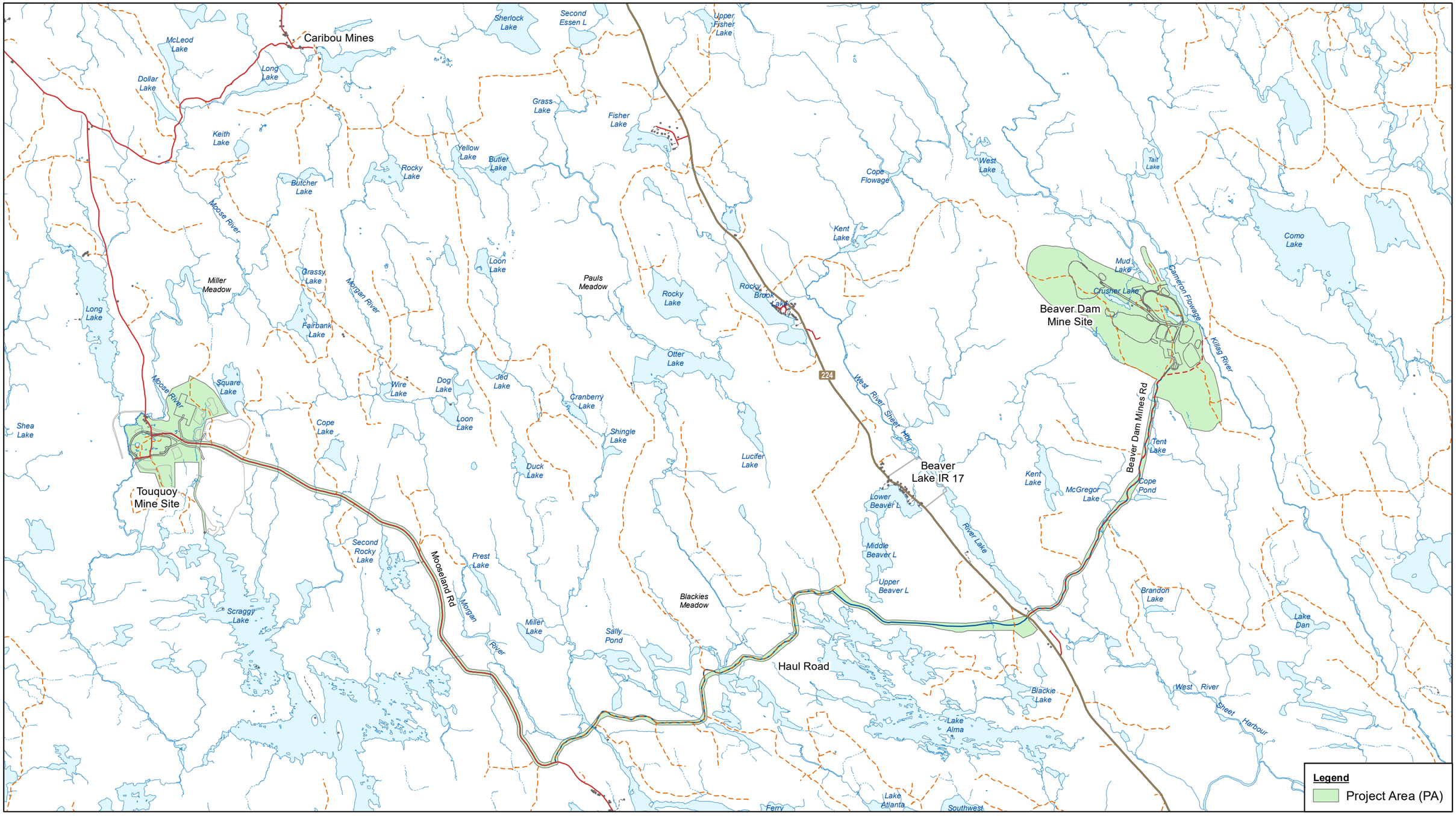
The temporal boundaries used for the assessment of effects to groundwater quality and quantity are the construction, operation, active closure/reclamation and post-closure phases.

6.6.6.1.3 Technical Boundaries

No technical boundaries were identified for the effects assessment of groundwater quality and quantity.

6.6.6.1.4 Administrative Boundaries

Groundwater Quality at the Beaver Dam Mine Site, the Touquoy Mine Site, and along the Haul Road will be compared to NSE Tier 1 EQS for potable groundwater, GCDWQ, NSE Tier 2 PSS for groundwater discharge to surface water and baseline conditions/background groundwater concentrations, where applicable. The comparison to potable groundwater quality is in recognition that the Project is occurring on crown land and although there are no current potable groundwater uses, there could be in the future. There may be other requirements for monitoring of groundwater as an outcome of the provincial approval process (i.e., Industrial Approval) that AMNS will integrate into the monitoring before the start of Beaver Dam Mine Site Project Construction. A draft Groundwater Monitoring Plan (Appendix G of Appendix P.4 Mine Water Management Plan) is provided to assess groundwater during construction, operation, active closure and post-closure of the Beaver Dam Mine Site.



Source: Service Nova Scotia

0 700 1,400 2,100
Metres

Coordinate System:
NAD 1983 CSRS UTM Zone 20N

ATLANTIC MINING NS INC
MARINETTE, HALIFAX CO., NOVA SCOTIA
ENVIRONMENTAL IMPACT STATEMENT - BEAVER DAM MINE

PROJECT AREA
GROUNDWATER

088664
May 7, 2021

FIGURE 6.6-7

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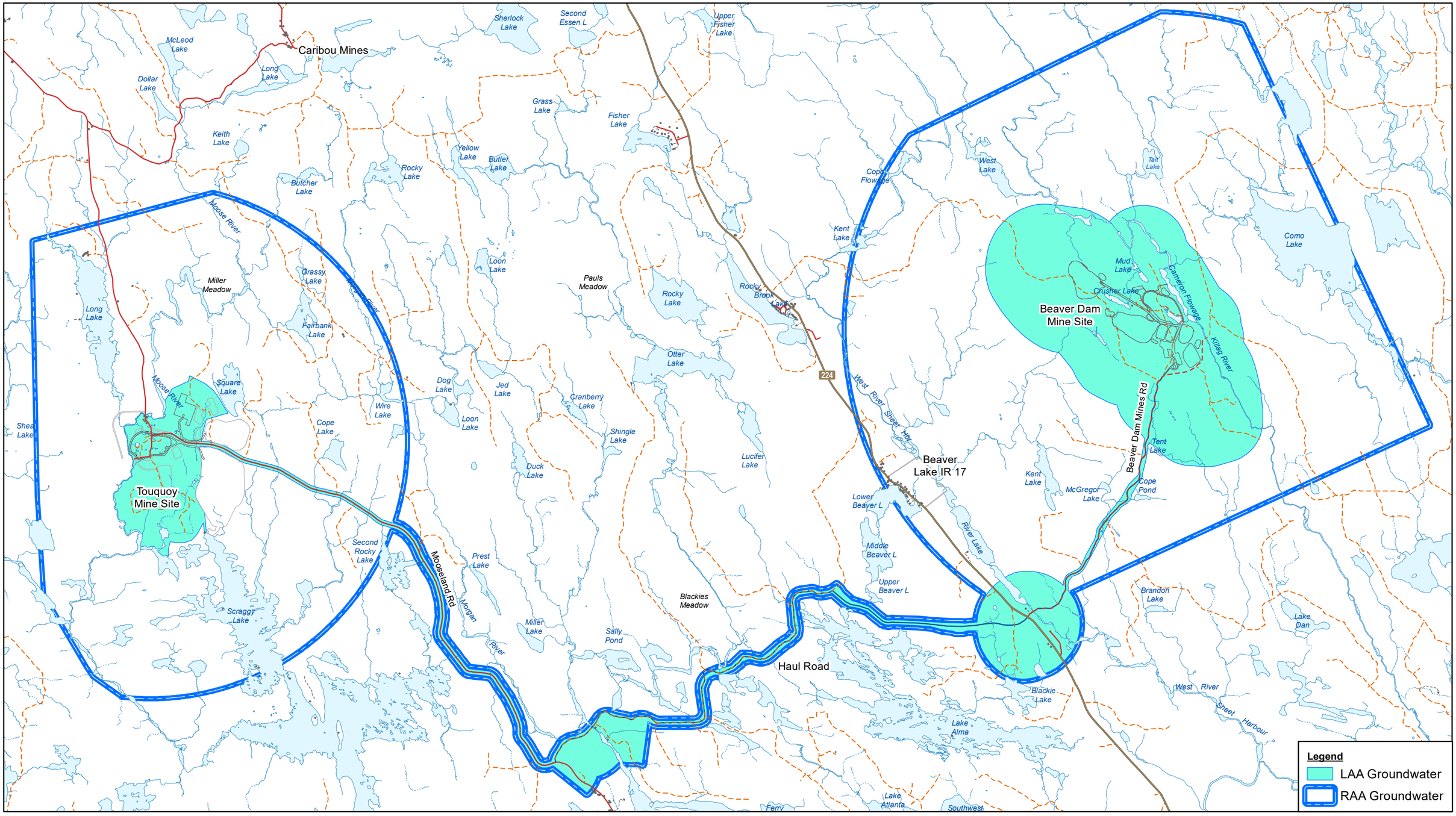

Source: Service Nova Scotia

0 700 1,400 2,100
Metres

Coordinate System:
NAD 1983 CSRS UTM Zone 20N

ATLANTIC MINING NS INC
MARINETTE, HALIFAX CO., NOVA SCOTIA
ENVIRONMENTAL IMPACT STATEMENT - BEAVER DAM MINE

LOCAL AND REGIONAL ASSESSMENT AREAS GROUNDWATER

088664
May 7, 2021

FIGURE 6.6-8

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6.6.6.2 Beaver Dam Mine Site Groundwater Modelling Methodology

A 3D groundwater flow model for the Beaver Dam Mine Site (Beaver Dam Model) was developed by GHD for the following purposes:

- To enhance the understanding of groundwater flow conditions at and surrounding the Beaver Dam Mine Site to facilitate developing a hydrogeologic CSM to use as the basis for developing the numerical groundwater flow model.
- To construct and calibrate the numerical groundwater flow model consistent with the CSM to represent observed Beaver Dam Mine Site conditions.
- To apply the calibrated groundwater flow model to evaluate potential changes in groundwater quality and quantity with respect to groundwater flow and groundwater interactions with surface water at the Beaver Dam Mine Site under End of Mine (EOM) and Post-closure (PC) conditions.

The Beaver Dam Model was based on site-specific and available regional data including surface water features, topography, water well records and geologic information. The scope of work completed by GHD to develop the Beaver Dam Model and apply the model to evaluate potential impacts to groundwater and surface water flow regimes included the following:

- Compilation, review, and interpretation of the geologic, groundwater flow, and surface water flow data available for the Beaver Dam Mine Site and surrounding area.
- Development of a 3D geologic model, a CSM, and a 3D groundwater flow model of the Beaver Dam Mine Site and surrounding area based on available regional and site-specific data. The Beaver Dam Model was calibrated under steady-state conditions and the sensitivity of the model calibration was evaluated with reference to model input parameters such as measured groundwater elevations, groundwater flow directions, and estimated baseflow.
- Application of the calibrated Beaver Dam Model to evaluate potential changes in groundwater quality and quantity with respect to groundwater flow and groundwater interactions with surface water at the Beaver Dam Mine Site under EOM and PC conditions.

The detailed methodology and results of the Beaver Dam Model are documented in the Hydrogeologic Modelling Report (Appendix F.5).

6.6.6.3 Touquoy Mine Site Groundwater Modelling Methodology

A groundwater flow and solute transport model (Appendix F.6) has been developed to evaluate:

- Evaluate the dewatering rate from the Touquoy open pit and changes in groundwater flow conditions and discharges when it is fully dewatered which will be used as the baseline conditions to assess impacts.
- Evaluate the groundwater seepage rates to the Touquoy open pit as it is filled with Beaver Dam tailings.
- Identify areas where water in contact with the Beaver Dam tailings disposed in the Touquoy open pit is discharged to the receiving environment, and the potential for surface and groundwater interactions.
- Predict the potential impacts of discharging groundwater from the Touquoy open pit to the receiving environment.

The groundwater flow model was based on site-specific and available regional data including surface water features, topography, water well records and geologic information. The scope of work completed by Stantec to develop the groundwater flow model and apply the model to evaluate potential impacts to groundwater and surface water flow regimes included the following:

- Compilation, review, and interpretation of the geologic, groundwater flow, and surface water flow data available for the Touquoy Mine Site and surrounding area.
- Development of a CSM and steady-state 3D groundwater flow model of the Touquoy Mine Site and surrounding area. The groundwater flow model was calibrated under mean annual and summer low-flow steady-state conditions and the sensitivity of the model calibration was evaluated with reference to model input parameters such as measured groundwater elevations, groundwater flow directions, and estimated baseflow.
- Application of the calibrated groundwater flow model to evaluate potential changes in groundwater quality and quantity with respect to groundwater flow and groundwater interactions with surface water at the Touquoy Mine Site under Baseline (conditions prior to the deposition of Beaver Dam tailings at the Touquoy Mine Site, in the exhausted pit), end of Operations (conditions at the end of deposition of Beaver Dam tailings at the Touquoy Mine Site, in the exhausted pit), and Post-closure conditions.

The detailed methodology and results of the groundwater flow model for the Touquoy Mine Site were documented in the Groundwater Flow and Solute Transport Modelling to Evaluate Disposal of Tailings in Touquoy Open Pit which is included in Appendix F.6.

6.6.6.4 Thresholds for Determination of Significance

In response to IAAC (CEAA 2019) IR2 CEAA-2-02, the significance determination is revised and is described in Table 6.6-5. Changes in groundwater chemistry and quantity are assessed as input or pathway to determining impacts to surface water quantity and quality (Section 6.7), wetlands (Section 6.8) and Fish and Fish Habitat (6.9) Sections

Significant adverse effect from the Project on groundwater is focused on effects to potable groundwater resources defined as an effect on groundwater quality exceeds the NSE Tier 1 EQS for potable groundwater or GCDWQ. Specifically, the predicted COC concentrations in groundwater are compared against the lower of the Tier 1 EQS for potable groundwater or GCDWQ, hereafter referred to as the 'Potable Criteria'. The residual effects of this groundwater VC are characterized using standard criteria, including magnitude, geographical extent, duration, frequency, reversibility, and context of the effect (Table 6.6-5). The residual effects assessment concludes with a determination of significance with respect to potable groundwater resources. The screening of project effects, mitigation measures, and the subsequent groundwater results are assessed in aggregate to determine whether the residual impacts are "Not Significant" or "Significant" according to the following definitions:

- **Significant Residual Effect:** residual effects have high magnitude, be of potential regional geographic extent and of medium to long term duration, occur at any frequency and only be partially reversible to irreversible.
- **Not Significant Residual Effect:** is defined as: negligible to moderate magnitude, are restricted to the PA are of sporadic or short-term duration, occur at any frequency and are reversible to partially reversible.

Table 6.6-5: Definitions of Characterization Criteria for Residual Effects on Groundwater

Criteria	Description of Ratings
Magnitude	• **Negligible:** no measurable change in groundwater quality exceeds the Potable Criteria • **Low:** a measurable change in groundwater quality exceeds the Potable Criteria but does not exceed background levels • **Moderate:** a measurable change in groundwater quality exceeds the Potable Criteria and exceeds background levels but does not represent a decrease in the reasonable use of groundwater (i.e., if arsenic concentrations are predicted to increase, but background concentrations of arsenic already exceed Potable Criteria, then the reasonable use of groundwater as a potable resource is not reduced by the increase in arsenic concentrations) • **High:** a measurable change in groundwater quality exceeds the Potable Criteria and exceeds background levels to all receptors.
Geographical Extent	• **Discrete:** effect is limited to receiving environments in the immediate footprint or Project Area (PA). • **Local:** effect is limited to the Local Assessment Area (LAA). • **Potential** Regional: effect is limited to the Regional Assessment Area (RAA).
Timing	• Timing represents seasonal occurrence of the effect (e.g., spring vs winter; high flows vs. low flows) and represents effect criteria for designated water users (aquatic resources, human health).
Duration	• **Short term:** effect is restricted to Construction Phase or EOM modelling. • **Medium term:** effect occurs in Construction Phase and EOM Phase. • **Long term:** Effect occurs in Construction Phase, EOM Phase, or PC Phase and persists in PC.
Frequency	• **Sporadic:** VC interaction or effect will occur at irregular intervals throughout any Project Phase. • **Regular:** effect occurs on a regular basis but not continuous basis. • **Continuous:** effect occurs constantly (e.g., every modelled timestep throughout a given Project Phase).
Reversibility	• **Reversible:** effect can be reversed. • **Partially reversible:** effect can be partially reversed. • **Irreversible:** effect cannot be reversed, is of permanent duration.

6.6.7 Project Activities/Interactions with Groundwater Quality and Quantity

Potential interaction between Project activities and groundwater quality and quantity within the PA is outlined in Tables 6.6-6 to 6.6-8 below and in Table 6.6-4 for Groundwater-Surface Water Interactions.

Table 6.6-6: Potential Project Activities/Interactions with Groundwater Quality and Quantity at the Beaver Dam Mine Site

Project Phase	Duration	Project Interactions
Construction	1 year	• Rock blasting in preparation of construction • Watercourse and wetland alteration in preparation of construction • Mine Site road construction
Operation and Maintenance	5 years	• Rock blasting to access and extract ore • Surface mine dewatering to facilitate access to and extraction of ore • Effluent treatment as required of site surface water runoff and surface mine pumped water
Active Closure	2 years	• Infrastructure demolition • Site reclamation activities
Post-closure	10+ years (monitoring, adaptive management)	• Water treatment as required • Water quality and quantity

Table 6.6-7: Potential Project Activities/Interactions with Groundwater Quality and Quantity along the Haul Road

Project Phase	Duration	Project Interactions
Construction	1 year	• Rock blasting in preparation of construction • Watercourse and wetland alteration in preparation of construction • Haul road construction and upgrades
Operation and Maintenance	5 years	• N/A[(a)]
Active Closure[(b)]	2 years	• N/A[(b)]
Post-closure	10+ years (monitoring, adaptive management)	• N/A

Notes: [(a)] No impacts to groundwater are expected during operation of the Haul Road.

[(b)] Decommissioning and Reclamation of the Haul Road is not expected. The Haul Road will be returned to owner for forestry industry.

N/A = not applicable.

Table 6.6-8: Potential Project Activities/Interactions with Groundwater Quality and Quantity at the Touquoy Mine Site

Project Phase	Duration	Project Interactions
Construction	1 year	• Tailings pipeline, make-up water pipeline alteration, and relocation of reclaim infrastructure
Operation and Maintenance	5 years	• Disposal of tailings from processing the Beaver Dam Mine or at Touquoy Mine Site into the exhausted Touquoy Pit
Active Closure	2 years	• Tailings from processing the Beaver Dam Mine ore within the Touquoy Site pit lake
Post-closure	10+ years (monitoring, adaptive management)	• Water treatment as required • Water quality and quantity monitoring (e.g., groundwater monitoring wells)

Note: Reclamation and closure for Touquoy Mine Site is part of a separate Industrial Approval.

6.6.7.1 Beaver Dam Mine Site

The groundwater assessment for the Beaver Dam Mine Site has been updated to reflect additional hydrogeologic data collected since the Revised 2019 EIS (AMNS 2019), updates to Project layout, additional Contaminant of Concern (COC) source terms and comparison of predicted COC concentrations in groundwater to NSE Tier 1 EQS for potable groundwater, GCDWQ or NSE Tier 2 PSS for groundwater discharge to surface water (>10 m) (Section 6.6.7.1) (CEAA-2-35, NSE-2-2, NSE-2-35, NSE-2-135, NSE-2-145, NSE-2-150, NSE-2-166) (CEAA 2019; NSE 2019).

Groundwater and surface water at the Beaver Dam Mine Site interact in many areas with the main controls including topography, bedrock permeability, and surface water bodies. Areas of recharge are typically the elevated areas with discharge occurring in the low-lying areas. Evidence of groundwater discharge to the surface water systems are abundant and mainly appear in the form of seeps and wetlands. Abundant groundwater/surface water interactions are supported by high levels of precipitation (an average of approximately 1,357 millimetres per year [mm/yr] from Environment Canada's Middle Musquodoboit climate station [Station ID 8203535, 1981 to 2010]), undulating topography, and relatively low permeable shallow bedrock overlain by permeable soil and till units. As discussed in Section 6.6.6.1, the most appropriate spatial boundary at which to evaluate projected impacts is the LAA. Effects will range from locally significant to insignificant. No adverse groundwater impacts from the Beaver Dam Mine Site are predicted beyond the boundary of the RAA, and in general, the majority of impacts do not extend beyond the LAA.

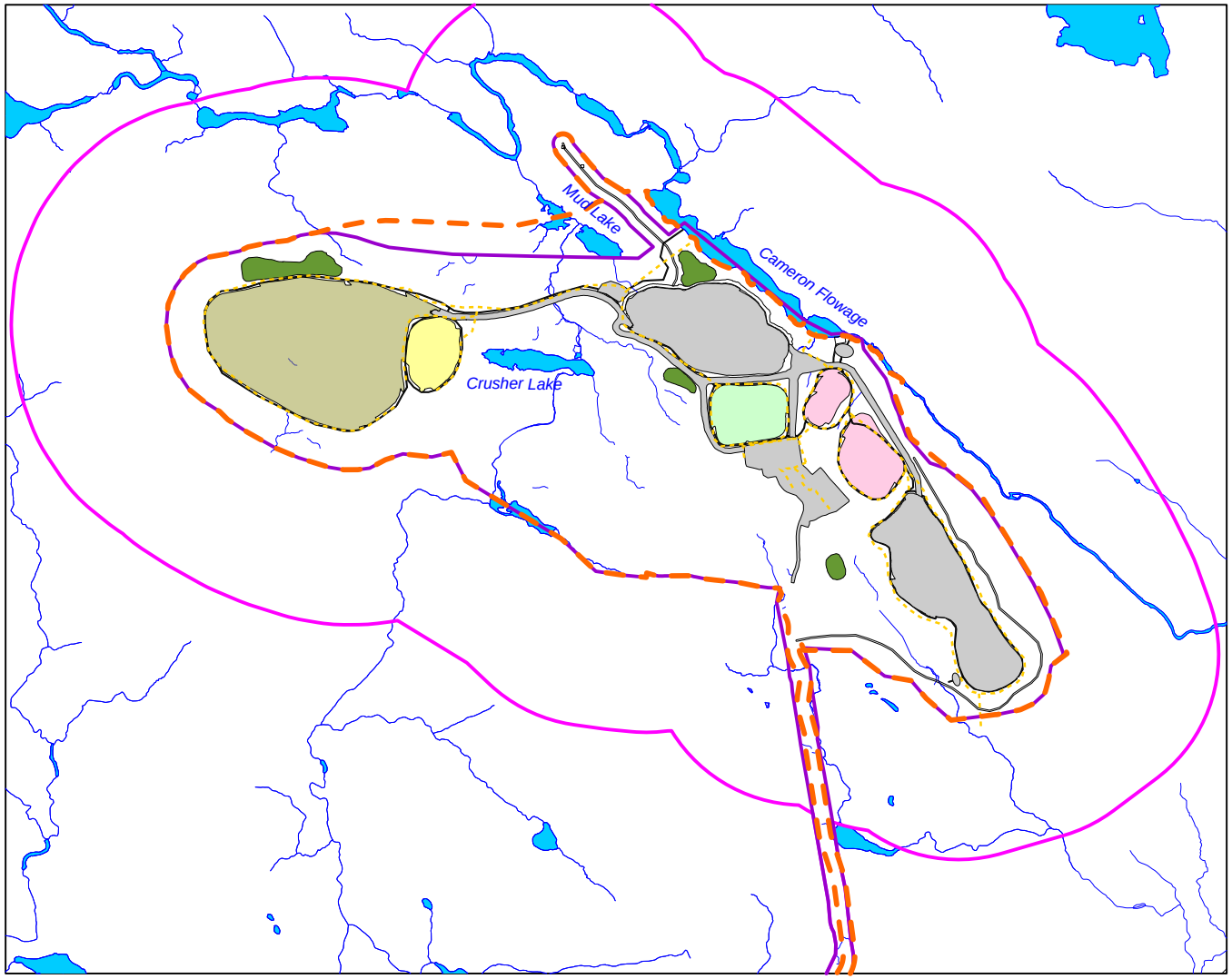
Potential impacts of Project activities on groundwater quality and quantity at the Beaver Dam Mine Site were predicted through the application of the Beaver Dam Model. The Beaver Dam Model was applied to predict pit inflow rates, groundwater elevation drawdowns, COC transport, and changes in baseflow within the PA, LAA, and RAA, where appropriate.

Simulated steady-state inflow rates to the open pit at the Beaver Dam Mine Site range from 531 to 655 m^3/d under average dry and average wet conditions, respectively. A sensitivity analysis was conducted to examine the impact of both the Mud Lake Fault and Cameron Flowage Fault on pit inflow rates. The sensitivity analysis was conducted in accordance with British Columbia Ministry of the Environment guidelines (Wels et al., 2012) and consistent with the fault representation and analysis method presented in BGC Engineering Inc. (2015) for groundwater modelling in support of the environmental impact statement developed for the AJAX Project near Kamloops, British Columbia. The sensitivity analysis presented in Table 7.6 of Appendix F.5 (Hydrogeologic Modelling Report), shows that simulated steady-state inflow rates increase by 24% to 829 m^3/d when the hydraulic conductivity of the Mud Lake Fault Zone is increased by two orders of magnitude above the calibrated hydraulic conductivity value. Pit inflow rates are insensitive to changes in the hydraulic conductivity of the Cameron Flowage Fault Zone as it does not intersect the proposed pit.

The sensitivity analysis of simulated pit inflow rates also included testing variations in bedrock hydraulic conductivity. As shown in Table 7.6 of Appendix F.5 (Hydrogeologic Modelling Report), the simulated steady-state pit inflow rates under wet conditions range from 655 to 1,835 m^3/d for all pit inflow sensitivity simulations. However, the maximum steady-state inflow rate of 1,835 m^3/d corresponds to a significant deterioration in model calibration statistics, and thus, is not supported by observed groundwater elevations. As a result, the expected range in simulated steady-state pit inflow rates under wet conditions obtained through the sensitivity analysis is 655 to 829 m^3/d, which compares well with the range estimate pit inflow rates of 550 to 1,450 m^3/d presented in PCA (2015).

The Beaver Dam Model was applied to assess changes in groundwater flow and groundwater/surface water interactions under end of mine life conditions (open pit excavated to maximum proposed depth) and post-closure conditions (open pit infilled with water to an elevation of 127 masl). Specifically, drawdown (i.e., the degree to which groundwater levels decrease) and changes in baseflow were evaluated. Figures 6.6-9 and 6.6-10 show simulated drawdown under base case conditions for EOM and PC, respectively. Figures 6.6-11 and 6.6-12 show simulated drawdown under dry conditions for EOM and PC and Figures 6.6-13 and 6.6-14 show simulated drawdown contours under wet conditions for EOM and PC, respectively. The greatest extent of simulated drawdown is shown on Figure 6.6-11, corresponding to simulated dry conditions at end of mine life. Figure 6.6-12 shows that a maximum drawdown of 0.5 m is simulated adjacent to Cameron Flowage within the PA during PC. Simulated drawdown is generally less than 10 cm outside of the PA, and simulated drawdown is negligible beyond the LAA. Simulated water levels recover slightly under post-closure conditions, as demonstrated by a reduction in drawdown shown on Figures 6.6-10, 6.6-12, and 6.6-14 but remain depressed relative to baseline conditions. Additional details are provided in Appendix F.5.

The maximum radius of groundwater drawdown influence under dry (conservative) conditions has been simulated at 1 km (in a southerly direction) and less in all other directions from the pit, with the exception some localized drawdown at the surface water management ditches surrounding the Beaver Dam Mine Site infrastructure. At the horizontal extent of this radius of influence, there is a predicted drawdown of 10 cm. Beyond this radius of influence, there is little to no potential impact from the Beaver Dam Mine Site development on groundwater quantity interactions with surface water features or potable wells.



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 SIMULATED DRAWDOWN (m)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

0 300 600 900m

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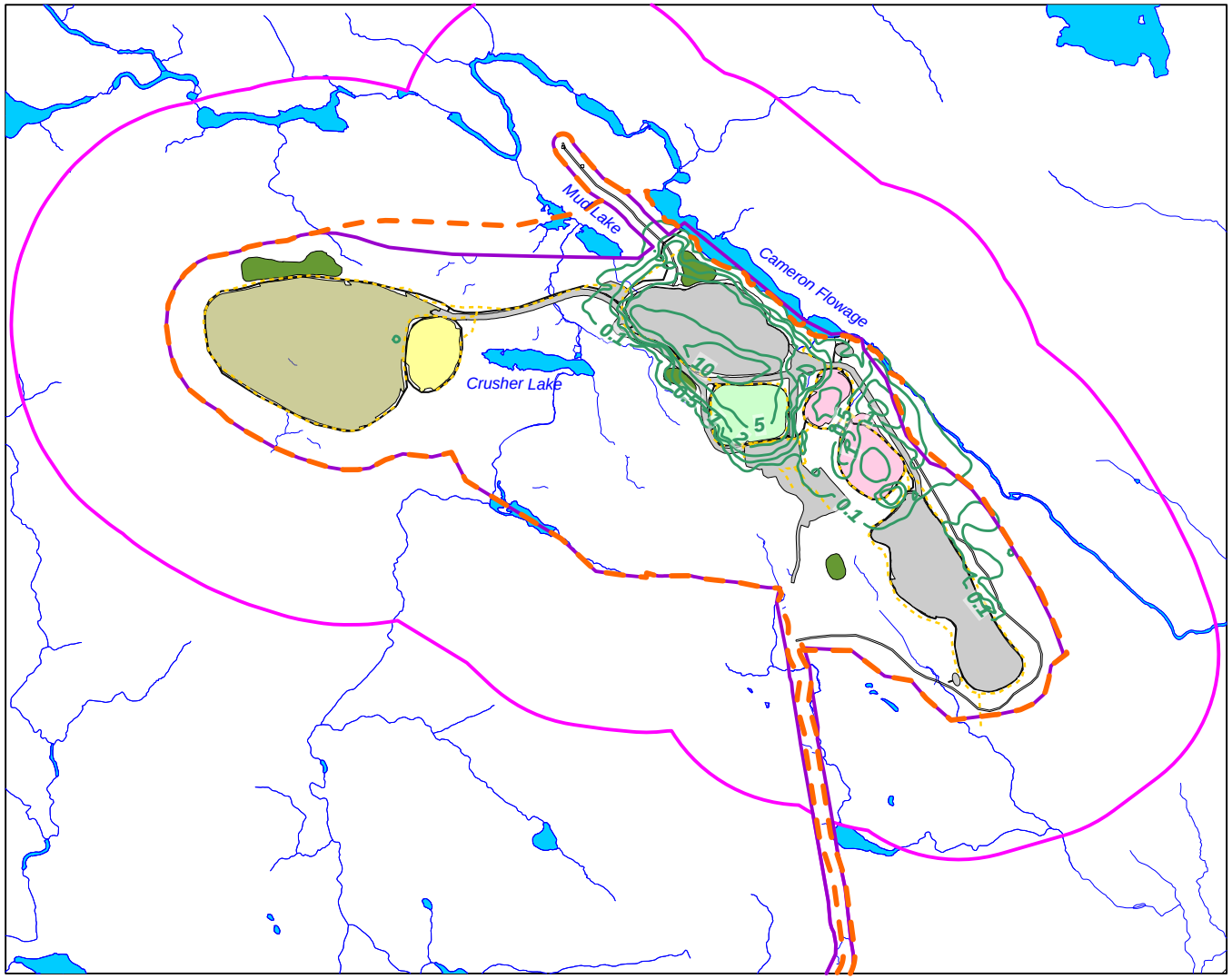
SIMULATED DRAWDOWN EOM - BASE CASE CONDITION

FIGURE 6.6-9

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.1a - Simulated Drawdown Base Case Condition - EOM.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 — SIMULATED DRAWDOWN (m)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

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SIMULATED DRAWDOWN PC - BASE CASE CONDITION

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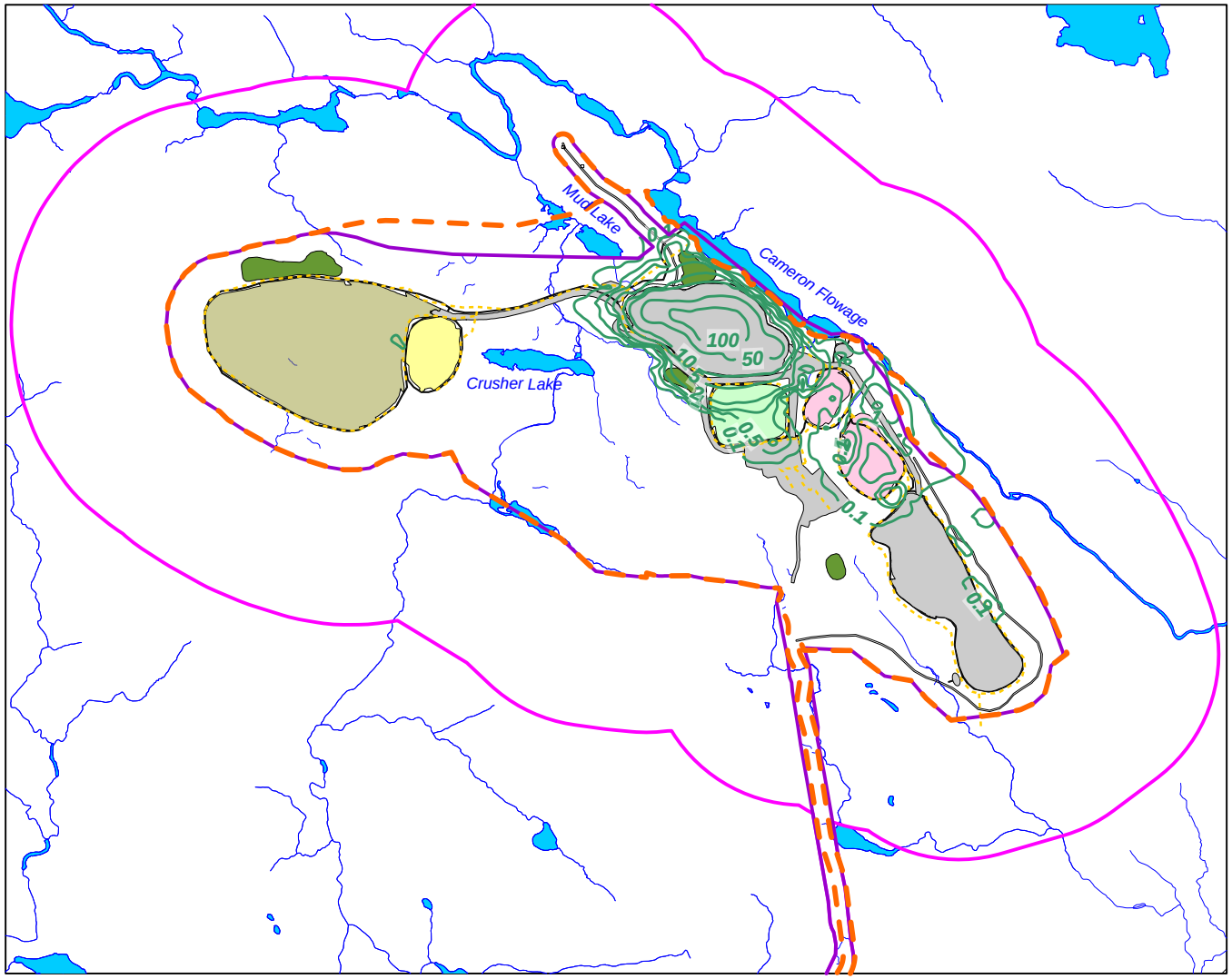
FIGURE 6.6-10

HEG file: Z:\\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.1b - Simulated Drawdown Base Case Condition - PC.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 — SIMULATED DRAWDOWN (m)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
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0 300 600 900m

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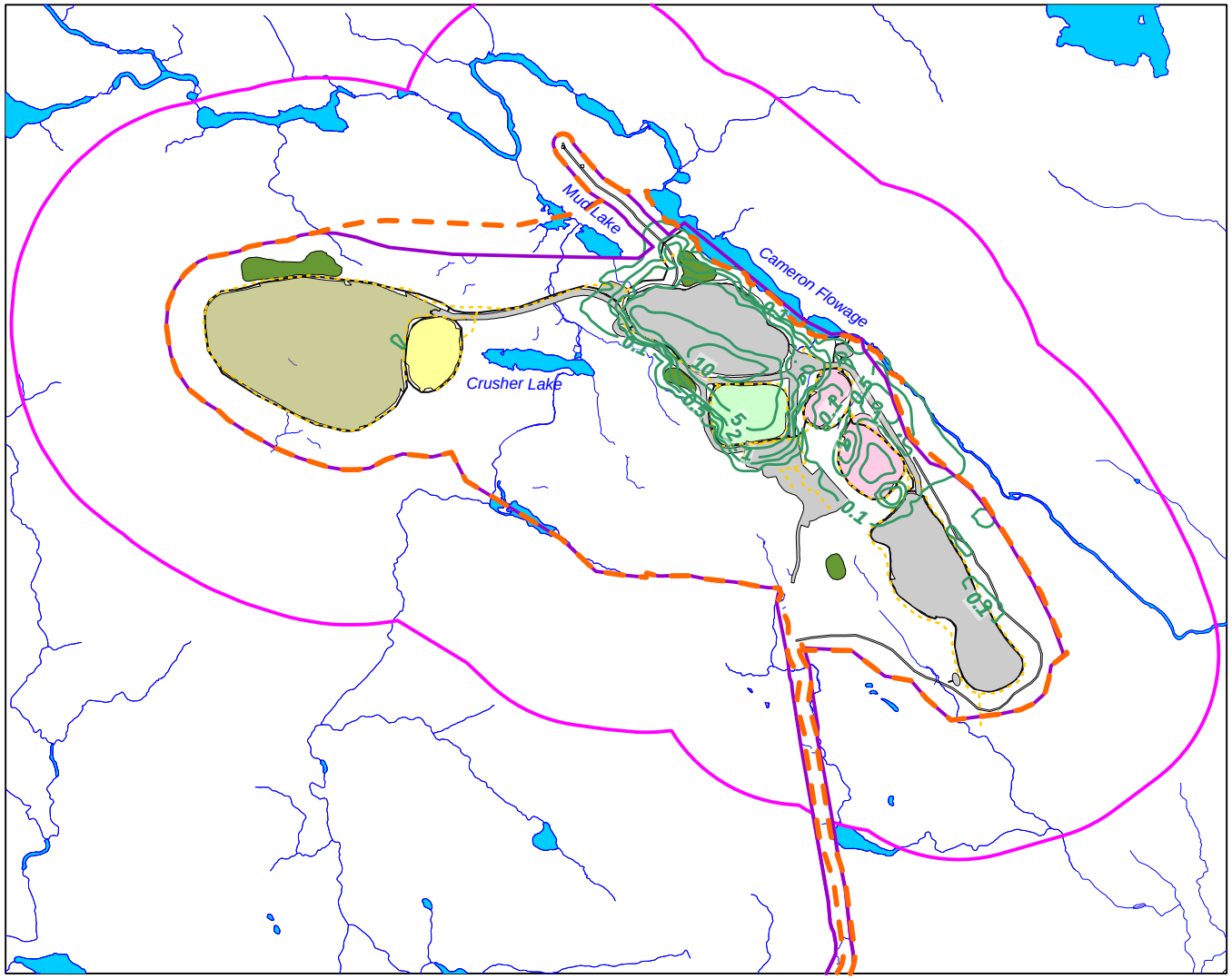
SIMULATED DRAWDOWN EOM - DRY CONDITION

FIGURE 6.6-11

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.2a - Simulated Drawdown Dry Condition - EOM.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 — SIMULATED DRAWDOWN (m)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
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- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
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0 300 600 900m

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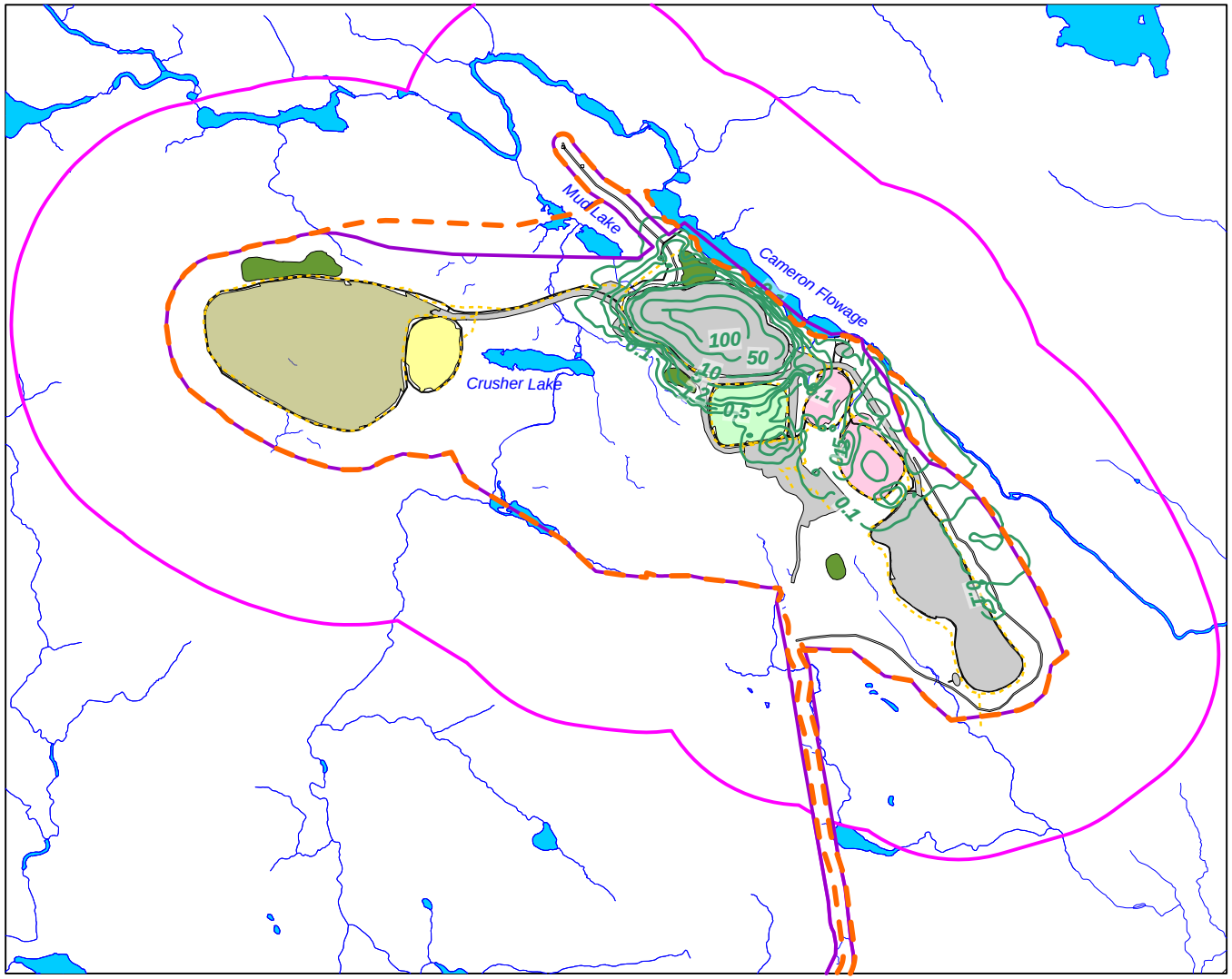
SIMULATED DRAWDOWN PC - DRY CONDITION

FIGURE 6.6-12

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.2b - Simulated Drawdown Dry Condition - PC.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 — SIMULATED DRAWDOWN (m)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
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0 300 600 900m

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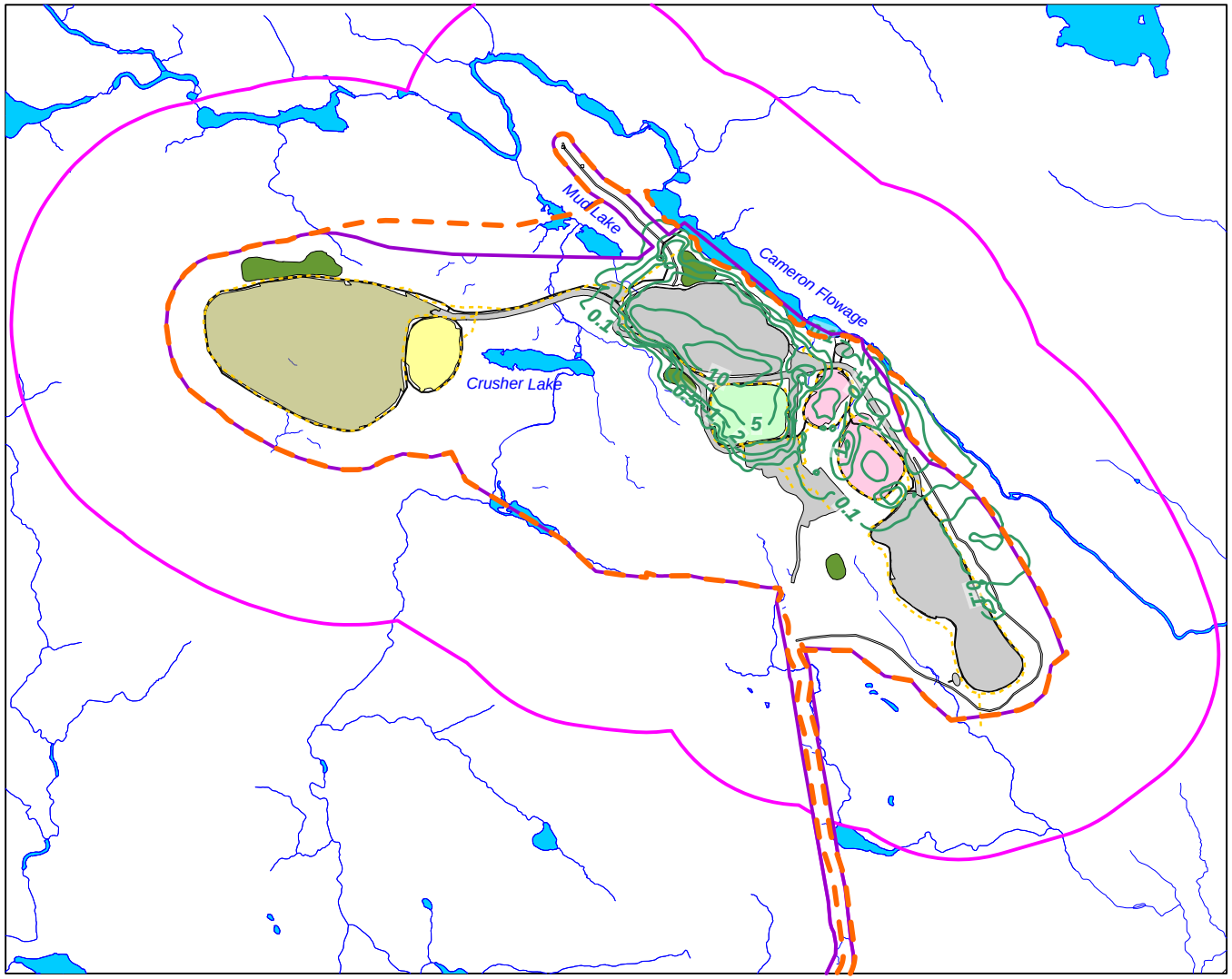
SIMULATED DRAWDOWN EOM - WET CONDITION

FIGURE 6.6-13

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.3a - Simulated Drawdown Wet Condition - EOM.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 — SIMULATED DRAWDOWN (m)
- SURFACE WATER MANAGEMENT DITCHES
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SIMULATED DRAWDOWN PC - WET CONDITION

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FIGURE 6.6-14

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.3b - Simulated Drawdown Wet Condition - PC.srf

The simulated change in baseflow throughout the Cameron Flowage watershed is presented in Table 7.4 of Appendix F.5 (Hydrogeologic Modelling Report). The simulated baseflow reduction ranges from 677 to 754 m^3/d at EOM and from 446 to 620 m^3/d at PC. The range in baseflow reduction represents 2 to 3% of total baseflow in the Cameron Flowage watershed and is under 1% of the total average annual flow in Cameron Flowage. Approximately 50 to 60% of the total baseflow reduction is simulated to occur within the Property Boundary, and the remaining 40 to 50% of total baseflow reduction is simulated to occur between the Property Boundary and the LAA, indicating that Beaver Dam Mine Site operations will not impact the baseflow contribution to Cameron Flowage beyond the LAA. Further analysis of the potential effects of this baseflow reduction to Cameron Flowage are discussed in Section 6.7 (Surface Water Quality and Quantity).

The Beaver Dam Model was also applied to simulate the transport of COCs from potential source zones (e.g., waste rock piles, low grade ore stock pit, and pit lake) to surface water bodies. The COC concentrations discharging to surface water were estimated for both base case and upper case source term concentrations developed for EOM and PC conditions (Appendix E.3 Geochemical Source Terms). A conservative tracer (i.e., considering the solute transport processes of advection and dispersion only) at a unit concentration was applied to simulate COC migration from each source. The simulated tracer concentration in groundwater was scaled based on the source term concentrations developed to estimate the COC concentrations throughout the Beaver Dam Mine Site and surrounding area (Appendix E.3). All simulated COC mass loadings from groundwater to surface water were provided as input to the Predictive Water Quality Model (Appendix D of Appendix P.4 Mine Water Management Plan) to estimate the cumulative impact of groundwater and surface water loadings to surface waterbodies (Section 6.7). The COC transport simulations are described in detail in Section 7.1.5 of Appendix F.5.

The COC transport simulations were conducted to estimate the extent and significance of potential COC impacts to groundwater and surface water. The potential COC impacts to groundwater are assessed by comparing predicted COC concentrations in groundwater against the lower of the Tier 1 EQS for potable groundwater or GCDWQ, hereafter referred to as the 'Potable Criteria'. Predicted COC concentration distributions are presented for COCs that are simulated to exceed the Potable Criteria. For these COCs, the extent of the simulated exceedance is compared to the spatial boundaries described in Section 6.6.6.1.

The potential COC impacts to surface water are assessed through comparing predicted COC concentrations in groundwater against Tier 2 PSS and through developing simulated groundwater COC mass loadings to surface water for all COCs. The simulated groundwater COC mass loadings to surface water are provided as inputs into the Predictive Water Quality Assessment (Appendix D of Appendix P.4 Mine Water Management Plan). Within the Predictive Water Quality Assessment, the groundwater COC mass loadings are combined with COC mass loadings from surface water runoff to assess the combined potential impact of surface water and groundwater discharge from the Beaver Dan Mine Site on Killag River surface water quality.

Figures 7.7 through 7.13 in Appendix F.5 (Hydrogeologic Modelling Report) present the simulated COC exceedances of the Potable Criteria for the base case and upper case source terms under base case conditions for EOM, as follows:

- Arsenic (Figures 7.7 and 7.8 in Appendix F.5) is predicted to exceed its Potable Criteria in the vicinity of the NAG and PAG waste rock stockpiles for both the base case and upper case source terms, and in the vicinity of the topsoil stockpiles for the upper case source term. The simulated arsenic Potable Criteria exceedances occur within the Property Boundary, except small isolated areas north of the NAG waste rock stockpile and the topsoil stockpile south of Mud Lake. As discussed in Appendix E.3 (Geochemical Source Terms), the simulated arsenic exceedance is expected to be temporary since arsenic concentrations will decrease as EOM source terms transition to the PC source terms. It should be noted that arsenic is naturally occurring in groundwater at the Beaver Dam Mine Site and is found at concentrations above the Potable Criteria under baseline conditions. Therefore, the potential release of arsenic at concentrations above its Potable Criteria does not represent a significant reduction in the beneficial use of groundwater at the Beaver Dam Mine Site, since groundwater requires treatment for arsenic to meet its Potable Criteria under baseline conditions.

- Manganese (Figure 7.9 in Appendix F.5) is predicted to exceed its Potable Criteria at the till stockpiles for the upper case source term. The simulated manganese Potable Criteria exceedance is located within the Property Boundary and the exceedance is expected to be temporary since the till stockpiles are to be removed during reclamation of the Beaver Dam Mine Site.
- Nitrate (Figures 7.10 and 7.11 in Appendix F.5) is predicted to exceed its Potable Criteria in the vicinity of the NAG waste rock stockpile for both the base case and upper case source terms. The simulated nitrate Potable Criteria exceedance is located within the Property Boundary. Furthermore, nitrate concentrations will decrease as nitrate is leeched from and depleted within NAG waste rock stockpile. Nitrate concentrations are predicted to decrease from the maximum simulated concentrations shown on Figures 7.10 and 7.11 in Appendix F.5 to below the Potable Criteria within approximately 10 years and 25 years for base case and upper case source terms, respectively.
- Uranium (Figures 7.12 and 7.13 in Appendix F.5) is predicted to exceed its Potable Criteria in the vicinity of the NAG waste rock stockpile for both the base case and upper case source terms, and in vicinity of the PAG waste rock stockpile for the upper case source term. The simulated uranium Potable Criteria exceedance is located within the Property Boundary. As discussed in Lorax Environmental (2019a), the simulated uranium exceedance is expected to be temporary since uranium concentrations will decrease as EOM source terms transition to the PC source terms.

Figures 7.14 through 7.28 in Appendix F.5 (Hydrogeologic Modelling Report) present the simulated COC exceedances of the Potable Criteria for base case and upper case source terms under base case conditions for PC, as follows:

- Arsenic (Figure 7.14 in Appendix F.5), cadmium (Figure 7.16 in Appendix F.5), cobalt (Figure 7.18 in Appendix F.5), manganese (Figure 7.20 in Appendix F.5), nickel (Figure 7.22 in Appendix F.5), lead (Figure 7.24 in Appendix F.5), and uranium (Figure 7.26 in Appendix F.5) are predicted to exceed the Potable Criteria in the vicinity of the PAG waste rock stockpile for the base case source term. The predicted exceedances of the Potable Criteria all occur within the Property Boundary.
- Arsenic (Figure 7.15 in Appendix F.5), cadmium (Figure 7.17 in Appendix F.5), cobalt (Figure 7.19 in Appendix F.5), manganese (Figure 7.21 in Appendix F.5), nickel (Figure 7.23 in Appendix F.5), lead (Figure 7.25 in Appendix F.5), uranium (Figure 7.27 in Appendix F.5), and zinc (Figure 7.28 in Appendix F.5) are predicted to exceed the Potable Criteria in the vicinity of the PAG waste rock stockpile for the upper case source term. In all cases the pit lake contains the majority of COCs migrating from the PAG waste rock stockpile, and no predicted exceedances of the Potable Criteria occur beyond the Property Boundary.

Simulated COC exceedances of the Potable Criteria for the base case and upper case source terms for EOM and PC under dry conditions are presented on Figures D.1 to D.22 of Appendix D in Appendix F.5 (Hydrogeologic Modelling Report). Simulated COC exceedances of the Potable Criteria for the base case and upper case source terms for EOM and PC under wet conditions are presented on Figures E.1 to E.22 of Appendix E in Appendix F.5 (Hydrogeologic Modelling Report). The Appendix D and E in Appendix F.5 (Hydrogeologic Modelling Report) figures show that simulated COC exceedances of the Potable Criteria in groundwater do not change significantly from that predicted under base case conditions.

Figures 7.29 through 7.32 in Appendix F.5 present the simulated COC exceedances of the Tier 2 PSS for the base case and upper case source terms under base case conditions for EOM, as follows:

- Aluminum (Figure 7.29 and Figure 7.30 in Appendix F.5 is predicted to exceed its Tier 2 PSS in the vicinity of the topsoil stockpiles for both the base case and upper case source terms. The predicted exceedance is within the Property Boundary for the base case source terms (Figure 7.29 in Appendix F.5) and extends slightly beyond the Property Boundary for the upper case source terms (Figure 7.30 in Appendix F.5).

- Arsenic (Figure 7.31 in Appendix F.5) and Cadmium (Figure 7.32 in Appendix F.5) are predicted to exceed the Tier 2 PSS in the vicinity of the topsoil stockpiles for the upper case source term. The predicted exceedance is within the Property Boundary for both Arsenic and Cadmium.

Figures 7.33 through 7.47 in Appendix F.5 present simulated COC exceedances of the Tier 2 PSS for base case and upper case source terms under base case conditions for PC, as follows:

- Aluminum (Figure 7.33 in Appendix F.5), cobalt (Figure 7.37 in Appendix F.5), iron (Figure 7.40 in Appendix F.5), nickel (Figure 7.42 in Appendix F.5), lead (Figure 7.44 in Appendix F.5), and zinc (Figure 7.46 in Appendix F.5) are predicted to exceed the Tier 2 PSS in the vicinity of the PAG waste rock stockpile for the base case source terms. The predicted exceedances do not reach nearby surface water features and are within the Property Boundary.
- Cadmium (Figure 7.35 in Appendix F.5) is predicted to exceed the Tier 2 PSS in the vicinity of the PAG waste rock stockpile for the base case source terms. The simulated exceedances encroach on the Property Boundary and/or reach surface water features (either Cameron Flowage to the northeast of the PAG waste rock stockpile or mapped streams to the west of the PAG waste rock stockpile).
- Aluminum (Figure 7.34 in Appendix F.5), cobalt (Figure 7.38 in Appendix F.5), copper (Figure 7.39 in Appendix F.5), iron (Figure 7.41 in Appendix F.5), and zinc (Figure 7.47 in Appendix F.5) are predicted to exceed the Tier 2 PSS in the vicinity of the PAG waste rock stockpile for the upper case source terms. The predicted exceedances do not reach the nearby surface water features and are within the Property Boundary.
- Cadmium (Figure 7.36 in Appendix F.5), nickel (Figure 7.43 in Appendix F.5), and lead (Figure 7.45 in Appendix F.5) are predicted to exceed the Tier 2 PSS in the vicinity of the PAG waste rock stockpile for the upper case source terms. The simulated exceedances encroach on the Property Boundary and/or reach surface water features (either Cameron Flowage to the northeast of the PAG waste rock stockpile or mapped streams to the west of the PAG waste rock stockpile).

Simulated COC exceedances of Tier 2 PSS for the base case and upper case source terms for EOM and PC under dry conditions are presented on Figures F.1 to F.19 of Appendix F in Appendix F.5 (Hydrogeologic Modelling Report). Simulated COC exceedances of Tier 2 PSS for the base case and upper case source terms for EOM and PC under wet conditions are presented on Figures G.1 to G.19 of Appendix G in Appendix F.5 (Hydrogeologic Modelling Report). The Appendix F and G figures in Appendix F.5 (Hydrogeologic Modelling Report) show that simulated COC exceedances of the Tier 2 PSS in groundwater do not change significantly from that predicted under base case conditions.

To further evaluate the potential risk to surface water features as a result of predicted Tier 2 PSS exceedances, GHD incorporated the simulated COC mass loading to surface water features into the Predictive Water Quality Assessment (Appendix D of Appendix P.4 Mine Water Management Plan) to predict COC concentrations in surface water features. The total simulated mass loading for each COC from groundwater discharge to surface water within the Killag River watershed is presented in Table 7.5 for EOM and PC for both the base case and upper case source terms. The predicted COC concentrations in surface water are compared to Canadian Council of Ministers of the Environment (CCME) Guidelines for the Protection of Aquatic Life at the near-field and far-field locations within the Killag River/Cameron Flowage. The Predictive Water Quality Assessment (Appendix D of Appendix P.4 Mine Water Management Plan) addresses any potential need for treatment of the effluent water prior to discharge into the Killag River such that the combined groundwater and surface water discharge into the Killag River will meet CCME Guidelines for the Protection of Aquatic Life. However, potential localized impacts to surface water features located to the west of the potentially acid generating (PAG) waste rock stockpile may not be addressed. Therefore, GHD evaluated the effectiveness of potential mitigation measures that could be applied to address the potential migration of COCs to the west of the PAG waste rock stockpile should

groundwater quality monitoring indicate that there may be potential exceedances of Tier 2 PSS. The evaluation of potential mitigation measures for groundwater migration west of the PAG waste rock stockpile is presented in Section 6.6.8.

It is also recognized that potential uncertainty in the quality or quantity of PAG waste rock deposited in the PAG waste rock stockpile could impact potential COC concentrations. Therefore, monitoring of the PAG waste rock material deposited in the PAG waste rock pile will be addressed through the draft Beaver Dam Mine Metal Leaching Acid Rock Drainage Management Plan (Appendix E.5). A contingency of in-pit disposal will be maintained throughout operation should the Geochemical Characterization Management Plan identify that the quality or quantity of PAG may exceed prediction.

The key sensitive receptor in the area of the Beaver Dam Mine Site is the Beaver Lake IR 17. The Beaver Lake IR 17 is a satellite community of the Millbrook First Nation located approximately 5 km southwest of the Beaver Dam Mine Site and beyond the LAA boundary. No significant impacts to groundwater quality or quantity are predicted outside of LAA boundary, and thus, no impacts are predicted at the Beaver Lake IR 17.

The nearest potable well, Beaver Lake IR 17, is approximately 5 km southwest from the Beaver Dam Mine Site, at a residence along Hwy 224 that is located beyond the LAA boundary (Figure 6.6-8). No significant impacts to groundwater quality or quantity are predicted outside of the LAA boundary, and thus, no impacts are predicted at the potable wells from the Beaver Dam Mine Site.

6.6.7.2 Haul Road

The nearest identified potable water supplies are located at a permanent residence near the intersection of Beaver Dam Mines Road and Hwy 224, at the Beaver Lake IR 17 approximately 3 km from the primary Haul Road. The nearest residents at the intersection of the Haul Road and the Mooseland Road is approximately 1 km.

Clearing, grubbing and grading of the Haul Road surface in preparation for construction has the potential to affect the groundwater flow regime. Also, there will be limited wetland alteration required to facilitate Haul Road construction. In consideration of the overall small linear extent of the disturbed area, this disturbance is a low to negligible potential for interaction and affect to the groundwater flow regime.

Localized rock blasting will occur along the Haul Road to support construction activities. In general, there is potential to increase fracturing and permeability within 10 m from a well-executed blast. Given the small radius of influence of blasting it is highly unlikely that any nearby shallow potable wells will be impacted by localized changes to the groundwater flow regime. In addition, there is the potential for the release of blasting residues to groundwater via surface water pathways. However, given the small radius of blasting influence and that COC loadings from blast residues will decrease rapidly over time as those COCs are leached from the rock through precipitation infiltration, any potential impacts will be limited in both extent and duration. Therefore, potential impacts to groundwater quantity and groundwater quality would be highly localized and limited in extent.

During operations, there will be maintenance activities that would include grading and repairs to the road as well as the application of a non-toxic biodegradeable dust suppressant. These interactions are predicted to be limited in extent.

During operations, traffic using the Haul Road will generate dust that will be deposited along, and near the Haul Road. A fugitive dust management plan (Appendix C.3) with (i.e., minimum of 80% dust mitigation) will be applied to reduce the amount of dust generated by traffic using the Haul Road. However, there remains the potential for COCs in dust to impact groundwater receptors along the Haul Road through leaching of metals COCs from dust deposited on surficial soil at sensitive receptor locations to precipitation infiltrating through surficial soil and ultimately reaching groundwater.

GHD conducted air dispersion modelling to predict dust deposition rates near the Haul Road and at each sensitive receptor location where there is a potable groundwater resources or could be a potential future potable well source. Dust deposition was predicted based on emissions from the Haul Road while being used for the Project only, and then for cumulative emissions from the Haul Road while being used for the Project combined with the nearby projects. Section 6.2 and Appendix C.1 (Air Emissions Assessment Technical Report) presents the documentation of the air dispersion modelling methodology and results.

Using methods outlined in United States Environmental Protection Agency's (USEPA's) guidance, "*Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*" (USEPA, 2005), GHD applied to the maximum estimated dust deposition rate for the cumulative emissions from the Haul Road while being used for the Project combined with nearby projects (assumed to persist over the entire project lifespan), to estimate the potential metals COCs concentrations in soil leachate that could migrate to groundwater. GHD compared the estimated metals COCs concentration in soil leachate to applicable potable groundwater criteria (NSE Tier 1 EQS for potable groundwater and GCDWQ) (Potable Criteria). There are no predicted exceedances of the applicable groundwater criteria, and therefore, no significant risk to groundwater is predicted to groundwater at the sensitive receptor locations as a result of dust deposition along the Haul Road. The detailed methodology applied to estimate potential metals COCs concentrations in soil leachate is presented in Appendix F.9 (Response to Information Request Nos. CEAA-2-36, CEAA-2-37, and NSE-2-130 - Evaluation of Potential Impacts from Metals COCs to Groundwater and Surface Water from Dust Deposition along the Haul Road).

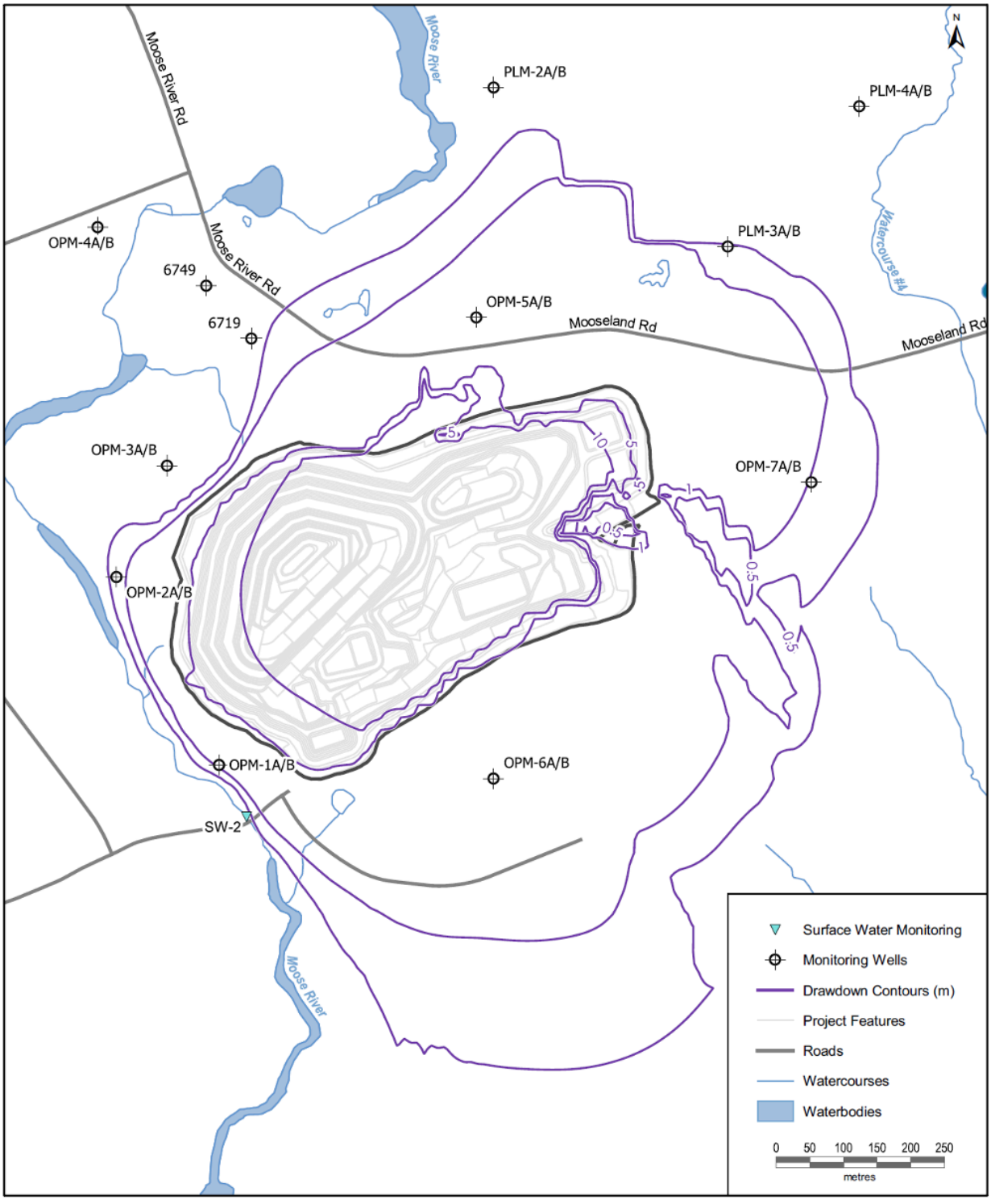
There is the potential for a groundwater interaction from haul road activity in the event of an accident or malfunction (i.e., potential spill). Accidents and Malfunctions are identified and described in Section 6.18.

6.6.7.3 Touquoy Mine Site

The processing of the Beaver Dam ore will result in the generation of tailings (Beaver Dam tailings) that will be deposited into the Touquoy pit. The deposition of tailings into the exhausted pit has the potential to interact with groundwater quality around the Touquoy pit, and the water quality in Moose River from groundwater seepage into the river.

The tailings will be deposited into the exhausted pit, which will have been dewatered as part of the Touquoy Gold Project. Therefore, the dewatering of the open pit will be the initial condition. This condition was simulated during the Touquoy groundwater modelling exercise, as described in Appendix F.6. The dewatering of the Touquoy open pit, prior to tailings deposition, is predicted to occur at a rate of 768 m^3/d, and will result in drawdowns around the open pit, as shown on Figure 6.6-15. The extent of the drawdown cone, as delineated by the 0.5 m drawdown contour, extends approximately 600 m south of the limits of the Touquoy open pit and about 50 m west of the Touquoy open pit toward Moose River.

Figure 6.6-15: Predicted Drawdown Contours from Fully Development Open Pit at Touquoy Mine Site Prior to Deposition of Beaver Dam Mine Tailing

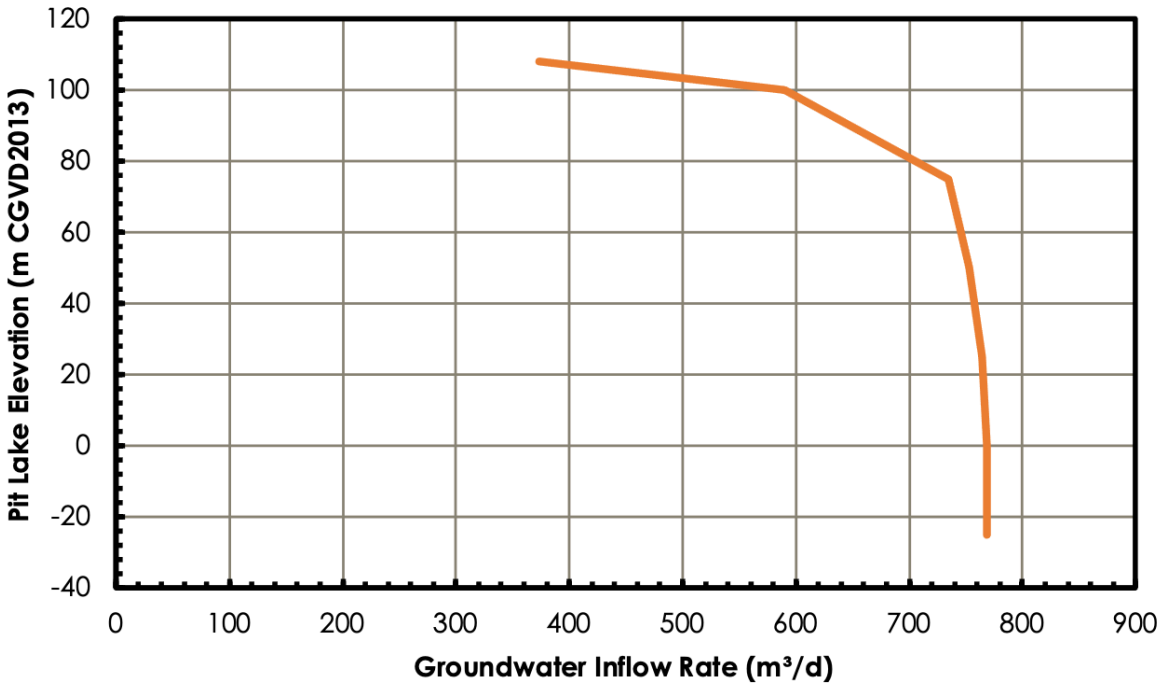


Camp Kidston, which operates only in the summer months, is located 3.5 km northeast of the Touquoy facility. According to the Proponent, the nearest permanent full-time occupied residences are located approximately 5.8 km to the north of the Touquoy open pit along Caribou Road. The next closest permanent residences to the Touquoy Mine Site are approximately 7.4 km to the northwest and 11.7 km to the southeast.

Compared to the existing conditions, the dewatering of the open pit is anticipated to reduce the flow in Moose River by 549 m^3/d. This accounts for approximately 0.6% of the mean annual flow at Moose River, as estimated 99,360 m^3/d (1.15 m^3/s) at SW-2. In the summer months, the dewatering of the Touquoy open pit occurs at a rate of 444 m^3/d, which is anticipated to reduce the flow in Moose River by 339 m^3/d. This accounts for approximately 1.7% of the mean summer flow at Moose River of 18,938 m^3/d at SW-2.

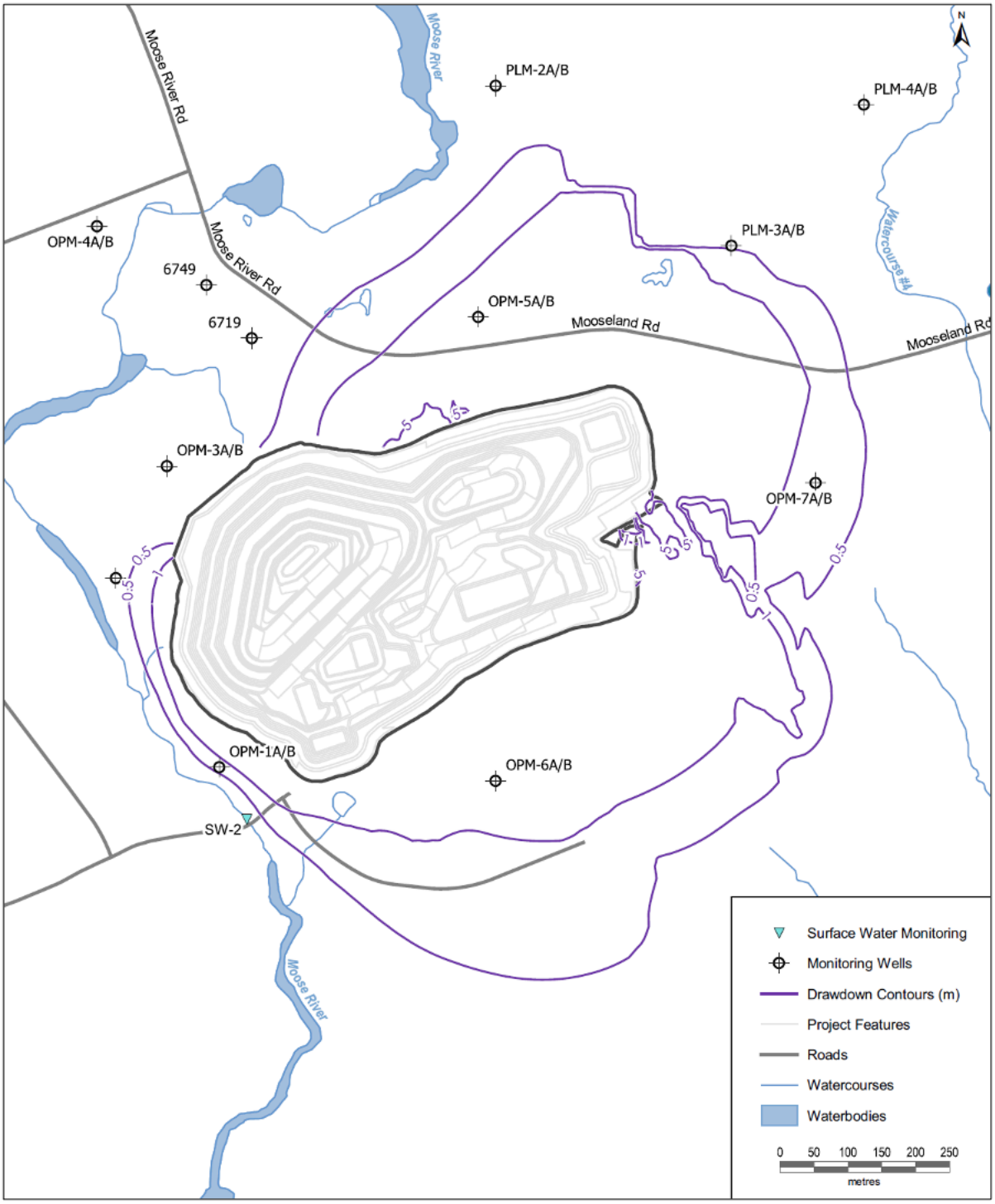
The groundwater inflow rates to the open pit during the filling of the pit were simulated by adding tailings to the model, and then predicting the inflow rates to the pit lake above the tailings over time. The predicted inflow rates compared to the pit lake stage are presented on Figure 6.6-16. As shown, the inflow rates decrease from 768 m^3/d when the pit stage is at -25 m relative to the Canadian Geodetic Vertical Datum of 2013 (CGVD2013), to 373 m^3/d at a pit stage of 108 m CGVD2013, at which point the pit lake will overflow to Moose River through a spillway.

Figure 6.6-16: Groundwater Inflow Rates to the Open Pit During the Filling of the Open Pit



The drawdown at the end of pit filling (i.e., when the pit lake stage is 108 m CGVD2013) was simulated using the Touquoy groundwater model and is shown on Figure 6.6-17. As presented on Figure 6.6-17 the groundwater flow to the open pit remains at 373 m^3/d because the 108 m CCGVD2013 level is below the natural groundwater elevation within the footprint of the open pit. However, at this elevation, there are both groundwater inflows to and outflows from the open pit that are not observed with the fully dewatered open pit where no outflows are observed.

Figure 6.6-17: Predicted Drawdown Contours from Filled Open Pit at Touquoy Mine Site following Deposition of Beaver Dam Tailings



During the Post-Closure period, the deposited Beaver Dam tailings at the Touquoy Mine Site will degrade the water quality in the pit, including the pore water quality in the tailings within the Touquoy open pit. This lower quality water has the potential to migrate toward Moose River via groundwater. The Touquoy groundwater model was used to simulate the migration of solutes from the open pit to Moose River. As described in Appendix F.6, the model simulated the release of water from the pore space in the deposited tailings, and the pit lake quality based on a relative contribution basis. This process simulates the transport of a conservative solute with a concentration of 1 mg/L through the groundwater to the receiving environment over time. The relative concentrations are multiplied by the source term concentrations (refer to Appendix E.3 Geochemical Source Terms) for the parameters of primary concern (POPC) in the open pit to predict the concentrations and mass loadings to the receiving environment over time. The distributions of the concentrations after 50 years are shown on Figure 6.6-18, and after 500 years on Figure 6.6-19. The average concentrations of arsenic discharged to Moose River over the 500-year simulation period are shown on Figure 6.6-20. As shown on Figure 6.6-20, the average concentrations in the discharge to the river stabilize after about 150 years. Refer to Section 6.7 Surface Water Quality and Quantity for a further discussion and effects assessment of the modelled COC in surface water that originates from groundwater seepage. However, the concentration of all parameters at the property line after 500 years of travel are predicted to be less than the CDWG, as shown in Table 6.6-9.

Table 6.6-9: Potential Groundwater Interactions with Project Activities at Touquoy Mine Site

Parameter	Source Term Concentration (mg/L)	Simulated Concentration at South-western Property Line (mg/L)	Canadian Drinking Water Quality Guideline (mg/L)
Sulphate	897	0.018	500
Aluminum	0.0469	9×10^{-7}	0.1
Silver	0.00001	2×10^{-10}	-
Arsenic	3.07	6×10^{-4}	0.01
Calcium	86.9	0.002	-
Cadmium	0.00002	4×10^{-10}	0.005
Cobalt	0.0262	5×10^{-7}	-
Chromium	0.0002	4×10^{-9}	0.05
Copper	0.00937	2×10^{-7}	2
Iron	0.0326	6×10^{-7}	0.3
Mercury	0.000005	1×10^{-10}	0.001
Magnesium	14.8	0.0003	-
Manganese	0.37	7×10^{-6}	0.12
Molybdenum	0.0603	1×10^{-6}	-
Nickel	0.00685	1×10^{-7}	-
Lead	0.0000248	5×10^{-10}	0.005
Tin	0.00604	1×10^{-7}	-
Selenium	0.000193	4×10^{-9}	0.05
Tellurium	0.0000154	3×10^{-10}	-
Uranium	0.00203	4×10^{-8}	0.02
Zinc	0.0096	2×10^{-7}	5
Weak Acid Dissociable Cyanide	0.005	1×10^{-7}	0.2
Total Cyanide	0.087	2×10^{-6}	0.2
Nitrate (as N)	0.053	1×10^{-6}	10
Nitrite (as N)	0.11	2×10^{-6}	1
Ammonia (as N)	34	0.0007	-

Figure 6.6-18: Relative Solute Concentrations in Groundwater (mg/L) after 50 Years of Travel Based on Concentrations in Open Pit of 1 mg/L

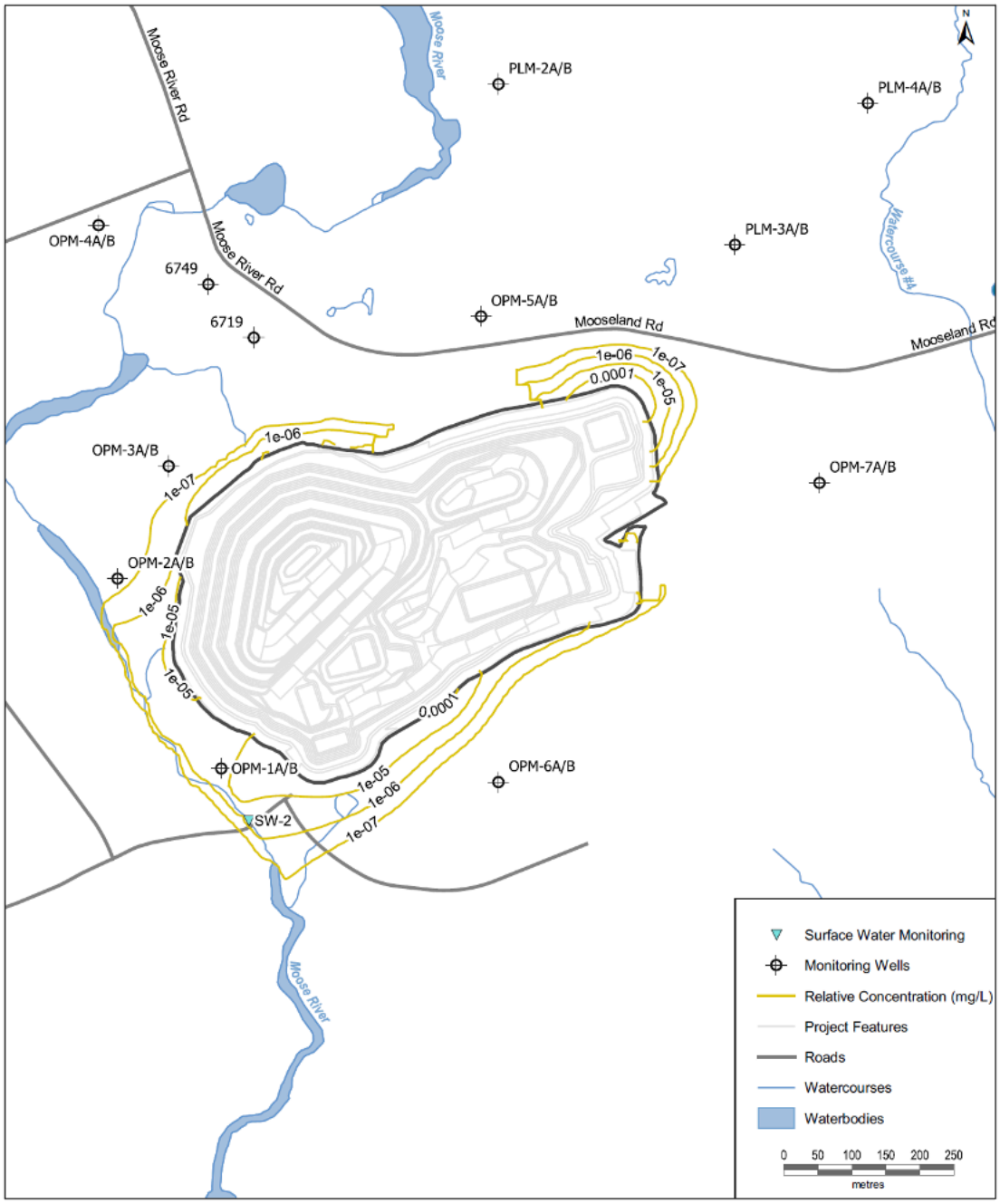


Figure 6.6-19: Relative Solute Concentrations in Groundwater (mg/L) after 500 Years of Travel Based on Concentrations in Open Pit of 1 mg/L

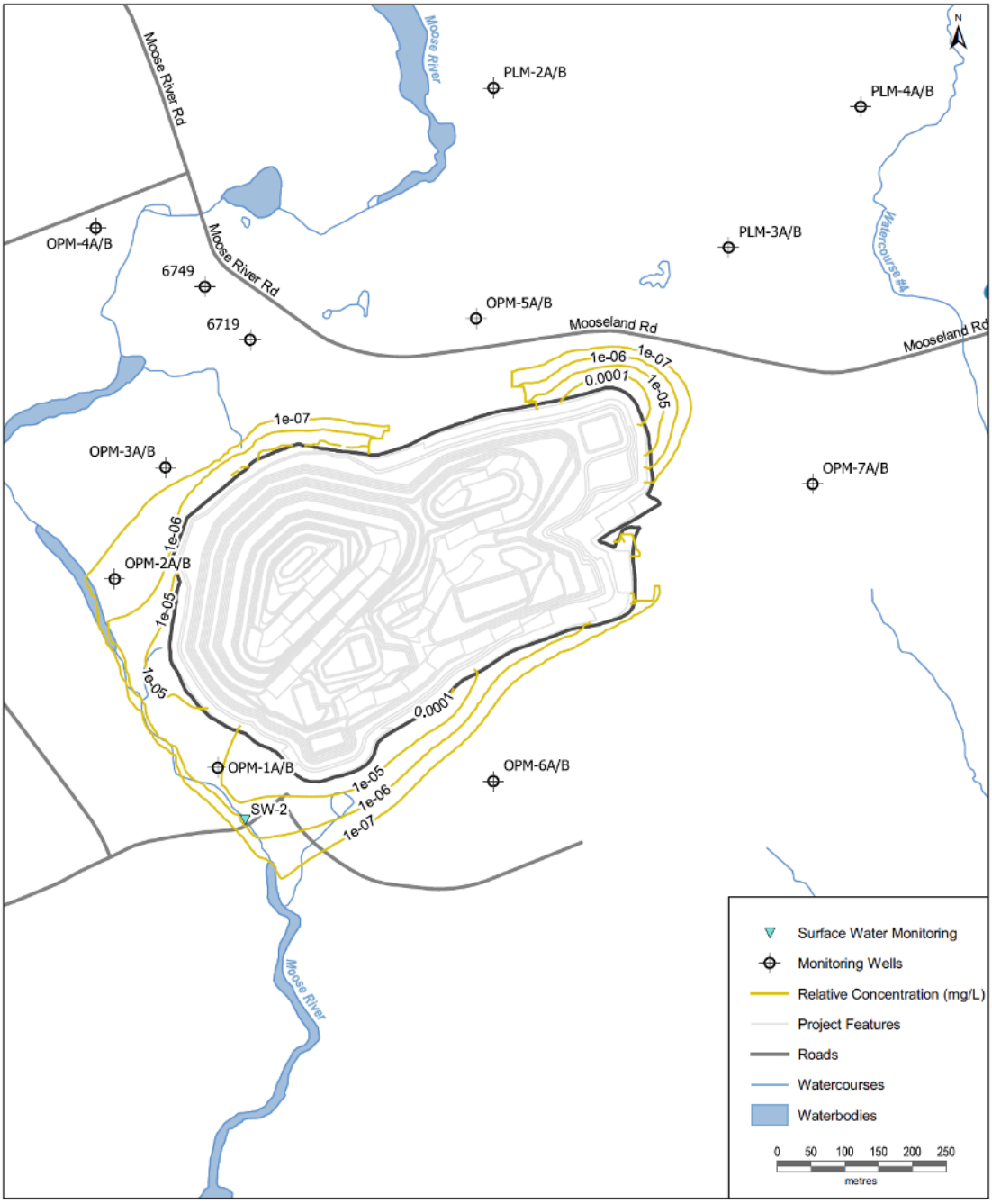
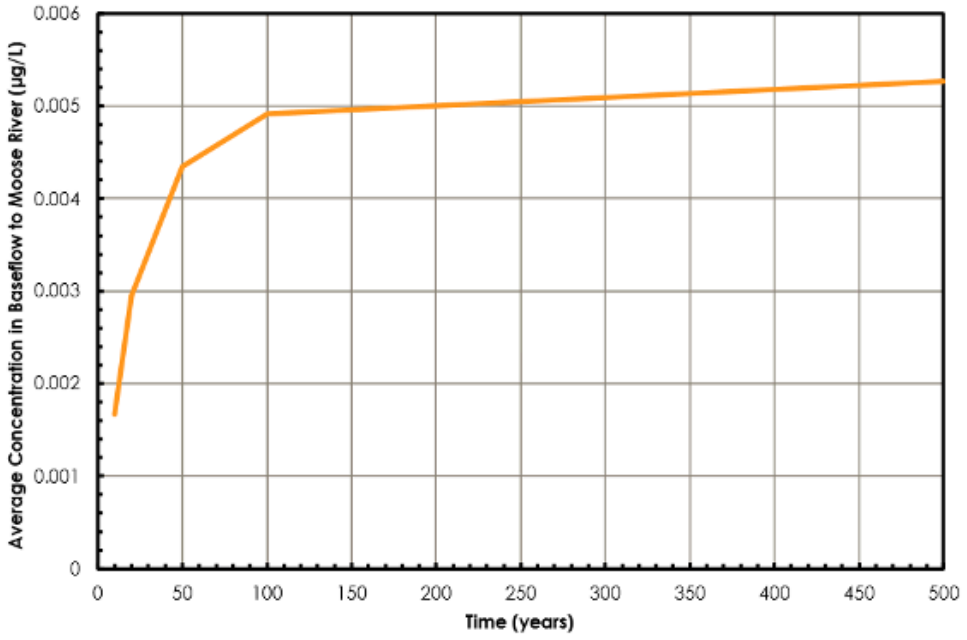


Figure 6.6-20: Simulated Average Concentrations of Arsenic Discharged to Moose River in Groundwater Seepage



A sensitivity analysis of the assumed porosity of the bedrock (Appendix F.6 Groundwater Flow and Solute Transport Modelling to Evaluate Disposal of Tailings in Touquoy Open Pit) was shown to affect the timing of the solute to arrive at Moose River, but did not alter the maximum concentration or underlying groundwater flow rates to the river.

Section 6.7.8.4.2 (Surface Water Quality Modelling Results) provides a discussion and effects assessment of the modelled Parameters of Primary Concern (POPC) in surface water originating from groundwater seepage. This groundwater seepage into the Moose River is an input into the surface water quality modelling and analysis of the assimilative capacity of the Moose River.

6.6.7.4 Groundwater Project Effects Summary

The following summaries are provided for each Mine Site specific to pre-mitigation project interactions, based on results of predictive modelling completed at each Mine Site.

6.6.7.4.1 Beaver Dam Mine Site

The range of potential groundwater inflow rates into the Beaver Dam open pit is approximately 655 to 829 m^3/d.

The maximum radius of groundwater drawdown influence under dry (conservative) conditions has been simulated at 1 km (in a southerly direction) and less than 1 km in all other directions from the Beaver Dam open pit, the impacts from groundwater drawdown is limited to localized drawdown at the surface water management ditches surrounding the Beaver Dam Mine Site infrastructure. Beyond 1 km, simulated drawdown decreases below 10 cm and there is little to no potential impact from the Beaver Dam Mine Site development on groundwater quantity interactions with surface water or potable wells.

The range in **simulated baseflow reduction to the Cameron Flowage watershed is from 2 to 3% of average annual baseflow and is under 1% of total average annual flow**. Potential effects of this baseflow reduction that includes surface water inputs as

well as groundwater on Cameron Flowage/Killag River is assessed in the Surface Water (Section 6.7). In addition, potential impacts wetlands from this localize change in groundwater on Wetlands is discussed in Section 6.8 and on Fish and Fish habitat is assessed in Section 6.9.

At EOM, it was identified that there is potential for arsenic and uranium to exceed the Potable Criteria near the non-potentially acid generating (NAG) waste rock stockpile; however, the impact is expected to be temporary as arsenic and uranium concentrations within the NAG waste rock stockpile are predicted to decrease as the source terms transition from EOM to PC conditions. Furthermore, the predicted exceedance of Potable Criteria for uranium does not extend beyond the Property Boundary, and arsenic is naturally occurring in groundwater at the Beaver Dam Mine Site at concentrations above Potable Criteria. Therefore, at EOM, no significant impact to the reasonable use of groundwater is predicted beyond the Property Boundary.

At PC, using the Base Case (i.e., median) source terms, predicted exceedances of the Potable Criteria for arsenic, cadmium, cobalt, manganese, nickel, lead, and uranium occur in the vicinity of the PAG waste rock stockpile. Using the Upper Case (i.e., 90th percentile) source concentrations, zinc is also predicted to exceed the Potable Criteria in the vicinity of the PAG waste rock stockpile. All predicted long-term PC impacts are contained within the PA boundary.

Simulated COC concentrations for groundwater discharge to surface exceed Tier 2 PSS guidelines under EOM conditions for aluminum for both the base case and upper case source terms and for arsenic and cadmium for the upper case source terms. The predicted exceedances at EOM are related to the topsoil stockpiles which will be removed following operations. For PC, exceedances of Tier 2 PSS were predicted in association with the PAG waste rock stockpile for aluminum, cadmium, cobalt, copper, iron, nickel, lead, and zinc. The predicted exceedances occur either towards Cameron Flowage or towards surface water features west of the PAG waste rock stockpile. To address predicted exceedances of Tier 2 PSS in the vicinity of Cameron Flowage, simulated COC mass loadings to the Killag River watershed were provided as inputs to the Predictive Water Quality Assessment that combined impacts from groundwater discharge and surface water runoff to assess the cumulative impact on the Killag River watershed, as discussed in Section 6.7 Surface Water. To address predicted exceedances of the Tier 2 PSS west of the PAG waste rock stockpile, an interceptor trench was evaluated as a potential mitigation measure. Implementing an interceptor trench is effective for achieving hydraulic containment of potential COC migration west from the PAG waste rock stockpile in the event that groundwater quality monitoring indicates COC concentrations are approaching the Tier 2 PSS in this area.

Potential impacts to groundwater quality and quantity are generally confined to within the PA and LAA. No impacts to groundwater quality and quantity are predicted approaching the RAA or at key receptors including Beaver Lake IR 17 or the nearest potable well located along Hwy 224.

6.6.7.4.2 Touquoy Mine Site

Water levels in the vicinity of the Touquoy Mine Site open pit will be depressed at the beginning of Beaver Dam operations. The Touquoy open pit is forecast to be dewatered at a rate of approximately 768 m^3/d at the end of mining.

Water levels in the vicinity of the Touquoy will recover slightly at the end of Beaver Dam operations but will continue to be depressed relative to existing conditions as the final water level in the Touquoy open pit will be at 108 m CGVD2013. At this stage, there will be both groundwater inflows to and outflows from the filled open pit, with a net groundwater discharge of 251 m^3/d.

Groundwater in the filled Touquoy open pit will seep to Moose River during Post Closure. The total groundwater seepage rate is simulated to contribute approximately 0.6% of the flow in Moose River, therefore the mass loading of the primary compounds of concern are predicted to be low and are not anticipated to adversely affect the water quality in Moose River. These concentrations are considered and evaluated through surface water modelling in Section 6.7.8.4.2.

6.6.7.4.3 Haul Road

No adverse impacts to potable groundwater resources are predicted at sensitive receptor locations along the Haul Road. There is no exceedance of the Potable Criteria.

6.6.8 Mitigation

Groundwater modelling was completed for the Project for potential changes to the quality and quantity of groundwater for the Beaver Dam Mine Site and Haul Road. No current potable groundwater resources for domestic use will be affected by the current Project design as described in Section 2 (Project Description). Potential exceedances of Potable Criteria (i.e., Tier 1 EQS for potable groundwater or GCDWQ) beyond the property boundary are predicted to be short term.

The groundwater quality and quantity effects assessment has been completed and evaluated the effectiveness of mitigation measures that may be included in the design of the Project, and/or as part of adaptive management monitoring, specifically:

- At closure, an engineered cover will be installed over the PAG at closure to reduce infiltration and oxidation, which will reduce the potential acid generation. Runoff from the PAG stockpile will be directed towards the pit.
  - Should monitoring indicate that an interceptor trench is necessary, additional data collected throughout development of the Beaver Dam Mine Site can be applied to refine the design of this potential mitigation measure.
  - An interceptor trench will be constructed to achieving hydraulic containment of potential COC migration west from the NAG and PAG waste rock stockpile.
- During operations and closure at the Beaver Dam Mine Site, water management system collects water from the stockpiles and Waste Rock Storage Area that will be directed towards the north settling pond for treatment at closure the drainage will be directed toward the pit. Water quality will be monitored and if water quality does not exceed predictions and are within water quality guidelines natural drainage will be restored.

The summary of mitigation measures provided in Table 6.6-10 will be implemented where potential direct and indirect impacts to groundwater quality and quantity are possible.

The Touquoy Mine Site is currently operational, mitigation measures for the Touquoy Gold Project can be found in the 2007 Focus Report (CRA 2007b), Industrial Approval and Touquoy Mine Site in annual monitoring reports.

Table 6.6-10: Mitigation for Groundwater Quality and Quantity

Mitigation Category	Project Phase	Mitigation Measure
Quality	C	Conduct pre-construction well survey at Beaver Lake IR 17
	C, O	Use above ground fuel storage tanks that meet applicable regulatory standards
	C, O	Select appropriate type of explosive that will minimize nitrogen release to surface water and groundwater; explosive management plan will be developed before construction and a Nitrogen Management Plan has been developed with site specific adaptive management measures in the event that Nitrogen levels exceed predictions.
	C, O, CL	Sub-aqueous deposition of mine tailings to reduce/prevent oxides and leaching
	CL	In the event of acid rock drainage and metal leaching, implement mitigative measures that will manage the source material and drainage effectively utilizing methods such as an engineered cover to reduce infiltration and oxidation thereby limiting potential acid drainage.
	C, O, CL	Flowage, and existing groundwater wells at Touquoy between the open pit and the Moose River. The purpose of this groundwater treatment is to intersect groundwater seepage impacted with COCs above Tier 2 pathway specific guidelines or groundwater baseline/background prior to seepage discharging into surface water bodies.
Quantity	C, O	Use blasting and pit construction techniques that minimize the potential for negatively interacting the adjacent groundwater table and nearby surface water
	C, O	Implement water conservation program for onsite facilities
	C, O	Recycle site water for reuse wherever practical to reduce water withdrawal from lakes or streams
	C, O	Recycled water must meet acceptable water quality criteria for its intended use

Note: C = construction; O = operations; CL = active closure (decommissioning and reclamation); IR = Indian Reserves; COC = contaminates of concern.

6.6.9 Significance of Residual Effects

The predicted residual environmental effects of Project development on groundwater drawdown are assessed to be adverse, but not significant, beyond the LAA. There is the potential for residual groundwater quality effects within the PA/LAA.

The overall residual effect of the Project on groundwater is assessed as not significant after mitigation measures have been implemented. Effects to groundwater potable resources are not predicted to extend beyond the immediate PA. At the Beaver Dam Mine site changes in potable groundwater resources will likely persist immediately adjacent to the NAG and PAG stockpiles. Groundwater quality will be monitored to determine if an interception trench should be installed to isolate hydraulic connectivity to the surrounding environment.

The reclamation plan for both sites includes a refilling of each pit to attain steady state groundwater flow conditions so that post-mining groundwater conditions are stable (i.e., inflow is equal to outflow).

Interactions or pathways on receptors are assessed in the Surface Water (Section 6.7) Wetlands (Section 6.8) and Fish Habitat (Section 6.9) sections.

A significant adverse environmental effect for Groundwater with respect to potable recourses is not predicted for the Project for the following reasons, with consideration of the ecological and social context of the LAA surrounding the Project:

- During Construction: effects to groundwater potable resources are limited to PA and more specifically the mine site.
- During Operations: Effects are limited to the PA and more specifically the mine site.
- During Closure: Effects are limited to the mine site, and specifically adjacent to the NAG and PAG stockpiles at Beaver Dam Mine.

Table 6.6-11: Residual Environmental Effects for Groundwater

Project - VC Interactions	Mitigation and Compensation Measures	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction – Beaver Dam Mine Site and Haul Road (Surface Water Alteration resulting in reduction of recharge to groundwater, blasting effects on GW, elevated nitrogen in GW from blasting residue)	Sediment and erosion control, pre-blast surveys within 800 m of potable wells, watercourse alteration permitting, inclusion of use of pit dewatering water and collected surface water instead of groundwater for dust control in the project design	M Mitigation strategies and best management practices reduce the magnitude of impact	PA VC confined to the Mine Site	A VC interaction is by timing considerations/during low flows	LT VC interaction effects extend into PCs	R VC interaction will occur regularly during construction phase	PR Mitigation not necessarily return to baseline conditions	Reduction in Water Quantity	Not Significant
Post-Closure – Beaver Dam Mine Site (Groundwater seepage from stockpiles discharge to surface water [Mud Lake, outlet watercourse from Mud Lake, Crusher Lake])	Installation of groundwater wells at the shores of these locations; periodic sampling to evaluate this prediction; modelling updates to include updated source term data/water quality inputs; if necessary groundwater will be intercepted (i.e., interception trench) upstream of wells and treatment will be considered to meet regulatory requirements prior to discharge into receiving environment. Monitoring will determine if additional adaptive management measures will be applied.	L Mitigation strategies and best management practices reduce the magnitude of impact	PA VC confined to the Mine Site	A VC interaction during low flow conditions is assessed	LT VC interaction effects extend into PCs	R Effects will occur at regular intervals during post closure phase of project	PR Mitigation not necessarily return to baseline conditions	Reduction in Water Quality	Not Significant

Notes: See Section 6.6.6.4, Table 6.6-5 for definitions of the below characteristics.

Magnitude

N	Negligible
L	Low
M	Moderate
H	High

Geographic Extent

PA	Project Area
LAA	Local Assessment Area
RAA	Regional Assessment Area

Timing

N/A	Not Applicable
A	Applicable

Duration

ST	Short-Term
MT	Medium-Term
LT	Long-Term
P	Permanent

Frequency

O	Once
S	Sporadic
R	Regular
C	Continuous

Reversibility

R	Reversible
IR	Irreversible
PR	Partially Reversible

6.6.10 Proposed Compliance and Effects Monitoring Program

Groundwater monitoring will be completed to confirm predicted environmental effects and the effectiveness of the mitigation measure groundwater quality. Mitigations are outlined in Table 6.6-10. Groundwater monitoring programs will continue during baseline/pre-construction, to document groundwater baseline conditions. A Proposed Groundwater Monitoring Plan (Appendix G of Appendix P.4 Mine Water Management Plan) has been developed in consideration of wetland and watercourse alteration. The plan provides methods, timing, frequency, and locations for groundwater monitoring. This document will evolve through regulatory permitting, as well as public and Mi'kmaq engagement. Information generated from the groundwater monitoring will be included as part of the Aquatic Effects Monitoring Program that will be developed as part of the permitting process and submitted with the Industrial Approval application.

Groundwater monitoring at Touquoy Mine Site is ongoing and will be expanded before Beaver Dam Mine tailings are deposited in the mined out pit.

6.7 Surface Water Quantity and Quality

6.7.1 Introduction

6.7.1.1 Summary of Surface Water Quality and Quantity Before the Updates

The Beaver Dam Mine (the Project) comprises approximately 592 hectares (ha) of lakes, rivers and forested lands that are in Varying degrees of re-growth due to historical logging. The Project will operate as a satellite surface mine to the existing and fully permitted Touquoy Gold Mine, located nearby in Moose River Gold Mines, Nova Scotia. The ore that is mined from the Beaver Dam Mine Site will be processed at the existing Touquoy Mine.

Prior to updates, Section 6.7 described the methods and results of baseline characterization as well as predictive studies that were undertaken to support characterization of potential Project effects on the Surface Water Quality and Quantity Value Components (VCs). Surface water quality and quantity represent physical components of the natural environment and are protected under both provincial and federal legislation (Canada Water action 1985a, *Fisheries Act* (1985b), *Fisheries Protect Act* (1997), *Nova Scotia Environment Act* (1995)). The regulations help protect ecological components, as well as human health.

Water quality constitutes the physical, chemical, biological, and aesthetic characteristics of water which are, in turn, determined by a variety of regional and local factors including rock weathering, surface transport, biological activity, and anthropogenic influences.

Surface hydrology (used interchangeably with surface water quantity or stream flow) also forms a key component of the aquatic environment, as the magnitude, frequency, duration and timing of stream discharge are directly linked to other components of the aquatic ecosystem. These include groundwater quantity and quality, surface water quality, fish and fish habitat, and aquatic resources.

Prior to updates, the Surface Water Effects Assessment was developed to incorporate quantitative data from baseline reports as well as predictive water quality modelling including sensitivity analyses. The subsequent assessment of residual effects incorporated mitigation and management plans for Project effects and, although residual effects were identified, they were characterized as Not Significant.

6.7.1.2 Summary of Updates to Surface Water Quantity and Quality

The Surface Water Quality and Quantity Effects Assessment (EA) for the Project has been updated to reflect updates of the Project Description (Section 2) and to address Round 2, Information Requests (IR2) issued by the Impact Assessment Agency of Canada (IAAC, formerly the Canadian Environmental Assessment Agency [CEAA 2019]) and Nova Scotia Environment (NSE 2019). This includes:

- Updated description of the existing environment based on ongoing surface water monitoring studies (Section 6.7.4 and Appendix G.1);
- Identification and evaluation of potential water treatment for the Project is described in the Mine Water Management Plan (Appendix P.4) including:
  - Construction Phase (i.e., metals originating from historic mining and tailings Appendix F.1 of Appendix P.4);
  - Operation Phase (i.e., nitrite removal technologies (Appendix F.2 of Appendix P.4); and
  - Post-closure Phase Water treatment Assessment (Appendix F.3 of Appendix P.4).

- Update of the Mine Water Management Plan (Appendix P.4);
- Revised predictive water quality assessment for Construction, End-of-Mine (EOM) and Post-closure phases (Appendix D of Appendix P.4); and
- Assessed the potential effects of Haul Road activities on Surface Water (IR2 responses CEAA-2-36, CEAA-2-37, and NSE-2-130) and included as Appendix F.9 [Evaluation of Potential Impacts from Metals COCs to Groundwater and Surface Water from Dust Deposition along the Haul Road].

Standalone responses to IR2s are provided in AMNS (2021). An outline of updates to the Surface Water Environmental Effects Assessment are summarized in Table 6.7-1.

Table 6.7-1: Updated Subsections from the 2019 Revised Environmental Impact Statement – Surface Water Quantity and Qualtiy

2019 Revised EIS Submission (February 28, 2019)	Updated in 2021	Corresponding 2021 EIS Update Section Number	Reason for Update
-	-	6.7.1 Introduction	• new
6.7.1 Rationale for Valued Component Selection	No	6.7.2 Rationale for Valued Component Selection	• N/A
6.7.2 Baseline Program Methodology	Yes	6.7.3 Baseline Program Methodology	• As a part of this EIS update, the baseline study area was adjusted to allow for the micro-siting of infrastructure, as described in the updated Project Description (Section 2). As a result, targeted surface water surveys were conducted within the modified project area in July and August 2019 to identify and delineate additional surface water features. During the 2019 field evaluations, one new watercourse (WC-AI) and an extension of a previously identified watercourse (WC-O) were delineated along the Haul Road. New watercourses assessed are described in Section 6.7.4.
6.7.3 Baseline Conditions	Yes	6.7.4 Water Quantity Baseline Conditions	• Updated to reflect additional water quality and quantity data collected since the 2019 Revised EIS (AMNS 2019).
-	-	6.7.5 Water Quality Baseline Conditions	• Adjusted heading levels to have Water Quantity and Quality as separated sections. • Updated to reflect additional water quality and quantity data collected since the 2019 Revised EIS (AMNS 2019).
6.7.4 Consideration of Consultation and Engagement Results	No	6.7.6 Consideration of Engagement Results	• Updated to reflect updated engagement with the Public (Section 3), Indigenous Peoples including Mi'kmaq of Nova Scotia (Sections 4 and 6.14).

Table 6.7-1: Updated Subsections from the 2019 Revised Environmental Impact Statement – Surface Water Quantity and Qualtiy (continued)

2019 Revised EIS Submission (February 28, 2019)	Updated in 2021	Corresponding 2021 EIS Update Section Number	Reason for Update
6.7.5 Effects Assessment Methodology – **Boundaries**	Yes	6.7.7 Effects Assessment Methodology – **Boundaries**	• Effects assessment methodology has been updated to reflect updated to models that included additional sampling undertaken since 2018. The additional information has been used either to update the model or calibrate the modelling. The approach for modelling is described is section 6.7.7.3; the associated results are presented in Section 6.7.8.
6.7.5 Effects Assessment Methodology – **Thresholds for Determination of Significance**	Yes	6.7.7 Effects Assessment Methodology – **Thresholds for Determination of Significance**	• Assessment of effects of Haul Road activities on surface water quality has been added, including consideration of surface water from dust depositions. (CEAA-2-37). Significant thresholds clearly define quantitative definitions criteria for Residual Effects on Surface Water Quantity (and Surface Water Quality (Table 6.7-45)
6.7.6 Project Activities and Surface Water Quality and Quantity Interactions and Effects	No	6.7.8 Project Activities/Interactions with Surface Water Quantity and Quality	• Reflect updates in Project Description (Section 2)
6.7.7 Preferred Alternative Haul Road	Yes	Section removed	• Preferred Alternative Haul Road sections and references are removed from the EIS.
6.7.8 Mitigation and Monitoring	Yes	6.7.9 Mitigation	• Additional mitigation measures that reduce noise at the property boundary have been added for the Project.
6.7.9 Residual Effects and Significance	Yes	6.7.10 Residual Effects and Significance	• Updated based on quantitative definitions of magnitude.
6.7.10 Proposed Compliance and Effects Monitoring Program	No	6.7.11 Proposed Compliance and Effects Monitoring Program	• Updated to reflect changes in monitoring.
-	-	6.7.12 Summary of Residual Effects to Surface Water Quantity and Quality	• new

Notes: PA = Project Area; LAA = Local Assessment Area; RAA = Regional Assessment Area; - = no update; IR2 = Round 2, Information Requests; CEAA = Canadian Environmental Assessment Agency; EIS = environmental impact statement; N/A = not applicable.

6.7.2 Rationale for Valued Component Selection

Surface water (quality and quantity) was selected as a VC for its significance to ecological, and socio-economic systems. Hydrologically and hydrogeologically, surface water consists of stormwater runoff that feeds into various water systems (i.e., rivers, lakes, oceans) including groundwater through recharge.

In summary, Surface Water was selected as a Valued Component for the following reasons:

- Its ecological value in providing habitat for aquatic species;
- The importance of surface water in the daily lives of terrestrial species;
- Its potential to convey stormwater;
- The socio-economic importance of surface water from a recreational and resource perspective; and
- Its potential to interact with Project activities.

The proposed Project has the potential to affect surface water quality during the construction, operations, active closure, and post-closure phases. This effects assessment discretizes Surface Water into two VCs: Surface Water Quality and Quantity, whereby changes to these VCs are, in turn, evaluated using indicators that are relevant, practical, measurable, responsive, accurate and predictable.

The assessment of surface water as individualized VCs, rather than assessing individual physical or chemical constituents, was selected through a review of relevant regulations and guidelines, scientific literature, as well as professional experience and judgement. Indicators, listed in Table 6.7-2, are parameters that allow changes in surface water to be measured. Surface Water Quality and Quantity indicators are assessed quantitatively in predictive modelling, semi-quantitatively using best available data, or qualitatively using professional judgement and experience (Section 6.7.7).

Table 6.7-2: Valued Components Selected for Surface Water Quantity and Quality Assessment

Assessment Pillar	Subject Area	Valued Component	Indicators
Environment	Physical Environment	Surface water quantity	Changes in: • stream volume volumes; and • shifts in seasonal distribution of stream flow.
		Surface water quality	Changes in: • total and dissolved metals; • anions; • nutrients; • TSS; • pH; and • temperature.

Note: TSS = total suspended solids.

6.7.3 Baseline Program Methodology

Surface water monitoring (quality and quantity) for the proposed Project has occurred since 2014; the scope of monitoring programs has varied slightly from year to year to reflect updates to the Project Description (Section 2) as well as to respond to IR2 requests issued by IAAC (CEAA 2019) and Nova Scotia Environment (NSE 2019). However, monitoring has continued to be focused in three geographically distinct areas:

1. Beaver Dam Mine Site;

2. The Haul Road; and

3. The existing Touquoy Mine.

The Killag River, Crusher Lake, Mud Lake, Tent Brook and Cope Brook (Beaver Dam Mine Site area), and Moose River (existing Touquoy Mine) constitute the primary focus of the Project baseline surface water characterization studies, as well as subsequent effects assessment. These watercourses will receive direct discharge and/or their catchment areas have potential to be impacted by Project water management activities, such as non-contact water diversions.

Surface water quality baseline monitoring stations for the Beaver Dam Mine Site, the Haul Road, and the existing Touquoy Mine are presented in Figures 6.7-1, 6.7-2A to 6.7-2D, and 6.7-3, respectively. The baseline program methodology is summarized below, including delineation of the baseline study area and identification of monitoring locations; results of surface water baseline characterization studies are presented in Sections 6.7.4 and 6.7.5.

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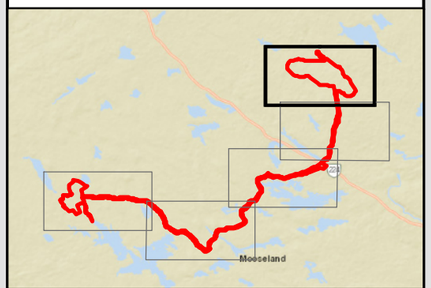
FIGURE 6.7-1

Surface Water Quality Baseline Sampling Locations, Beaver Dam Mine Site

SW29
SW19
SW30
SW4A
Mid Lake
SW26A
Cameron Flowage
WC-17
WC-16
WC-15
WC-6
WC-5
WC-7
SW6A
WC-12
SW14
SW5A
WC-13
SW5
WC-14
SW1
SW1A
WC-18
WC-21
Crusher Lake
WC-20
WC-22
WC-24
WC-3
WC-2
WC-4
WC-11
WC-10
SW12
WC-23
WC-1
WC-2
WC-19
WC-3
WC-B
WC-C
WC-28
SW28
WC-D
SW11
SW31
520000
4990000

- Baseline Surface Water Quality Monitoring Location Haul Road
- Baseline Surface Water Quality Monitoring Location Mine Site
- Field Delineated Watercourses
- NSTDB Mapped Watercourses
- Local Road
- Dry Weather / Seasonal Road
- Track
- Proposed Infrastructure
- Field Delineated Wetlands
- NSE Wetlands
- Water Bodies
- Project Area



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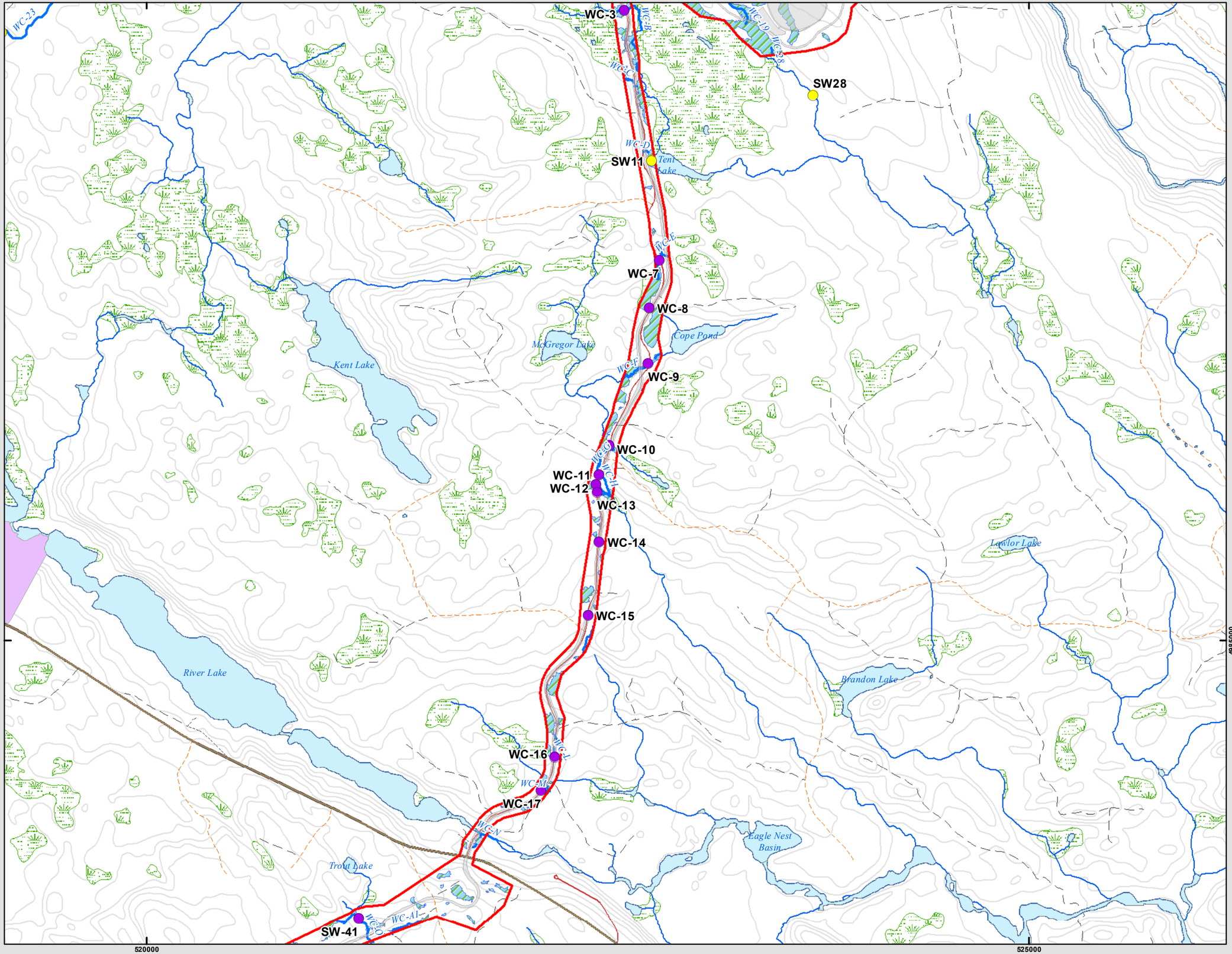

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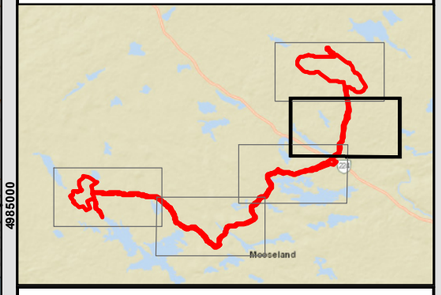
FIGURE 6.7-2A

Surface Water Quality Baseline Sampling Locations, Haul Road

- Baseline Surface Water Quality Monitoring Location Haul Road
- Baseline Surface Water Quality Monitoring Location Mine Site
- Field Delineated Watercourses
- NSTDB Mapped Watercourses
- Collector Road
- Local Road
- Dry Weather / Seasonal Road
- Diveways (>300 m)
- Track
- Beaver Lake Indian Reserve
- Proposed Infrastructure
- Field Delineated Wetlands
- NSE Wetlands
- Water Bodies
- Project Area



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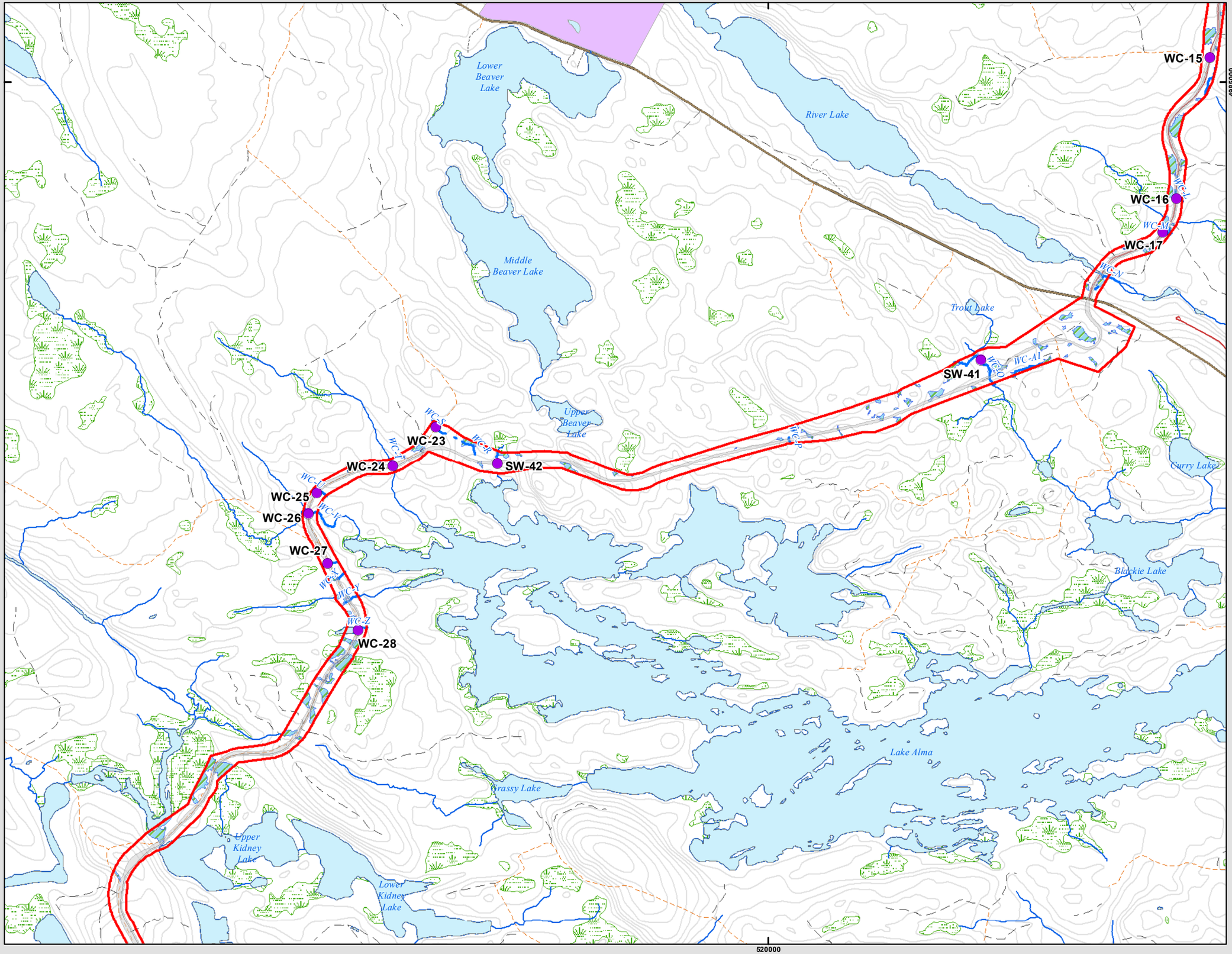

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FIGURE 6.7-2B

Surface Water Quality Baseline Sampling Locations, Haul Road

- Baseline Surface Water Quality Monitoring Location Haul Road
- Field Delineated Watercourses
- NSTDB Mapped Watercourses
- Collector Road
- Local Road
- Dry Weather / Seasonal Road
- Diveways (>300 m)
- Track
- Beaver Lake Indian Reserve
- Proposed Infrastructure
- Field Delineated Wetlands
- NSE Wetlands
- Water Bodies
- Project Area

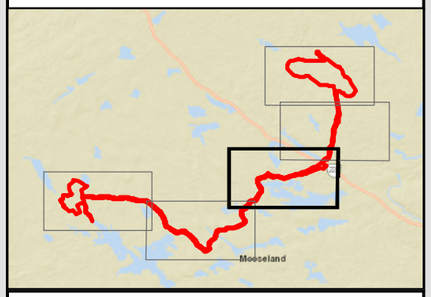

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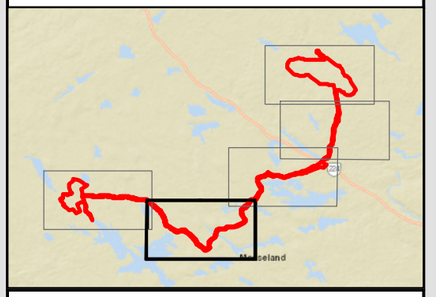
FIGURE 6.7-2C

Surface Water Quality Baseline Sampling Locations, Haul Road

- Baseline Surface Water Quality Monitoring Location Haul Road
- Field Delineated Watercourses
- NSTDB Mapped Watercourses
- Local Road
- Dry Weather / Seasonal Road
- Diveways (>300 m)
- Track
- Proposed Infrastructure
- Field Delineated Wetlands
- NSE Wetlands
- Water Bodies
- Project Area



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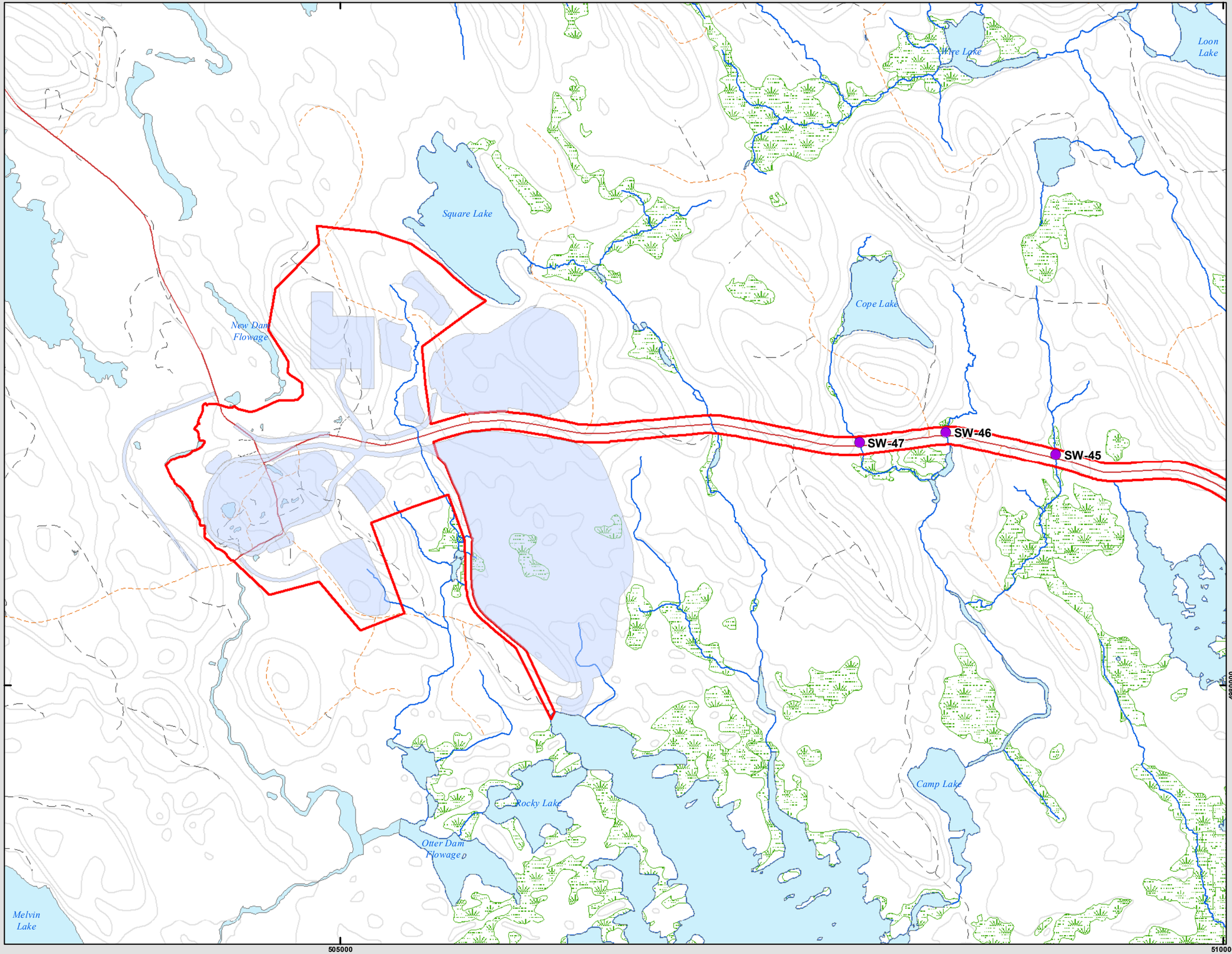

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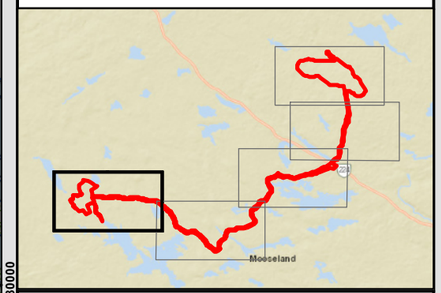
FIGURE 6.7-2D

Surface Water Quality Baseline Sampling Locations, Haul Road

- Baseline Surface Water Quality Monitoring Location Haul Road
- NSTDB Mapped Watercourses
- Local Road
- Dry Weather / Seasonal Road
- Diveways (>300 m)
- Track
- Touquoy Mine Infrastructure
- NSE Wetlands
- Water Bodies
- Project Area



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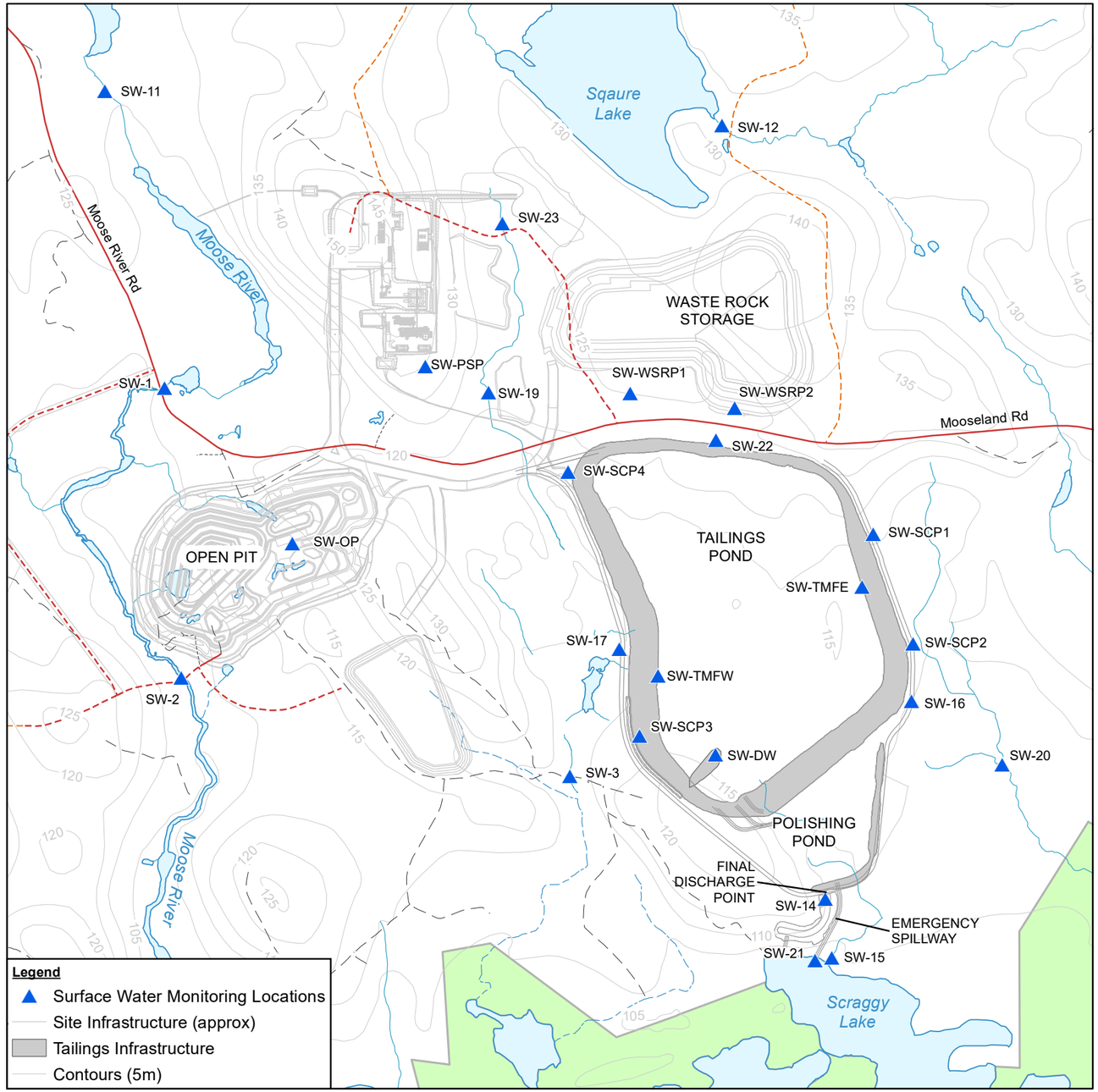

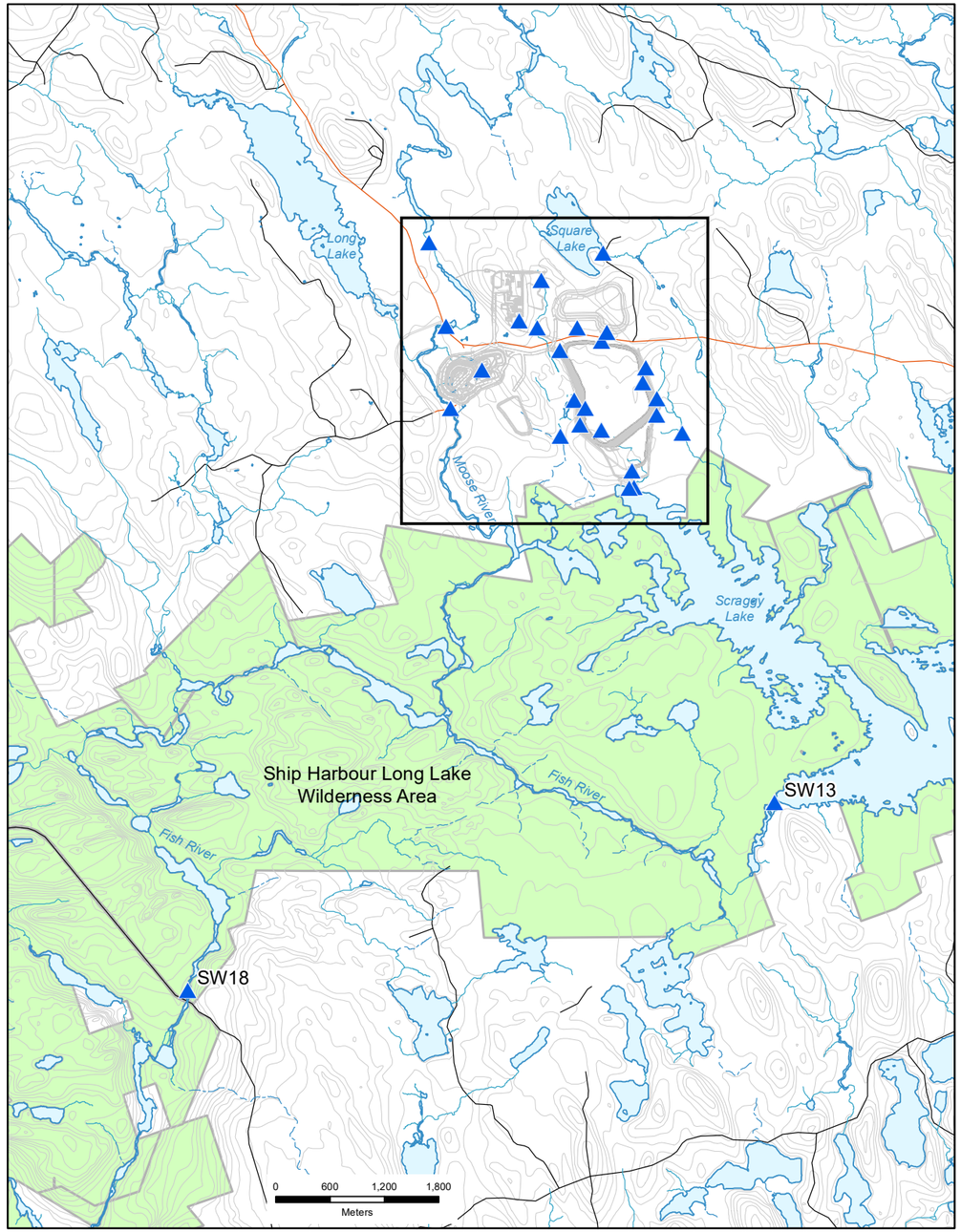

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ATLANTIC MINING NS INC
MARINETTE, HALIFAX CO., NOVA SCOTIA
ENVIRONMENTAL IMPACT STATEMENT - BEAVER DAM MINE

TOUQUOY MINE
SURFACE WATER MONITORING LOCATIONS

088664
May 10, 2021

FIGURE 6.7-3

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To identify waterbodies requiring monitoring and characterization, available databases were evaluated to identify mapped waterbodies and watercourses within the Beaver Dam Mine Site and the Haul Road. A field evaluation followed in the spring and summer of 2015 to confirm the presence of the identified water features within and surrounding the site; initially, no mapped waterbodies were identified within the Haul Road. Field evaluation followed in fall 2015 and spring 2016 to confirm the presence of mapped watercourses along the Haul Road and the identification of additional watercourses within the Haul Road corridor; given the linear nature of the Haul Road, mapped watercourses were grouped into watercourse systems 1 to 7 based on their tertiary watershed affiliations to aid in field identification.

As a part of this EIS update, the baseline study area was adjusted to allow for the micro-siting of infrastructure, as described in the Project Description (Section 2). As a result, targeted surface water surveys were conducted within the modified PA in July and August 2019 to identify and delineate additional surface water features. During the 2019 field evaluations, one new watercourse (WC-AI) and an extension of a previously identified watercourse (WC-O) were delineated along the Haul Road. New watercourses are described in Section 6.7.4; summary of physical characterization of watercourses (e.g., wetted widths, average depth, habitat type, etc.) are provided in Appendix G.4 (Physical Characterization of Watercourses).

All open water features identified during the 2019 field evaluations are wetland features, most of which are anthropogenic resulting from historic mine activities that are described in Geology, Soils, and Sediment Quality (Section 6.5, Appendices E.6 to E.9 [i.e., Phase I Environmental Site Assessment (ESA), Limited Phase II ESA, Extended Phase II ESA, and draft Historic Tailings and Waste Rock Management Plan, respectively]). An assessment of historic mining activities and tailings have been updated since the Revised 2019 EIS (AMNS 2019) with more comprehensive sampling program including sediments, which replaces results reported in Appendix E.1 (Sediment Baseline Analytical Results). Open water features associated with wetlands are addressed within the Wetlands Section 6.8.

For the Haul Road, 16 mapped watercourses, including two major rivers, West River Sheet Harbour (WRSH) and Morgan River. Five smaller waterbodies are mapped west of Lake Alma. During field assessments, however, these five waterbodies were confirmed to be wetland habitat. The wetlands are described in Section 6.8.

During field investigations, watercourses were documented using an SXBlue II Global Positioning System (GPS) receiver unit capable of sub-meter accuracy with a handheld SXPad field computer. Blue flagging tape was used to mark the locations of all watercourses. Watercourses were mapped within the Beaver Dam Mine Site and Haul Road and provided a specific watercourse identification number. Each identified watercourse was described for physical parameters, including bank full width, wetted width, water depth, structure (pool, riffle, run, flat, others), littoral zone description, fish habitat potential, overhanging and in-stream vegetation, substrate, potential to support species at risk (SAR) and species of conservation interest (SOCI) and bank stability.

In-stream flow monitoring was conducted at the Beaver Dam Mine Site at two locations, SW-1A and SW-19, in 2018, with four and seven monitoring events completed, respectively. In 2019, a more extensive program was conducted at four locations; SW-1A, SW-2A, SW-6A and SW-19 monthly from April to December. In 2020, three additional baseline flow monitoring locations were established at SW-30, SW-31, and SW-32. These new locations were monitored monthly from April to November 2020. The 2019 and 2020 analysis can be found in IR2 NSE-2-95 response (AMNS 2021). There are a total of seven long-term flow monitoring stations located at the Beaver Dam Mine Site to support the effectiveness of mitigation measures on reducing surface water quantity impacts (Section 6.7.9).

6.7.4 Water Quantity Baseline Conditions

6.7.4.1 Overview

Baseline characterization of Surface Water Quantity (hydrology) conditions at the Project was undertaken to define the existing hydro-climatic regime for the watersheds that could potentially be affected by Project development. The results of these investigations are summarized in the following sections. The primary objectives of the surface hydrology baseline program were to:

- collect stream flow data from a representative suite of Project area watersheds;
- calculate relevant stream flow metrics, including annual runoff, low flows and peak flows, unit yields, etc.; and
- integrate the site-specific data with the available regional hydrometric data to estimate stream flow variability and recurrence intervals for low and peak flows.

The results of baseline characterization studies informed predictive water balance and water quality modelling, informed proposed water mitigation and management activities, and support the effects assessment for the Project (Section 6.7.9 and 6.7.8, respectively).

The proposed Project activities encompass three geographically distinct areas:

- Beaver Dam Mine Site;
- Haul Road; and
- Existing Touquoy Mine.

The Killag River, Crusher Lake, Mud Lake, Tent Brook and Cope Brook (Beaver Dam Mine Site area), and Moose River (existing Touquoy Mine) constitute the primary focus of the Project baseline surface water characterization studies (Appendix G.4), as well as subsequent effects assessment, as these watercourses will receive direct discharge and/or catchment areas have potential to be impacted by Project water management activities.

6.7.4.1.1 Beaver Dam Mine

The Beaver Dam Mine Site lies within the West River Sheet Harbour (WRSH) drainage basin, which is directly east of the Musquodoboit River Valley system. The watershed occupies an area of roughly 576 square kilometers (km^2), a moderately sized watershed in the Province. The area is characterized by rolling till plains, drumlin fields, extensive rockland, and numerous freshwater lakes, streams, bogs and wetlands having relatively low relief, hummocky type terrain. This inland area is somewhat removed from the immediate climatic influence of the Atlantic Ocean and is characterized by warmer summers and cooler winters.

The Killag River and Cameron Flowage is the main mapped linear watercourses of the Beaver Dam Mine Site, and Crusher Lake and Mud Lake are the major mapped lakes. The complex system of streams, lakes, bogs, and wetlands is a direct result of the underlying bedrock geology of greywacke and slate found in the region. The basin ultimately drains to the south via the West River Sheet Harbour, and discharge peaks are likely attenuated to a large extent by the numerous lakes and wetlands through which runoff is routed. The West River Sheet Harbour and Tangier River Secondary boundary runs through the center of the Project Area (Section 6.7.3) along the proposed Haul Road. Elevations within the catchment vary from approximately 135 to 165 meters above sea level (masl) in the headwater areas and gradually decrease to sea level at the final outlet located at Sheet Harbour. The headwaters of the drainage basin are located along the topographic divide separating the Musquodoboit River Valley to the northwest.

An inventory of surface water features was undertaken to identify water features that may be impacted directly or indirectly by the proposed mine and Haul Road construction and operations. Initially three waterbodies (Crusher Lake, Mud Lake, and an unnamed waterbody in the southwest section of the Project Area) were identified through a desktop review of available mapping as requiring characterization of baseline conditions. During the 2019 field evaluations, 10 additional watercourses were identified within the Beaver Dam Mine Site, totaling 24 watercourses within the Beaver Dam Mine Site area. Three additional watercourses outside of the Beaver Dam Mine Site were also delineated (WC23 [Outlet to Cope Brook], WC26 [Outlet to Killag], and WC27 [Outlet of Mud Lake]), due to potential impacts to fish and fish habitat within the LAA (Section 6.9). New watercourses are described in Section 6.7.5 and shown in Figures 6.7-1 and 6.7-2A through 6.7-2D.

Most watercourses within the Beaver Dam Mine Site are first order streams originating within headwater wetland habitat inside of the PA. Many streams across the Beaver Dam Mine Site are generally small with minimal pool/riffle structure and consist of mucky organic substrate. While most are generally perennial in nature, many have intermittent patches, which go dry during prolonged rainless periods when percolation depletes all flow (Alberta Transportation 2009).

Tertiary basins potentially affected by the Project including four within the Beaver Dam Mine Site and six along the Haul Road footprint; were identified as a result of baseline characterizations studies, are listed below and shown on Figure 6.7-4).

The four tertiary basins affected within the Beaver Dam Mine Site:

- Portion of Killag River (1EM-2-D);
- Tent Brook (1EM-2-F);
- Paul Brook (1EM-2-H); and
- Cope Brook (1EM-2-J).

The six tertiary basins affected along the Haul Road:

- Tent Brook (1EM-2-F);
- Keef Brook (1EM-2-G);
- Jack Lowe Brook (1EM-2-N);
- Little River (1EM-2-P);
- Portion of Sandy Pond (1EL-2-C); and
- Portion of Morgan River (1EL-2-H).

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FIGURE 6.7-4

Beaver Dam Mine Project

Tertiary Watersheds Beaver Dam Mine Site and along the Haul Road

- NSSA Lime Dosers
- Aquatic Local Assessment Area
- Project Area

Tertiary Watershed

- Sandy Pond (1EL-2-C)
- Morgan River (1EL-2-H)
- Killag River (1EM-2-D)
- Tent Brook (1EM-2-F)
- Keef Brook (1EM-2-G)
- Paul Brook (1EM-2-H)
- Cope Brook (1EM-2-J)
- Jack Lowe Brook (1EM-2-N)
- Little River (1EM-2-P)
- Second Rocky Lake (1EL-5-H)
- Camp Lake (1EL-5-K)
- Fish River (1EL-5-M)
- Moose River (1EL-5-P)



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Units: Meter

0 1 2 4 km

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6.7.4.1.2 Touquoy Mine Site, Existing Conditions

The Touquoy Mine Site is an active Mine Site that commenced operation on October 11, 2017 and is subject to an Industrial Approval to operate issued by NSE. A Class I Environmental Assessment under the *Nova Scotia Environment Act* and Environmental Assessment Regulations for the Project was reviewed and approved in 2008, subject to Approval conditions. The use of the Touquoy Mine Site for the processing of Beaver Dam Mine ore and deposition of the associated tailings will occur after ore extraction from the Touquoy open pit has ceased. As such, the baseline conditions for the Touquoy Mine Site for the Project operations will be the conditions expected near the end of the Touquoy ore processing operations.

Existing conditions with respect to surface water for the watershed was based on the available data collected as part of the 2007 submission (CRA), 2013 LiDAR (Leading Edge), and Water Management Plan (Stantec 2017a) for operation, the Reclamation Plan (Stantec 2017b) for reclamation and closure, and the 2017 surface water quality/quantity monitoring reports (Stantec 2018b).

The existing Touquoy Mine Site is part of the Moose River drainage basin, which is directly east of the Musquodoboit River Valley system. As described in the Environmental Assessment Registration Document (CRA 2007b), the Moose River watershed can be characterized by rolling till plains, drumlin fields, extensive rock land, and numerous freshwater lakes, streams, bogs and wetlands in the headwaters and the relatively low relief hummocky terrain. Forests are predominantly coniferous of red and black spruce (CRA 2007b). Local ground surface elevations at the Touquoy Mine Site range from 102 to 145 masl. The Touquoy Mine Site is approximately 10 kilometers (km) northwest of the Tangier Grand Lake Wilderness Area. This protected area consists of 16,000 ha of predominantly coniferous forest and has abundant lakes, wetlands, and waterways. The waterbodies within the Wilderness Area are contained within a separate watershed from that of the Touquoy Mine Site, which lies in the Fish River Watershed.

The Moose River drainage basin ultimately drains to the south via Moose River, and runoff through the catchment to Moose River is likely attenuated by the many lakes and wetlands in the catchment thus reducing the peak flow. The catchment area of Moose River is 3,904 ha at surface water monitoring station TQ-SW-2 draining from topographical highs of 180 to 110 masl in elevation (CGVD 2013) at the banks of Moose River. Moose River flows south approximately 2.3 km downstream of SW-2 where it joins the Fish River. Watercourse No. 4 has a catchment area of 136.3 ha at surface water monitoring station TQ-SW-3 and flows south between the existing open pit and Tailings management Facility (TMF) to Moose River and eventually to the Fish River.

6.7.4.2 Monitoring Results

Site-specific baseline results for the effects assessment are presented in this section. The results were calculated for five assessment points selected to assess the hydrologic conditions at the two major mapped lakes (Mud Lake, Crusher Lake) and the main watercourses of the three tertiary basins assessed for the Project including the Killag River, Tent Brook and Cope Brook. The catchment areas were delineated upstream of the assessment points. A summary of baseline catchment areas is provided in Table 6.7-4. Detailed descriptions of the catchment areas are provided in Appendix G.4, Table G.4-1 and presented in Figure 6.7-5. Descriptions and baseline conditions for all 16 assessment points considered in the aquatic effects assessment are provided in Appendix P.4 (Mine Water Management Plan, Appendix A).

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FIGURE 6.7-5

Beaver Dam Mine Project

Catchment Areas and Assessment Point Locations. Baseline

Killag River (Upstream)
WC-26
Killag River (at WC-26)
Killag River (at WC-27)
WC-27 (at Mud Lake)
WC-27 (at Killag River)
Killag River (at Cameron Flowage)
WC5 (at Mud Lake)
WC-5 (at Crusher Lake)
Killag River (at Doser)
Killag River (Downstream)
Cope Brook (Upstream)
Cope Brook (at WC-23)
WC-23
Tent Brook
Killag River 1EM-2-D
Cope Brook 1EM-2-J
Paul Brook 1EM-2-H
Tent Brook 1EM-2-F
Keef Brook 1EM-2-G
Highway 224
West Lake
Sand Lake Brook
West Brook
Como Lake
Seven Mile Stream
Crusher Lake
Mud Lake
Cameron Flowage
Killag River
Paul Brook
Kent Lake
McGregor Lake
Cope Pond
Keef Brook
Tent Brook
West River Sheet Harbour
Cope Brook
WC-26
WC-27
WC-5
WC-23
4990000
520000
525000

- Indirect Impact to Flow
- No Significant Impact to Flow
- Upstream Reference
- NSSA Lime Dosing Station
- Direct Impact: Watercourses
- Indirect Impact: Flow Reduction
- Fisheries Resources
- Provincially Regulated Watercourses
- Beaver Lake I.R.
- Project Area

Note: Arrows show flow direction



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Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 0.25 0.5 1 kilometer

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Document Name: BD_EIS_Figure6.7-2BDCathmentAreas

Table 6.7-3: Summary of Catchment Areas and Baseline Conditions (Area) for the Beaver Dam Mine Project

Catchment	Baseline Conditions (ha)
Killag River (Killag River DS Assessment Point)	3,933.5
Crusher lake (WC5 US Assessment Point)	58.8
Mud Lake (WC27 US Assessment Point)	223.2
Tent Brook (Tent Brook Assessment Point)	306.2
Cope Brook (Cope Brook DS #2 Assessment Point)	640.0

Note: Assessment point IDs as defined in brackets next to the catchment name; DS = Downstream; US = Upstream.

6.7.4.2.1 Beaver Dam Mine Site

Climate and Baseline Runoff Estimates

Average daily temperature values and daily precipitation totals were obtained from the Environment Canada Middle Musquodoboit Climate Station (Climate ID 8203535). The station was selected based on its proximity to the Project Site and relatively long, complete and current record. Monthly lake evaporation normal were obtained from the Environment Canada Truro Climate Station (Climate ID 8205990), which is the closest climate station to the site that collects lake evaporation data. Table 6.7-4 summarizes the monthly precipitation totals and average temperatures at the Project Site.

Table 6.7-4: Climate Normals, Hydrological Baseline Conditions Beaver Dam Project

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Average Temperature (°C)	-6.2	-5.3	-1.1	4.3	9.9	15.0	18.5	18.3	13.9	8.3	3.4	-2.5
Precipitation (mm of rain)	128.8	103.3	125.6	105.1	102.6	94.8	97.8	97.7	103.0	123.9	137.1	136.0
Lake Evaporation (mm/day)	0	0	0	0	2.9	3.4	3.8	3.1	2.3	1.3	0	0

Note: Data from Middle Musquodoboit and Truro Environment Climate Stations

To characterize baseline conditions, daily rainfall, snowfall and mean temperature data were obtained from the Environment Canada Middle Musquodoboit Climate Station daily precipitation record for 41 years including 1968 to 2005, 2009, 2014, and 2016. The years that have a significant amount of missing data were excluded from the analysis. The average monthly temperature at the site ranges from a low of -6.2°C in January to a high of 18.5°C in July. The lowest average total monthly precipitation occurs in June (94.8 mm), while the highest occurs in November (137.1 mm). Snowfall was converted to snowmelt using the degree-day method. The rainfall plus snowmelt values were taken from this analysis for use in the water balance and predictive water quality assessments. Rainfall plus snowmelt depths peaked in March due to the rising temperature depleting the snow pack, creating a greater volume of available water for discharge. The lowest rainfall plus snowmelt occurred in June to August.

The catchment areas and assessment points of the Project site under existing (baseline) conditions are presented in Figure 6.7-5 and summarized in Table 6.7-3. The total contributing drainage area to the Killag River downstream of the site, which includes the Project Site and Mud Lake and Crusher Lake, is approximately 3,933.5 ha.

Killag River

Table 6.7-5 presents the monthly baseline metrics (runoff volumes) for the Killag River catchment area. The Killag River catchment was delineated upstream of the Killag River (Killag River DS) assessment point, which is located at the point along the river that fully captures the hydrologic impact of the mine development. The Killag River is one major tributary to the WRSH. The Killag is a long and narrow drainage basin, with a main channel length of approximately 27 km. This system is also organic-acid stained, similar to the WRSH. Land-use within this tertiary watershed is similar to the overall secondary watershed, with sparse development and abundant timber harvesting. The Killag River system has several associated waterbodies. West Lake, Mud Lake and Crusher Lake are associated with sub-tertiary basins that are tributaries to the Killag River. According to local knowledge, most salmon (as well as brook trout, white suckers, American eel and lake chub) spawned in this part of the system. As previously discussed, the Nova Scotia Salmon Federation has installed a second lime dosing station along the Killag River.

Table 6.7-5: Monthly Site Runoff Flow Estimates for the Killag River, Hydrological Baseline Conditions Beaver Dam Project

Month	Average Runoff (m^3)
January	3,644,162
February	3,216,235
March	5,543,553
April	4,107,511
May	2,751,927
June	1,544,772
July	1,159,993
August	1,043,753
September	1,389,421
October	3,139,108
November	4,487,350
December	3,549,515

Note: Estimated for the Killag River DS assessment point (Appendix A Water Balance Analysis of Appendix P.4 Mine Water Management Plan). m^3 = cubic metre.

Monthly runoff values are highest in March due to the combination of rainfall and snowmelt from the snowpack. Monthly runoff values are lowest in July, August, and September due to the lower precipitation and baseflow, and higher evaporation rates.

Mud Lake and Crusher Lake

Tables 6.7-7 and 6.7-8 present the monthly baseline metrics for the Mud Lake and Crusher Lake catchment areas, respectively. The Mud Lake catchment was delineated upstream of the Mud Lake (WC27 US) assessment point at the lake outlet to WC27. The Crusher Lake catchment was delineated upstream of the Crusher Lake (WC5 US) assessment point at the lake outlet to WC5. Monthly runoff volumes are highest in March and lowest in July, August, and September.

Table 6.7-6: Monthly Site Runoff Flow Estimates for Mud Lake, Hydrological Baseline Conditions Beaver Dam Project

Month	Average Runoff (m^3)
January	208,040
February	183,358
March	316,138
April	234,530
May	151,496
June	83,876
July	61,860
August	57,347
September	78,583
October	178,371
November	256,314
December	203,690

Note: Estimated for the WC27 US (Mud Lake outlet) assessment point (Appendix A Water Balance Analysis of Appendix P.4 Mine Water Management Plan). m^3 = cubic metre.

Table 6.7-7: Monthly Site Runoff Flow Estimates for Crusher Lake, Hydrological Baseline Conditions Beaver Dam Project

Month	Average Runoff (m^3)
January	55,154
February	48,542
March	83,721
April	62,188
May	38,628
June	21,056
July	15,240
August	14,666
September	20,557
October	47,031
November	67,983
December	54,289

Note: Estimated for the WC5 US (Crusher Lake outlet) assessment point (Appendix P.4,). m^3 = cubic metre.

Tent Brook

Table 6.7-8 presents the monthly baseline metrics for the Tent Brook catchment area. The Tent Brook assessment point is located immediately downstream of the WC19 confluence to fully capture the hydrologic impact of the Project on Tent Brook. Monthly runoff values are highest in March and lowest in July, August, and September.

Table 6.7-8: Monthly Site Runoff Flow Estimates for Tent Brook, Hydrological Baseline Conditions Beaver Dam Project

Month	Average Runoff (m^3)
January	283,563
February	250,286
March	431,391
April	319,617
May	214,600
June	120,560
July	90,623
August	81,403
September	107,846
October	244,328
November	349,224
December	276,112

Note: Estimated for the Tent Brook assessment point (Appendix A Water Balance Analysis of Appendix P.4 Mine Water Management Plan). m^3 = cubic metre.

Cope Brook

Table 6.7-9 presents the monthly baseline metrics for the Cope Brook catchment area. The Cope Brook catchment was delineated upstream of the Cope Brook (Cope Brook DS#1) assessment point. The Cope Brook assessment point is located immediately downstream of the WC23 confluence to fully capture the impact of the Project on Cope Brook. Monthly runoff values are highest in March and lowest in July, August, and September.

Table 6.7-9: Monthly Site Runoff Flow Estimates for Cope Brook, Hydrological Baseline Conditions Beaver Dam Project

Month	Average Runoff (m^3)
January	445,351
February	393,087
March	677,518
April	501,972
May	337,039
June	189,345
July	142,328
August	127,847
September	169,896
October	383,737
November	548,379
December	433,648

Note: Estimated for the Cope Brook DS#1 assessment point (Appendix A Water Balance Analysis of Appendix P.4 Mine Water Management Plan). m^3 = cubic metre.

Haul Road

During field assessments in spring and summer 2016, 34 watercourses were mapped and evaluated within the Haul Road corridor. These watercourses straddle seven tertiary watersheds, and many are classified as first order streams, in high positions within the tertiary basins. Others, however, are second and third order streams, positioned lower in the tertiary watersheds and broader secondary watersheds, and offer more substantial aquatic and fish habitat.

Main West River, Sheet Harbour (WRSH)

The West River Sheet Harbour (WRSH) commences at headwater lakes including Sand Lake and West Lake just southeast of the community of Pleasant Valley near Upper Musquodoboit and crosses the Haul Road just north of the intersection of the Haul Road with Highway 224. The river drains in the southeast direction, parallel to Highway 224, across the Haul Road and into the Atlantic Ocean at Sheet Harbour, Nova Soctia. The Killag River joins the main West River Sheet Harbour southeast of the Haul Road.

There is a current bridge crossing at this location that will require upgrading to support road widening and increased truck traffic. The Atlantic Salmon Conservation Centre has completed recent liming programs (2009, 2010) on the West River Sheet Harbour with a goal to maintain a pH of 5.5 at the river mouth to support quality salmon habitat in the river (Atlantic Salmon Conservation Foundation: West River Sheet Harbour Project, lime doser support).

The WRSH watershed is largely undeveloped, though extensive timber harvesting is present. Water within the WRSH is naturally high in tannins and flash prone. There are two, large lake-like pools on the system, the uppermost being River Lake at roughly 0.5 km^2 and the lower, Sheet Harbour lake, at roughly 1.2 km^2. A waterfall forms a natural barrier to fish passage approximately 30 km upstream of the head of tide (9.5 km upstream of Beaver Dam Mines Road, where the proposed Haul Road will cross the WRSH).

The Morgan River

The Morgan River is one major tributary to the Tangier River that originates at the headwater lakes (including First and Second Essen Lakes) and south of the community of Pleasant Valley, near Upper Musquodoboit. The river drains south/southeast across the Haul Road and into River Lake, east of the Haul Road, and then joins the main Tangier River to the southeast of the study area. The Tangier River drains from Tangier Grand Lake to the Atlantic Ocean at Tangier, Nova Scotia.

During field assessments in spring and summer 2016, 34 watercourses were mapped and evaluated within the Haul Road corridor. These watercourses straddle seven tertiary watersheds, and many are classified as first order streams, in high positions within the tertiary basins. Others, however, are second and third order streams, positioned lower in the tertiary watersheds and broader secondary watersheds, and offer more substantial aquatic and fish habitat. All watercourses observed within the Haul Road are described in Table 6.7-11 and shown on Figures 6.7-2A to 6.7-2D.

6.7.4.2.2 Touquoy Mine Site

The use of the Touquoy Mine Site for the processing of Beaver Dam ore and deposition of the associated tailings will occur after ore extraction from the Touquoy open pit has ceased. As such, the baseline conditions for the Touquoy Mine Site for the Project operations will be the conditions expected near the end of the Touquoy ore processing operations.

The existing Touquoy open pit is actively dewatered and pumped to the TMF. Based on the groundwater flow model (Appendix F.6), the open pit acts as a groundwater sink resulting in groundwater inflows at an average rate of 450 m^3/d. Water in the TMF is decanted to the effluent treatment plant for treatment. Effluent then drains to the polishing pond through a series of geobags, then

to a constructed wetland where water infiltrates through the berm and finger drains to Scraggy Lake, the receiving water body for the Mine Site. The approved Touquoy Environmental Assessment stated that the exhausted open pit would be allowed to fill naturally with water over a period through the collection of direct precipitation, surface flow and groundwater inflow. No change to this method is planned for the deposition of Beaver Dam tailings, except that the time frame for refilling will be shorter given the decrease in available volume taken by the tailings.

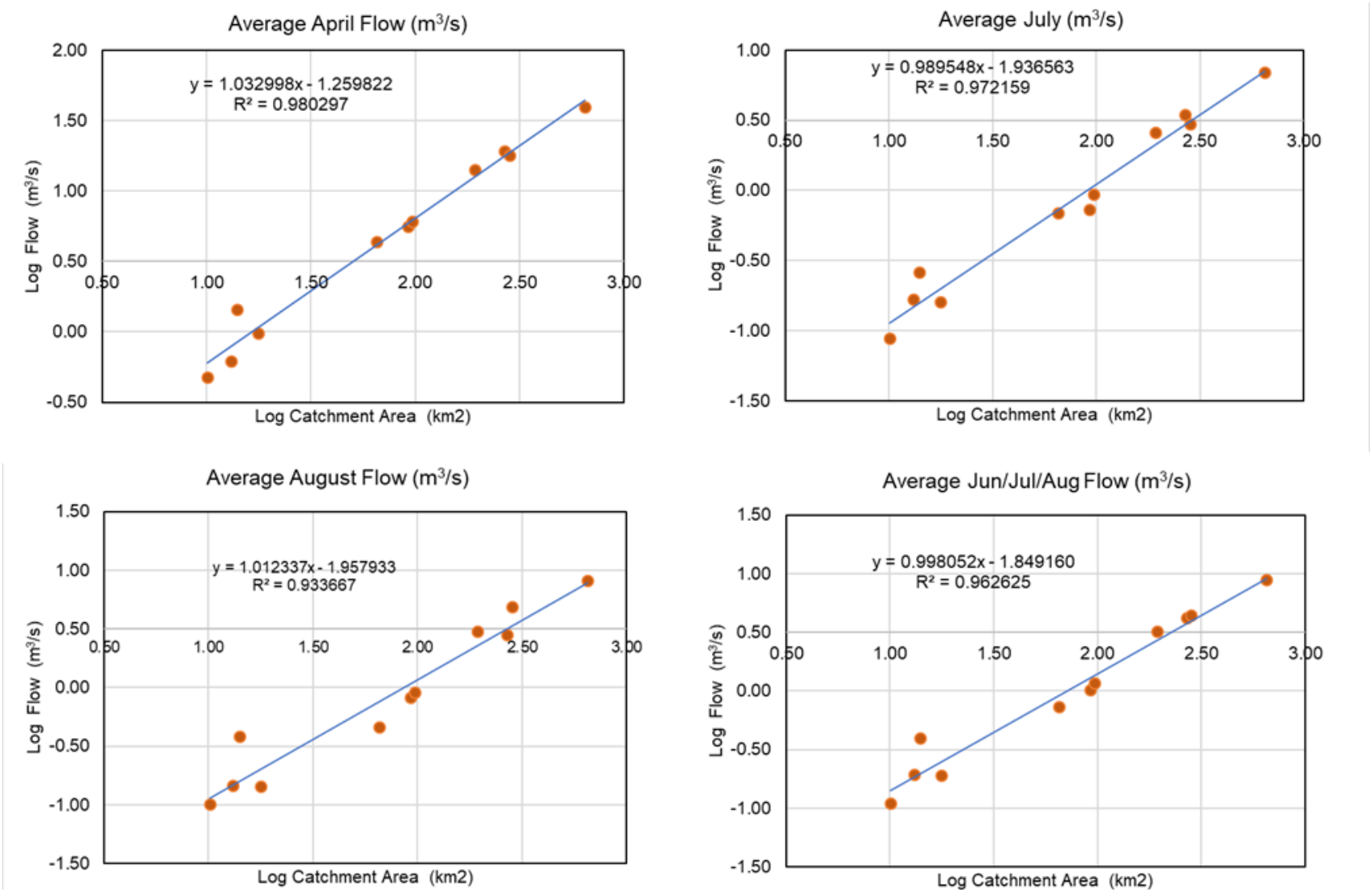
Scraggy Lake is part of the Moose River drainage system. It has an area of 6.4 km^2 (Stantec 2018c) and forms two major basins which are separated by islands and peninsulas. Scraggy Lake is the freshwater make-up supply for the active Touquoy mill process. Water flows into Scraggy Lake from approximately twenty-two inlets consisting of mapped watercourses or adjacent waterbodies. Water flows out of Scraggy Lake over the Fish River Dam and into the Fish River. The Fish River drains Square Lake located north of the existing Touquoy waste rock area to Scraggy Lake. Both lakes are part of the Fish River Watershed which flows west and then south into Lake Charlotte, eventually emptying into the Atlantic Ocean at Ship Harbour.

As per the Reclamation Plan for Touquoy (Stantec 2017b), Moose River is proposed as a second point of final discharge under closure of the exhausted Touquoy open pit. At SW-2, Moose River is a 3rd order watercourse with an approximately 12.5 m bankfull width as measured in the 2017 hydrometric program. The substrate was noted in the 2017 hydrometric monitoring report (Atlantis 2017) as characteristically muddy consisting predominantly of cobbles and small boulders, silt/sand with gravel.

Baseline flow in Moose River and Scraggy Lake at the end of Touquoy operations will be similar to the existing conditions prior to the development of the Touquoy Gold Project. The flow conditions in Moose River are represented by a stage-discharge curve derived based on an annual hydrometric monitoring program at stations SW-2, HM-1, and SW-11. Baseline flow statistics on Moose River were generated based on a regional analysis of thirteen representative ECCC (ECCC 2018) hydrometric stations, prorated to the Moose River catchment area at TQ-SW-2. The record of daily average flow for each station was fitted to the Log Pearson Type III distribution and prorated to the site based on catchment area. The log relationship of catchment area and flow was graphically plotted to establish a relationship between the catchment area and the average spring flow (April), summer flow (June/July/August), and low flow (July).

Surface water in Moose River is based a statistical analysis of regional flow records. As presented on Figure 6.7-6, strong linear trends exist between the average monthly flow rates of the selected monitoring stations and drainage area for April, August, and June to August with a correlation coefficient (R^2) of 0.98, 0.93, and 0.96, respectively. From these regional relationships, the average April and August flows for SW-2 in Moose River (catchment area of 39.03 km^2) are estimated to be 2.42 m^3/s and 0.45 m^3/s, respectively. Results of the analysis indicated that generally the peak and low flow events occur in April and August, respectively.

Figure 6.7-6: Regional Regression Analysis - Touquoy



Source: Stantec 2019.

6.7.5 Water Quality Baseline Conditions

6.7.5.1 Overview

This section describes Surface Water Quality baseline monitoring studies conducted in the Project area. The surface water quality program aimed to provide sufficient data for the Mine Water Management Plan (Appendix P.4), Predictive Water Quality Assessment (Appendix D of Appendix P.4) and Environmental Effects Assessments (Sections 6.6 (Groundwater), 6.7 (Surface Water), 6.8 (Wetlands) and 6.9 (Fish and Fish Habitat)) and an Aquatics Effects Monitoring Program (AEMP), which will be developed as part of the permitting process. The objectives of the baseline program were the following:

- identification of waterbodies that could be directly or indirectly affected by the Project;
- collection of water quality data from potentially affected waterbodies; and
- compilation and presentation of surface water quality data from sampled waterbodies in the PA, LAA, and RAA.

The results of baseline characterization studies informed predictive water balance water quality modelling, performed to support the effects assessment for the Project.

The proposed Project activities encompass three geographically distinct areas:

1. Beaver Dam Mine Site;
2. Haul Road; and
3. Existing Touquoy Mine.

The Killag River, Crusher Lake, Mud Lake, Tent Brook and Cope Brook (Beaver Dam Mine Site area), and Moose River (existing Touquoy Mine) constitute the primary focus of the Project baseline surface water characterization studies, as well as subsequent effects assessment, as these watercourses will receive direct discharge and/or catchment areas have potential to be impacted by Project water management activities.

The Project is in a highly mineralized region and the geology contributes to naturally elevated concentrations of many water quality parameters in the area, including iron, arsenic and aluminum. The occurrence of naturally elevated concentrations in surface waters is commonly observed in regions of planned/proposed mining activities, all over the world (e.g., “Golden Triangle“ of northwestern British Columbia, Canada). In such regions, naturally elevated concentrations of certain water quality parameters generally occur where exposure of rock or other geologic materials to oxygen and water results in natural weathering processes, including chemical oxidation and leaching of solid-phase constituents (e.g., metals), which are then transported to surface waters.

Natural exceedances of water quality guidelines in baseline conditions are not a Project effect and, for these parameters, generic water quality guidelines (WQG) such as Canadian Council of Ministers of the Environment Water Quality Guidelines for the Protection of Freshwater Aquatic life (CCME FAL), do not necessarily apply. That is, WQG generally represent generic criteria that are developed by governments or international organizations to identify the concentrations of parameters in the receiving environment that are not expected to cause an adverse effect on various receptors or uses (e.g., aquatic life, wildlife, livestock/agriculture, drinking water. As WQG are intended to apply universally, they do not necessarily account for site-specific factors including the presence/absence of specific species in the receiving environment, or naturally occurring elevated existing water quality due to mineralization of the watershed.

To support baseline characterization for the Project, and subsequent effects assessment, site-specific water quality objectives (SSWQO) have been developed for arsenic (As). SSWQOs are site-specific criteria developed by proponents as part of ESIAs or permit applications in many jurisdictions, for example Canada, on a site-by-site basis to replace the generic WQG guidelines of the receiving environment; take instead, site-specific water quality. Here, arsenic is naturally elevated in Project area-streams and, in this instance, CCME FAL is not appropriate.

Baseline surface water monitoring was conducted at 19 locations around the Beaver Dam Mine Site and 29 locations along the Haul Road and 13 locations at the Touquoy Mine site, to obtain water quality data. The purpose of this program was to establish a baseline for comparison of surface water quality and quantity before site activities for the Beaver Dam Mine site commence. Key baseline water quality sampling locations are depicted in Figures 6.7-1 though 6.7-3; description of sampling locations is provided in Table 6.7-10 through Table 6.7-12. Baseline samples were collected in 2014, 2015, 2019 and 2020, with sub-samples collected in 2017.

Table 6.7-10: Baseline Surface Water Locations for Beaver Dam Mine Site (2015 to 2020)

Sample ID	Sample Location	Rationale
SW-1	Killag River	Characterize surface water quality downstream and east of mine activities
SW-1A	Killag River	Characterize surface water quality and quantity further downstream and east of mine activities
SW-2A	Killag River upstream of Cameron Flowage	Characterize surface water quantity upstream and north of mine activities
SW-4A	Wetland downstream of Mud Lake (WC27)	Characterize surface water quality and quantity downstream and north of mine activities
SW-5	Historical settling pond outlet (WC13)	Characterize surface water quality exiting the historical settling pond into Cameron Flowage and near mine activities
SW-5A	Killag River downstream of Cameron Flowage	Characterize surface water quality downstream of a proposed site discharge. Located downstream and east of Project activities
SW-6A	Watercourse between Crusher Lake and Mud Lake (WC5)	Characterize surface water quality downstream and west of mine activities
SW-9	West River Sheet Harbour	Characterize surface water quality in a different watershed for reference
SW-10	Upstream of historical settling pond (WC12)	Characterize surface water quality entering the historical settling pond
SW-11	Tent Lake	Characterize surface water quality downstream and south of mine activities
SW-12	Unnamed lake/wetland - headwaters of Paul Brook (WL-29)	Characterize surface water quality downstream and southwest of mine activities
SW-14	Historical settling pond	Characterize surface water quality in the historical settling pond into Cameron Flowage and near mine activities
SW-19	Killag River	Characterize surface water quality and quantity upstream and north of mine activities
SW-26A	Cameron Flowage	Characterize surface water quality in Cameron Flowage downstream of a proposed Site discharge location and north of mine activities
SW-28	Tributary to Tent Brook (WC19)	Characterize surface water quality downstream of proposed Organic Stockpile south of mine activities

Table 6.7-10: Baseline Surface Water Locations for Beaver Dam Mine Site (2015 to 2020) (continued)

Sample ID	Sample Location	Rationale
SW-29	Killag River	Characterize surface water quality upstream of the site northwest of mine activities
SW-30	Killag River	Characterize surface water quality and quantity prior to entering the Killag River, down gradient of the NAG Stockpile northwest of mine activities
SW-31	Tributary of the Cope Brook system (WC23)	Characterize surface water quality and quantity located in a natural watercourse downgradient of the NAG Stockpile, southwest of mine activities
SW-32	Killag River	Characterize surface water quality and quantity downstream of Killag River, located where the NSSA lime doser mixing occurs, southeast of mine activities

Notes: NAG = non-acid generating; NSSA = Nova Scotia Salmon Association.

Table 6.7-11: Baseline Surface Water Locations for Haul Road (2015 to 2020)

Sample ID	Sample Location Description	Rationale
WC2 WC3 WC7 to WC17	Watercourses along Beaver Dam Mines Road portion of the Haul Road	To characterize surface water quality in watercourses upstream of the Beaver Dam Mines Road portion of the Haul Road
SW-41 SW-42	Watercourses along new construction through greenfield environment	To characterize surface water quality in watercourses upstream of the new construction portion of the Haul Road
WC23 to WC 31	Watercourses along Moose River Cross Road portion of Haul Road	To characterize surface water quality in watercourses upstream of Moose River Cross Road portion of the Haul Road
SW-43 to SW-47	Watercourses along the Mooseland Road portion of the Haul Road	To characterize surface water quality in watercourses upstream of the Mooseland Road portion of the Haul Road

Table 6.7-12: Surface Water Monitoring Locations at Touquoy Mine Site

Sample ID	Sample Location	Location Description	Rationale
TQ-SW1	504325E, 4981604N	Moose River - adjacent to site and upstream of Moose River road culvert and open pit	Background
TQ-SW2	504378E, 4980703N	Moose River - downstream of Facility and upstream of Bridge, just below the open pit	Downstream - Near- field
TQ-SW3	505587E, 4980396N	Watercourse No.4 (unnamed tributary to Moose River) downstream of Site, east of the Tailings pond	Downstream - Near- field
TQ-SW11	504140E, 4982529N	Moose River - upstream of the Site to represent relatively un-impacted conditions upstream of the facility	Background
TQ-SW12	506060E, 4982420N	Outlet from Square Lake	Background
TQ-SW13	507950E, 4976355N	Outlet from Scraggy Lake at Dam	Downstream - Far-field
TQ-SW14	506380E, 4980022N	Final liquid effluent discharge point (MDMER) located at outfall from Polishing Pond	Final Discharge Point

Table 6.7-12: Surface Water Monitoring Locations at Touquoy Mine Site (continued)

Sample ID	Sample Location	Location Description	Rationale
TQ-SW15	506397E, 49798321N	Outlet of unnamed Tributary to Scraggy Lake, at confluence with Scraggy Lake	Downstream - Near- field
TQ-SW18	501475E, 4974281N	Fish River north of pughole and upstream of bridge	Downstream - Far-field
TQ-SW19	505333E, 4981589N	Watercourse No.4 (unnamed tributary to Moose River) - upstream of the tailings pond, adjacent to the waste rock storage area	Downstream - Near- field
TQ-SW20	506931E, 4980433N	East of the tailing's impoundment on an unnamed tributary to Scraggy Lake	Downstream - Near- field
TQ-SW21	506349E, 4979823N	In Scraggy Lake, at outlet of polishing pond emergency spillway	Downstream - Near- field
TQ-SW23	505369E, 4982094N	Watercourse No.4 (unnamed tributary to Moose River) upstream of Site to represent relatively un- impacted upstream conditions	Background

Source: CRA 2007a.

6.7.5.2 Baseline Results

Site-specific baseline results most salient to the effects assessment are presented in this section; results are summarized by Project Area and catchment; surface water monitoring locations are presented in Figures 6.7-1 through 6.7-3. Physical characteristics of water courses are appended as Appendix G.4.

Seventeen water quality sampling events were completed between 2014 to 2015 and 2019 to 2020 with an additional standalone event occurring in 2017. From these 18 samples, eight of these were collected during baseflow conditions, with the remaining 10 being collected during precipitation events. However, during this time frame, only four of the sample locations collected 18 sampling events. Two locations collected 13 events, two locations collected nine events, one location collected seven events, nine locations collected four events and one location only had two sample events. In response to IR2 response NSE-2-90 (AMNS 2021). Table 6.7-13 presents water quality sample date, precipitation amount, and whether it was a baseflow or precipitation event.

Surface water quality results are compared to Nova Scotia Environment Contaminated Sites Regulation 2013 Tier 1 Environmental Quality Standards (EQS) as per a requirement of the Industrial Approval to operate (NSE 2017), in addition to the CCME FAL.

Table 6.7-13: Precipitation Versus Baseflow, Monitoring Results

Sample Date	Weather Stations	Precipitation Amount				Precipitation or Baseflow	Continuous Flow Monitoring (Rough Range L/s)						
		Day of Sample	1 Day Prior	2 Days Prior	7 Day Cumulative		SW1A	SW2	SW6A	SW19	SW30	SW31	SW32
10/9/2014	8203535	0	2.6	0	13.2	Baseflow	-	-	-	-	-	-	-
11/13/2014	8204193	0.9	1.2	0	31.8	Baseflow	-	-	-	-	-	-	-
12/18/2014	8204193	3.9	5,2	0	28.7	Precipitation	-	-	-	-	-	-	-
1/22/2015	8204193	0	0	0	14.9	Baseflow	-	-	-	-	-	-	-
4/29/2015	8204193	0	1.4	10.9	20.9	Precipitation	-	-	-	-	-	-	-
5/28/2015	8203535	0	0	7	18.8	Baseflow	-	-	-	-	-	-	-
6/30/2015	8204193	0	0	10.2	22.5	Precipitation	-	-	-	-	-	-	-
7/29/2015	8204193	0	2.8	1.7	10.8	Baseflow	-	-	-	-	-	-	-
8/24/2015	8204193	0.6	0	2.4	3	Baseflow	-	-	-	-	-	-	-
9/5/2017[(a)]	8204193	0	0	0	16	Baseflow	-	-	-	-	-	-	-
4/10/2019	8203405	0.2	2	7.1	15.4	Precipitation	-	-	-	-	-	-	-
6/12/2019	8204193	1.2	11.4	0	52.2	Precipitation	800 to 1,050	815 to 1,025	15 to 30	-	-	-	-
9/12/2019	8204193	0	15.5	0	45	Precipitation	710 to 920	930 to 1,100	13 to 17	-	-	-	-
12/2/2019	8203405/ 8202251	2.7	0	2.2	101.7	Precipitation	2,500 to 4.650	2,400 to 3,550	47 to 57	-	-	-	-
4/21/2019	8203405	0	0	0	2.5	Precipitation	950 to 1,310	815 to 1,005	32 to 41	540 to 650	-	-	-
4/22/2019	8203405	14.9	0	0	16.9	Precipitation	790 to 1,400	770 to 1,025	31 to 41	520 to 660	-	-	-
6/17/2019	8203405	0	0	1	7.8	Baseflow	110 to 150	140 to 240	2.5 to 3.5	110 to 140	0.8 to 1.3	2 to 3.2	190 to 324
6/18/2020[(b)]	8203405	0.2	0	0	8	Baseflow	95 to 140	105 to 140	2.2 to 3.0	85 to 120	0.7 to 1.1	1.7 to 2.3	150 to 250
9/24/2020[(b)]	8203405	0	24.8	40.1	67.4	Precipitation	2,400 to 4.300	-	-	-	37 to 52	33 to 43	1,740 to 2,800
9/25/2020[(b)]	8203405	0	0	24.8	64.9	Precipitation	1,800 to 3,600	-	-	-	17 to 37	22 to 33	1,600 to 2,600
12/15/2020[(b)]	8203405	1	1.4	15.1	22.1	Precipitation	-	-	-	-	-	-	-
12/16/2020[(b)]	8203405	0	1	1.4	22.1	Precipitation	-	-	-	-	-	-	-

Weather Stations

8203405 MALAY FALLS – 21.17 km

8204193 UPPER STEWIACKE RCS – 31.68 km

8203535 MIDDLE MUSQUODOBOIT – 29.80 km

8200051 HALIFAX STANFIELD INT'L A – 65.57 km (Dec. 1 and 2, 2019 ONLY)

Notes:

(a) Only two monitoring locations were sampled during this event.

(b) 2020 surface water samples were collected over a 2-day period, specific sample date/time not provided. Only one event was counted.

(c) This event was classified as a precipitation event based on recorded continuous flow monitoring from McCallum Environmental Ltd.

6.7.5.2.1 Beaver Dam Mine Site

Generally, water quality at the Beaver Dam Mine Site is characterized as having been affected somewhat from the influence of past mining activities, local industry, road salting, or local residents. Some localized influences from road work (culverts, ditching) or forestry use would have occurred historically (total suspended solids for example), but these would be localized and short-term variations. Portions of the Haul Road where Nova Scotia Department of Transportation and Infrastructure Renewal (NSTIR) had a role in winter maintenance may have experienced salt and/or sanding, but there is little publicly available information on these activities or potential influence on surface waters.

Monitoring results for the Killag River (identified receiving water for the Project) are presented in Table 6.7-14 and a summary of baseline exceedances for all sampling locations is presented in Table 6.7-15. Detailed surface water baseline analytical results and guideline exceedance comparison, specifically for total metals are presented in Appendix G.1, Table G.1-3.

Data in Table 6.7-14 is for station SW1, the most relevant station to characterize the receiving environment. The baseline summary statistics water quality results for all stations are presented in Appendix G.1 (Surface Water Baseline Analytical Results). Metal concentrations were typically below detectable levels. Three of the baseline water quality locations (i.e., SW-5, SW-10 and SW-14A) located either within, or directly downstream of historic tailings, show metal concentrations exceeding guideline concentrations. During Construction, water impacted by historic activities will be treated as described in Section 6.7.9 and Appendix P.4 (Mine Water Management Plan, Appendix F.1 [Water Treatment Assessment - Construction Phase]).

Most nutrients were below or slightly above detectable concentrations, but below available water quality guidelines, indicating little to no influence from agricultural operations in the area. The watersheds have been logged extensively, yet turbidity is low, indicating generally little long-term impacts and a lack of silt in the soils and/or little erosion from logging practices. The existing Haul Roads at the in and around the Beaver Dam Mine Site have been used to haul timber as well; however, measured TSS levels were low, which may be attributable to limited use, existing road conditions and allowable speeds.

Table 6.7-14: Baseline Surface Water Concentrations Collected from Killag River, Station SW1 (Total Metals; µg/L; N = 7-15)[(a)]

Parameter	Min	Max	Mean	75th Percentile	90th Percentile	Number of Non-Detects	CCME (µg/L)	Nova Scotia Tier 1 (µg/L)
Silver	<1.0	<1.0	0.05	0.05	0.05	20/20	0.25	0.1
Aluminum	20	400	206	280	334	0/20	5	5
Arsenic	<0.1	3.7	1.3	2.1	2.6	7/20	5	5
Cadmium	<0.01	0.032	0.017	0.022	0.028	1/20	0.04	0.01
Cobalt	<0.40	0.55	0.27	0.21	0.52	15/20	0.78[(d)]	10
Copper	<0.50	1	0.67	1	1	18/20	2	2
Iron	5	1000	399	593	760	0/20	300	300
Mercury	0.0065	0.032	0.0082	0.0065	0.0074	18/20	0.026	0.026
Manganese	0	79	37	51.5	63.5	0/20	190	820
Molybdenum	1	1	1	1	1	0/20	73	73
Nickel	1	2.6	1.1	1	1	19/20	25	25
Lead	0.25	0.57	0.32	0.30	0.54	13/20	1	1
Antimony	0.5	0.5	0.5	0.5	0.5	20/20	NV	20
Selenium	0.25	0.5	0.4	0.5	0.5	20/20	1	1
Thallium	0.05	0.05	0.05	0.05	0.05	20/20	0.8	0.8

Table 6.7-14: Baseline Surface Water Concentrations Collected from Killag River, Station SW1 (continued)

Parameter	Min	Max	Mean	75th Percentile	90th Percentile	Number of Non-Detects	CCME (µg/L)	Nova Scotia Tier 1 (µg/L)
Uranium	0.05	0.05	0.05	0.05	0.05	20/20	15	300
Zinc	0.15	7.8	3.1	2.5	5.3	15/20	7[e]	30
Nitrate	0.025	0.096	0.044	0.061	0.081	11/20	13,000	NV
Nitrite	0.005	0.01	0.0053	0.005	0.005	20/20	60	NV
Ammonia	0.025	0.1	0.029	0.025	0.025	19/20	27,550[f]	NC
pH	2.63	6.48	5.1	5.8	5.9	-	6 to 9.5	6 to 9.5
Hardness (mg/L as $CaCO_3$)	1.6	16	4.9	4.8	8.3	-	NV	NV
TOC (mg/L)	2	20	10	12	18	-	NV	NV

Notes: NV indicates no value provided; reported pH is based on lab analysis, as field measurements were unusually low (range of 2.63 to 6.48); less than indicates that the concentration reported is the analytical detection limit (value was not detected).

[a] Summary statistics were calculated using the maximum value between duplicate samples and half the detection limit value when a chemical was not detected in a sample.

[b] Concentrations are in µg/L unless noted otherwise.

[c] For parameters measured below the detection limit, half of the detection limit was used when calculating this metric.

[d] Selected guideline represents Environment Canada (2017) FEQG for the protection of aquatic life at water hardness of 52 mg/L, which is the lowest hardness level cited for the FWQG equation. Site specific hardness falls below the accepted range of values for the equation.

[e] Selected guideline represents the Long-term CWQG, SSD 5th percentile at water hardness of 50 mg·L-1, pH of 7.5 and DOC of 0.5 mg·L-1. The CCME equation is valid between hardness of 23.4 and 399 mg $CaCO_3$/L, pH of 6.5 to 8.13, and DOC of 0.3 to 22.9 mg/L. The site-specific hardness and pH values in the Killag are slightly below the accepted ranges for these parameters. For screening purposes, the guideline of 7 was used, as site specific DOC will increase the guideline beyond 7 ug/L.

[f] Selected guideline represents the ammonia (total) CCME guideline value at pH 6.0 and temperature of 25ºC, multiplied by 0.8224 (for the conversion of NH_3 to total ammonia-N).

At the Beaver Dam Mine Site, the following baseline observations include:

- **Aluminum and iron:** exceeded the CCME FWAL guidelines and NSEQSs at all sampling locations during most sampling events; however, this is a common feature of surface water in Nova Scotia (Dalhousie Hydrology Group 2018). Further, as described above, the Project is in a highly mineralized region; the geology will contribute to naturally elevated concentrations of many water quality parameters in the area, including aluminum. This is indicated here by elevated aluminum and iron concentrations recorded at both upstream (i.e., background) and downstream monitoring locations (Table 6.7-15). Detailed surface water baseline analytical results and guideline exceedance comparison, specifically for total metals are presented in Appendix G.1, Table G.1-3.
- **Mercury**: exceeded the CCME FWAL guidelines and NSEQSs at all sampling locations during the August 2015 sampling event; there were no mercury exceedances in recent sampling events (2018/2019).
- **Arsenic**: exceeded the CCME FWAL guidelines and NSEQSs at SW-4A, SW-5, SW-6A, SW-10, SW-14, SW-26, and SW-30. Arsenic concentrations were variable at all sampling locations but were generally elevated in the summer months. As described above, the Project is in a highly mineralized region; the geology will contribute to naturally elevated concentrations of many water quality parameters in the area, including arsenic (Section 6.5 Geology, Soils, and Sediment). This is indicated here by elevated arsenic concentrations recorded at both upstream and downstream monitoring locations (Table 6.7-15). Here, sulphide minerals (Section 6.5), such as myrrhotitie and arsenopyrite (an iron arsenic sulfide) are common in the surficial and bedrock geology in the Project area, and is the likely source of natural/background arsenic loadings. Detailed surface water

baseline analytical results and guideline exceedance comparison, specifically for total metals are presented in Appendix G.1, Table G.1-3.

- **Lead**: fluctuates in surface water at most sampling locations and at times slightly exceeded the CCME FWAL guidelines and NSEQSs at SW-1A, SW-5, SW-10, and SW-32.
- **Copper**: fluctuates in surface water at most sampling locations and at times slightly exceeded the CCME FWAL guidelines and NSEQSs at SW-6A and SW-10.
- **Cadmium**: The NSEQS for cadmium, which is lower than the CCME FWAL guideline, was exceeded at most sampling locations during most sampling events. The CCME FWAL guideline for cadmium was only exceeded at five sampling locations, SW-4A, SW-6A, SW-10, SW-11, and SW-12, throughout the sampling program.
- **TSS**: levels were sampled during the 2019 to 2020 monitoring program, and exceeded the CCME FQAL guideline at SW-1A, SW-26A and SW-32.

Opportunities for improvement of the existing surface water conditions through proper sediment and erosion control measures during construction and maintenance and properly designed and installed culverts (Section 6.7.9). Similarly, proposed water treatment technologies (WTP) indicate that for some parameters (e.g., aluminum, arsenic) concentrations will be lower in Project discharges than baseline conditions of the receiving environment. In these instances, there is potential to reduce in-stream concentrations for these parameters, relative to existing conditions.

Table 6.7-15: Summary of Baseline Surface Water Quality for Beaver Dam Mine Site, All Stations

Sample ID	Sample Location	Parameters Exceeding CCME FWAL	Parameters Exceeding NS Tier 1 EQS for Freshwater
SW-1	Killag River	pH, DO, Aluminum, Iron, Mercury	pH. Aluminum, Iron, Mercury
SW-1A	Killag River	pH, DO, TSS, Aluminum, Iron, Lead	Aluminum, Iron, Lead
SW-2A	Killag River upstream of Cameron Flowage	pH, DO, Aluminum, Iron, Mercury	Aluminum, Iron, Mercury
SW-4A	Wetland downstream of Mud Lake (WC27)	pH, DO, Aluminum, Arsenic, Cadmium, Iron, Mercury	Aluminum, Arsenic, Cadmium, Iron, Mercury
SW-5	Historical settling pond outlet (WC13)	pH, DO, Aluminum, Arsenic, Iron, Lead, Mercury	Aluminum, Arsenic, Iron, Lead, Mercury
SW-5A	Killag River	pH, DO, Aluminum, Iron	Aluminum, Iron
SW-6A	Watercourse between Crusher Lake and Mud Lake (WC5)	pH, DO, Aluminum, Arsenic, Cadmium, Copper, Iron, Mercury	Aluminum, Arsenic, Cadmium, Copper, Iron, Mercury
SW-9	West River Sheet Harbour	pH, DO, Aluminum, Iron, Mercury	Aluminum, Iron, Mercury
SW-10	Upstream of historical settling pond (WC12)	pH, DO, Aluminum, Arsenic, Cadmium, Copper, Iron, Lead, Mercury	Aluminum, Arsenic, Cadmium, Copper, Iron, Lead, Mercury
SW-11	Tent Lake	pH, DO, Aluminum, Iron	Aluminum, Iron
SW-12	Unnamed lake/wetland - headwaters of Paul Brook	pH, DO, Turbidity, Aluminum, Iron	Aluminum, Iron
SW-14	Historical settling pond	pH, DO, Aluminum, Arsenic, Iron	Aluminum, Arsenic, Iron
SW-19	Killag River	pH, DO, Aluminum, Iron	Aluminum, Iron
SW-26A	Cameron Flowage	pH, DO, TSS, Turbidity, Aluminum, Arsenic, Iron	Aluminum, Arsenic, Iron
SW-28	Tributary to Tent Brook (WC19)	pH, DO, Aluminum, Iron	Aluminum, Iron
SW-29	Killag River	pH, DO, Aluminum, Iron	Aluminum, Iron
SW-30	Killag River	pH, DO, Aluminum, Arsenic, Iron	Aluminum, Arsenic, Iron
SW-31	Tributary to Cope Brook (WC23)	pH, DO, Aluminum, Iron	Aluminum, Iron
SW-32	Killag River	pH, DO, TSS, Aluminum, Iron, Lead	Aluminum, Iron, Lead

Notes: CCME FWAL = Canadian Council of Ministers of the Environment Freshwater Aquatic Life; NSEQS = Nova Scotia Environmental Quality Standards; DO = dissolved oxygen; TSS = total suspended solids.

6.7.5.2.2 Haul Road

Monitoring results for the proposed haul road area are presented in Table 6.7-16; a summary of baseline exceedances are presented in Table 6.7-16. Similar to as described for the Beaver Dam Mine Site Area, most nutrients were below or slightly above detectable concentrations, but below available water quality guidelines, indicating little to no influence from agricultural operations in the area. The watersheds have been logged extensively, yet turbidity is low, indicating generally little long-term impacts and a lack of silt in the soils and/or little erosion from logging practices. Detailed haul route surface water baseline analytical results and guideline exceedance comparison, specifically Appendix G.1, Table G.1-5.

Metal concentrations were typically below detectable levels and/or available water quality guidelines. At the Haul Road the following baseline. Baseline observations include:

- **Aluminum and iron:** aluminum exceeded the CCME FWAL guideline and NSEQS at all sampling locations, and iron exceeded both guidelines at all but three sampling locations.
- **Arsenic, copper, and lead:** concentrations were identified to exceed the CCME FWAL guidelines and NSEQSs at several sampling locations (SW-43, SW-45, and/or SW-47).
- **Cadmium**: The NSEQS for cadmium, which is lower than the CCME FWAL guideline, was exceeded at most sampling locations during most sampling events. The CCME FWAL guideline for cadmium was not exceeded.

Note, there is also an opportunity for improvement of the existing surface water conditions through proper sediment and erosion control measures during construction and operation including maintenance and properly designed installed culverts (Section 6.7.9 and Appendix C [draft Erosion and Sediment Control Plan] of Appendix P.4 [Mine Water Management Plan]).

Table 6.7-16: Summary of Baseline Surface Water Quality along the Haul Road

Sample ID	Sample Location Description	Parameters Exceeding CCME FWAL	Parameters Exceeding NSEQS for Freshwater
WC2, WC7 to WC17	Watercourses along Beaver Dam Mines Road portion of the Haul Road	Aluminum, iron, pH	Aluminum, cadmium, iron
WC3	Watercourses along Beaver Dam Mines Road portion of the Haul Road	Aluminum, iron, pH	Aluminum, iron
SW-41	Watercourse along new construction through greenfield environment	Aluminum, pH	Aluminum, cadmium, iron
SW-42	Watercourse along new construction through greenfield environment	Aluminum, iron, pH	Aluminum, cadmium, iron
WC23 to WC28	Watercourses along the Moose River Cross Road portion of Haul Road	Aluminum, iron, pH	Aluminum, cadmium, iron
WC29	Watercourse along the Moose River Cross Road portion of Haul Road	Aluminum, pH	Aluminum, cadmium
WC30, WC31	Watercourses along the Moose River Cross Road portion of Haul Road	Aluminum, iron, pH	Aluminum, cadmium, iron
SW-43	Watercourse along the Mooseland Road portion of the Haul Road	Aluminum, copper, iron, lead, pH	Aluminum, cadmium, copper, iron, lead
SW-44	Watercourse along the Mooseland Road portion of the Haul Road	Aluminum, iron, pH	Aluminum, cadmium, iron
SW-45	Watercourse along the Mooseland Road portion of the Haul Road	Aluminum, arsenic, iron, pH	Aluminum, arsenic, cadmium, iron

Table 6.7-16: Summary of Baseline Surface Water Quality along the Haul Road (continued)

Sample ID	Sample Location Description	Parameters Exceeding CCME FWAL	Parameters Exceeding NSEQS for Freshwater
SW-46	Watercourse along the Mooseland Road portion of the Haul Road	Aluminum, iron, pH	Aluminum, cadmium, iron
SW-47	Watercourse along the Mooseland Road portion of the Haul Road	Aluminum, iron, lead, pH	Aluminum, cadmium, iron, lead

Notes: CCME FWAL = Canadian Council of Ministers of the Environment Freshwater Aquatic Life; MDMER = Metals and Diamonds Effluent Regulations; NSEQS = Nova Scotia Environmental Quality Standards.

6.7.5.2.3 Touquoy Mine Site

The Touquoy Mine Site is currently in operation and will be used for the processing of Beaver Dam Mine ore and deposition of the associated tailings. As such, the baseline conditions for the Touquoy Mine Site for the Project operations will be the conditions expected near the end of the Touquoy ore processing operations. However, the surface water quality in Moose River is not anticipated to be adversely affected by the operation of the Touquoy Mine Site. Therefore, the baseline conditions in Moose River for the Project at the Touquoy Mine Site are anticipated to be similar to the existing conditions.

As required under the Industrial Approval for operation of the Touquoy Mine Site, surface water quality monitoring is conducted at thirteen surface water monitoring locations applicable to the Beaver Dam Mine ore processing and tailings deposition (exhausted Touquoy pit), as shown in Figure 6.7-3. Existing surface water quality monitoring locations at the Touquoy Mine Site are shown in Figure 6.7-3 and summarized in Table 6.7-12. Surface water monitoring locations TQ-SW-1, TQ-SW-11, and TQ-SW-2 are located on Moose River. TQ-SW-1 and TQ-SW-11 are identified as “background” as they are located upstream from the Touquoy Mine Site and are not expected to be affected by the Touquoy Gold Project or the Project. Surface water quality monitoring station TQ SW-2 is located downstream of the project on Moose River and is used to identify potential impacts from the Project by comparison to the upstream monitoring stations. Surface water quality results both in 2016 and 2017 are used to represent the baseline conditions at these monitoring locations.

A baseline environmental effects monitoring program was conducted in 2017 and 2018 to establish existing conditions in what was designed to be the future aquatic receiving environment for effluent in Scraggy Lake. The program was designed to meet the MDMER. Near surface and near bottom surface water quality samples were collected at each location on Scraggy Lake (SGL-001, -002, -003, -004 and -008) for laboratory analysis which included general chemistry, dissolved metals, total metals, strong acid dissociated cyanide and chlorophyll a. Results are provided in the Baseline Environmental Effects Monitoring Program (Stantec 2018c).

Based on a review of the 2017 baseline surface water quality results (Stantec 2018a), surface water at the monitoring stations upstream and downstream of the Touquoy Mine Site had elevated baseline concentrations of arsenic, aluminum, iron, cadmium, copper, lead, zinc, and manganese that exceeded Nova Scotia Environment Tier 1 EQS. Table 6.7-17 summarizes parameter exceedances by monitoring locations. In addition, cobalt, manganese, silver and mercury exceeded the Canadian Council of Ministers of the Environment (CCME 2018) guideline for the protection of freshwater aquatic life. These exceedances are considered to be naturally occurring, or the result of historical anthropogenic (i.e., non- Project related) activities, varying seasonally and representing baseline conditions at the Touquoy Mine Site. Site-specific standards have been developed for both the Beaver Dam Mine and the Touquoy Mine Site to establish thresholds for surface water quality that include the elevated concentrations of parameters under baseline conditions (Appendix G.2 Beaver Dam Mine: Killag River and Moose River Water Quality Predictions and Aquatic Effects Assessment – Reassessment of Killag River based on February 2021 Update [GHD modelling Provided

February 12, 2021]; Reassessment of Moose River based on March 2021 Update [Stantec modelling of March 11, 2021]). Surface water quality in Watercourse #4 and Scraggy Lake are predicted to have different water quality at the end of Touquoy operations (Appendix G.5a [Assessment of Water Quality Downstream of Railings Management Facility, Touquoy Gold Project]). These predictions are used as the baseline conditions for the Project at the Touquoy Mine Site in these watercourses. Surface water locations TQ-SW-12 located at the outlet of Square Lake, and TQ-SW-23 located on TQ-WC4 are identified as "background" as they are located upstream from the Touquoy Mine Site and are not expected to be affected by the Touquoy Gold Project or the Project. Water quality predictions are made at downstream locations TQ-SW-3 on TQ-WC4, and TQ-SW-13 on Scraggy Lake (Figure 6.7-3 and Table 6.7-12).

As reported in the 2017 groundwater and surface water monitoring report (Stantec 2018b), spatial trends were not apparent between conductivity and the observed Tier 1 EQS exceedances, or between background and downstream monitoring locations to indicate an effect of a specific mine facility (i.e., TMF, waste rock pile, open pit) on surface water resources during construction. Arsenic was noted to consistently exceed the Tier 1 EQS at TQ-SW-2 downstream of the open pit in both 2016 and 2017. As no trends in water quantity or quality were identified between baseline and operation, these elevated arsenic concentrations are not attributed to operation and may be from historical tailing piles and/or the Touquoy ore body itself. A remedial action plan is currently underway by AMNS that involves the delineation, removal, and management of these historical tailings piles around the open pit area (Appendix E.9 [draft Historic Tailings and Waste Rock Management Plan]) .

Table 6.7-17: Summary of Baseline 2016 and 2017 Surface Water Quality for Touquoy Mine Site Parameter Exceedance

Water Quality Parameter	TQ-SW-1	TQ-SW-2	TQ-SW-3	TQ-SW-11	TQ-SW-12	TQ-SW-13	TQ-SW-15	TQ-SW-18	TQ-SW-19	TQ-SW-20	TQ-SW-21	TQ-SW-23	No. of Stations with Parameter Exceedance
Exceedance of Tier 1 EQS													
pH	20	20	6	22	20	20	10	19	18	16	16	9	12
Total Aluminum (Al)	21	22	20	22	21	20	19	21	21	19	19	9	12
Total Arsenic (As)	20	18	14	22	0	2	9	11	8	2	0	3	10
Total Cadmium (Cd)	12	14	11	15	13	11	17	13	20	17	14	9	10
Total Cobalt (Co)[(a)]	0	0	0	0	0	0	0	0	1	0	0	0	1
Total Copper (Cu)	0	0	3	1	0	0	6	0	3	2	0	0	5
Total Iron (Fe)	17	17	14	16	1	2	18	14	17	18	6	7	12
Total Lead (Pb)	0	0	5	0	0	1	12	0	2	4	2	0	6
Total Manganese (Mn)[(a)]	0	0	1	0	0	0	1	0	2	0	0	0	3
Total Mercury (Hg)	0	0	0	0	0	1	3	0	0	1	0	0	3
Total Silver (Ag)[(a)]	0	0	0	0	0	0	0	0	1	0	0	0	1
Total Vanadium (V)	0	0	0	0	0	0	0	0	1	1	0	0	2
Total Zinc (Zn)	0	0	0	0	1	2	2	0	1	1	0	0	5
No. of Monitoring Events per Station	21	22	20	22	21	20	19	21	21	19	19	19	12

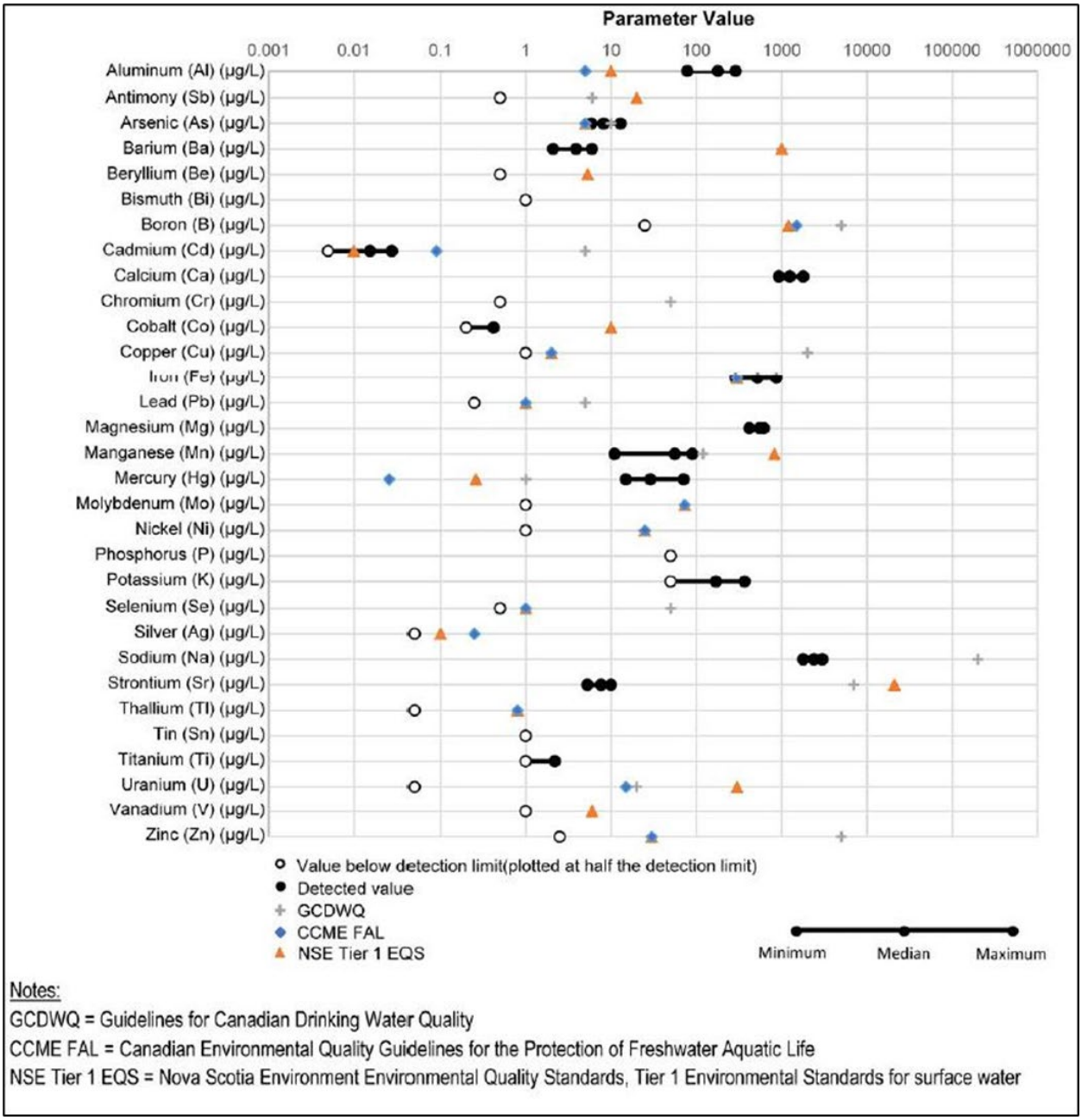
Source: Stantec 2018a.

Note: Surface water quality parameter is listed if there is at least 1 exceedance in 2016/2017 monitoring. MDMER = Metal and Dimond Mining Effluent Regulations; Tier 1 EQS = Nova Scotia Tier 1 (Contaminated Sites) Environmental Quality Standards for Surface Water (Fresh Water).

[(a)] Indicates exceedance of CCME guideline.

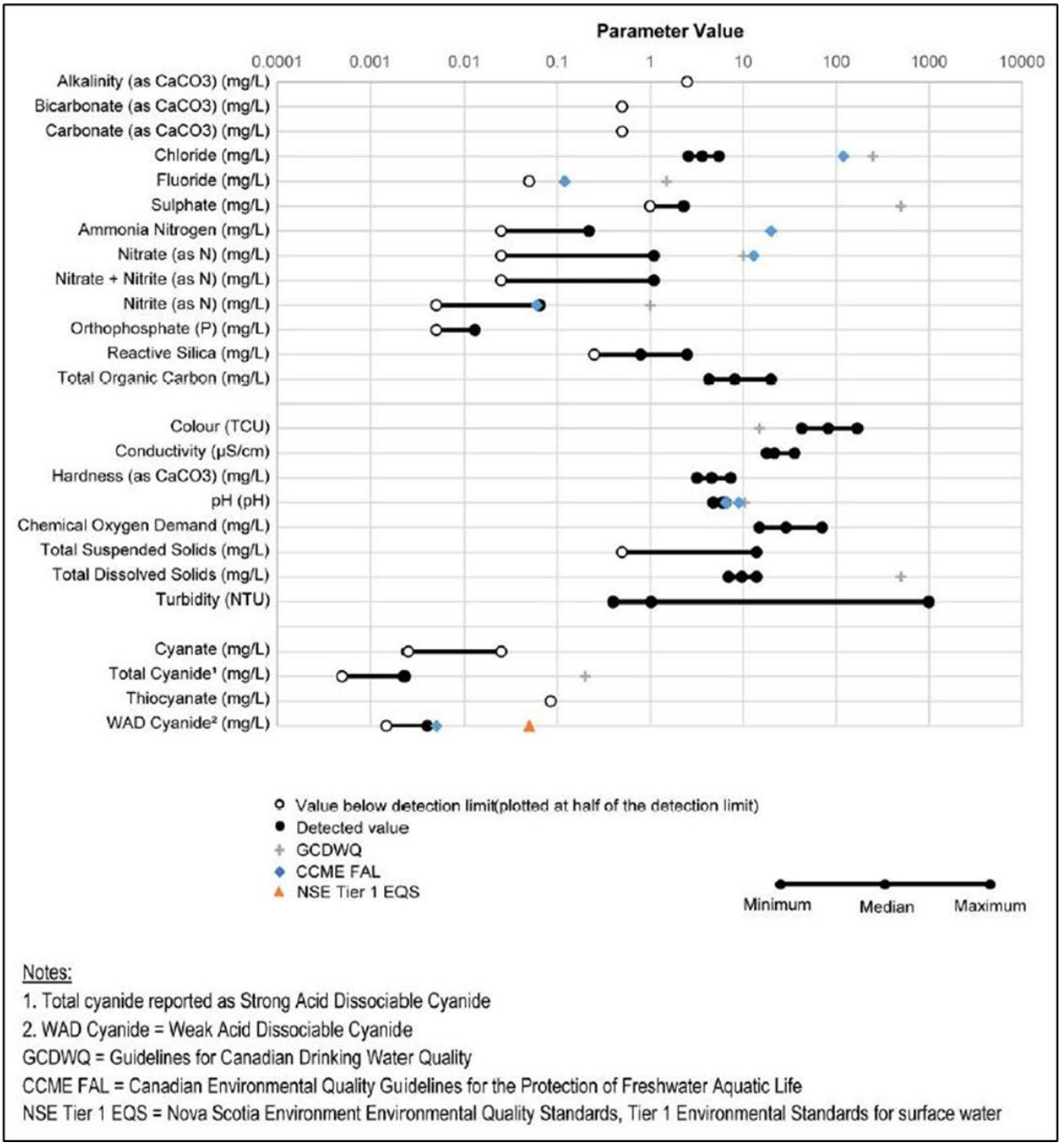
Figures 6.7-7 to 6.7-10 present box plots that summarize the surface water quality for both the background and downstream locations at the Touquoy Mine Site. These represent the baseline conditions for the use of the Touquoy Mine Site for the processing of the ore for the Beaver Dam Mine Project. The minimum, mean, and maximum concentration or value for the parameters are presented on a logarithmic scale. Values below the detection limits are flagged in the plots, as are the relevant guidelines or discharge limits. For example, in Figure 6.7-9, all values for total bismuth in the background data set (i.e., TQ-SW-1, TQ-SW-11 TQ-SW-12, and TQ-SW-23) are below the detection limit. In Figure 6.7-9 for the background data set, the minimum cadmium value is below the detection limit, the mean and maximum value is above Tier 1 EQS and CCME FWAL guideline.

Figure 6.7-7: Background Water Quality at Touquoy – Metal Parameters



Source: Stantec (2017a).

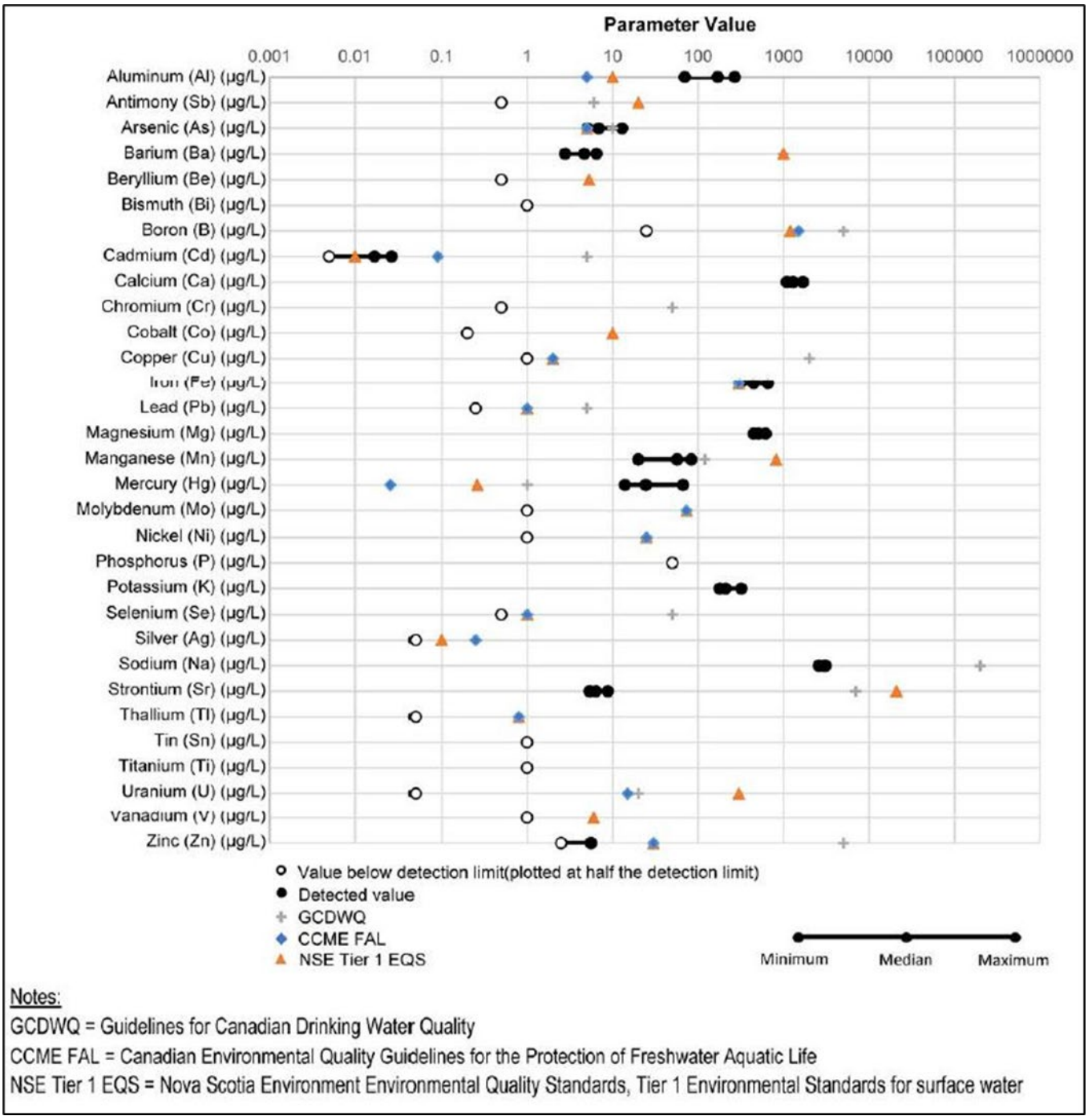
Figure 6.7-8: Background Water Quality at Touquoy – General Chemistry, Cyanide and Petroleum Hydrocarbons



Notes:
1. Total cyanide reported as Strong Acid Dissociable Cyanide
2. WAD Cyanide = Weak Acid Dissociable Cyanide
GCDWQ = Guidelines for Canadian Drinking Water Quality
CCME FAL = Canadian Environmental Quality Guidelines for the Protection of Freshwater Aquatic Life
NSE Tier 1 EQS = Nova Scotia Environment Environmental Quality Standards, Tier 1 Environmental Standards for surface water

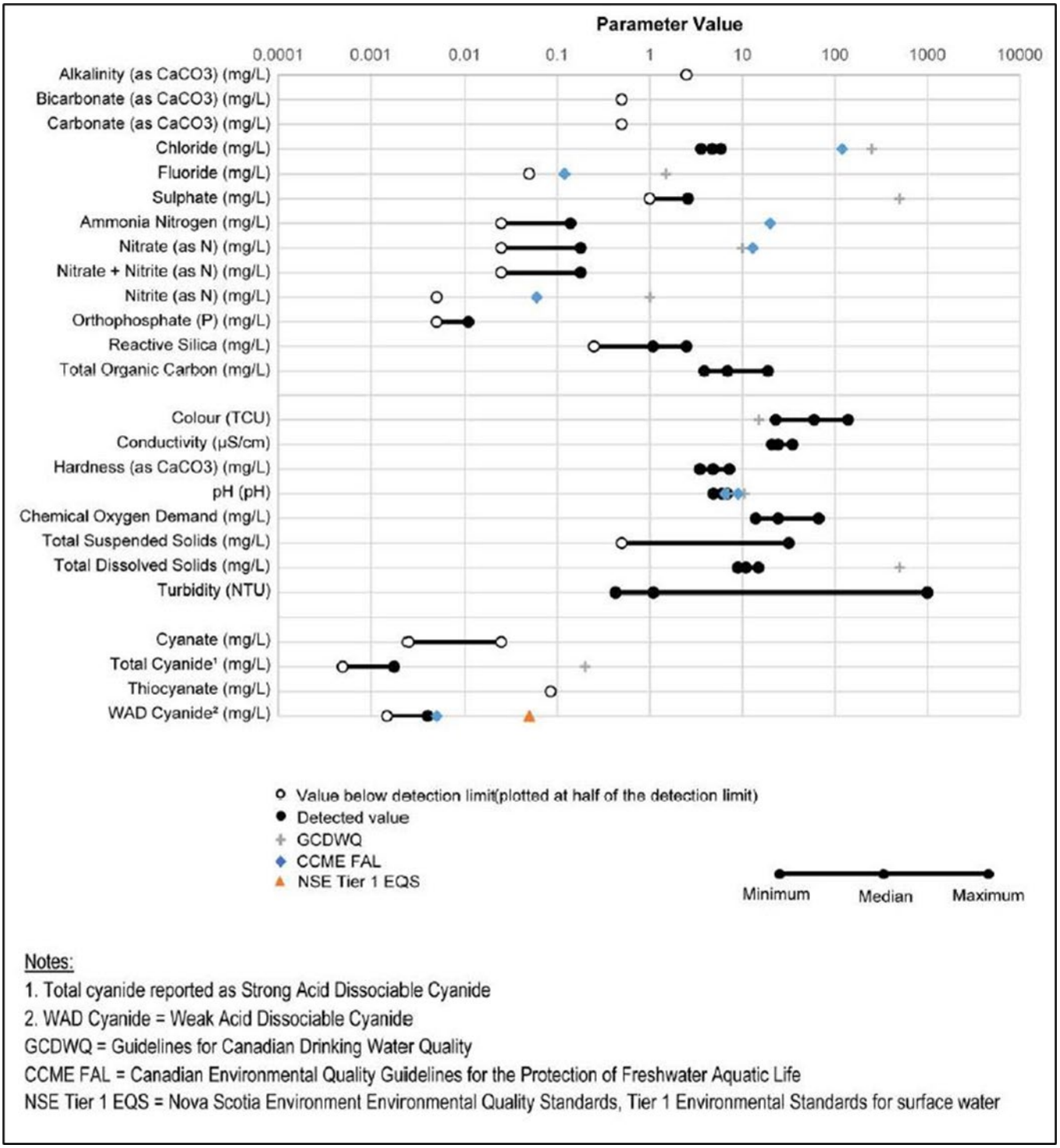
Source: Stantec (2017a).

Figure 6.7-9: Downstream Water Quality at Touquoy – Metal Parameters



Source: Stantec (2017a).

Figure 6.7-10: Downstream Surface Water Quality at Touquoy – General Chemistry, Metals and Petroleum Hydrocarbons



Notes:

1. Total cyanide reported as Strong Acid Dissociable Cyanide
2. WAD Cyanide = Weak Acid Dissociable Cyanide

GCDWQ = Guidelines for Canadian Drinking Water Quality

CCME FAL = Canadian Environmental Quality Guidelines for the Protection of Freshwater Aquatic Life

NSE Tier 1 EQS = Nova Scotia Environment Environmental Quality Standards, Tier 1 Environmental Standards for surface water

Source: Stantec (2017a).

Overall, the water quality is similar between background and downstream surface water quality presented in the 2017 monitoring report (Stantec 2018b). All applicable parameters meet MDMER discharge limits, with the exception of pH which is slightly acidic in background water quality conditions. Organic sampling parameters related to hydrocarbons as well as cyanide related parameters were all below the detection limits for all 2016/2017 sampling locations, thus no exceedances are reported under the Tier 1 EQS for freshwater. There were no detections of radium 226 at the locations sampled (i.e., TQ-SW-2, TQ-SW-21).

Conductivity is generally stable at each location by month in 2016 and 2017 and is generally low (<43 microSiemens per centimeter [µS/cm]) at most sampling locations. The pH in surface water was noted to be slightly acidic and generally at or below 6.0 at both background and downstream locations with the exception of TQ-SW-3 where more neutral values (i.e., pH generally between 6 and 7) were observed. Total suspended solids (TSS) were generally less than 10 mg/L. Turbidity was generally low at less than 5.5 NTU at background locations but were slightly elevated in downstream locations at the site. Ammonia nitrogen concentrations were typically not detected or were less than 0.1 mg/L. There were no Tier 1 EQS surface water guideline exceedances noted for antimony, barium, beryllium, boron, molybdenum, mercury, nickel, selenium, strontium, thallium, uranium, benzene, toluene, ethylbenzene, total xylenes and total cyanide (i.e., strong acid dissociated cyanide). The surface water sampling locations are presented in Figures 6.7-1 through 6.7-3. Complete water quality results are presented in the 2017 Annual Report - Surface Water & Groundwater Monitoring (Stantec 2018b).

6.7.6 Consideration of Engagement Results

Key issues raised during public consultation and Mi'kmaq engagement relating to surface water quality and quantity include potential effect from acid rock drainage, suspended solids and leached metals from the Beaver Dam Mine Site activities. Potential effects on the quantity of surface water near the Beaver Dam pit were noted, specifically potential effects on water levels in Cameron Flowage. Concerns were identified related to effects on surface waters along the Haul Road, specifically during construction activities, including River Lake, a segment of the West River Sheet Harbour, near the Beaver Lake Indian Reserve (IR) 17. At the Touquoy Mine Site, questions arose about potential effects on Moose River from placement of tailings in the mined-out pit.

Questions were identified on potential effects on receiving waters in the event of unplanned releases due to accidents and malfunctions, specifically during operations. Potential effects on traditional uses of land and resources by the Mi'kmaq were noted, including importance of clean water to support the natural environment, including fish, flora, fauna, and drinking water.

The results of the public consultation and Mi'kmaq engagement have been considered in the environmental effects assessment, including AMNS's commitments to mitigation and monitoring measures and proposed compliance and effects monitoring programs, as well as AMNS's broader commitment to ongoing public consultation and Mi'kmaq engagement. Specific to evaluating the effect on surface water quality and quantity, these commitments are described within the following environmental effects assessment.

6.7.7 Effects Assessment Methodology

The Project is part of the Moose River Consolidated (MRC) Project, which includes the existing and fully permitted Touquoy Gold Project, located in Moose River Gold Mines, Nova Scotia. The Project will operate as a satellite surface mine to the MRC Project, and the ore that is mined from the Project Site will be processed at the existing Touquoy plant.

This section describes the boundaries of the effects assessment including the quantitative modelling methods for surface water quality and quantity, and the thresholds for determination of significance for both surface water quality potential effects and surface water quantity potential effects of the Project.

6.7.7.1 Boundaries

6.7.7.1.1 Spatial Boundaries

Assessment boundaries define the maximum limit within which the effects assessment and supporting studies (e.g., predictive models) are conducted. Boundaries encompass where and when the Project is expected to interact with identified VCs as well as constraints that may be placed on the assessment of those interactions due to political, social, and economic realities (administrative boundaries), and limitations in predicting or measuring changes (technical boundaries). The definition of these assessment boundaries is an integral part of the assessment process of surface water quality, and encompasses possible direct, indirect, and induced Project effects, as well as the trends in processes that may be relevant.

The spatial boundaries used for the assessment of Project effects to surface water quality and quantity are the Project Area (PA), the Local Assessment Area (LAA), and the Regional Assessment Area (RAA). These are defined below and shown in Figure 6.7-11:

- The Project Area (PA) (Figure 6.7-11) consists of the three project components; Beaver Dam Mine Site, Touquoy Mine Site, and the Haul Road, which extends from Marinette to Moose River Gold Mines, Halifax County, Nova Scotia. The Beaver Dam Mine Site is located at the eastern end of the Beaver Dam Mines Road. The Haul Road spans from the Beaver Dam Mine Site to Moose River Gold Mines, where the Touquoy Mine Site [processing and exhausted pit (to be used to dispose Beaver Dam tailings) is located. The PA has changed as a result of the expansion of the Beaver Dam Mine Site to accommodate micro-siting of mine infrastructure and ongoing modifications to the Haul Road design, as described in Project Description (Section 2). These changes have been captured under the existing and additional desktop and field evaluations.
- The Local Assessment Area (LAA) includes the Project Area and further encompasses watersheds that could be potentially directly affected by mine construction and operation phases. Water quality will be assessed at release points (e.g., end-of-pipe) and receiving environment locations in the LAA. Figure 6.7-12 presents the location of mine discharge relative to proposed Project infrastructure and water assessment points.

Prepared For:

Atlantic Gold

FIGURE 6.7-11

Beaver Dam Mine Project

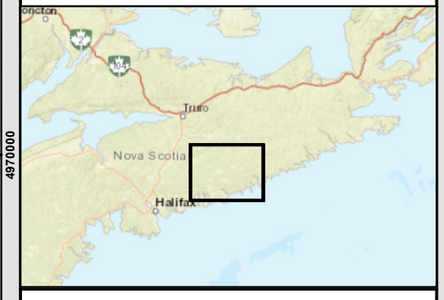
Beaver Dam Mine Project Area and Local and Regional Assessment Areas

Beaver Dam Mine Site

Touquoy Mine Site

Haul Road

- Project Area
- Aquatic Local Assessment Area
- Aquatic Regional Assessment Area



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 2.5 5 10 km

1:175,000 Scale when printed @ 11" x 17"

Drawn By: AS
Reviewed By: KR

Date: 2021-04-01

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

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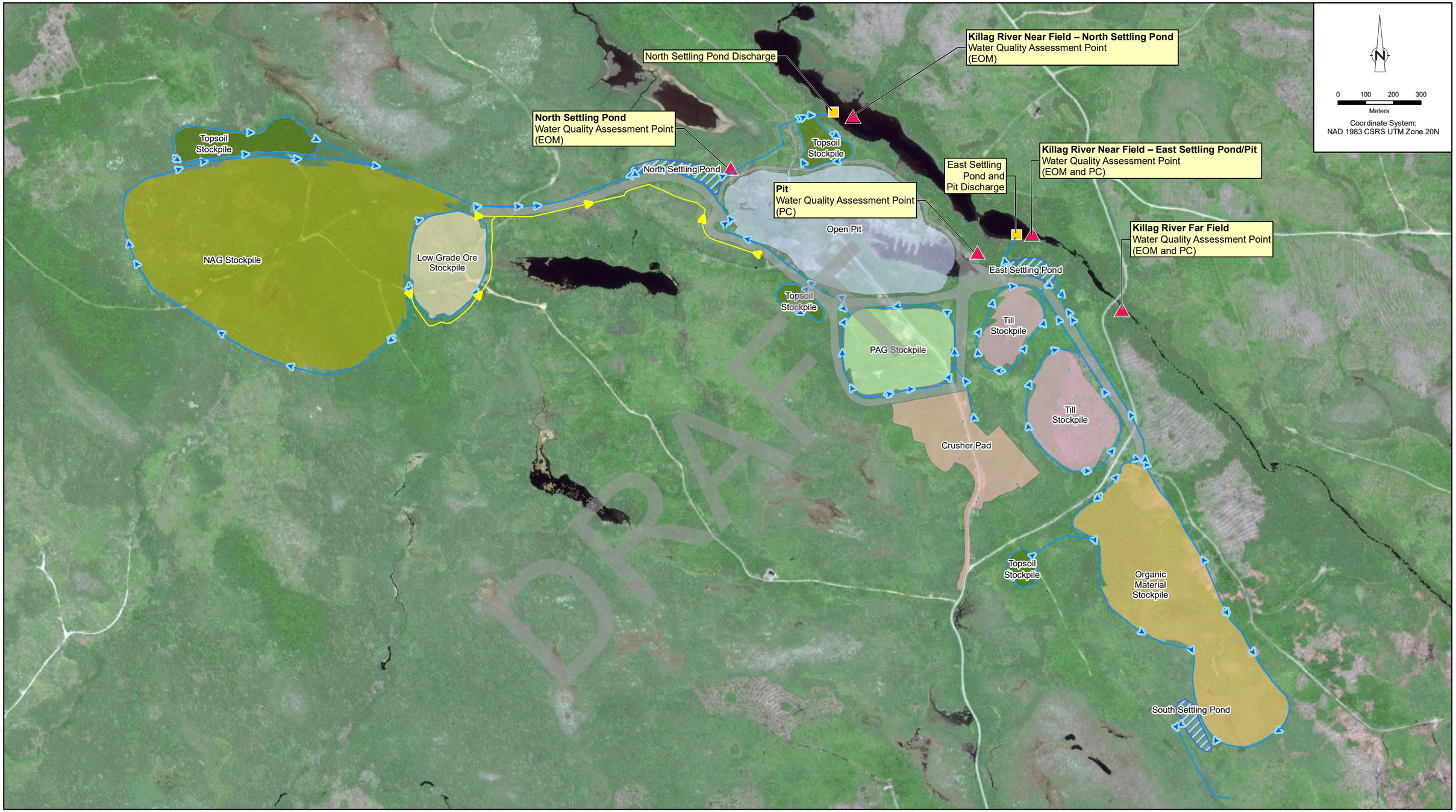

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- Contact Water Ditch
- Clean Water Ditch
- Settling Pond
- Road
- Bypass Road
- Crusher Pad
- Low Grade Ore Stockpile
- NAG Stockpile
- Open Pit
- Organic Material Stockpile
- PAG Stockpile
- Till Stockpile
- Topsoil Stockpile
- Water Pump Intake
- Discharge Point
- Water Quality Assessment Point

EOM = End of Mine
PC = Post Closure

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BEAVER DAM MINE
MINE WATER MANAGEMENT PLAN
PREDICTIVE WATER QUALITY ASSESSMENT

088664-27
Feb 12, 2021

MINE DISCHARGE AND WATER QUALITY ASSESSMENT POINTS FIGURE 6.7-12

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The LAA boundaries were defined considering the maximum expected extent of direct and indirect impacts to the aquatic environment as well as the location of Project activities across all PA components. The LAA surrounding the Touquoy Mine Site incorporates the Moose River to the west, and only includes the portion of the Square Lake watershed which interacts with the PA. No Project related aquatic effects are expected in the headwater portions of these watersheds. The lakes and watercourses that are included as part of the baseline programs and/or predictions of effects are located within the LAA boundary. The list below identifies tertiary watershed boundaries intersected by each component of the Project. The LAA is defined as the collection of all tertiary watersheds listed below:

- Beaver Dam Mine Site:
  - Portion of Killag River (1EM-2-D);
  - Tent Brook (1EM-2-F);
  - Paul Brook (1EM-2-H); and
  - Cope Brook (1EM-2-J).
- Haul Road:
  - Tent Brook (1EM-2-F);
  - Keef Brook (1EM-2-G);
  - Jack Lowe Brook (1EM-2-N);
  - Little River (1EM-2-P);
  - Portion of Sandy Pond (1EL-2-C); and
  - Portion of Morgan River (1EL-2-H).
- Touquoy Mine Site:
  - Portion of Moose River (1EL-P-5);
  - Portion of Square Lake (1EL-5-M); and
  - Portion of Scraggy Lake (1EL-5-N).

The RAA encompasses the three secondary watersheds that the PA is located within. These watersheds are:

- West River Sheet Harbour secondary watershed (1EM-2, incorporating the Beaver Dam Mine Site and Haul Road);
- Tangier River secondary watershed (1EL-2, incorporating the Haul Road); and
- Fish River-Lake Charlotte secondary watershed (1EL-5, which incorporates the Touquoy Mine Site).

The RAA is broader than expected Project impacts and considers other project boundaries as per the cumulative effects assessment methodology. As the Project has the potential to cause direct and indirect effects to fish and fish habitat outside of the PA, the LAA is the appropriate boundary for evaluation of this VC.

6.7.7.1.2 Temporal Boundaries

Temporal boundaries reflect those periods during which planned Project activities are reasonably expected to potentially affect a VC. The temporal boundaries used for the assessment of effects to Surface Water are the Construction phase, Operational phase, and Active Closure and Post-closure

To support the effects assessment for the operations phase, predictive models were developed for the end of operations (EOM) model (i.e., max build out) as well as Post-closure. EOM represents the Project stage with the highest potential for significant effects to the receiving environment and thus the prediction and assessment of potential effects at EOM, and applying to the whole of operations, is a conservative approach.

6.7.7.1.3 Technical Boundaries

The surface water effects assessment was developed to incorporate quantitative data from baseline reports as well as predictive water modelling including sensitivity analyses; the modelling domains of predictive models represent a technical boundary for the effects assessment.

Effects on indicators of Surface Water Quantity (e.g., base flow, L/s) and Surface Water Quality (total and dissolved metals, anions, and nutrients; mg/L) were either assessed quantitatively by predictive water modelling or qualitatively based on geochemical characterization studies and professional judgement and experience (e.g., pH, TSS). The goals were to remove as much subjectivity as possible from the assessment and to increase certainty in the predictions of alteration of the Surface Water VC, residual effects, and the determination of significance to ensure a robust, transparent, and defensible approach to the effects assessment.

The effects assessment for Surface Water Quality VC further considers several different pathways through which surface water quality indicators can be affected by Project activities and components, many of which overlap in terms of definition and scope. These include:

- discharges, including direct discharge to the receiving environment and management of contact water;
- groundwater seepage from Project components to receiving environment;
- metal leaching and acid rock drainage (ML/ARD) generated from excavating or exposing material with the potential for ML/ARD, or in runoff from stockpiles;
- erosion and sedimentation during site clearing, construction, maintenance activities, and reclamation efforts; and
- dust deposition along the Haul Road route (CEAA-2-37 [AMNS 2021]).

6.7.7.1.4 Administrative Boundaries

The Project is subject to the MDMER criteria at the point(s) of discharge. Three discharge points are planned that are expected to be subject to MDMER:

- **Construction:** discharge from the north settling pond following treatment of historic tailings may be subject to MDMER and will be confirmed during the permitting phase.
- **Operations:** discharge from the north, east, and south settling ponds to the Cameron Flowage (Killag River) and WC19 of the Tent Brook system at the Beaver Dam Mine Site;
- **Closure:** discharge from the pit to the Cameron Flowage (Killag River) at the Beaver Dam Mine Site; and
- **Closure:** discharge from the pit to the Moose River at the existing Touquoy Mine Site.

CCME FWAL guidelines, NSE Tier 1 criteria and established background concentrations for each river will be applied in the receiving environment to support the effects assessment are presented in Table 6.7-18. A site-specific water quality objective was developed for arsenic in the receiving environment, following CCME (2007) protocols, using a species sensitivity distribution (SSD) approach. The resultant Site-Specific Water Quality Objective (SSWQO) can be found in Appendix G.2. This the site-specific criteria established by Intrinsik and included in Appendix G.2 will be requested arsenic in both the Killag and Moose Rivers, which is anticipated to be consistent with current site-specific criteria (CRA 2007b).

Table 6.7-18: Selected Receiving Environment Guidelines Informing the Effects Assessment to Surface Water Quality Valued Component

Chemical	CCME (µg/L)	Nova Scotia Tier 1 (µg/L)	Selected Guideline	Regulation
Silver	0.25	0.25	0.25	Nova Scotia Tier 1
Aluminium	5/100[(a)]	5	5	Nova Scotia Tier 1
Antimony	NV	20	20	Nova Scotia Tier 1
Arsenic	5	5	5	Nova Scotia Tier 1
Cadmium	0.04/0.09[(b)]	0.04	0.04	Nova Scotia Tier 1
Chromium	8.9[(c)]	1[(d)]	8.9	CCME
Cobalt	NV	10	10	Nova Scotia Tier 1
Copper	2/4[(e)]	2	2	Nova Scotia Tier 1
Iron	300	300	300	Nova Scotia Tier 1
Mercury	0.026	0.026	0.026	Nova Scotia Tier 1
Manganese	NV	820	820	Nova Scotia Tier 1
Molybdenum	73	73	73	Nova Scotia Tier 1
Nickel	25	25	25	Nova Scotia Tier 1
Lead	1/7[(f)]	1	1	Nova Scotia Tier 1
Selenium	1	1	1	Nova Scotia Tier 1
Sulphate	NG	NG	128 mg/L[(g)]	BC ENV
Thallium	0.8	0.8	0.8	Nova Scotia Tier 1
Uranium	15	300	15	CCME
Zinc	7	30	7	CCME
WAD Cyanide	5	5	5	Nova Scotia Tier 1
Total Cyanide (based on Strong Acid Dissociated)	NG	NG	5[(h)]	CCME
Nitrite (as N)	NG	60	60	CCME
Total Ammonia - N	NG	Varies with pH and temperature	Varies with pH and temperature	CCME

Notes: NG = No guideline available from that agency

(a) The CCME water quality guideline for aluminum of 5 µg/L is for pH<6.5, and 100 µg/L is for pH 26.5. The background pH of the Killag River is 4.59 and 6; and mean pH of Moose River is 6.05; therefore, the guideline of 5 µg/L is appropriate for use at both sites.

(b) The CCME water quality guideline for cadmium of 0.04 µg/L is for water hardness >0 to <17 mg/L, and 0.09 µg/L is for water of 50 mg/L hardness. The background water hardness of the Killag River is between 1.6 and 5.5 mg/L $CaCO_3$; and the mean hardness of Moose River is 5.0 mg/L; therefore, the guideline of 0.04 µg/L is appropriate for use at both sites.

(c) Based on Cr6+; this value was selected to be conservative and that is assumed that Cr will exist in the oxidized state under oxygenated conditions characteristic of fast-moving streams/rivers as well as epilimnetic environments.

(e) The CCME water quality guideline for copper of 2 µg/L is for water hardness of 0 to <82 mg/L or when the hardness is unknown.

When the hardness is >82 to :5180 mg/L, the following equation is used to calculate the guideline: CWQG (µg/L) = 0.2 * e{0.8545[ln(hardness)]-1.465}, and at a hardness >180 mg/L, the guideline is 4 µg/L. The background water hardness of the Killag River is between 1.6 and 5.5 mg/L $CaCO_3$ and the mean hardness of Moose River is 5.0 mg/L; therefore, the guideline of 2 µg/L is appropriate for use at both sites.

(f) The CCME water quality guideline for lead of 1 µg/L is for water hardness of 0 to :560 mg/L or when the hardness is unknown.

When the hardness is >60 to :5180 mg/L, the following equation is used to calculate the guideline: CWQG (µg/L) = e{1.273[ln(hardness)]-4.705}, and at a hardness >180 mg/L, the guideline is 7 µg/L. The background water hardness of the Killag River is between 1.6 and 5.5 mg/L $CaCO_3$ and the mean hardness in Moose River is 5.0 mg/L; therefore, the guideline of 1 µg/L is appropriate for use at both sites.

(g) No CCME or NS Tier 1 guideline is available; therefore, a guideline from BC Moe was used (https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/wqgs-wqos/approved- wqgs/wqg_summary_aquaticlife_wildlife_agri.pdf).

(h) This guideline is for free CN, and hence does not apply to Total CN. It is used to provide perspective only in the effects assessment.

6.7.7.2 Thresholds for Determination of Significance

6.7.7.2.1 Surface Water Quantity

Residual effects of the Project on Surface Water Quantity VC identified are characterized using standard criteria, including magnitude, geographical extent, duration, frequency, reversibility, and context of the effect (Table 6.7-19). The residual effects assessment concludes with a determination of Significance. The screening of project effects, mitigation measures, and the subsequent water balance model results are assessed in aggregate to determine whether the residual impacts are "Not Significant" or "Significant" according to the following definitions:

- **Significant Residual Effect:** residual effects have high magnitude, be of potential regional geographic extent and of medium to long term duration, occur at any frequency and only be partially reversible to irreversible.
- **Not Significant Residual Effect:** to Surface Water Quality VC is defined as: negligible to moderate magnitude, are restricted to the PA or near-field receiving environment, are of sporadic or short-term duration, occur at any frequency and are reversible to partially reversible.

6.7.7.2.2 Surface Water Quality

Residual effects of the Project on Surface Water Quality VC identified are characterized using standard criteria, including magnitude, geographical extent, duration, frequency, reversibility, and context of the effect (Table 6.7-20). The residual effects assessment concludes with a determination of Significance. The screening of project effects, mitigation measures, and the subsequent water quality model results are assessed in aggregate to determine whether the residual impacts are "Not Significant" or "Significant" according to the following definitions:

- **Significant Residual Effect:** residual effects have high magnitude, be of potential regional geographic extent and of medium to long term duration, occur at any frequency and only be partially reversible to irreversible.
- **Not Significant Residual Effect:** to Surface Water Quality VC is defined as: negligible to moderate magnitude, are restricted to the PA or near-field receiving environment, are of sporadic or short-term duration, occur at any frequency and are reversible to partially reversible.

Table 6.7-19: Definitions of Characterization Criteria for Residual Effects on Surface Water Quantity

Criteria	Description of Ratings
Magnitude	• **Negligible:** change to surface water flow or catchment area indicator is less than 1% of background conditions, (i.e., no measurable change of state of indicator from background conditions) • **Low:** change to surface water flow or catchment area is detectable, but less than 10% over baseline levels • **Medium:** change to surface water flow or catchment area is detectable, but less than 15% over baseline levels • **High:** change to surface water flow or catchment area is detectable, and differ substantially from baseline conditions (greater than 15%)
Geographical Extent	• **Discrete:** effect is limited to receiving environments in the immediate footprint or Project Area (PA) • **Local:** effect is limited to the near-filed Local Assessment Area • **Potential** Regional: effect persists to the far-field Local Assessment Area
Timing	• Timing represents seasonal occurrence of the effect (e.g., spring vs winter; high flows vs. low flows) and represents effect criteria for designated water users (aquatic resources, human health). The characterization of effect of changes to surface water on designated water resources is assessed in their respective; for surface water quality timing is considered redundant to duration and frequency criteria and is not further considered here

Table 6.7-19: Definitions of Characterization Criteria for Residual Effects on Surface Water Quantity (continued)

Criteria	Description of Ratings
Duration	• **Short term:** effect is restricted to Construction Phase and/or EOM modelling. • **Medium term:** effect occurs in Construction Phase and EOM Phase • **Long term:** Effect occurs in Construction Phase and EOM Phase and/or persists in PC
Frequency	• **Sporadic:** VC interaction or effect will occur at irregular intervals throughout any Project Phase • **Regular:** effect occurs on a regular basis but not continuous basis • **Continuous:** effect occurs constantly (e.g., every model timestep in a given Project Phase)
Reversibility	• **Reversible:** effect can be reversed • **Partially reversible:** effect can be partially reversed • **Irreversible:** effect cannot be reversed, is of permanent duration

Table 6.7-20: Definitions of Characterization Criteria for Residual Effects on Surface Water Quality

Criteria	Description of Ratings
Magnitude	• **Negligible:** predicted change of surface water quality indicator is less than 10% of background conditions, (i.e., no measurable change of state of indicator from background conditions). • **Low:** indicator is predicted to be greater than guidelines **and** increase by greater than 10% over baseline levels but remains well within the observed range of natural variation (defined as 25th to 75th percentile baseline water quality). • **Medium:** indicator is predicted to be greater than guidelines and differ substantially from baseline levels and approaches upper observed limits of natural variation (defined as percentile baseline water quality). • **High:** indicator is predicted to be greater than guidelines and differ substantially from baseline water quality (outside of 75th to 95th baseline water quality), resulting in a detectable change beyond the range of natural variation.
Geographical Extent	• **Discrete:** effect is limited to receiving environments in the immediate footprint or Project Area (PA). • **Local:** effect is limited to the near-field Local Assessment Area. • **Potential Regional:** effect persists to the far-field Local Assessment Area.
Timing	• Timing represents seasonal occurrence of the effect (e.g., spring vs winter; high flows vs. low flows), and represents characterization criteria for designated water users (i.e., to aquatic resources, fish, and human health). The characterization of effect of changes to surface water on designated water resources is assessed in their respective sections; for Surface Water Quantity timing is considered redundant criteria to duration and frequency characterizations (see below) and is not further considered.
Duration	• **Short term:** effect is restricted to Construction Phase and/or EOM modelling. • **Medium term:** effect occurs in Construction Phase and EOM Phase • **Long term:** Effect occurs in Construction Phase and EOM Phase and persists in PC
Frequency	• **Sporadic:** VC interaction or effect will occur at irregular intervals throughout any Project Phase. • **Regular:** effect occurs on a regular basis but not continuous basis. • **Continuous:** effect occurs constantly (e.g., every model timestep in a given Project Phase).
Reversibility	• **Reversible:** effect can be reversed. • **Partially reversible:** effect can be partially reversed. • **Irreversible:** effect cannot be reversed, is of permanent duration.

6.7.7.3 Surface Water Modelling: Methodology

In support of the environmental assessment, water quality and quantity predictions for the Project were produced through the development of deterministic mass and water balance modelling for both the Beaver Dam Mine Site and Touquoy Mine. Summaries of model approaches, assumptions, and sensitivity analyses as they relate to surface water predictive efforts are provided in the following sections. Full details and results of surface water studies conducted to support the environmental assessment for the Project are appended here as:

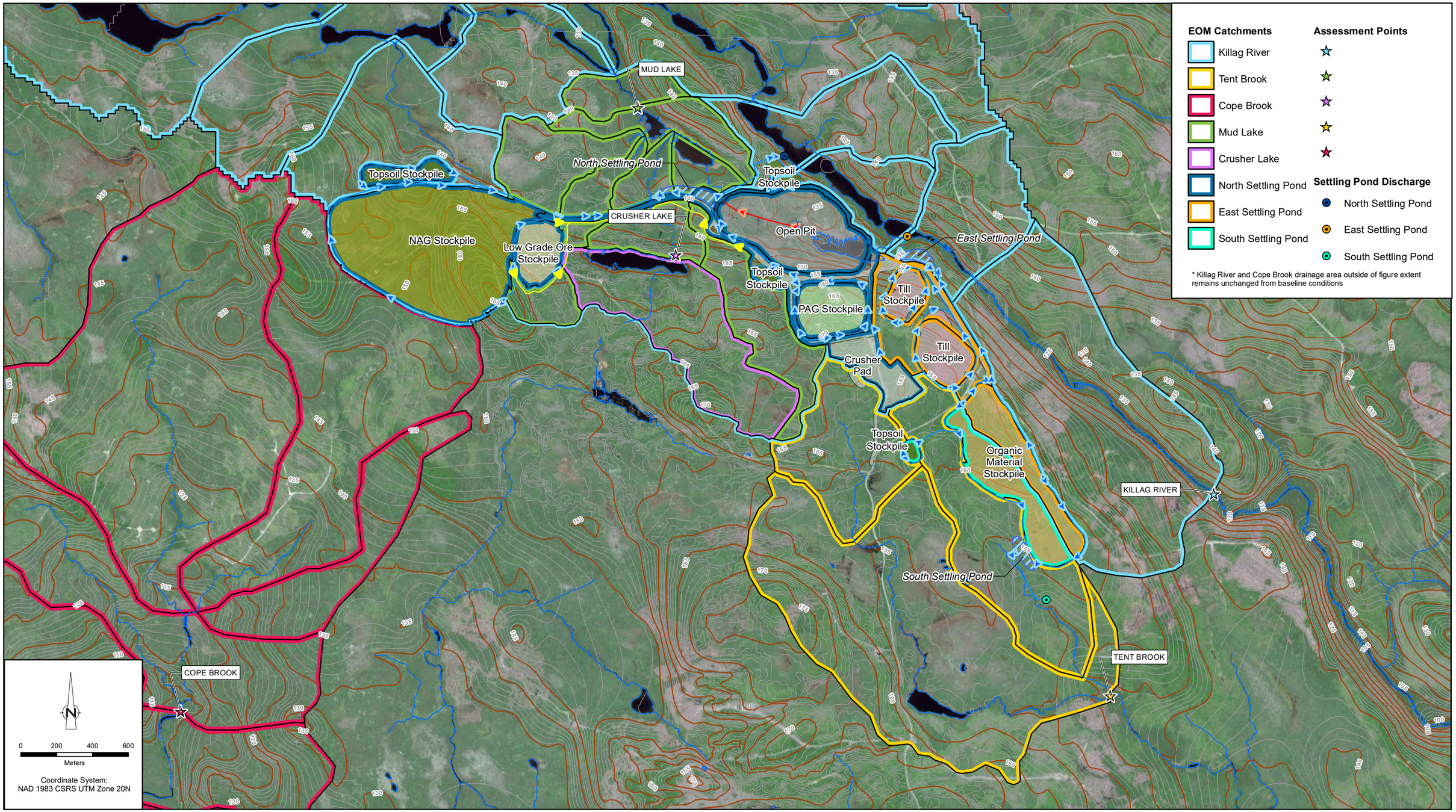
- Appendix P.4 Mine Water Management Plan:
  - Appendix A Water Balance Analysis, GHD (2021); and
  - Appendix D Predictive Water Quality Assessment, GHD (2021).
- Appendix G.2 Beaver Dam Mine: Killag River and Moose River Water Quality Predictions and Aquatic Effects Assessment – Reassessment of Killag River based on February 2021 Update (GHD modelling Provided February 12, 2021); Reassessment of Moose River based on March 2021 Update (Stantec modelling of March 11, 2021), Intrinsik (2021);
- Appendix F.8 Beaver Dam Gold Project Assimilative Capacity Study of Moose River – Touquoy Pit Discharge, Stantec (2021);
- Appendix G.10 Additional Water Quality Modelling, GHD (2021); and
- Appendix F.9 Response to IR2s CEAA-2-36, CEAA-2-37, and NSE-2-130 Evaluation of Potential Impacts from Metals COCs to Groundwater and Surface Water from Dust Deposition along the Haul Road, Beaver Dam Mine Project, GHD (2021).

The overall objective of the surface water modelling (quantity and quality) is to predict discharge water quality and quantity, identify potential needs for water treatment (Section 6.7.9) and assess the short and long-term impacts of the Project on the receiving environment. As such, model predictions herein presented do not include effects of planned water treatment.

Surface Water Model Results for the receiving environment informing the effects assessment are presented in Section 6.7.8; predictions for mine site contact water and effluent quality informing the effects assessment are presented in Appendix P.4 (Mine Water Management Plan, Appendix D).

Predictions are compared between the three mine life-cycle stages (baseline, EOM and PC) at three discharge points including Mud Lake, Tent Lake, and the Killag River.

Figures 6.7-13 and 6.7-14 depict the catchment areas contributing drainage area to the Killag River at the proposed receiving waterbody for the Project.



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NOTES:
1. WC-27 and Tent Brook Contributing Areas derived from LiDAR measurements supplied by Leading Edge Geomatics, 2015.
2. Killag River Contributing Area derived from a combination of LiDAR measurements, Nova Scotia Department of Natural Resources (Forestry Division) hydrologically-corrected 20m DEM, and interpretations from satellite imagery and topographic maps.

- Pumping Path
- SWM Ditches
- Clean Water Ditch
- Contours (5m)
- Contours (1m)
- Settling Ponds
- Crusher Pad
- Low Grade Stockpile
- NAG Stockpile
- Open Pit
- Organic Material Stockpile
- PAG Stockpile
- Road
- Topsoil Stockpile
- Till Stockpile
- Watercourse

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MINE WATER MANAGEMENT PLAN
WATER BALANCE ANALYSIS

088664
May 11, 2021

CATCHMENT AREAS – EOM CONDITIONS

FIGURE 6.7-13

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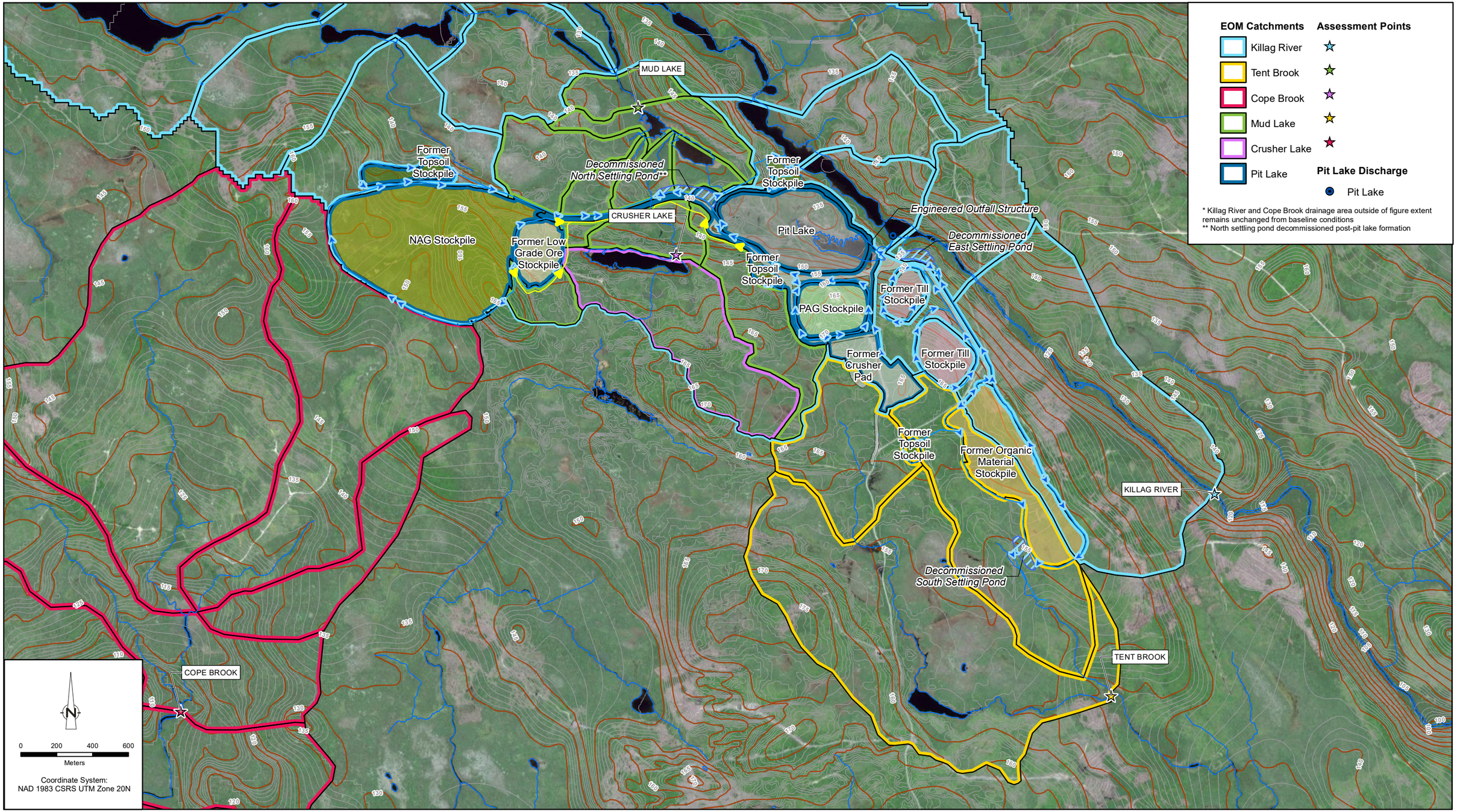

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NOTES:
1. WC-27 and Tent Brook Contributing Areas derived from LiDAR measurements supplied by Leading Edge Geomatics, 2015.
2. Killag River Contributing Area derived from a combination of LiDAR measurements, Nova Scotia Department of Natural Resources (Forestry Division) hydrologically-corrected 20m DEM, and interpretations from satellite imagery and topographic maps.

- SWM Ditches
- Clean Water Ditch
- Contours (5m)
- Contours (1m)
- Watercourse
- Settling Ponds
- Former Crusher Pad
- Former Low Grade Stockpile
- Former Organic Material Stockpile
- Former Topsoil Stockpile
- Former Till Stockpile
- NAG Stockpile
- Open Pit
- PAG Stockpile
- Road

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BEAVER DAM MINE
MINE WATER MANAGEMENT PLAN
WATER BALANCE ANALYSIS

CATCHMENT AREAS – PC CONDITIONS

088664
May 11, 2021

FIGURE 6.17-14

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6.7.7.3.1 Beaver Dam Mine Site

Surface Water Quantity Modelling

A water balance analysis was conducted for three stages of mine development including baseline, EOM, and PC conditions. An objective of the water balance analysis was to assess the impacts of the proposed mine development on drainage patterns in surrounding watercourses. Monthly and annual runoff (streamflow) volumes were compared between baseline and EOM/PC conditions at five assessment points where the site will discharge or impact flows in the natural environment.

The water balance model (WBM) was developed using the GoldSim software. GoldSim is a highly graphical program used for carrying out dynamic simulations to support decision making. GoldSim is particularly well-suited to simulating dynamic, computationally intensive, but well-defined network models such as a water balance. GoldSim can perform Monte Carlo simulations, tracks outputs from those simulations, and provides a graphic interface to facilitate the review and identification of interactions between system components.

Hydrologic processes in the predictive model include evaporation, infiltration, direct runoff, and seepage from the stockpile areas. These processes were modelled using coefficients of the rainfall and snowmelt. The coefficients were determined from a combination of literature and observations at the existing Touquoy Mine Site. A runoff coefficient of 1.0 was applied to impervious surfaces, including the site roads, crusher pad, and administrative building areas based on the assumption that all rainfall and snowmelt that occurs on impervious surfaces will generate surface runoff. Baseflow volume variations due to the influence of the mine development (particularly the pit development) on groundwater flow patterns were determined using the groundwater model (Appendix F.5 Hydrogeologic Modelling Report [GHD, 2021h]).

Baseflow impacts were incorporated into the WBM as percent changes from baseline conditions at the five assessment points or included as an input (groundwater inflow rate) to the open pit. Pit dewatering was included as an input to the Killag River streamflow volume based on the assumption that the pit water will be continuously pumped to the north settling pond, which will discharge to the Killag River, and the pit itself will be kept dry during operating conditions.

Surface Water Quality Modelling

The overall objective of the surface water modelling quality modelling is to predict discharge water quality, identify potential needs for water treatment (Section 6.7.9) and assess the short and long-term impacts of the Project on the receiving environment. As such, model predictions herein presented to not include effects of planned water treatment.

A predictive water quality assessment model was developed for two life cycle stages of the Beaver Dam Mine Site development, including EOM and PC. To support the effects assessment for the operations phase, predictive models were developed for the end of operations (EOM) model (i.e., max build out). This represents the Project stage with the highest potential for significant effects to the receiving environment; the prediction and assessment of potential effects at EOM is a conservative approach.

The predictive water quality assessment model was calculated monthly for the average year climatic conditions. Performing the water quality assessment monthly allows for the prediction of the seasonality characteristics of water quality in the Killag River. This allows for the assessment of the average wet and dry months to determine the month with the highest potential impacts on the water quality in the Killag River and will assist with the design of water quality treatment options at the site. A detailed summary of the predictive water quality assessment is provided in Appendix P.4 (Mine Water Management Plan, Appendix D).

To determine the concentration of each constituent of concern in the site effluent, the geochemistry of each stockpile (till, non-acid generating (NAG) waste rock, potentially acid generating (PAG) waste rock, low grade ore (LGO), topsoil), and the pit wall rock

were assessed individually by Lorax Environmental (Appendix E.3 Beaver Dam Project - Geochemical Source Term Update). This assessment established both the base case and the upper-case scenarios of constituent concentrations for EOM and PC mine life cycle conditions. Base case conditions represent the most likely concentration scenario (median) while upper case conditions represent the likely worst-case loadings (90th percentile) concentration scenario.

For the EOM conditions, the water quality model assumed the following:

- NAG and PAG waste rock stockpiles have reached their maximum height but remain uncovered and unrestored.
- The LGO stockpiles have an area of 86,000 m^2 (8.6 ha) and remain uncovered and unrestored.
- The pit is constantly being dewatered and discharged into the north settling pond.
- Standard best practice erosion and sediment control measures have been implemented on the soil and till piles.

For the PC conditions, the water quality model assumed the following:

- The NAG waste rock stockpile has been covered and seeded.
  - The PAG waste rock stockpile has been covered with a High-Density Polyethylene (HDPE) liner allowing for an estimated infiltration rate of 3% of total precipitation through the liner. The cap is covered with soil and re-vegetated.
- The LGO stockpile has been removed from the site and processed at the Touquoy Mine Site. Surface water from this restored stockpile area is diverted to Mud Lake.
  - The till and topsoil stockpiles have been removed and restored.
- The pit has been allowed to naturally fill with water to an elevation of 127 masl.
- All site water will drain to the pit prior to discharge into the Killag River.
- Other than what is mentioned above no other reclamation activities have been incorporated into the predictive water quality modelling of the site.

The predictive water quality assessment incorporated mine impacted groundwater recharge into the surface water ditches and the Killag River. Concentrations of constituents of concern and discharge volumes were taken from GHD's groundwater model for the Beaver Dam Mine Site (Appendix F.5 Hydrogeologic Modelling Report for Beaver Dam Mine Site).

During the operational phase of the open pit, dewatering will have to occur since the natural groundwater table is above the mining elevation. During EOM conditions, the precipitation that fell into the pit was assumed to contact the freshly exposed pit walls causing the release of the weathering products, in particular those related to sulphide oxidation (Lorax Environmental, 2018). Groundwater inflows are expected to contain constituents of concern equal to the background groundwater monitoring concentration levels. Average measured groundwater concentrations were used for the base case scenario while maximum measured groundwater concentrations were used for the upper-case scenario. During PC conditions, the direct precipitation into the pit is assumed clean as it will fall directly onto the lake, which has formed in the pit.

Mine rock materials are not expected to turn acidic during the mine operational phase. Based on the geochemical and modelling completed to date (Appendices E.3 [Beaver Dam Project - Geochemical Source Term Update] and E.4 [Beaver Dam Project: 2020 Kinetic Test Update (IR NSE 2-74) – DRAFT], respectively), which was based on conservative assumptions, there is a potential for some of the mine rock to turn acidic over the long term during the post-closure phase. This effect is mitigated naturally due to the alkaline groundwater inflows into the open pit and, as required, by the adoption of closure measures such as water treatment and/or the installation of a cover on the waste rock pile. All mine contact water released from the site must meet the stringent

MDMER limits for pH which ranges from 6.0 to 9.5. If deviation from modelling detected through monitoring, system will be adapted to meet discharge criteria (i.e., water treatment).

6.7.7.3.2 Haul Road

Sedimentation/Erosion and dust deposition represent the primary pathways of interaction for the Project to Surface Water along the Haul Road.

Potential effects on surface water quality from increased erosion and sedimentation are qualitatively assessed (Section 6.7.8).

Potential effects on surface water quality from dust deposition were quantitively assessed by air dispersion modelling. Appendix F.9 (Evaluation of Potential Impacts from Metal Contaminates of Concern to Groundwater and Surface Water from Dust Deposition along the Haul Road) presents the air dispersion model and associated results, including the quantitative evaluation of potential impacts to surface water from metals found in dust that may be deposited on surficial soil and surface water along the Haul Road for the Project. Air dispersion modelling was performed to predict dust deposition rates in the immediate vicinity of the Haul Road and at each sensitive receptor location (Section 6.2) where there is a domestic water source (groundwater or surface water) or where it was identified there could be a potential future domestic water source. Dust deposition was predicted based on emissions from the Haul Road while being used for the Project only, and then for cumulative emissions from the Haul Road while being used for the Project combined with the nearby projects. Appendix F.9 presents the documentation of the air dispersion modelling methodology and results; results of modelling informed the effects assessment for the Haul Road (Section 6.7.8.3).

6.7.7.3.3 Touquoy Mine

Overview

Predictive modelling at the Touquoy Mine has been updated to reflect updates of the Project Description (Section 2) and to address IR2 issued by IAAC (CEAA 2019) and Nova Scotia Environment (NSE 2019). The water balance model of the Touquoy Mine Site has been updated to available to simulate the quantity of runoff at the Touquoy Mine Site under existing conditions. The water balance model development includes multiple revisions to reflect the changes to the mine site during design, construction, commissioning, and operation of the Touquoy Gold Project that have improved the accuracy of the model. Inputs to the model include groundwater inflows, surface runoff, direct precipitation, and Touquoy pit dewatering for Touquoy ore processing. Precipitation in the water balance model was based on the Environment and Climate Change Canada Middle Musquodoboit climate station (ID 8205990) and evaporation based on the Truro climate station (ID 8205990). The proportion of the precipitation that contributes to runoff collected in the Touquoy pit was estimated in the model through a runoff coefficient, with 100% of direct precipitation on the pond and 85% of precipitation as runoff on natural ground. Runoff from the WRSA captured in the collection ponds is assumed to increase from 5 to 30% of precipitation by the end of Touquoy Gold Project mine life.

Water management at the currently operating Touquoy Mine Site includes directing all wastewater and surface runoff that comes in contact with the ore to the existing tailings management facility (TMF) for treatment. Treatment includes the addition of ferric sulphate to the effluent to precipitate arsenic, hydrated lime to adjust pH, and coagulant polymer to facilitate the removal of colloidal sized suspended matter. The treated effluent is then directed into the polishing pond where additional settling will occur before being released into a constructed wetland for subsequent discharge into the northwestern end of Scraggy Lake. At the point of final discharge, the effluent meets MDMER water quality criteria.

Surface Water Quantity

A water balance model has been developed to simulate the quantity of runoff at the existing mine facilities under existing conditions, and for future conditions (i.e., influence of Beaver Dam Mine activities) and various climate scenarios. The water balance model was developed through multiple iteration and revisions during design, construction, commissioning, and operation of the Touquoy Gold Project to improve accuracy. Model inputs accounted for groundwater inflows, surface runoff, direct precipitation, and Touquoy pit dewatering for Touquoy ore processing.

Results of the monthly water balance model at the end of processing of Touquoy ore is used to represent the baseline conditions for the use of the Touquoy Mine Site for the Beaver Dam Mine Project. Details of the modelling are presented in the Touquoy Integrated Water and Tailings Management Plan included in Appendix F.7.

As described in more detail the technical report (Stantec, 2018d), the water balance was refined to simulate the existing conditions (water quantity and water quality) at the end of Touquoy mine life and the start of processing Beaver dam ore. The Touquoy Mine Site was divided into five sub-catchment areas based on the available LiDAR topography (Leading Edge 2013) and the water management at the site. The catchment areas for each of the mine facilities include the mill site (13.8 ha), TMF (94.0 ha), open pit (40.4 ha), waste rock area (55.1 ha), and polishing pond (16.9 ha). Other model assumptions include:

- at the start of the mode, the TMF dam is at the maximum elevation of 130 m with an emergency spillway at 128.5 m in elevation;
- the maximum tailings capacity in the Touquoy TMF is reached in April/May 2022 and the pond water level is at normal operating water level;
- at the start of the model, the Touquoy waste rock storage area is fully developed and reached the maximum capacity;
- at the start of the model, the Touquoy open pit is exhausted and empty; the exhausted open pit used as a tailing's management facility assuming an average deposited dry density of 1.3 t/m^3 for subaqueous tailings deposition;
- processing Beaver Dam Mine ore occurs at the existing Touquoy mill;
- process water decant from the existing Touquoy TMF during start-up until pond volumes are depleted;
- existing decant barge relocated to exhausted open pit for reclaim throughout the remainder of operation;
- natural filling of the open pit over time to create a pit lake overtop of the tailings;
- groundwater inflow to the pit varying from 768 m^3/d when the pit is completely dewatering, and decreasing to 363 m^3/d when the pit lake water elevation reaches 108 m CGVD2013;
- an emergency spillway in the open pit with an invert elevation of 108 m to prevent overtopping and a conveyance channel to Moose River;
- effluent treatment as a batch reactor in the open pit; and
- effluent further treated or pumped and treated at the existing effluent treatment plant for treatment and discharged to the downstream treatment facilities and Scraggy Lake receiving environment.

Surface Water Quality Modelling

The prediction of surface water quantity effects was completed for the operations and closure phases of the Project at the Touquoy Mine Site using qualitative and numerical modelling to simulate the water and tailings management at the Touquoy Mine Site during and after the processing of the Beaver Dan Mine ore.

Water quality in Scraggy Lake and WC4 were evaluated qualitatively, as the Beaver Dam Mine ore processing and deposition to the exhausted pit are not expected to change the water quality in the TMF, nor downstream.

Numerical modelling was conducted to assess the water quality effects in Moose River. A water quality model was prepared from the water balance model described in Section 6.7.5.3. Flow terms in the water balance were assigned water quality source terms (Appendix F.6 Groundwater Flow and Solute Transport Modelling to Evaluate Disposal of Beaver Dam Tailings in Touquoy Open Pit) to simulate the overall water quality of metal parameters and nitrogen species including cyanide, ammonia, nitrate, and nitrite in the Touquoy pit during operation and post closure. Mixing of the discharge from the Touquoy pit through the spillway at SW-2 at post-closure with Moose River was conducted using an assimilative capacity model (Appendix F.8 Project Assimilative Capacity Study of Moose River – Touquoy Pit Discharge).

The objectives of numerical modelling are to predict the period of time that water treatment will be required prior to the pit water effluent discharge to Moose River, and the water quality of effluent discharge to Moose River at biological monitoring stations in place to assess environmental effects.

Water quality modelling considered the pore water quality in the tailings and the groundwater inflow quality in the pit floor/ walls, dilution from surface runoff, direct precipitation, and process water surplus, and the geochemistry of the individual water quality parameters. As discussed in source terms memo (Appendix E.3 Beaver Dam Project - Geochemical Source Term Update), the pore water quality in the tailings and pit walls/floor was based on geochemical source term predictions that were derived from upscaling of kinetic tests and Touquoy monitoring data. The kinetic test and Touquoy monitoring data are considered representative for Beaver Dam ore processing as the Beaver Dam and Touquoy pits mine ore from the same geologic formation with similar sulphur content and Beaver Dam ore processing and cyanide detoxification in the Touquoy mill will follow the same general approach as the Touquoy ore processing. These source terms were coupled with the inflow rates for the various components of inflow to the Touquoy pit and mixed to predict the water quality in the pit over time. The volume in the pit increased until discharge was predicted to occur in Beaver Dam Mine Year 12. Further details of the modelling can be found in the Touquoy Integrated Water and Tailings Management Plan (Appendix F.7).

As summarized in the assimilative capacity study of Moose River (Appendix F.8 Project Assimilative Capacity Study of Moose River – Touquoy Pit Discharge), a CORMIX mixing zone model (Doneker and Jirka 2017) was run in to predict the distance in Moose River downstream of the open pit spillway where full mixing is achieved. Based on mass balance, water quality in Moose River is a result of the climate- driven effluent discharge and the continuous seepage input from the pit lake at the post closure phase. Several climate statistics were run to identify the worst-case dilution ratio between effluent discharge and flow volume in Moose River that would result in the highest metal and nitrogen species concentrations at the MDMER biological monitoring stations located at 100 m and 200 m downstream of the effluent discharge point. Full mixing of discharge effluent in Moose River is achieved 120 m downstream of the discharge point, and water quality was predicted for 100 m, and 120 m downstream, with areas more of 120 m downstream will have similar or better water quality due to Project related effects. Effluent discharge water quality from the pit lake was assumed to meet MDMER discharge criteria for an existing mine in 2021 prior to discharge to Moose River. Operational plans are in place so that effluent not meeting criteria would either be further treated or pumped to the existing Touquoy effluent treatment plant for treatment prior to discharge to the downstream Touquoy discharge facilities and finally Scraggy Lake.

6.7.8 Project Activities/Interactions with Surface Water Quantity and Quality

6.7.8.1 Overview of Potential Surface Water Interactions

The purpose of this section is to identify how the Surface Water VCs may be affected by interactions with the Project's components and activities (Tables 6.7-21 to 6.7-23). The Project is part of the Moose River Consolidated (MRC) Project, which includes the existing and fully permitted Touquoy Gold Project, located in Moose River Gold Mines, Nova Scotia. The Project will operate as a satellite surface mine to the MRC Project, and crushed ore from the will be transported by truck via the Haul Road to the existing and fully permitted Touquoy Mine.

Table 6.7-21: Potential Project Activities/Interactions with Surface Water Quantity and Quality at the Beaver Dam Mine Site

Project Phase	Duration	Project Interaction
Construction	1 year (monitoring and adaptive management)	• Clearing, grubbing, and grading in preparation of construction • Rock blasting in preparation of construction • Till and waste rock from site preparation transport and storage • Historical settling pond dewatering in preparation of construction • Watercourse and wetland alteration in preparation of construction • Mine Site road construction • Surface infrastructure installation and construction • Collection and settling pond construction • Dewatering pf historical tailings facility and associated discharge to the receiving environment
Operation and Maintenance	5 years (monitoring and adaptive management)	• Rock blasting to access and extract ore • Surface mine dewatering to facilitate access to and extraction of ore • Management of waste rock produced from crushing and preparing ore for transport • Treatment of site surface water runoff and surface mine pumped water. • Discharge to Killag River from North Settling Pond • Petroleum products management • Site maintenance and repairs
Active Closure	2 years (monitoring and adaptive management)	• Infrastructure demolition, Earthworks, Revegetation, and other site reclamation activities
Post-closure	+10 years (monitoring, adaptive management)	• Discharges from Open Pit lake to Killag River

Table 6.7-22: Potential Project Activities/Interactions with Surface Water Quantity and Quality along Haul Road

Project Phase	Duration	Project Interaction
Construction	1 year (monitoring and adaptive management)	• Clearing, grubbing, and grading in preparation of construction • Rock blasting in preparation of construction • Till and waste rock from site preparation transport and storage • Watercourse and wetland alteration in preparation of construction • Haul road construction and upgrades
Operation and Maintenance	5 years (monitoring and adaptive management)	• Ore transport • Haul road maintenance and repairs
Active Closure[(a)]	2 years (monitoring and adaptive management)	• An inventory of the condition of culverts and bridges will be undertaken once the Haul Road is not longer used for ore transport.
Post-closure	+10 years (monitoring, adaptive management)	• Not anticipated since Project related activities will be no longer occurring and no reclamation is planned.

Notes: [(a)] Decommissioning and Reclamation of the Haul Road is not expected. The Haul Road will be returned to owner for forestry industry. N/A = not applicable.

Table 6.7-23: Potential Project Activities/Interactions with Surface Water Quantity and Quality at Touquoy Mine Site

Project Phase	Duration	Project Interaction
Construction	1 year (monitoring and adaptive management)	• Tailings pipeline, make-up water pipeline alteration, and relocation of reclaim infrastructure
Operation and Maintenance	5 years (monitoring and adaptive management)	• Ore management (drilling, blasting, loading and hauling of ore and waste rock) • Ore processing (ore crushing and conveyance, ore milling) • Management of tailings produced from processing ore (Sub-aqueous deposition in Touquoy open pit) • Environmental monitoring of surface water • General management of waste derived from processing activities • Water treatment as a batch reactor as pit is filling
Active Closure	2 years (monitoring and adaptive management)	• Water treatment of Touquoy pit lake surplus at water treatment plan until water quality meets MDMER criteria • Effluent Discharge from Touquoy pit lake to Moose River
Post-closure	+10 years (monitoring, adaptive management)	• Monitoring is expected to occur until the Touquoy pit is refilled and groundwater depressurization zone achieves stability. • Discharge from Touquoy pit lake to Moose River

Notes: MDMER = Metal and Diamond Mining Effluent Regulations.

In general, the Project has the potential to change Surface Water by:

- discharges, including direct discharge to the receiving environment and management of contact water;
- water management activities, including diversions of contact and non-contact water;
- groundwater seepage from Project components to receiving environment;
- ML/ARD generated from excavating or exposing material with the potential for ML/ARD, or in runoff from temporary stockpile or road cuts;
- erosion and sedimentation during site clearing, construction, and maintenance activities; and
- dust deposition along the Haul Road Corridor (CEAA-2-37).

Project components/activities are not expected to interact with the Surface Water VCs, these components and activities are considered to have no potential effects and are not considered further in the assessment. These include interactions between the Project and surface water quality and quantity resulting from hazardous waste materials and potential spills well as potential failures of water management structures (e.g., failure settling pond); these are related to occurrences of low likelihood outside of normal operating conditions. These potential effects are addressed in Section 6.18, Accidents and Malfunctions, as well as the Spill Contingency Plan (Appendix A of Appendix P.1), which is included as part of the Emergency Response Plan (Appendix P.1).

Effects on indicators of Surface Water Quantity (e.g., base flow, L/s) and Surface Water Quality (total and dissolved metals, anions, and nutrients; mg/L) were either assessed quantitatively by predictive water modelling or qualitatively based on geochemical characterization studies and professional judgement and experience (e.g., pH, TSS). The goals were to remove as much subjectivity as possible from the assessment and to increase certainty in the predictions of alteration of the Surface Water VC, residual effects, and the determination of significance to ensure a robust, transparent, and defensible approach to the effects assessment.

6.7.8.2 Surface Water Effects: Beaver Dam Mine

In support of the environmental assessment, Surface Water Quantity predictions for the Project were produced through the development of deterministic water -balance modelling for both the Beaver Dam Mine Site and the existing Touquoy Mine. Summaries of model approaches, assumptions, and sensitivity analyses as they relate to surface water predictive efforts are provided in Section 6.7.7.3; a summary of model results is provided in the following Sections.

Full details and results of surface water studies conducted to support the environmental assessment for the Project are appended here as:

- Appendix D (Predictive Water Quality Assessment) of Appendix P.4 Mine Water Management Plan;
- Appendix A (Water Balance Analyses) of Appendix P.4 Mine Water Management Plan;
- Appendix F.8 Beaver Dam Gold Project Assimilative Capacity Study of Moose River – Touquoy Pit Discharge; and
- Appendix G.3 Additional Water Quality Modelling to Support the Mine Site Water Management Plan.

6.7.8.2.1 Surface Water Quantity Modelling Results

A water balance analysis was conducted to assess the hydrologic impact of mine development on the surrounding water features. The water balance was calculated for five assessment points where the site will discharge or impact flows in the natural environment, including the Killag River, Mud Lake (outlet to WC27), Crusher Lake (outlet to WC5), Tent Brook and Cope Brook systems.

A summary of catchment areas at EOM condition and change relative to baseline are presented in Table 6.7-24. Table 6.7-25 through Table 6.7-29 present the monthly and annual metrics for identified assessment points in the receiving environment relative to baseline conditions. Mine site development will increase the Killag River catchment area, and decrease the Mud Lake, Tent Brook and Cope Brook catchments due to the placement of mine features in their baseline drainage areas. Surface runoff from mine features will be directed to settling ponds for treatment prior to being released into the Killag River and Tent Brook systems. The north settling pond will receive and treat runoff from the waste rock, low-grade ore and topsoil stockpiles, the crusher pad, administrative building area and site roads. Surface water and groundwater collected in the pit sump will also be dewatered to the north settling pond. The east settling pond will receive runoff from the till stockpiles, part of the organic stockpile and site roads.

The north and east settling ponds discharge to the Killag River. The south settling pond will receive runoff from another other part of the organic stockpile and a topsoil stockpile. The south settling pond discharges to WC19 of the Tent Brook system.

Table 6.7-24: Summary of Catchment Areas under Baseline, End-of-Mine and Post-closure Conditions

Assessment Point	Catchment Area for Water Balance Assessment Points (ha)			Change from Baseline Condition (%)	
	Baseline	EOM	PC	EOM	PC
Killag River	3,933.5	3,974.5	3,974.5	1.0	1.0
Crusher Lake	58.8	58.8	58.8	0	0
Mud Lake	223.2	184.0	192.6	-17.6	-13.7
Tent Brook	306.2	301.6	301.6	-1.5	-1.5
Cope Brook	481.0	444.8	444.8	-7.5	-7.5

Source: Appendix P.4 Mine Water Management Plan, Appendix A Water Balance Analysis.

Notes: ha = hectares; EOM = end-of-mine; PC = Post-closure; % = percent; < = less than.

As part of the site reclamation plan, the pit will be filled with water from groundwater inflows, direct precipitation, and site contact water. Water will no longer be pumped from the pit to the north settling pond, and the north settling pond discharge will be re-directed into the pit. Once the pit is filled, the north settling pond will be decommissioned and site runoff will be diverted directly into the pit (Figure 6.7-14). Overflow from the pit will be directed to the Killag River through an engineered outfall in the east pit wall and existing outlet channel (WC13). The capacity of the pit is approximately 16,000,000 m^3. During PC conditions an additional 8.6 ha will be routed to Mud Lake, reducing the impact to the Mud Lake drainage area to from a 18.3% decrease between baseline and EOM conditions to a 13.7% decrease between baseline and PC conditions. The impact to the drainage area of the Tent Brook and Cope Brook assessment points remain the same as in EOM conditions.

Killag River

The WBM output shows there is a 1.7% decrease in baseflow and a 2.2% increase in total annual streamflow at the Killag River assessment point between baseline and EOM conditions. The increase in streamflow is due to the proposed site development and increase in impervious area. The reduction in baseflow is due to the formation of the open pit, which draws water from the local aquifer (refer to Section 6.6 for discussion on groundwater quality and quantity).

The WBM simulates a 1.3% decrease in baseflow and a 1.1% increase in total annual streamflow at the Killag River assessment point between baseline and PC conditions after the pit is filled with water. The reduced impact to surface runoff and baseflow to the Killag River between EOM and PC conditions can be explained by the proposed site modifications as part of the reclamation plan. These modifications include vegetating or removing stockpiles and filling the open pit with water to reduce its capacity to draw groundwater from the local aquifer compared to EOM conditions.

The impacts to the Killag River while the open pit fills with water were also assessed. The WBM simulates a 1.7% decrease in baseflow and 2.2% decrease in annual streamflow between baseline and PC conditions at the Killag River assessment point during this period. The decrease in streamflow is caused by the reduction in drainage area as a large portion of the site that drains to the Killag River under baseline conditions will be directed to the open pit to reduce the pit filling time. The pit filling time is estimated to be approximately 13 years. Contingency measures will be in place to mitigate baseflow reduction in the Killag River during dry months of the pit filling period as described in Appendix P.4 (Mine Water Management Plan, Appendix H Baseflow Mitigation Assessment).

There is a low probability of detectable impacts to ecosystems that support fisheries, when the alterations are less than 10% of the natural flow regime. Further there is unlikely to be negative effects on these systems for a flow reduction up to 15%. The predicted impacts in the Killag River from alteration of surface runoff from the Project during construction, operation and closure is below 10% , which results in a low probability of detectable impact to ecosystems that support fish. This is detailed and discussed in the Fish and Fish Habitat effects assessment (Section 6.9).

Crusher Lake

Crusher Lake is part of the Mud Lake catchment. Its drainage area remains unchanged from baseline conditions throughout the mine development stages; however, the groundwater modelling results show a small increase in baseflow contributions to the lake in the order of 2 to 3% annually. The small gain in baseflow is likely attributed to the placement of waste rock and low-grade ore stockpiles overtop of a watercourse in a neighbouring watershed. Under baseline conditions the watercourse would have collected baseflow prior to reaching the Crusher Lake catchment. Under EOM and PC conditions this portion of the baseflow emerges in the Crusher Lake catchment. In addition, during operations, water will be extracted from the lake at a rate of 3 m^3/hour to meet the domestic and truck wash water demands. The combined impact is a 4.4% decrease in annual lake discharge. In PC conditions, the Project impact is reversed as water extraction from the lake is discontinued. The WBM simulates a 0.6% increase in annual lake discharge.

Mud Lake

The WBM simulates a 18.1% decrease in annual total inflow and 18.3% decrease in annual discharge at Mud Lake between baseline and EOM conditions. These results are attributed to a 4.4% decrease in annual Crusher Lake discharge through WC5 a 24.5% decrease in annual surface runoff and a 21.9% decrease in annual baseflow. The decrease in surface runoff volume is proportional to the reduction in drainage area due to stockpile and road development within the baseline Mud Lake catchment. The decrease in baseflow is caused by the impact of the open pit on groundwater patterns in the Mud Lake catchment.

The WBM simulates a 13.6% decrease in annual total inflow and 13.7% decrease in annual discharge at Mud Lake between baseline and PC conditions. The impact to surface runoff in the Mud Lake catchment is reduced from EOM to PC conditions, because the low-grade ore stockpile will be removed and the area where the pile once was will be directed to Mud Lake. The impact to baseflow will be reduced between EOM and PC conditions because of the change in drainage area and because the pit will be filled with water, reducing its capacity to draw water from the local aquifer.

The predicted impacts to Mud Lake water levels are highest in wet periods and lowest in dry periods of the year. The results from the WBM indicated that Mud Lake has a surplus of water throughout all periods of the year. Therefore, it is predicted that the discharge channel from Mud Lake to the Killag River will not run dry as a result of the mine development (i.e., extreme long-term drought can lead to dry conditions, which are out of the control of site development).

Tent Brook

The WBM predicts a 0.4% decrease in baseflow, and 1.1 to 1.2% decrease in annual streamflow at the Tent Brook assessment point between baseline and EOM/PC conditions. The decrease in streamflow is caused by the diversion of runoff from the crusher pad and administrative building areas, which are partially located in the baseline Tent Brook catchment, toward the Killag River system.

The annual impact to the streamflow components at the Tent Brook assessment point are the same between EOM and PC conditions; however, the monthly variation of impacts is reduced. This is due to the removal of the organic material and topsoil stockpiles, and restoration of these areas to baseline conditions. The water balance analysis (Appendix P.4 Mine Water Management, Appendix A) details the monthly impacts to all assessment points for EOM and PC development stages. The predicted impacts from alteration of surface runoff from the Project during construction, operation and closure is below 10%, which results in a low probability of detectable impact to ecosystems that support fish. This is discussed in the Fish and Fish Habitat effects assessment (Section 6.9).

Cope Brook

The WBM simulates a decrease in surface runoff contributing to the Cope Brook system under EOM and PC conditions due to the placement of the waste rock stockpile in its baseline catchment, and the diversion of stockpile runoff to the north settling pond for treatment. The hydrologic impacts to Cope Brook are predicted to be consistent between EOM and PC conditions. The WBM simulates a 0.5% decrease in baseflow, and 5.7% decrease in annual streamflow at the Cope Brook assessment point between baseline and EOM/PC conditions. The predicted impacts from alteration of surface runoff from the Project during construction, operation and closure is below 10%, which results in a low probability of detectable impact to ecosystems that support fish. This is discussed in the Fish and Fish Habitat effects assessment (Section 6.9).

Table 6.7-25: Summary Monthly and Annual Water Balance Results for End-of-Mine and Post-closure Conditions, Killag River

Water Balance Components	Baseline Monthly and Annual Water Balance Volumes for the Killage River (m^3)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual
Precipitation over Catchment	4,256,155	3,633,860	6,309,494	4,814,726	4,035,874	3,728,659	3,845,487	3,841,554	4,051,608	4,873,730	5,314,294	4,653,449	53,358,891
Evaporation over Catchment	276,525	342,230	626,453	1,110,593	2,015,253	2,975,988	3,746,912	3,072,986	1,801,105	989,587	490,804	309,487	17,757,923
Surface Runoff Summary													
Mud Lake Outflow	208,040	183,358	316,138	234,530	151,496	83,876	61,860	57,347	78,583	178,371	256,314	203,690	2,013,603
North Pond Outflow	-	-	-	-	-	-	-	-	-	-	-	-	-
East Pond Outflow	-	-	-	-	-	-	-	-	-	-	-	-	-
Surface Runoff	2,448,729	2,048,008	4,091,849	2,767,117	1,679,757	760,401	526,285	484,137	959,444	2,649,860	3,867,973	2,669,551	24,953,111
Total Surface Runoff	2,656,769	2,231,366	4,407,988	3,001,647	1,831,252	844,277	588,146	541,484	1,038,027	2,828,231	4,124,287	2,873,241	26,966,715
Net Baseflow	987,393	984,868	1,135,565	1,105,864	920,675	700,495	571,847	502,270	351,394	310,878	363,062	676,275	8,610,586
Streamflow	3,644,162	3,216,235	5,543,553	4,107,511	2,751,927	1,544,772	1,159,993	1,043,753	1,389,421	3,139,108	4,487,350	3,549,515	35,577,300
Water Balance Components	**EOM Monthly and Annual Water Balance Volumes for the Killag River (m^3)**												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual
Precipitation over Catchment	4,300,409	3,671,643	6,375,098	4,864,788	4,077,837	3,767,429	3,885,471	3,881,497	4,093,735	4,924,406	5,369,550	4,701,834	53,913,695
Evaporation over Catchment	284,279	345,265	630,639	1,092,398	1,988,956	2,919,420	3,669,250	3,011,911	1,776,147	987,202	495,577	317,730	17,518,774
Surface Runoff Summary													
Mud Lake Outflow	170,928	150,719	260,314	193,045	123,116	67,339	49,136	45,757	63,091	145,030	209,568	167,119	1,645,162
North Pond Outflow	153,588	136,442	168,178	187,084	129,431	110,340	106,046	109,782	115,826	141,146	173,078	168,091	1,699,032
East Pond Outflow	29,450	25,011	45,122	33,371	25,054	20,172	19,772	19,744	22,614	32,814	39,610	32,188	344,922
Surface Runoff	2,374,615	1,986,022	3,968,004	2,683,366	1,628,917	737,387	510,357	469,484	930,405	2,569,658	3,750,904	2,588,754	24,197,873
Total Surface Runoff	2,728,580	2,298,195	4,441,619	3,096,867	1,906,518	935,238	685,310	644,767	1,131,937	2,888,649	4,173,161	2,956,151	27,886,992
% Change from Baseline Conditions	2.7%	3.0%	0.8%	3.2%	4.1%	10.8%	16.5%	19.1%	9.0%	2.1%	1.2%	2.9%	3.4%
Net Baseflow	970,961	968,478	1,116,667	1,087,460	905,353	688,837	562,330	493,911	345,546	305,704	357,020	665,020	8,467,287
% Change from Baseline Conditions	-1.7%	-1.7%	-1.7%	-1.7%	-1.7%	-1.7%	-1.7%	-1.7%	-1.7%	-1.7%	-1.7%	-1.7%	-1.7%
Streamflow	3,699,541	3,266,673	5,558,285	4,184,326	2,811,871	1,624,076	1,247,640	1,138,678	1,477,483	3,194,353	4,530,181	3,621,171	36,354,278
% Change from Baseline Conditions	1.5%	1.6%	0.3%	1.9%	2.2%	5.1%	7.6%	9.1%	6.3%	1.8%	1.0%	2.0%	2.2%
Water Balance Components	**PC Monthly and Annual Water Balance Volumes for the Killag River during the Pit Filling Time (m^3)**												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual
Precipitation over Catchment	4,300,409	3,671,643	6,375,098	4,864,788	4,077,837	3,767,429	3,885,471	3,881,497	4,093,735	4,924,406	5,369,550	4,701,834	53,913,695
Evaporation over Catchment	299,599	359,760	656,242	1,120,361	2,026,742	2,969,153	3,731,407	3,063,251	1,811,572	1,013,669	516,652	334,580	17,902,988
Surface Runoff Summary													
Mud Lake Outflow	178,833	157,481	272,030	201,619	129,241	71,212	52,298	48,783	67,447	153,680	221,010	175,500	1,729,134
North Pond Discharge	-	-	-	-	-	-	9,393	9,393	9,090	-	-	-	27,876
Mine Pit Outflow	-	-	-	-	-	-	-	-	-	-	-	-	
East Pond Catchment Runoff	32,082	26,916	52,716	36,261	23,257	12,655	10,173	9,699	15,233	35,019	49,086	34,993	338,090
Surface Runoff	2,377,849	1,988,727	3,973,408	2,687,021	1,631,135	738,391	511,052	470,123	931,432	2,573,158	3,754,361	2,592,279	24,228,936
Total Surface Runoff	2,588,764	2,173,124	4,298,154	2,924,900	1,783,634	822,259	582,916	537,998	1,023,201	2,761,856	4,024,457	2,802,771	26,324,034
% Change from Baseline Conditions	-2.6%	-2.6%	-2.5%	-2.6%	-2.6%	-2.6%	-0.9%	-0.6%	-1.4%	-2.3%	-2.4%	-2.5%	-2.4%
Net Baseflow	970,921	968,459	1,116,655	1,087,453	905,350	688,836	562,329	493,910	345,548	305,688	356,917	664,958	8,467,024
% Change from Baseline Conditions	-1.7%	-1.7%	-1.7%	-1.7%	-1.7%	-1.7%	-1.7%	-1.7%	-1.7%	-1.7%	-1.7%	-1.7%	-1.7%
Streamflow	3,559,686	3,141,582	5,414,808	4,012,354	2,688,983	1,511,094	1,145,245	1,031,908	1,368,749	3,067,544	4,381,374	3,467,729	34,791,056
% Change from Baseline Conditions	-2.3%	-2.3%	-2.3%	-2.3%	-2.3%	-2.2%	-1.3%	-1.1%	-1.5%	-2.3%	-2.4%	-2.3%	-2.2%

Table 6.7-25: Summary Monthly and Annual Water Balance Results for End-of-Mine and Post-closure Conditions, Killag River (continued)

Water Balance Components	PC Monthly and Annual Water Balance Volumes for the Killag River Post-Pit Lake Formation (m³)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual
Precipitation over Catchment	4,300,409	3,671,643	6,375,098	4,864,788	4,077,837	3,767,429	3,885,471	3,881,497	4,093,735	4,924,406	5,369,550	4,701,834	53,913,695
Evaporation over Catchment	299,599	359,760	656,242	1,120,361	2,026,742	2,969,153	3,729,556	3,063,251	1,811,140	1,013,669	516,652	334,580	17,900,705
Surface Runoff Summary													-
Mud Lake Outflow	179,746	158,389	273,077	202,638	130,090	71,858	52,825	49,244	67,785	153,968	221,435	176,126	1,737,181
Mine Pit Outflow	109,511	95,107	144,861	126,351	78,022	62,071	57,873	63,512	76,489	106,263	133,013	119,015	1,172,088
East Pond Catchment Runoff	32,082	26,916	52,716	36,261	23,257	12,655	10,173	9,699	15,235	35,019	49,105	34,993	338,111
Surface Runoff	2,377,849	1,988,727	3,973,408	2,687,021	1,631,135	738,391	511,052	470,123	931,672	2,573,158	3,756,012	2,592,279	24,230,827
Total Surface Runoff	2,699,187	2,269,140	4,444,062	3,052,272	1,862,504	884,976	631,923	592,578	1,091,181	2,868,406	4,159,564	2,922,412	27,478,205
% Change from Baseline Conditions	1.6%	1.7%	0.8%	1.7%	1.7%	4.8%	7.4%	9.4%	5.1%	1.4%	0.9%	1.7%	1.9%
Net Baseflow	974,812	972,320	1,121,097	1,091,774	908,945	691,570	564,561	495,870	346,917	306,917	358,437	667,658	8,500,878
% Change from Baseline Conditions	-1.3%	-1.3%	-1.3%	-1.3%	-1.3%	-1.3%	-1.3%	-1.3%	-1.3%	-1.3%	-1.3%	-1.3%	-1.3%
Streamflow	3,673,999	3,241,460	5,565,159	4,144,045	2,771,449	1,576,546	1,196,484	1,088,448	1,438,098	3,175,323	4,518,001	3,590,071	35,979,083
% Change from Baseline Conditions	0.8%	0.8%	0.4%	0.9%	0.7%	2.1%	3.1%	4.3%	3.5%	1.2%	0.7%	1.1%	1.1%

Source: Appendix P.4 Mine Water Management Plan, Appendix A Water Balance Analysis.

Table 6.7-26: Summary Monthly and Annual Water Balance Results for End-of-Mine and Post-closure Conditions, Crusher Lake

Water Balance Components	Baseline Monthly and Annual Water Balance Volumes Crusher Lake (m^3)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual
Precipitation over Catchment	63,622	54,319	94,315	71,971	60,329	55,737	57,483	57,424	60,564	72,853	79,439	69,560	797,616
Evaporation over Catchment	3,826	4,735	8,667	15,364	31,818	45,640	56,997	46,723	27,940	15,456	6,790	4,282	268,238
Lake Input Summary													
Direct Precipitation	4,868	4,157	7,220	5,508	4,618	4,266	4,399	4,395	4,633	5,576	6,082	5,325	61,047
Surface Runoff	35,836	29,972	59,882	40,495	24,582	11,128	7,702	7,085	14,041	38,779	56,606	39,068	365,176
Net Baseflow	14,450	14,413	16,618	16,184	13,474	10,251	8,369	7,350	5,142	4,550	5,313	9,897	126,011
Total Inflow	55,154	48,542	83,721	62,188	42,674	25,645	20,470	18,830	23,816	48,905	68,001	54,289	552,235
Lake Output Summary													
Lake Evaporation	-	-	-	-	4,046	4,590	5,301	4,325	3,105	1,814	-	-	23,181
Lake Discharge	55,154	48,542	83,721	62,188	38,628	21,056	15,240	14,666	20,557	47,031	67,983	54,289	529,055
Water Balance Components	**EOM Monthly and Annual Water Balance Volumes for Crusher Lake (m^3)**												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Annual**
Precipitation over Catchment	63,622	54,319	94,315	71,971	60,329	55,737	57,483	57,424	60,564	72,853	79,439	69,560	797,616
Evaporation over Catchment	3,826	4,735	8,667	15,364	31,818	45,640	56,997	46,723	27,940	15,456	6,790	4,282	268,238
Lake Input Summary													
Direct Precipitation	4,868	4,157	7,220	5,508	4,618	4,266	4,399	4,395	4,633	5,576	6,082	5,325	61,047
Surface Runoff	35,836	29,972	59,882	40,495	24,582	11,128	7,702	7,085	14,041	38,779	56,606	39,068	365,176
Net Baseflow	14,782	14,745	17,001	16,556	13,784	10,487	8,561	7,520	5,261	4,654	5,435	10,125	128,911
% Change from Baseline Conditions	2.3%	2.3%	2.3%	2.3%	2.3%	2.3%	2.3%	2.3%	2.3%	2.3%	2.3%	2.3%	2.3%
Total Surface Runoff	55,487	48,873	84,103	62,560	42,984	25,881	20,662	18,999	23,935	49,010	68,123	54,517	555,134
% Change from Baseline Conditions	0.6%	0.7%	0.5%	0.6%	0.7%	0.9%	0.9%	0.9%	0.5%	0.2%	0.2%	0.4%	0.5%
Lake Output Summary													
Lake Evaporation	-	-	-	-	4,046	4,590	5,301	4,325	3,105	1,814	-	-	23,181
Lake Discharge	53,255	46,857	81,871	60,400	36,706	19,181	13,485	12,928	18,537	44,629	65,539	52,320	505,708
% Change from Baseline Conditions	-3.4%	-3.5%	-2.2%	-2.9%	-5.0%	-8.9%	-11.5%	-11.9%	-9.8%	-5.1%	-3.6%	-3.6%	-4.4%
Water Balance Components	**PC Monthly and Annual Water Balance Volumes for Crusher Lake (m^3)**												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Annual**
Precipitation over Catchment	63,622	54,319	94,315	71,971	60,329	55,737	57,483	57,424	60,564	72,853	79,439	69,560	797,616
Evaporation over Catchment	3,826	4,735	8,667	15,364	31,818	45,640	56,997	46,723	27,940	15,456	6,790	4,282	268,238
Lake Input Summary													
Direct Precipitation	4,868	4,157	7,220	5,508	4,618	4,266	4,399	4,395	4,633	5,576	6,082	5,325	61,047
Surface Runoff	35,836	29,972	59,882	40,495	24,582	11,128	7,702	7,085	14,041	38,779	56,606	39,068	365,176
Net Baseflow	14,797	14,759	17,017	16,572	13,797	10,497	8,570	7,527	5,266	4,659	5,441	10,135	129,037
% Change from Baseline Conditions	2.4%	2.4%	2.4%	2.4%	2.4%	2.4%	2.4%	2.4%	2.4%	2.4%	2.4%	2.4%	2.4%
Total Surface Runoff	55,501	48,888	84,119	62,576	42,997	25,891	20,671	19,007	23,940	49,014	68,128	54,527	555,259
% Change from Baseline Conditions	0.6%	0.7%	0.5%	0.6%	0.8%	1.0%	1.0%	0.9%	0.5%	0.2%	0.2%	0.4%	0.5%
Lake Output Summary													
Lake Evaporation	-	-	-	-	4,046	4,590	5,301	4,325	3,105	1,814	-	-	23,181
Lake Discharge	55,501	48,888	84,119	62,576	38,952	21,302	15,436	14,839	20,686	47,142	68,111	54,527	532,079
% Change from Baseline Conditions	0.6%	0.7%	0.5%	0.6%	0.8%	1.2%	1.3%	1.2%	0.6%	0.2%	0.2%	0.4%	0.6%

Source: Appendix P.4 Mine Water Management Plan, Appendix A Water Balance Analysis.

Table 6.7-27: Summary Monthly and Annual Water Balance Results for End-of-Mine and Post-closure Conditions, Mud Lake

Water Balance Components	Baseline Monthly and Annual Water Balance Volumes for Mud Lake (m^3)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual
Precipitation over Catchment	241,502	206,192	358,013	273,197	229,003	211,571	218,200	217,977	229,896	276,545	301,543	264,046	3,027,686
Evaporation over Catchment	15,119	18,711	34,251	60,722	117,493	171,005	214,440	175,829	104,085	57,382	26,835	16,921	1,012,793
Lake Input Summary													
Direct Precipitation	4,435	3,788	6,578	5,019	4,207	3,887	4,008	4,004	4,221	5,081	5,541	4,851	55,620
Crusher Lake Discharge	55,154	48,542	83,721	62,188	38,628	21,056	15,240	14,666	20,557	47,031	67,983	54,289	529,055
Surface Runoff	105,792	88,480	176,780	119,547	72,570	32,852	22,737	20,916	41,451	114,482	167,108	115,332	1,078,047
Net Baseflow	42,658	42,549	49,060	47,777	39,776	30,263	24,705	21,700	15,181	13,431	15,685	29,217	372,002
Total Inflow	208,040	183,358	316,138	234,530	155,181	88,058	66,690	61,286	81,410	180,024	256,317	203,690	2,034,722
Lake Output Summary													
Lake Evaporation	-	-	-	-	3,686	4,182	4,830	3,940	2,829	1,652	-	-	21,119
Lake Discharge	208,040	183,358	316,138	234,530	151,496	83,876	61,860	57,347	78,583	178,371	256,314	203,690	2,013,603
Water Balance Components	**EOM Monthly and Annual Water Balance Volumes for Mud Lake (m^3)**												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual
Precipitation over Catchment	199,088	169,979	295,136	225,216	188,784	174,414	179,878	179,694	189,520	227,976	248,584	217,672	2,495,942
Evaporation over Catchment	12,357	15,294	27,995	49,630	97,443	141,371	177,120	145,221	86,156	47,533	21,933	13,830	835,883
Lake Input Summary													
Direct Precipitation	4,435	3,788	6,578	5,019	4,207	3,887	4,008	4,004	4,221	5,081	5,541	4,851	55,620
Crusher Lake Discharge	53,255	46,857	81,871	60,400	36,706	19,181	13,485	12,928	18,537	44,629	65,539	52,320	505,708
Surface Runoff	79,922	66,843	133,550	90,313	54,824	24,818	17,177	15,801	31,314	86,486	126,243	87,129	814,420
% Change from Baseline Conditions	-24.5%	-24.5%	-24.5%	-24.5%	-24.5%	-24.5%	-24.5%	-24.5%	-24.5%	-24.5%	-24.5%	-24.5%	-24.5%
Net Baseflow	33,316	33,231	38,316	37,313	31,065	23,636	19,295	16,947	11,857	10,489	12,250	22,818	290,533
% Change from Baseline Conditions	-21.9%	-21.9%	-21.9%	-21.9%	-21.9%	-21.9%	-21.9%	-21.9%	-21.9%	-21.9%	-21.9%	-21.9%	-21.9%
Total Inflow	170,928	150,719	260,314	193,045	126,802	71,521	53,965	49,681	65,929	146,685	209,573	167,119	1,666,281
% Change from Baseline Conditions	-17.8%	-17.8%	-17.7%	-17.7%	-18.3%	-18.8%	-19.1%	-18.9%	-19.0%	-18.5%	-18.2%	-18.0%	-18.1%
Lake Output Summary													
Lake Evaporation	-	-	-	-	3,686	4,182	4,830	3,940	2,829	1,652	-	-	21,119
Lake Discharge	170,928	150,719	260,314	193,045	123,116	67,339	49,136	45,757	63,091	145,030	209,568	167,119	1,645,162
% Change from Baseline Conditions	-17.8%	-17.8%	-17.7%	-17.7%	-18.7%	-19.7%	-20.6%	-20.2%	-19.7%	-18.7%	-18.2%	-18.0%	-18.3%
Water Balance Components	**PC Monthly and Annual Water Balance Volumes for Mud Lake (m^3)**												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual
Precipitation over Catchment	208,393	177,924	308,930	235,742	197,608	182,566	188,286	188,093	198,378	238,631	260,203	227,846	2,612,600
Evaporation over Catchment	12,963	16,043	29,367	52,063	101,842	147,872	185,307	151,936	90,090	49,694	23,008	14,508	874,693
Lake Input Summary													
Direct Precipitation	4,435	3,788	6,578	5,019	4,207	3,887	4,008	4,004	4,221	5,081	5,541	4,851	55,620
Crusher Lake Discharge	55,501	48,888	84,119	62,576	38,952	21,302	15,436	14,839	20,686	47,142	68,111	54,527	532,079
Surface Runoff	85,597	71,590	143,034	96,727	58,717	26,580	18,397	16,923	33,538	92,628	135,208	93,316	872,255
% Change from Baseline Conditions	-19.1%	-19.1%	-19.1%	-19.1%	-19.1%	-19.1%	-19.1%	-19.1%	-19.1%	-19.1%	-19.1%	-19.1%	-19.1%
Net Baseflow	34,212	34,124	39,346	38,317	31,900	24,271	19,814	17,403	12,175	10,772	12,580	23,432	298,346
% Change from Baseline Conditions	-19.8%	-19.8%	-19.8%	-19.8%	-19.8%	-19.8%	-19.8%	-19.8%	-19.8%	-19.8%	-19.8%	-19.8%	-19.8%
Total Inflow	179,746	158,389	273,077	202,638	133,776	76,040	57,654	53,170	70,621	155,622	221,440	176,126	1,758,299
% Change from Baseline Conditions	-13.6%	-13.6%	-13.6%	-13.6%	-13.8%	-13.6%	-13.5%	-13.2%	-13.3%	-13.6%	-13.6%	-13.5%	-13.6%
Lake Output Summary													
Lake Evaporation	-	-	-	-	3,686	4,182	4,830	3,940	2,829	1,652	-	-	21,119
Lake Discharge	179,746	158,389	273,077	202,638	130,090	71,858	52,825	49,244	67,785	153,968	221,435	176,126	1,737,181
% Change from Baseline Conditions	-13.6%	-13.6%	-13.6%	-13.6%	-14.1%	-14.3%	-14.6%	-14.1%	-13.7%	-13.7%	-13.6%	-13.5%	-13.7%

Source: Appendix P.4 Mine Water Management Plan, Appendix A Water Balance Analysis.

Table 6.7-28: Summary Monthly and Annual Water Balance Results for End-of-Mine and Post-closure Conditions, Tent Lake

Water Balance Components	Baseline Monthly and Annual Water Balance Volumes for the Tent Brook System (m^3)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual
Precipitation over Catchment	331,308	282,868	491,145	374,789	314,161	290,247	299,341	299,035	315,386	379,382	413,676	362,235	4,153,572
Evaporation over Catchment	21,572	26,698	48,871	86,640	156,612	231,761	291,495	239,087	140,129	76,869	38,289	24,144	1,382,167
Surface Runoff	202,081	169,011	337,679	228,356	138,622	62,752	43,432	39,953	78,861	218,686	319,265	220,304	2,059,002
Baseflow	81,482	81,275	93,712	91,261	75,978	57,808	47,192	41,450	28,985	25,642	29,959	55,808	710,552
Streamflow	283,563	250,286	431,391	319,617	214,600	120,560	90,623	81,403	107,846	244,328	349,224	276,112	2,769,553
Water Balance Components	**EOM Monthly and Annual Water Balance Volumes for Tent Brook System (m^3)**												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual
Precipitation over Catchment	326,331	278,618	483,766	369,158	309,442	285,887	294,844	294,543	310,648	373,682	407,462	356,793	4,091,174
Evaporation over Catchment	26,765	30,524	55,332	87,943	151,533	220,410	276,220	227,637	136,205	79,040	43,942	29,783	1,365,334
Surface Runoff Summary													
South Pond Outflow	10,246	8,749	15,195	11,593	9,123	8,277	8,441	8,570	9,245	11,446	12,782	11,206	124,873
Surface Runoff	187,232	156,592	312,866	211,576	128,436	58,141	40,240	37,017	73,066	202,617	295,805	204,116	1,907,704
Total Surface Runoff	197,477	165,341	328,061	223,169	137,559	66,418	48,681	45,587	82,312	214,062	308,588	215,322	2,032,577
% Change from Baseline Conditions	-2.3%	-2.2%	-2.8%	-2.3%	-0.8%	5.8%	12.1%	14.1%	4.4%	-2.1%	-3.3%	-2.3%	-1.3%
Baseflow	81,156	80,950	93,337	90,896	75,674	57,577	47,003	41,284	28,869	25,540	29,839	55,585	707,710
% Change from Baseline Conditions	-0.4%	-0.4%	-0.4%	-0.4%	-0.4%	-0.4%	-0.4%	-0.4%	-0.4%	-0.4%	-0.4%	-0.4%	-0.4%
Streamflow	278,634	246,291	421,398	314,065	213,233	123,995	95,684	86,871	111,181	239,602	338,427	270,907	2,740,288
% Change from Baseline Conditions	-1.7%	-1.6%	-2.3%	-1.7%	-0.6%	2.8%	5.6%	6.7%	3.1%	-1.9%	-3.1%	-1.9%	-1.1%
Water Balance Components	**PC Monthly and Annual Water Balance Volumes for Tent Brook System (m^3)**												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual
Precipitation over Catchment	326,331	278,618	483,766	369,158	309,442	285,887	294,844	294,543	310,648	373,682	407,462	356,793	4,091,174
Evaporation over Catchment	21,248	26,297	48,137	85,339	154,260	228,279	287,116	235,496	138,024	75,714	37,714	23,781	1,361,405
Surface Runoff Summary													
South Pond Catchment Runoff	-	-	-	-	-	-	-	-	-	-	-	-	-
Surface Runoff	199,045	166,472	332,606	224,925	136,539	61,809	42,779	39,353	77,676	215,401	314,469	216,995	2,028,069
Total Surface Runoff	199,045	166,472	332,606	224,925	136,539	61,809	42,779	39,353	77,676	215,401	314,469	216,995	2,028,069
% Change from Baseline Conditions	-1.5%	-1.5%	-1.5%	-1.5%	-1.5%	-1.5%	-1.5%	-1.5%	-1.5%	-1.5%	-1.5%	-1.5%	-1.5%
Baseflow	81,156	80,950	93,337	90,896	75,674	57,577	47,003	41,284	28,869	25,540	29,839	55,585	707,710
% Change from Baseline Conditions	-0.4%	-0.4%	-0.4%	-0.4%	-0.4%	-0.4%	-0.4%	-0.4%	-0.4%	-0.4%	-0.4%	-0.4%	-0.4%
Streamflow	280,201	247,422	425,943	315,821	212,214	119,386	89,782	80,637	106,546	240,940	344,308	272,579	2,735,779
% Change from Baseline Conditions	-1.2%	-1.1%	-1.3%	-1.2%	-1.1%	-1.0%	-0.9%	-0.9%	-1.2%	-1.4%	-1.4%	-1.3%	-1.2%

Source: Appendix P.4 Mine Water Management Plan, Appendix A Water Balance Analysis.

Table 6.7-29: Summary Monthly and Annual Water Balance Results for End-of-Mine and Post-closure Conditions, Cope Brook

Water Balance Components	Baseline Monthly and Annual Water Balance Volumes for Cope Brook (m^3)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Precipitation over Catchment	520,334	444,255	771,364	588,622	493,403	455,845	470,128	469,647	495,327	595,835	649,696	568,905	6,523,360
Evaporation over Catchment	33,880	41,931	76,754	136,072	245,966	363,550	457,839	375,497	219,948	120,822	60,134	37,919	2,170,312
Surface Runoff	317,377	265,440	530,339	358,642	217,711	98,555	68,211	62,748	124,352	343,445	501,323	345,997	3,234,140
Baseflow	127,975	127,648	147,179	143,330	119,328	90,790	74,116	65,098	45,544	40,292	47,056	87,651	1,116,007
Streamflow	445,351	393,087	677,518	501,972	337,039	189,345	142,328	127,847	169,896	383,737	548,379	433,648	4,350,147
Water Balance Components	**EOM Monthly and Annual Water Balance Volumes for Cope Brook (m^3)**												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Precipitation over Catchment	481,165	410,814	713,299	544,313	456,262	421,531	434,739	434,294	458,041	550,983	600,790	526,080	6,032,311
Evaporation over Catchment	31,330	38,774	70,977	125,830	227,451	336,184	423,375	347,231	203,392	111,727	55,608	35,065	2,006,944
Surface Runoff	293,486	245,459	490,418	331,645	201,323	91,136	63,077	58,025	114,992	317,592	463,586	319,952	2,990,691
% Change from Baseline Conditions	-7.5%	-7.5%	-7.5%	-7.5%	-7.5%	-7.5%	-7.5%	-7.5%	-7.5%	-7.5%	-7.5%	-7.5%	-7.5%
Baseflow	127,297	126,972	146,400	142,571	118,696	90,310	73,724	64,754	45,303	40,079	46,807	87,187	1,110,100
% Change from Baseline Conditions	-0.5%	-0.5%	-0.5%	-0.5%	-0.5%	-0.5%	-0.5%	-0.5%	-0.5%	-0.5%	-0.5%	-0.5%	-0.5%
Streamflow	420,783	372,430	636,818	474,216	320,019	181,446	136,801	122,779	160,294	357,671	510,393	407,139	4,100,789
% Change from Baseline Conditions	-5.5%	-5.3%	-6.0%	-5.5%	-5.0%	-4.2%	-3.9%	-4.0%	-5.7%	-6.8%	-6.9%	-6.1%	-5.7%
Water Balance Components	**PC Monthly and Annual Water Balance Volumes for Cope Brook (m^3)**												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Precipitation over Catchment	481,165	410,814	713,299	544,313	456,262	421,531	434,739	434,294	458,041	550,983	600,790	526,080	6,032,311
Evaporation over Catchment	31,330	38,774	70,977	125,830	227,451	336,184	423,375	347,231	203,392	111,727	55,608	35,065	2,006,944
Surface Runoff	293,486	245,459	490,418	331,645	201,323	91,136	63,077	58,025	114,992	317,592	463,586	319,952	2,990,691
% Change from Baseline Conditions	-7.5%	-7.5%	-7.5%	-7.5%	-7.5%	-7.5%	-7.5%	-7.5%	-7.5%	-7.5%	-7.5%	-7.5%	-7.5%
Baseflow	127,297	126,972	146,400	142,571	118,696	90,310	73,724	64,754	45,303	40,079	46,807	87,187	1,110,100
% Change from Baseline Conditions	-0.5%	-0.5%	-0.5%	-0.5%	-0.5%	-0.5%	-0.5%	-0.5%	-0.5%	-0.5%	-0.5%	-0.5%	-0.5%
Streamflow	420,783	372,430	636,818	474,216	320,019	181,446	136,801	122,779	160,294	357,671	510,393	407,139	4,100,789
% Change from Baseline Conditions	-5.5%	-5.3%	-6.0%	-5.5%	-5.0%	-4.2%	-3.9%	-4.0%	-5.7%	-6.8%	-6.9%	-6.1%	-5.7%

Source: Appendix P.4 Mine Water Management Plan, Appendix A Water Balance Analysis.

6.7.8.2.2 Surface Water Quality Results: Mine Site Water

Surface water runoff from the surrounding area of the Mine Site, waste rock, till, topsoil and organic material stockpiles, and site roads will be managed with the aid of berms and newly constructed channels, which will discharge into settling ponds. Surface runoff that falls directly into the pit will be dewatered to the north settling pond during operations. Further details on the surface water management during EOM and PC conditions, including the settling pond design criteria and surface water management infrastructure layout, are provided in the Stormwater Management Assessment - Hydrologic Modelling Technical Memorandum (Appendix P.4 Mine Water Management Plan, Appendix B).

Contact/Mine Site water quality predictions (Appendix P.4 Mine Water Management Plan, Appendix D [Predictive Water Quality Assessment]) were generated for:

1. North Settling Pond and Discharges (EOM, PC); and

2. Open Pit Water Discharges (PC).

The constituent concentrations entering the North Settling Pond during EOM conditions for base case and upper-case scenarios are presented in Appendix P.4 (Mine Water Management Plan, Appendix D, Tables 3-2 and 3-3). The pond will likely be decommissioned for PC conditions.

Water quality predictions for contact water quality, prior to water treatment, are presented in Appendix P.4 (Appendix D [Predicted Water Quality] and Appendix F [Mine Water Treatment Assessments). In summary results indicate:

- North Settling Pond: MDMER objectives are not exceeded in the during either base case or uppercase scenarios for EOM and PC;

- Open Pit Water Discharges: Under PC conditions, all site contact water will be routed through the pit prior to discharge into the Killag River. Arsenic exceeds MDMER objectives for most of the year in the pit during the base case scenario, indicating a need for water treatment. Water treatability studies for pit water quality are presented in Appendix P.4 (Appendix F Mine Water Treatment Assessments).

In response to IR2 issued by IAAC (CEAA 2019) and Nova Scotia Environment (NSE 2019), and as a result of ongoing water quality, water quantity and geochemical studies for the Project, water treatment for both EOM and PC is planned for the Project. Details for water management and planned water treatments are summarized in Section 6.7.9 and presented in Appendix P.4 Mine Water Management Plan, Appendix F.2 Mine Water Treatment Assessment Operations. The treatment system will be designed to ensure that all site effluent water meets MDMER and will reflect assimilation capacity of the receiving environment, such that any potential effects to the Surface Water Quality VC, and downstream water users, will be fully mitigated.

6.7.8.2.3 Surface Water Quality Results: Receiving Environment

During EOM conditions, site water from the waste rock, LGO stockpiles, crusher pad and the pit will be routed through the north settling pond prior to discharge into the Killag River. There will also be runoff from the till and organic material stockpiles to the east settling pond prior to discharge into the Killag River and from the organic material stockpiles south to the south settling pond prior to discharge to WC19. During PC conditions, site water from the waste rock stockpiles will be routed through the pit prior to discharge directly from the pit into the Killag River.

The only discharge points with potential for discharge of impacted mine effluent into the Killag River system are the north settling pond (EOM) and the pit (PC). There are three discharge points proposed during EOM conditions and PC conditions (Figure 6.7-13 and 6.7-14).

Receiving water quality predictions were generated for:

1. EOM: near-field mixing zone (100 m downstream of each discharge point with the potential for constituent transport);

2. PC: near-field mixing Zone on Killag River for the Pit; and

3. EOM and PC: far-field mixing zone (approximately 1 km downstream of Near Field - Pit - PC discharge point in the Killag River).

The predictive water quality assessment was calculated on a monthly basis for the average year climatic conditions. Performing the water quality assessment on a monthly basis allows for the prediction of the seasonality characteristics of water quality in the Killag River. This allows for the assessment of the wet and dry months to determine the month with the highest effect on the water quality in the Killag River and will assist with the design of water quality treatment options at the Project Site.

Cormix modelling was also performed for protect discharges; modelling details are included in Appendix P.4 Mine Water Management Plan, Appendix F (Water Treatment Assessments). Results indicate that full mixing would occur in a relatively short distance from the discharge point in Cameron Flowage.

Note, as limited information was available for the Construction Phase, the water quality of a similar site (i.e., Touquoy) was used as an indication of water quality for the Project (Appendix P.4 Mine Water Management Plan [Appendix F.1 Water Treatment Assessment –Construction]), rather than mass and water balance modelling.

Surface Water Quality predictions are presented in Table 6.7-30 through 6.7-38.

Table 6.7-30: Predicted Water Quality of Killag River at Near Field North Settling Pond Discharge Point - EOM Conditions Base Case

Constituent	*Selected Benchmark Concentration*[a]	*75th Percentile Baseline Surface Water*	Predicted Concentration (µg/L)											
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Silver	*0.25*[b]	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Aluminum	*290*[c]	280	241	241	244.	239	236	225	214	211	215	237	241	239
Arsenic	*30*[d]	2.1	2.09	2.10	1.91	2.18	2.33	2.78	3.20	3.36	3.14	2.22	2.07	2.17
Cadmium	*0.04*[b]	0.022	0.019	0.019	0.019	0.019	0.019	0.019	0.019	0.019	0.019	0.019	0.019	0.019
Cobalt	*0.78*[e]	0.21	0.36	0.36	0.34	0.37	0.39	0.45	0.51	0.53	0.50	0.38	0.36	0.37
Copper	*2*	1	0.84	0.84	0.84	0.84	0.84	0.83	0.82	0.82	0.82	0.83	0.84	0.84
Iron	*650*[c]	593	483	483	490	481	473	452	430	423	432	475	483	480
Mercury	*0.026*	0.0065	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Manganese	*190*[b]	51.5	47.7	47.7	47.2	47.9	47.9	48.0	48.0	48.1	47.9	47.4	47.5	47.7
Molybdenum	*73*	1	1.71	1.71	1.57	1.80	2.02	2.69	3.37	3.59	3.30	1.99	1.72	1.82
Nickel	*25*	1	2.23	2.25	1.85	2.42	2.75	3.76	4.71	5.07	4.59	2.54	2.20	2.41
Lead	*1*	0.30	0.33	0.33	0.33	0.33	0.33	0.32	0.31	0.31	0.32	0.33	0.33	0.33
Antimony	*20*	0.5	0.48	0.48	0.49	0.48	0.48	0.46	0.45	0.44	0.45	0.48	0.48	0.48
Selenium	*1*	0.5	0.49	0.49	0.47	0.49	0.50	0.52	0.54	0.55	0.53	0.49	0.48	0.49
Thallium	*0.8*	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Uranium	*15*[b]	0.05	1.05	1.06	0.78	1.19	1.49	2.40	3.30	3.62	3.20	1.38	1.04	1.20
Zinc	*7*[f]	2.5	3.59	3.60	3.55	3.62	3.63	3.67	3.70	3.72	3.69	3.59	3.58	3.61
Nitrate	*13,000*[b]	*25*	603	621	363	716	870	1,356	1,789	1,977	1,721	714	566	694
Nitrite	*60*[b]	*5*	11.1	11.2	9.14	12.1	13.8	19.0	23.9	25.8	23.3	12.7	10.9	12.0
Ammonia	*27,550*[g]	*25*	58.2	57.8	54.6	60.5	69.6	96.2	124.2	132.3	121.9	70.5	59.4	62.0

Source, with minor revisions from: Appendix G.2 Beaver Dam Mine: Killag River and Moose River Water Quality Predictions and Aquatic Effects Assessment – Reassessment of Killag River based on February 2021 Update (GHD modelling Provided February 12, 2021); Reassessment of Moose River based on March 2021 Update (Stantec modelling of March 11, 2021) (Intrinsik 2021).

Notes: All values are presented as µg/L. For the purposes of summary here, **bolded** predicted values are greater than applicable water quality criteria; grey shaded values are greater than 75th percentile baseline values. Results indicate that while concentrations are predicted to increase relative to baseline conditions for some parameters, no values are predicted to be greater than applicable water quality criteria (i.e., selected benchmark concentrations). As water quality criteria are defined by national and international entities as protective of the receiving environment and all water users, there are no anticipated effects to surface waters are a result of discharges from the Project to the Killag River in this scenario.

(a) Selected benchmarks represent Nova Scotia Tier 1 guidelines unless specified otherwise.

(b) Adopted from CCME.

(c) Based on baseline concentration in the Killag River (75th percentile).

(d) Site-specific water quality guideline.

(e) Selected guideline represents Environment Canada (2017) FEQG for the protection of aquatic life at water hardness of 52 mg/L.

(f) Selected guideline represents the Long-term CWQG, SSD 5th percentile at water hardness of 50 mg·L-1, pH of 7.5 and DOC of 0.5 mg·L-1.

(g) Selected guideline represents the ammonia (total) CCME guideline value at pH 6.0 and temperature of 25ºC, multiplied by 0.8224 (for the conversion of NH_3 to total ammonia-N).

Table 6.7-31: Predicted Water Quality of Killag River at Near Field North Settling Pond Discharge Point - EOM Conditions Upper Case

Constituent	*Selected Benchmark Concentration[a]*	*75th Percentile Baseline Surface Water*	Predicted Concentration (µg/L)											
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Silver	*0.25[b]*	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Aluminum	*290[c]*	280	241.3	241.3	244.3	240.0	236.5	226.1	215.7	212.2	216.9	237.4	241.3	239.7
Arsenic	*30[d]*	2.1	2.34	2.36	2.08	2.46	2.69	3.38	4.04	4.28	3.94	2.54	2.30	2.45
Cadmium	*0.04[b]*	0.022	0.020	0.020	0.019	0.020	0.020	0.020	0.021	0.021	0.021	0.020	0.020	0.020
Cobalt	*0.78[e]*	0.21	0.40	0.40	0.36	0.42	0.45	0.54	0.63	0.66	0.62	0.42	0.39	0.41
Copper	*2*	1	0.87	0.87	0.86	0.88	0.89	0.91	0.94	0.95	0.93	0.88	0.87	0.88
Iron	*650[c]*	593	484	484	490	481	474	452	430	423	433	476	484	480
Mercury	*0.026*	0.0065	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Manganese	*190[b]*	51.5	48.2	48.3	47.5	48.5	48.6	49.3	49.6	49.9	49.4	48.1	48.0	48.3
Molybdenum	*73*	1	2.69	2.69	2.33	2.88	3.41	4.99	6.58	7.10	6.42	3.32	2.71	2.93
Nickel	*25*	1	2.59	2.61	2.09	2.83	3.26	4.59	5.85	6.32	5.68	2.99	2.54	2.81
Lead	*1*	0.30	0.34	0.34	0.34	0.34	0.34	0.35	0.35	0.36	0.35	0.34	0.34	0.34
Antimony	*20*	0.5	0.49	0.49	0.49	0.49	0.49	0.48	0.48	0.47	0.48	0.49	0.49	0.49
Selenium	*1*	0.5	0.52	0.52	0.50	0.53	0.55	0.60	0.64	0.66	0.63	0.53	0.52	0.53
Thallium	*0.8*	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Uranium	*15[b]*	0.05	1.32	1.33	0.98	1.49	1.88	3.04	4.18	4.57	4.05	1.74	1.31	1.50
Zinc	*7[f]*	2.5	3.64	3.65	3.58	3.67	3.70	3.80	3.87	3.91	3.85	3.65	3.63	3.66
Nitrate	*13,000[b]*	*25*	1,096	1,127	666	1,301	1,595	2,519	3,353	3,703	3,226	1,324	1,034	1,266
Nitrite	*60[b]*	*5*	27.2	27.0	23.4	29.4	36.3	56.9	**76.5**	**84.6**	**76.1**	36.1	27.8	30.2
Ammonia	*27,550[g]*	*25*	120	118	113	125	156	243	337	362	330	164	126	132

Sourced, with minor revisions from: Appendix G.2 Beaver Dam Mine: Killag River and Moose River Water Quality Predictions and Aquatic Effects Assessment – Reassessment of Killag River based on February 2021 Update (GHD modelling Provided February 12, 2021); Reassessment of Moose River based on March 2021 Update (Stantec modelling of March 11, 2021) (Intrinsik 2021).

Notes: All values are presented as µg/L. For the purposes of summary here, **bolded** predicted values are greater than applicable water quality criteria; grey shaded values are greater than 75th percentile baseline values, Results indicate that nitrite concentrations are greater than baseline and water quality criteria in some months in this scenario. As a result of these predictions, Atlantic Mining has committed to implementation of a water treatment system to ensure that all site effluent water meets MDMER and will reflect assimilation capacity of the receiving environment, such that any potential effects to the Surface Water Quality VC, and downstream water users, will be fully mitigated.

(a) Selected benchmarks represent Nova Scotia Tier 1 guidelines unless specified otherwise.

(b) Adopted from CCME.

(c) Based on baseline concentration in the Killag River (75th percentile).

(d) Site-specific water quality guideline.

(e) Selected guideline represents Environment Canada (2017) FEQG for the protection of aquatic life at water hardness of 52 mg/L.

(f) Selected guideline represents the Long-term CWQG, SSD 5th percentile at water hardness of 50 mg·L-1, pH of 7.5 and DOC of 0.5 mg·L-1.

(g) Selected guideline represents the ammonia (total) CCME guideline value at pH 6.0 and temperature of 25ºC, multiplied by 0.8224 (for the conversion of NH_3 to total ammonia-N).

Table 6.7-32: Predicted Water Quality of Killag River at Near Field East Settling Pond Discharge Point - EOM Conditions Base Case

Constituent	*Selected Benchmark Concentration[a]*	*75th Percentile Baseline Surface Water*	Predicted Concentration (µg/L)											
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Silver	*0.25[b]*	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Aluminum	*290[c]*	280	240	240	243	239	235	224	213	209	214	236	240	238
Arsenic	*30[d]*	2.1	2.08	2.09	1.90	2.17	2.31	2.75	3.16	3.32	3.11	2.21	2.06	2.16
Cadmium	*0.04[b]*	0.022	0.019	0.019	0.019	0.019	0.019	0.019	0.019	0.019	0.019	0.019	0.019	0.019
Cobalt	*0.78[e]*	0.21	0.36	0.36	0.33	0.37	0.39	0.45	0.50	0.53	0.50	0.38	0.36	0.37
Copper	*2*	1	0.84	0.84	0.84	0.84	0.83	0.83	0.82	0.81	0.82	0.83	0.84	0.84
Iron	*650[c]*	593	483	483	489	480	472	450	427	420	429	474	482	479
Mercury	*0.026*	0.0065	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Manganese	*190[b]*	51.5	47.5	47.6	47.1	47.7	47.7	47.7	47.5	47.6	47.4	47.2	47.4	47.6
Molybdenum	*73*	1	1.71	1.70	1.56	1.79	2.01	2.66	3.33	3.54	3.26	1.97	1.72	1.81
Nickel	*25*	1	2.22	2.24	1.84	2.41	2.73	3.72	4.65	5.01	4.53	2.52	2.18	2.39
Lead	*1*	0.30	0.33	0.33	0.33	0.33	0.32	0.32	0.31	0.31	0.31	0.32	0.33	0.33
Antimony	*20*	0.5	0.48	0.48	0.49	0.48	0.47	0.46	0.44	0.44	0.45	0.48	0.48	0.48
Selenium	*1*	0.5	0.49	0.49	0.47	0.49	0.50	0.52	0.53	0.54	0.53	0.49	0.48	0.49
Thallium	*0.8*	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Uranium	*15[b]*	0.05	1.04	1.05	0.77	1.17	1.47	2.38	3.26	3.56	3.16	1.36	1.03	1.19
Zinc	*7[f]*	2.5	3.58	3.59	3.54	3.61	3.61	3.65	3.67	3.69	3.66	3.58	3.57	3.59
Nitrate	*13,000[b]*	*25*	598	616	361	710	862	1,341	1,765	1,949	1,697	707	561	688
Nitrite	*60[b]*	*5*	11.1	11.2	9.09	12.05	13.7	18.8	23.6	25.4	23.0	12.6	10.9	12.0
Ammonia	*27,550[g]*	*25*	57.9	57.5	54.3	60.2	69.1	95.3	123	131	120	70.0	59.1	61.6

Sourced with minor revisions from: Appendix G.2 Beaver Dam Mine: Killag River and Moose River Water Quality Predictions and Aquatic Effects Assessment – Reassessment of Killag River based on February 2021 Update (GHD modelling Provided February 12, 2021); Reassessment of Moose River based on March 2021 Update (Stantec modelling of March 11, 2021) (Intrinsik 2021).

Notes: All values are presented as µg/L. For the purposes of summary here, **bolded** predicted values are greater than applicable water quality criteria; grey shaded values are greater than 75th percentile baseline values. Results indicate that while concentrations are predicted to increase relative to baseline conditions for some parameters, no values are predicted to be greater than applicable water quality criteria (i.e., selected benchmark). As water quality criteria are defined by national and international entities as protective of the receiving environment and all water users, there are no anticipated effects to surface waters are a result of discharges from the Project to the Killag River in this scenario.

(a) Selected benchmarks represent Nova Scotia Tier 1 guidelines unless specified otherwise.

(b) Adopted from CCME.

(c) Based on baseline concentration in the Killag River (75th percentile).

(d) Site-specific water quality guideline.

(e) Selected guideline represents Environment Canada (2017) FEQG for the protection of aquatic life at water hardness of 52 mg/L.

(f) Selected guideline represents the Long-term CWQG, SSD 5th percentile at water hardness of 50 mg·L-1, pH of 7.5 and DOC of 0.5 mg·L-1.

(g) Selected guideline represents the ammonia (total) CCME guideline value at pH 6.0 and temperature of 25ºC, multiplied by 0.8224 (for the conversion of NH_3 to total ammonia-N).

Table 6.7-33: Predicted Water Quality of Killag River at Near Field East Settling Pond Discharge Point - EOM Conditions Upper Case

Constituent	*Selected Benchmark Concentration[a]*	*75th Percentile Baseline Surface Water*	Predicted Concentration (µg/L)											
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Silver	*0.25[b]*	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Aluminum	*290[c]*	280	241	241	244	240	236	225	214	211	215	237	241	240
Arsenic	*30[d]*	2.1	2.33	2.35	2.07	2.44	2.67	3.35	3.99	4.23	3.89	2.53	2.29	2.44
Cadmium	*0.04[b]*	0.022	0.020	0.020	0.019	0.020	0.020	0.020	0.021	0.021	0.021	0.020	0.019	0.020
Cobalt	*0.78[e]*	0.21	0.40	0.40	0.36	0.41	0.44	0.54	0.62	0.65	0.61	0.42	0.39	0.41
Copper	*2*	1	0.87	0.87	0.86	0.88	0.88	0.91	0.93	0.93	0.92	0.87	0.87	0.88
Iron	*650[c]*	593	483	483	489	480	472	450	428	420	430	474	483	480
Mercury	*0.026*	0.0065	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Manganese	*190[b]*	51.5	48.0	48.1	47.4	48.3	48.4	48.9	49.1	49.3	48.9	47.8	47.8	48.1
Molybdenum	*73*	1	2.67	2.67	2.32	2.86	3.38	4.93	6.49	6.99	6.33	3.29	2.69	2.91
Nickel	*25*	1	2.57	2.60	2.08	2.81	3.24	4.54	5.77	6.24	5.61	2.97	2.52	2.79
Lead	*1*	0.30	0.34	0.34	0.34	0.34	0.34	0.35	0.35	0.35	0.35	0.34	0.34	0.34
Antimony	*20*	0.5	0.49	0.49	0.49	0.49	0.49	0.48	0.47	0.47	0.47	0.49	0.49	0.49
Selenium	*1*	0.5	0.52	0.52	0.49	0.53	0.54	0.59	0.63	0.65	0.63	0.53	0.51	0.53
Thallium	*0.8*	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Uranium	*15[b]*	0.05	1.31	1.31	0.97	1.48	1.86	3.00	4.12	4.51	3.99	1.72	1.30	1.49
Zinc	*7[f]*	2.5	3.64	3.64	3.57	3.66	3.69	3.77	3.83	3.87	3.82	3.64	3.62	3.65
Nitrate	*13,000[b]*	*25*	1,087	1,117	660	1,290	1,580	2,490	3,307	3,650	3,182	1,311	1,025	1,254
Nitrite	*60[b]*	*5*	27.0	27.0	23.2	29.1	36.0	56.2	**75.5**	**83.4**	**75.1**	35.7	27.6	30.0
Ammonia	*27,550[g]*	*25*	119	117	112	125	155	240	332	357	325	162	125	131

Sourced, with minor revisions from: Appendix G.2 Beaver Dam Mine: Killag River and Moose River Water Quality Predictions and Aquatic Effects Assessment – Reassessment of Killag River based on February 2021 Update (GHD modelling Provided February 12, 2021); Reassessment of Moose River based on March 2021 Update (Stantec modelling of March 11, 2021) (Intrinsik 2021).

Notes: All values are presented as µg/L. For the purposes of summary here, **bolded** predicted values are greater than applicable water quality criteria; grey shaded values are greater than 75th percentile baseline values. No values are predicted to be greater than selected benchmarks. Results indicate that nitrite concentrations are greater than baseline and water quality criteria in some months in this scenario. As a result of these predictions, Atlantic Mining has committed to implementation of a water treatment system to ensure that all site effluent water meets MDMER and will reflect assimilation capacity of the receiving environment, such that any potential effects to the Surface Water Quality VC, and downstream water users, will be fully mitigated.

(a) Selected benchmarks represent Nova Scotia Tier 1 guidelines unless specified otherwise.

(b) Adopted from CCME.

(c) Based on baseline concentration in the Killag River (75th percentile).

(d) Site-specific water quality guideline.

(e) Selected guideline represents Environment Canada (2017) FEQG for the protection of aquatic life at water hardness of 52 mg/L.

(f) Selected guideline represents the Long-term CWQG, SSD 5th percentile at water hardness of 50 mg·L-1, pH of 7.5 and DOC of 0.5 mg·L-1.

(g) Selected guideline represents the ammonia (total) CCME guideline value at pH 6.0 and temperature of 25ºC, multiplied by 0.8224 (for the conversion of NH_3 to total ammonia-N).

Table 6.7-34: Predicted Water Quality of Killag River at Killag River at Near Field Pit Discharge Point - PC Conditions Base Case

Constituent	*Selected Benchmark Concentration*[a]	*75th Percentile Baseline Surface Water*	Predicted Concentration (µg/L)											
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Silver	*0.25*[b]	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Aluminum	*290*[c]	280	243	243	243	242	240	232	224	221	224	239	242	241
Arsenic	*30*[d]	2.1	1.59	1.59	1.57	1.59	1.60	1.62	1.62	1.63	1.61	1.58	1.58	1.59
Cadmium	*0.04*[b]	0.022	0.020	0.020	0.019	0.020	0.020	0.022	0.023	0.024	0.023	0.020	0.020	0.020
Cobalt	*0.78*[e]	0.21	0.39	0.40	0.35	0.39	0.44	0.56	0.69	0.72	0.65	0.42	0.38	0.40
Copper	*2*	1	0.82	0.82	0.82	0.82	0.82	0.81	0.79	0.78	0.79	0.81	0.82	0.82
Iron	*650*[c]	593	488	488	489	487	482	467	449	444	450	479	486	485
Mercury	*0.026*	0.0065	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Manganese	*190*[b]	51.5	46.6	46.7	46.3	46.6	46.5	46.2	45.6	45.4	45.3	46.0	46.3	46.5
Molybdenum	*73*	1	1.45	1.47	1.24	1.52	1.69	2.14	2.57	2.74	2.46	1.54	1.40	1.51
Nickel	*25*	1	2.15	2.18	1.77	2.08	2.64	3.86	5.14	5.49	4.74	2.46	1.98	2.20
Lead	*1*	0.30	0.34	0.34	0.33	0.34	0.34	0.35	0.36	0.36	0.35	0.34	0.33	0.34
Antimony	*20*	0.5	0.48	0.48	0.48	0.48	0.47	0.46	0.44	0.44	0.44	0.47	0.48	0.48
Selenium	*1*	0.5	0.45	0.45	0.45	0.45	0.45	0.44	0.43	0.43	0.43	0.44	0.45	0.45
Thallium	*0.8*	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Uranium	*15*[b]	0.05	0.11	0.11	0.08	0.12	0.14	0.20	0.26	0.28	0.25	0.12	0.10	0.12
Zinc	*7*[f]	2.5	4.12	4.14	3.88	4.05	4.41	5.15	5.94	6.14	5.66	4.29	3.99	4.13
Nitrate	*13,000*[b]	*25*	104	106	84	99	131	199	272	291	249	122	95	106
Nitrite	*60*[b]	*5*	6.48	6.53	6.03	6.35	7.04	8.48	10.00	10.40	9.48	6.82	6.25	6.51
Ammonia	*27,550*[g]	*25*	36.5	36.7	34.0	35.8	39.6	47.4	55.7	57.9	52.9	38.3	35.2	36.6

Sourced with minor revisions from: Appendix G.2 Beaver Dam Mine: Killag River and Moose River Water Quality Predictions and Aquatic Effects Assessment – Reassessment of Killag River based on February 2021 Update (GHD modelling Provided February 12, 2021); Reassessment of Moose River based on March 2021 Update (Stantec modelling of March 11, 2021) (Intrinsik 2021).

Notes: All values are presented as µg/L. For the purposes of summary here, **bolded** predicted values are greater than applicable water quality criteria; grey shaded values are greater than 75th percentile baseline values. Results indicate that while concentrations are predicted to increase relative to baseline conditions for some parameters, no values are predicted to be greater than applicable water quality criteria (i.e., selected benchmark). As water quality criteria are defined by national and international entities as protective of the receiving environment and all water users, there are no anticipated effects to surface waters are a result of discharges from the Project to the Killag River in this scenario.

(a) Selected benchmarks represent Nova Scotia Tier 1 guidelines unless specified otherwise.

(b) Adopted from CCME.

(c) Based on baseline concentration in the Killag River (75th percentile).

(d) Site-specific water quality guideline.

(e) Selected guideline represents Environment Canada (2017) FEQG for the protection of aquatic life at water hardness of 52 mg/L.

(f) Selected guideline represents the Long-term CWQG, SSD 5th percentile at water hardness of 50 mg·L-1, pH of 7.5 and DOC of 0.5 mg·L-1.

(g) Selected guideline represents the ammonia (total) CCME guideline value at pH 6.0 and temperature of 25ºC, multiplied by 0.8224 (for the conversion of NH_3 to total ammonia-N).

Table 6.7-35: Predicted Water Quality of Killag River at Killag River at Near Field Pit Discharge Point - PC Conditions Upper Case

Constituent	*Selected Benchmark Concentration[a]*	*75th Percentile Baseline Surface Water*	Predicted Concentration (µg/L)											
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Silver	*0.25[b]*	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Aluminum	*290[c]*	280	242	243	244	242	240	232	223	221	224	239	242	241
Arsenic	*30[d]*	2.1	1.60	1.60	1.57	1.61	1.62	1.64	1.66	1.67	1.64	1.59	1.59	1.60
Cadmium	*0.04[b]*	0.022	0.020	0.021	0.020	0.020	0.021	0.023	0.025	0.026	0.025	0.021	0.020	0.021
Cobalt	*0.78[e]*	0.21	0.42	0.43	0.37	0.41	0.49	0.64	**0.80**	**0.85**	0.75	0.46	0.40	0.43
Copper	*2*	1	0.84	0.84	0.83	0.84	0.84	0.84	0.84	0.84	0.83	0.83	0.83	0.83
Iron	*650[c]*	593	488	488	490	487	482	468	451	445	451	480	486	485
Mercury	*0.026*	0.0065	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Manganese	*190[b]*	51.5	46.7	46.7	46.3	46.7	46.7	46.4	45.8	45.7	45.6	46.1	46.4	46.5
Molybdenum	*73*	1	1.50	1.52	1.26	1.57	1.75	2.25	2.72	2.90	2.60	1.59	1.44	1.56
Nickel	*25*	1	2.68	2.73	2.11	2.58	3.42	5.25	7.16	7.70	6.58	3.15	2.44	2.76
Lead	*1*	0.30	0.36	0.36	0.35	0.35	0.37	0.41	0.44	0.45	0.43	0.36	0.35	0.36
Antimony	*20*	0.5	0.48	0.48	0.48	0.48	0.48	0.46	0.45	0.44	0.45	0.47	0.48	0.48
Selenium	*1*	0.5	0.46	0.46	0.46	0.46	0.47	0.47	0.47	0.48	0.47	0.46	0.46	0.46
Thallium	*0.8*	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Uranium	*15[b]*	0.05	0.12	0.12	0.09	0.13	0.15	0.22	0.28	0.31	0.27	0.13	0.11	0.13
Zinc	*7[f]*	2.5	4.42	4.45	4.07	4.32	4.84	5.94	7.09	7.39	6.70	4.68	4.25	4.44
Nitrate	*13,000[b]*	*25*	149	152	114	139	197	319	449	483	408	182	133	153
Nitrite	*60[b]*	*5*	7.53	7.60	6.72	7.28	8.56	11.3	14.1	14.9	13.2	8.2	7.13	7.58
Ammonia	*27,550[g]*	*25*	42.2	42.6	37.8	40.9	47.9	62.7	78.3	82.4	73.2	46.0	40.0	42.5

Sourced, with minor revisions from: Appendix G.2 Beaver Dam Mine: Killag River and Moose River Water Quality Predictions and Aquatic Effects Assessment – Reassessment of Killag River based on February 2021 Update (GHD modelling Provided February 12, 2021); Reassessment of Moose River based on March 2021 Update (Stantec modelling of March 11, 2021) (Intrinsik 2021).

Notes: All values are presented as µg/L. For the purposes of summary here, **bolded** predicted values are greater than applicable water quality criteria; grey shaded values are greater than 75th percentile baseline values. No values are predicted to be greater than selected benchmarks. Results indicate that cobalt and zinc concentrations are greater than baseline and water quality criteria in some months in this scenario. As a result of these predictions, Atlantic Mining has committed to implementation of a water treatment system to ensure that all site effluent water meets MDMER and will reflect assimilation capacity of the receiving environment, such that any potential effects to the Surface Water Quality VC, and downstream water users, will be fully mitigated.

(a) Selected benchmarks represent Nova Scotia Tier 1 guidelines unless specified otherwise.

(b) Adopted from CCME.

(c) Based on baseline concentration in the Killag River (75th percentile).

(d) Site-specific water quality guideline.

(e) Selected guideline represents Environment Canada (2017) FEQG for the protection of aquatic life at water hardness of 52 mg/L.

(f) Selected guideline represents the Long-term CWQG, SSD 5th percentile at water hardness of 50 mg·L-1, pH of 7.5 and DOC of 0.5 mg·L-1.

(g) Selected guideline represents the ammonia (total) CCME guideline value at pH 6.0 and temperature of 25ºC, multiplied by 0.8224 (for the conversion of NH_3 to total ammonia-N).

Table 6.7-36: Predicted Water Quality of Killag River at Killag River at Far-Field Discharge Point - EOM Conditions Base Case

Constituent	*Selected Benchmark Concentration[a]*	*75th Percentile Baseline Surface Water*	Predicted Concentration (µg/L)											
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Silver	*0.25[b]*	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Aluminum	*290[c]*	280	241	241	244	239	236	225	214	210	215	237	241	239
Arsenic	*30[d]*	2.1	2.08	2.09	1.90	2.16	2.31	2.74	3.15	3.31	3.09	2.20	2.06	2.15
Cadmium	*0.04[b]*	0.022	0.019	0.019	0.019	0.019	0.019	0.019	0.019	0.019	0.019	0.019	0.019	0.019
Cobalt	*0.78[e]*	0.21	0.36	0.36	0.33	0.37	0.39	0.45	0.50	0.52	0.49	0.37	0.36	0.37
Copper	*2*	1	0.84	0.84	0.84	0.84	0.84	0.83	0.82	0.82	0.82	0.83	0.84	0.84
Iron	*650[c]*	593	483	483	489	481	473	451	428	421	431	475	483	480
Mercury	*0.026*	0.0065	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Manganese	*190[b]*	51.5	47.6	47.6	47.1	47.8	47.7	47.8	47.6	47.7	47.5	47.3	47.4	47.6
Molybdenum	*73*	1	1.70	1.70	1.55	1.78	2.00	2.65	3.31	3.52	3.24	1.96	1.71	1.80
Nickel	*25*	1	2.21	2.23	1.84	2.39	2.71	3.69	4.62	4.97	4.49	2.51	2.17	2.38
Lead	*1*	0.30	0.33	0.33	0.33	0.33	0.32	0.32	0.31	0.31	0.31	0.32	0.33	0.33
Antimony	*20*	0.5	0.48	0.48	0.49	0.48	0.48	0.46	0.44	0.44	0.45	0.48	0.48	0.48
Selenium	*1*	0.5	0.49	0.49	0.47	0.49	0.50	0.52	0.53	0.54	0.53	0.49	0.48	0.49
Thallium	*0.8*	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Uranium	*15[b]*	0.05	1.03	1.03	0.77	1.16	1.46	2.35	3.23	3.53	3.13	1.35	1.02	1.17
Zinc	*7[f]*	*2.5*	3.59	3.59	3.54	3.61	3.62	3.65	3.67	3.69	3.66	3.58	3.57	3.60
Nitrate	*13,000[b]*	*25*	592	609	357	702	853	1,327	1,748	1,930	1,680	700	555	681
Nitrite	*60[b]*	*5*	11.0	11.1	9.05	12.0	13.6	18.7	23.4	25.2	22.8	12.5	10.0	11.9
Ammonia	*27,550[g]*	*25*	57.6	57.2	54.0	59.8	68.7	94.6	122	130	120	69.6	58.8	61.2

Sourced, with minor revisions form: Appendix G.2 Beaver Dam Mine: Killag River and Moose River Water Quality Predictions and Aquatic Effects Assessment – Reassessment of Killag River based on February 2021 Update (GHD modelling Provided February 12, 2021); Reassessment of Moose River based on March 2021 Update (Stantec modelling of March 11, 2021) (Intrinsik 2021).

Notes: All values are presented as µg/L. For the purposes of summary here, **bolded** predicted values are greater than applicable water quality criteria; grey shaded values are greater than 75th percentile baseline values. Results indicate that while concentrations are predicted to increase relative to baseline conditions for some parameters, no values are predicted to be greater than applicable water quality criteria (i.e., selected benchmark). As water quality criteria are defined by national and international entities as protective of the receiving environment and all water users, there are no anticipated effects to surface waters are a result of discharges from the Project to the Killag River in this scenario.

(a) Selected benchmarks represent Nova Scotia Tier 1 guidelines unless specified otherwise.

(b) Adopted from CCME.

(c) Based on baseline concentration in the Killag River (75th percentile).

(d) Site-specific water quality guideline.

(e) Selected guideline represents Environment Canada (2017) FEQG for the protection of aquatic life at water hardness of 52 mg/L.

(f) Selected guideline represents the Long-term CWQG, SSD 5th percentile at water hardness of 50 mg·L-1, pH of 7.5 and DOC of 0.5 mg·L-1.

(g) Selected guideline represents the ammonia (total) CCME guideline value at pH 6.0 and temperature of 25ºC, multiplied by 0.8224 (for the conversion of NH_3 to total ammonia-N).

Table 6.7-37: Predicted Water Quality of Killag River at Killag River at Far-Field Discharge Point - EOM Conditions Upper Case

Constituent	*Selected Benchmark Concentration[a]*	*75th Percentile Baseline Surface Water*	Predicted Concentration (µg/L)											
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Silver	*0.25[b]*	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Aluminum	*290[c]*	280	241	241	243.9	239	236	225	214	211	216	237	241	239
Arsenic	*30[d]*	2.1	2.33	2.34	2.06	2.44	2.67	3.34	3.97	4.21	3.87	2.52	2.29	2.43
Cadmium	*0.04[b]*	0.022	0.020	0.020	0.019	0.020	0.020	0.020	0.021	0.021	0.021	0.020	0.019	0.020
Cobalt	*0.78[e]*	0.21	0.39	0.40	0.36	0.41	0.44	0.53	0.62	0.65	0.61	0.42	0.39	0.41
Copper	*2*	1	0.87	0.87	0.86	0.88	0.89	0.91	0.93	0.94	0.92	0.88	0.87	0.88
Iron	*650[c]*	593	483	483	489	481	473	451	429	421	431	475	483	480
Mercury	*0.026*	0.0065	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Manganese	*190[b]*	51.5	48.0	48.2	47.5	48.4	48.5	49.0	49.3	49.6	49.1	47.9	47.9	48.2
Molybdenum	*73*	1	2.65	2.65	2.30	2.84	3.36	4.90	6.45	6.94	6.29	3.27	2.67	2.89
Nickel	*25*	1	2.55	2.58	2.06	2.79	3.21	4.51	5.72	6.19	5.56	2.95	2.50	2.78
Lead	*1*	0.30	0.34	0.34	0.34	0.34	0.34	0.35	0.35	0.35	0.35	0.34	0.34	0.34
Antimony	*20*	0.5	0.49	0.49	0.49	0.49	0.49	0.48	0.47	0.47	0.47	0.49	0.49	0.49
Selenium	*1*	0.5	0.52	0.52	0.49	0.53	0.54	0.59	0.63	0.65	0.63	0.53	0.51	0.53
Thallium	*0.8*	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Uranium	*15[b]*	0.05	1.29	1.30	0.96	1.46	1.84	2.97	4.08	4.47	3.96	1.70	1.28	1.47
Zinc	*7[f]*	2.5	3.64	3.64	3.57	3.66	3.69	3.77	3.84	3.87	3.82	3.64	3.62	3.65
Nitrate	*13,000[b]*	*25*	1,075	1,105	653	1,276	1,563	2,464	3,274	3,614	3,150	1,296	1,014	1,241
Nitrite	*60[b]*	*5*	26.7	26.6	23.0	28.9	35.6	55.7	**76.3**	**82.6**	**74.4**	35.4	27.3	29.7
Ammonia	*27,550[g]*	*25*	119	117	111	124	153	238	329	353	322	161	124	130

Sourced, with minor revisions from: Appendix G.2 Beaver Dam Mine: Killag River and Moose River Water Quality Predictions and Aquatic Effects Assessment – Reassessment of Killag River based on February 2021 Update (GHD modelling Provided February 12, 2021); Reassessment of Moose River based on March 2021 Update (Stantec modelling of March 11, 2021) (Intrinsik 2021).

Notes: All values are presented as µg/L. For the purposes of summary here, **bolded** predicted values are greater than applicable water quality criteria; grey shaded values are greater than 75th percentile baseline values. No values are predicted to be greater than selected benchmarks. Results indicate that nitrite concentrations are greater than baseline and water quality criteria in some months in this scenario. As a result of these predictions, Atlantic Mining has committed to implementation of a water treatment system to ensure that all site effluent water meets MDMER and will reflect assimilation capacity of the receiving environment, such that any potential effects to the Surface Water Quality VC, and downstream water users, will be fully mitigated.

(a) Selected benchmarks represent Nova Scotia Tier 1 guidelines unless specified otherwise.

(b) Adopted from CCME.

(c) Based on baseline concentration in the Killag River (75th percentile).

(d) Site-specific water quality guideline.

(e) Selected guideline represents Environment Canada (2017) FEQG for the protection of aquatic life at water hardness of 52 mg/L.

(f) Selected guideline represents the Long-term CWQG, SSD 5th percentile at water hardness of 50 mg·L-1, pH of 7.5 and DOC of 0.5 mg·L-1.

(g) Selected guideline represents the ammonia (total) CCME guideline value at pH 6.0 and temperature of 25ºC, multiplied by 0.8224 (for the conversion of NH_3 to total ammonia-N).

Table 6.7-38: Predicted Water Quality of Killag River at Killag River at Far-Field Discharge Point - PC Conditions Base Case

Constituent	*Selected Benchmark Concentration[a]*	*75th Percentile Baseline Surface Water*	Predicted Concentration (µg/L)											
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Silver	*0.25[b]*	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Aluminum	*290[c]*	280	243	244	244	243	240	234	226	223	226	240	243	242
Arsenic	*30[d]*	2.1	1.59	1.60	1.57	1.60	1.61	1.63	1.64	1.64	1.62	1.58	1.58	1.59
Cadmium	*0.04[b]*	0.022	0.020	0.020	0.019	0.020	0.021	0.022	0.023	0.024	0.023	0.020	0.020	0.020
Cobalt	*0.78[e]*	0.21	0.39	0.40	0.35	0.39	0.44	0.56	0.69	0.72	0.65	0.42	0.38	0.40
Copper	*2*	1	0.83	0.83	0.82	0.83	0.82	0.81	0.80	0.79	0.79	0.82	0.82	0.82
Iron	*650[c]*	593	489	489	491	488	484	470	454	449	454	481	487	487
Mercury	*0.026*	0.0065	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Manganese	*190[b]*	51.5	46.7	46.8	46.4	46.7	46.7	46.4	46.0	45.9	45.7	46.2	46.4	46.6
Molybdenum	*73*	1	1.45	1.47	1.24	1.52	1.68	2.14	2.57	2.74	2.47	1.54	1.40	1.51
Nickel	*25*	1	2.14	2.17	1.76	2.07	2.63	3.85	5.14	5.50	4.74	2.45	1.98	2.19
Lead	*1*	0.30	0.34	0.34	0.33	0.34	0.34	0.35	0.36	0.37	0.36	0.34	0.33	0.34
Antimony	*20*	0.5	0.48	0.48	0.48	0.48	0.48	0.46	0.45	0.44	0.45	0.47	0.48	0.48
Selenium	*1*	0.5	0.45	0.45	0.45	0.45	0.45	0.44	0.44	0.43	0.43	0.45	0.45	0.45
Thallium	*0.8*	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Uranium	*15[b]*	0.05	0.11	0.11	0.08	0.12	0.14	0.20	0.26	0.28	0.25	0.12	0.10	0.12
Zinc	*7[f]*	2.5	4.12	4.14	3.89	4.05	4.41	5.16	5.96	6.17	5.68	4.30	4.00	4.13
Nitrate	*13,000[b]*	*25*	104	106	84	99	130	199	271	291	249	122	95	106
Nitrite	*60[b]*	*5*	6.48	6.53	6.04	6.36	7.05	8.50	10.03	10.43	9.51	6.83	6.26	6.51
Ammonia	*27,550[g]*	*25*	36.5	36.7	34.1	35.8	39.6	47.5	55.9	58.1	53.0	38.4	35.3	36.6

Source: Appendix G.2 Beaver Dam Mine: Killag River and Moose River Water Quality Predictions and Aquatic Effects Assessment – Reassessment of Killag River based on February 2021 Update (GHD modelling Provided February 12, 2021); Reassessment of Moose River based on March 2021 Update (Stantec modelling of March 11, 2021) (Intrinsik 2021).

Notes: All values are presented as µg/L. For the purposes of summary here, **bolded** predicted values are greater than applicable water quality criteria; grey shaded values are greater than 75th percentile baseline values. Results indicate that while concentrations are predicted to increase relative to baseline conditions for some parameters, no values are predicted to be greater than applicable water quality criteria (i.e., selected benchmark). As water quality criteria are defined by national and international entities as protective of the receiving environment and all water users, there are no anticipated effects to surface waters are a result of discharges from the Project to the Killag River in this scenario.

(a) Selected benchmarks represent Nova Scotia Tier 1 guidelines unless specified otherwise.

(b) Adopted from CCME.

(c) Based on baseline concentration in the Killag River (75th percentile).

(d) Site-specific water quality guideline.

(e) Selected guideline represents Environment Canada (2017) FEQG for the protection of aquatic life at water hardness of 52 mg/L.

(f) Selected guideline represents the Long-term CWQG, SSD 5th percentile at water hardness of 50 mg·L-1, pH of 7.5 and DOC of 0.5 mg·L-1.

(g) Selected guideline represents the ammonia (total) CCME guideline value at pH 6.0 and temperature of 25ºC, multiplied by 0.8224 (for the conversion of NH_3 to total ammonia-N).

Table 6.7-39: Predicted Water Quality of Killag River at Killag River at Far-Field Discharge Point - PC Conditions Upper Case

Constituent	*Selected Benchmark Concentration[a]*	*75th Percentile Baseline Surface Water*	Predicted Concentration (µg/L)											
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Silver	*0.25[b]*	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Aluminum	*290[c]*	280	243	243	244	243	240	232	224	221	224	239	242	242
Arsenic	*30[d]*	2.1	1.60	1.60	1.57	1.61	1.62	1.64	1.66	1.67	1.64	1.59	1.59	1.60
Cadmium	*0.04[b]*	0.022	0.020	0.021	0.020	0.020	0.021	0.023	0.025	0.026	0.025	0.021	0.020	0.020
Cobalt	*0.78[e]*	0.21	0.42	0.43	0.37	0.41	0.48	0.64	**0.80**	**0.84**	0.75	0.46	0.40	0.43
Copper	*2*	1	0.84	0.84	0.83	0.84	0.84	0.84	0.84	0.84	0.83	0.83	0.83	0.84
Iron	*650[c]*	593	488	489	490	487	483	468	451	446	451	480	486	486
Mercury	*0.026*	0.0065	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Manganese	*190[b]*	51.5	46.7	46.8	46.4	46.7	46.7	46.4	45.8	45.7	45.6	46.1	46.4	46.6
Molybdenum	*73*	1	1.49	1.51	1.26	1.57	1.74	2.24	2.70	2.88	2.59	1.59	1.43	1.56
Nickel	*25*	1	2.66	2.71	2.09	2.57	3.39	5.20	7.10	7.63	6.52	3.13	2.42	2.74
Lead	*1*	0.30	0.36	0.36	0.35	0.35	0.37	0.41	0.44	0.45	0.43	0.36	0.35	0.36
Antimony	*20*	0.5	0.48	0.48	0.48	0.48	0.48	0.46	0.45	0.44	0.45	0.47	0.48	0.48
Selenium	*1*	0.5	0.46	0.46	0.46	0.46	0.47	0.47	0.47	0.48	0.47	0.46	0.46	0.46
Thallium	*0.8*	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Uranium	*15[b]*	0.05	0.12	0.12	0.09	0.12	0.15	0.22	0.28	0.31	0.27	0.13	0.11	0.13
Zinc	*7[f]*	2.5	4.41	4.44	4.07	4.31	4.83	5.91	**7.05**	**7.35**	6.66	4.67	4.24	4.43
Nitrate	*13,000[b]*	*25*	148	151	113	138	195	316	445	479	404	181	132	152
Nitrite	*60[b]*	*5*	7.50	7.57	6.71	7.26	8.53	11.19	14.03	14.76	13.10	8.18	7.11	7.56
Ammonia	*27,550[g]*	*25*	42.1	42.5	37.7	40.7	47.7	62.3	77.8	81.8	72.7	45.8	39.9	42.4

Source: Appendix G.2 Beaver Dam Mine: Killag River and Moose River Water Quality Predictions and Aquatic Effects Assessment – Reassessment of Killag River based on February 2021 Update (GHD modelling Provided February 12, 2021); Reassessment of Moose River based on March 2021 Update (Stantec modelling of March 11, 2021) (Intrinsik 2021).

Notes: All values are presented as µg/L. For the purposes of summary here, **bolded** predicted values are greater than applicable water quality criteria; grey shaded values are greater than 75th percentile baseline values. No values are predicted to be greater than selected benchmarks. Results indicate that cobalt and zinc concentrations are greater than baseline and water quality criteria in some months in this scenario. As a result of these predictions, Atlantic Mining has committed to implementation of a water treatment system to ensure that all site effluent water meets MDMER and will reflect assimilation capacity of the receiving environment, such that any potential effects to the Surface Water Quality VC, and downstream water users, will be fully mitigated.

(a) Selected benchmarks represent Nova Scotia Tier 1 guidelines unless specified otherwise.

(b) Adopted from CCME.

(c) Based on baseline concentration in the Killag River (75th percentile).

(d) Site-specific water quality guideline.

(e) Selected guideline represents Environment Canada (2017) FEQG for the protection of aquatic life at water hardness of 52 mg/L.

(f) Selected guideline represents the Long-term CWQG, SSD 5th percentile at water hardness of 50 mg·L-1, pH of 7.5 and DOC of 0.5 mg·L-1.

(g) Selected guideline represents the ammonia (total) CCME guideline value at pH 6.0 and temperature of 25ºC, multiplied by 0.8224 (for the conversion of NH_3 to total ammonia-N).

Construction Predictions-Killag River

As limited information was available for the Construction Phase, the water quality of a similar site (i.e., Touquoy) was used as an indication of water quality for the Project (Appendix P.4 Mine Water Management Plan, Appendix F.1 [Water Treatment Assessment Construction]), rather than mass and water balance modelling. There will be three main sources of impacted water that may need treatment before discharge during the construction phase. The first source will be the existing body of water in the open pit area which is expected to require minimal to no treatment. The second source of water would be impacted water which is in contact with historical tailings and is expected to have a high concentration of metals such aluminum, arsenic, cadmium, cobalt, copper, iron, manganese, mercury, lead, and zinc. This source of water will include any leachate that will be generated as the result of historical sediment removal. The third source of water that will need treatment during the construction phase would be precipitated water which comes in contact with impacted material.

To support assessment of effects during the Construction Phase, analysis results of two samples from the historical tailing water (HT-EXW-01 and HT-EXW-02) and one sample from the pit sump were provided by AMNS from the Touquoy site. Results of this evaluation indicate that aluminum, arsenic, cadmium, cobalt, copper, iron, manganese, mercury, lead, and zinc are among exceeded parameters and likely will require treatment (Appendix P.4 Mine Water Management Plan, Appendix F.1 [Water Treatment Assessment Construction]). The same results show that polyaromatic hydrocarbons such as anthracene, benzo(a)anthracene, benzo(a)pyrene, fluoranthene, and pyrene also exceeded Nova Scotia Environment (NSE) Tier 1 Environmental Quality Guidelines (EQS) for Surface Water in the historical tailing water. The concentrations of polyaromatic hydrocarbons were below the detection limit for the pit sump water. The complete water quality analytical report is presented in Appendix P.4, Appendix F.

In response to IR2 issued by IAAC (CEAA 2019) and Nova Scotia Environment (NSE 2019), and as a result of ongoing water quality and quantity and geochemical studies for the Project, water treatment for Construction is planned for the Project. Details for water management and evaluation of alternative water treatments are presented in Appendix F in Appendix P.4. Note, the treatment system will be designed to ensure that all site effluent water meets MDMER and will reflect assimilation capacity of the receiving environment, such that any potential effects to the Surface Water Quality VC, and downstream water users, will be fully mitigated.

EOM Predictions- Killag River

During EOM conditions site water from the waste rock, low grade ore stockpiles and the pit will be routed through the North Settling Pond prior to discharge into the Killag River. Additionally, clean water from the site will be diverted and discharged directly to Mud Lake. There will also be clean discharge from the eastern till stockpiles to the Killag River. During PC conditions, site water from the waste rock stockpiles will be routed through the pit prior to discharge into the Killag River.

In summary, under the EOM scenarios, predicted mass balance near-field mixing zone and far-field mixing zone chemical concentrations in the base case are consistently below selected water quality benchmarks. The initial analysis assumed no treatment of mine contact water in the north settling pond and only analyzed the results from a mass balance (dilution) calculation at the extent of the predicted mixing zone. The results indicated that, while concentrations for some parameters are anticipated to increase above baseline levels, at the near-field mixing zone there are no exceedances of either CCME, NSE Tier 1 criteria. As water quality criteria are defined by national and international entities as protective of the receiving environment and all water users, there are no anticipated effects to surface waters are a result of discharges from the Project to the Killag River.

However, in the EOM upper case scenario, nitrite is predicted to exceed CCME regulatory guidelines in three months of the year. Note, modelling for the Project is conservative, and based on the principles of mass balance. That is, while mass and water balance models (including GoldSim) provide capabilities for simulating mass and water balances, these processes do not represent complete reaction paths and water quality predictions are expected to be further governed by in situ processes. This included equilibrium reactions, sorption reactions and solubility limits which, together, would generally service to reduce concentrations of many quality parameters predicted by the mass balance. In particular, nitrite is known to be unstable in oxygenated environments (such as the Killag River), oxidizing to Nitrate and/or bio-assimilated. Thus, it is likely that nitrite concentrations have been overestimated for the Killag River, in both base case and upper-case scenarios. However, in response to IR2, potential nitrite removal technologies have been identified and evaluated for the Project (Appendix P.4 Mine Water Management Plan, Appendix F.2 [Water Treatment Assessment – Operations).

Similarly, in response to IR2 issued by Canadian Environmental Assessment Agency and Nova Scotia Environment, and as a result of ongoing water quality and quantity and geochemical studies for the Project, water treatment for both EOM and PC is planned for the Project. Details for water management and evaluation of alternative water treatments are presented in Appendix F.3 (Post-Closure Water Treatment Assessment) in Appendix P.4 (Mine Water Management Plan). Note, the treatment system will be designed to ensure that all site effluent water meets MDMER and will reflect assimilation capacity of the receiving environment, such that any potential effects to the Surface Water Quality VC, and downstream water users, will be fully mitigated (Section 6.7.9).

PC Predictions- Killag River

During PC conditions the pit lake discharges into the Killag River directly. Predictions were generated for the PC at near-field mixing zone assessment point and PC far-field mixing zone assessment point. The initial analysis assumed no treatment of mine contact water in the pit lake and only analyzed the results from a mass balance (dilution) calculation at the extent of the predicted mixing zone. There is contingency for an interception trench during PC if there are potential impacts from the PAG pile on groundwater. Water from the interception trench will be directed to the pit and/or treated.

At the near-field and far field mixing zones the results from the analysis concluded that during base case scenario, while concentrations for some parameters are anticipated to increase above baseline levels, there are no exceedances of either CCME, NSE Tier 1 criteria. As water quality criteria are defined by national and international entities as protective of the receiving environment and all water users, there are no anticipated effects to surface waters are a result of discharges from the Project to the Killag River. However, results from the upper-case scenario suggest there is potential for a slight exceedance of the CCME guideline for cobalt and zinc in July and August, which is within range of natural variability. If monitoring data deviates from impact predictions, then water treatment will be undertaken.

Under the PC scenarios, there is little difference between predicted chemical concentrations at near-field mixing zone (pit lake discharge) and far-field mixing zone locations for each assessment each case. The results for the mass balance assessment during the base case PC scenarios the chemical concentrations are consistently below selected water quality benchmarks. In upper case PC scenarios, cobalt and zinc concentrations are predicted to exceed selected water quality benchmarks at both locations without during the months of July and August. An aquatic ecological risk assessment is provided in (Appendix G.2). If monitoring data deviates from impact predictions, then water treatment will be undertaken. Results for cobalt and zinc, are further discussed below:

- **Cobalt**, the predicted PC cobalt concentration at the near-field location marginally exceeds the Federal Environmental Quality Guideline (FEQG; 0.78 µg/L) in the upper case (0.8 and 0.85 µg/L in July and August; Table 6.7-35). The concentrations are up to 1.1 times the FEQG. A similar situation occurs with the PC far field location, wherein cobalt

concentrations are predicted to range between 0.8 to 0.84 µg/L in July and August (upper case; Table 6.7-39). Additional water quality modelling was conducted to confirm hardness levels in the receiving environment, following effluent release. his modelling indicates that hardness in the near field receiving environment is predicted to increase to 11.4 mg/L $CaCO_3$ in the PC upper case. These hardness levels are also predicted for the far field location. The FEQG considers hardness as a modifying factor, and was derived for water hardness values ranging between 52 to 396 mg/L. The FEQG of 0.78 µg/L represents the guideline value using a water hardness of 52 mg/L. Given that the water hardness in the near field receiving environment is predicted to be below this range, there is some uncertainty associated with the use of this guideline value. However, the SSD model developed by Environment Canada in this guideline setting approach is very conservative, and the data used in the assessment do not fit the selected model of the SSD in the lower quartile of the dataset well (see Figure 1; ECCC, 2017). This results in the estimated HC5 value being considerably lower than it should be, relative to the toxicity dataset. This indicates that the selected guideline is over predicting toxicity of cobalt, and hence, the marginal exceedances predicted are unlikely to pose a risk in the receiving environment. In addition, Dissolved Organic Carbon (DOC) is an additional modifying factor for cobalt toxicity (Stubblefield et al., 2020). This factor was not considered in the development of the FEQG, and would assist in mitigating potential for toxicity, based values that cobalt is largely non-detect in the baseline data, at a detection limit of 0.4 µg/L (Table 6.7-12). The predicted concentrations have been added to a mean value which may be biased high due to the non-detect samples. For additional context, it is interesting to note that Stubblefield et al. (2020) published two water quality guidelines for cobalt recently as follows:

- European-based approach and EC_{10} values and a species sensitivity distribution (SSD), yielding a median hazardous concentration for 5% of the organisms (HC5, 50%) of 1.8 µg/L; and
- A US EPA-style approach, using EC_{20} values in a SSD to derive a final chronic value (FCV) of 7.13 µg/L (note: this approach is more relaxed than typical Canadian approaches for deriving water quality standards, and hence, it is not recommended to use this value).

Neither of these approaches used hardness, or other water quality factors as modifiers. Based on the marginal degree of exceedance, the presence of elevated DOC concentrations, and increased hardness levels associated with the release of effluent, cobalt is considered unlikely to pose a risk to aquatic life:

- **Zinc**: The predicted concentrations do not exceed the new CCME guideline for zinc (7 µg/L) in the EOM scenarios for near field or far field. Additionally, predicted concentrations do not exceed the CCME guideline for zinc in the PC scenarios for near or far field in the base case, but do in the upper case. In the near field PC scenario, upper case predicted exceedances from the pit are 7.09 and 7.39 µg/L in July and August, respectively (Table 6.7-35). In the far field PC scenario, upper case predicted exceedances are 7.05 and 7.35 µg/L in July and August, respectively (Table 6.7-39). The Lowest observed effect concentration (LOEC) listed in the CCME (2018) fact sheet is 9.89 µg/L (11-week study; development; Chironomid sp.; normalized to 50 mg/L $CaCO_3$ and Dissolved Organic Carbon (DOC) of 0.5 mg/L). The predicted concentrations are within the range of background (<5 to 7.8 µg/L; based on sample size N=15). The waters of the Killag River are soft (<10 mg/L $CaCO_3$), but the DOC is reasonably high (ranging from 7 to 20 mg/L; mean of 12.2 mg/L, based on 2019 and 2020 data), and would be expected to provide adequate protection, for several of the months where predictions indicate elevated levels. Additional water quality modelling was conducted to confirm hardness levels in the receiving environment, following effluent release. This modelling indicates in the PC base case, hardness in the near field receiving environment is predicted to increase to 11.4 mg/L $CaCO_3$ in the PC upper case. These hardness levels are also predicted for the far field location. Based on these hardness levels, and accounting for site specific pH and DOC, the zinc guideline changes to 33 µg/L (based on an assumed mean hardness: 11.4 mg/L; mean pH: 5.43; mean DOC: 12.2 mg/L). None of the predicted concentrations exceed this guideline value, and hence, predicted zinc concentrations are considered to have a low potential for toxicity.

The site will be monitored during construction and operations. The outcomes from the modelling will inform updates to water quality model to refine PC predictions. The principals of adaptive management will be applied if the outcomes from modelling differ from those predicted.

In response to IR2 issued by Canadian Environmental Assessment Agency and Nova Scotia Environment, and as a result of ongoing water quality, water quantity and geochemical studies for the Project, water treatment for both EOM and PC is planned for the Project. Details for water management and evaluation of water treatment alternatives are presented (Appendix P.4 Mine Water Management Plan, Appendix F [Water Treatment Assessments]). Note, the treatment system will be designed to ensure that all site effluent water meets MDMER and will reflect assimilation capacity of the receiving environment, such that any potential effects to the Surface Water Quality VC, and downstream water users, will be fully mitigated.

Sedimentation and Erosion Effects to the Receiving Environment

Sedimentation/Erosion and dust deposition represent the primary pathways of interaction for the Project to Surface Water. Surface disturbance during Project activities has the potential to increase sedimentation and erosion of soils and overburden materials.

The potential effects on surface water quality from increased erosion and sedimentation are qualitatively assessed; erosion and sedimentation effects on surface water quality can be indicated primarily by changes in turbidity and total suspended solids (TSS) in surface water bodies. However, for the Project there is generally minimal risk of effects from erosion and sedimentation on surface water quality due to the limited extent of planned surface disturbances and the proposed use of pre-existing infrastructure such as roads, camp, and the processing facility

Mitigation and management strategies for erosion and sediment control will follow best management practices (BMPs). General strategies for erosion prevention are described in Section 6.7.9; specific details of mitigation and management strategies for the minimization of erosion and control of sediment, including specific BMPs to be applied during Project Construction, Operations, and Closure, are discussed primarily in the Erosion and Sediment Control Plan (Appendix P.4 Mine Water Management Plan, Appendix C). Where soil erosion may still occur despite preventative measures, sediment control strategies may be implemented to capture sediments before they are released to the receiving environment. The success of erosion management and sediment control measures would be monitored by regular inspection and maintenance of all water management and sediment control structures, which will include prompt attention to potential erosion sites, ditch or culvert failure and blockage, or outside seepage. Accumulated sediment would also be routinely removed from ditches and retention structures.

Potential residual effects from sedimentation and erosion are most likely to occur during the Construction and (active) Closure phases, when surface materials will likely be disturbed during construction or reclamation activities. As TSS loads are generally low in Project are streams, any additional sediment loading has the potential to increase TSS and turbidity in the receiving environment. Potential residual effects due to sedimentation and erosion have the greatest potential to occur during periods of significant overland flow, such as freshet and rainfall events. However, planned disturbances in the Project Area are limited, and implementation of BMPs and mitigation measures as summarized in Section 6.7.9 and detailed in the Mine Water Management Plan (Appendix P.4), and will prevent substantial change of surface water quality near the proposed access corridor and other planned site upgrades. Further, water quality responses to run-off include increased concentrations of TSS but tend to be temporary and localized (Forman 1998).

pH Effects to the Receiving Environment

Effects on indicators of Surface Water Quality (total and dissolved metals, anions, and nutrients; mg/L) were either assessed quantitatively by predictive water modelling, as describe above, or qualitatively based on geochemical characterization studies and professional judgement and experience (e.g., pH and TSS). pH cannot be predicted with certainty by mass-balance models as used here. That is, while modelling for the Project is conservative, mass balances modelling processes/predictions do not represent complete reaction paths and thus for non-conservative parameters (such as pH) water quality predictions are expected to be further governed by in situ processes. Note, discharges from the project will be subject to the MDMER such that effluent concentrations must be within pH range of 6.0 to 9.5, which is protective of aquatic life. Therefore, there are no effects to Surface Water Quality as a result of Project effluent discharges.

6.7.8.3 Surface Water Quality Effects: Haul Road

6.7.8.3.1 Sedimentation and Erosion Effects

Sedimentation/Erosion and dust deposition represent the primary pathways of interaction for the Project to Surface Water. Surface disturbance during Project activities has the potential to increase sedimentation and erosion of soils and overburden materials. As described above for the Beaver Dam Mine Site, potential effects on surface water quality from increased erosion and sedimentation are qualitatively assessed; erosion and sedimentation effects on surface water quality can be indicated primarily by changes in turbidity and total suspended solids (TSS) in surface water bodies. However, for the Project there is generally minimal risk of effects from erosion and sedimentation on surface water quality due to the limited extent of planned surface disturbances and the proposed use of pre-existing infrastructure such as roads, camp, and the processing facility.

At the Haul Road, portion of the road will have to be widened to accommodate two-way traffic. However, some deviations in the existing route may be required as described in the Project Description (Section 2). Water courses potentially affected by development and use of the Haul Road are identified in Table 6.7-40.

Table 6.7-40: Watercourses Directly Impacted by Beaver Dam Mine Site Infrastructure and Haul Road

Watercourse ID	Total Delineated Watercourse Length (m)	Estimated Direct Impact Length (m)	Estimated Direct Impact Area (m^2)[a]	Infrastructure	Fish Habitat Potential?
1	70	4	2	Haul Road	Yes
5	1,495	50	65	Road in Mine Site, Drainage Ditch	Yes
12	147	147	331	Open Pit	Yes
14	196	115	115	Road in Mine Site	Yes
18	344	133	40	Road in Mine Site, Drainage Ditch	No
20	331	3	5	Drainage Ditch	No
21	60	60	12	NAG Stockpile	No
25	39	2	4	Road in Mine Site	Yes
WC-C	75	19	11	Haul Road	No
WC-D	34	12	6	Haul Road	No
WC-E	160	14	14	Haul Road	No
WC-F	269	14	15	Haul Road	Yes
WC-G	277	17	33	Haul Road	Yes
WC-H	211	17	52	Haul Road	No
WC-I	67	5	4	Haul Road	No

Table 6.7-40: Watercourses Directly Impacted by Beaver Dam Mine Site Infrastructure and Haul Road (continued)

Watercourse ID	Total Delineated Watercourse Length (m)	Estimated Direct Impact Length (m)	Estimated Direct Impact Area (m^2)[(a)]	Infrastructure	Fish Habitat Potential?
WC-J	119	26	33	Haul Road	No
WC-K	98	8	2	Haul Road	No
WC-L	99	60	18	Haul Road	No
WC-M	158	15	10	Haul Road	No
WC-N	210	20	240	Haul Road	No
WC-O	415	14	31	Haul Road	No
WC-P	35	17	12	Haul Road	No
WC-T	94	25	45	Haul Road	No
WC-U	91	11	9	Haul Road	No
WC-V	255	23	25	Haul Road	No
WC-W	85	15	13	Haul Road	Yes
WC-X	94	6	3	Haul Road	Yes
WC-Y	103	15	7	Haul Road	No
WC-AA	162	27	54	Haul Road	Yes
WC-AC	139	4	8	Haul Road	No
WC-AD	272	15	216	Haul Road	No
WC-AE	112	14	11	Haul Road	No
WC-AF	72	7	8	Haul Road	No
WC-AG	98	9	6	Haul Road	No

Notes: [(a)] Average wetted width used to calculate estimated impact area. m = meter; m^2 = square meter.

The Haul Road crosses three watercourses, which are between 6 and 13 m wide, via single lane timber bridges. These bridges will be replaced with dual lane, clear-span, pre-engineered, single arch modular bridges designed to not result in any impediment on water flow and fish passage. The road also crosses several smaller watercourses. Detailed discussion on current condition of culverts including recommendation on culvert replacements in provided in Fish and Fish Habitat effects assessment (Section 6.9 in Table 6.9-17 Potential Direct Fish Habitat Impacts within the Haul Road).

Water quality effects due to erosion and sedimentation will be mitigated by implementation of the draft Erosion and Sediment Control Plan (Appendix P.4 Mine Water Management Plan, Appendix C); mitigation and management strategies for erosion and sediment control will follow best management practices (BMPs); general strategies for erosion prevention are summarized in Section 6.7.9.

The success of erosion management and sediment control measures would be monitored by regular inspection and maintenance of all water management and sediment control structures, which will include prompt attention to potential erosion sites, ditch or culvert failure and blockage, or outside seepage. Accumulated sediment would also be routinely removed from ditches and retention structures.

At the Haul Road, potential residual effects from sedimentation and erosion are most likely to occur during the Construction and (active) Closure phases, when surface materials will likely be disturbed during construction or reclamation activities. As TSS loads are generally low in Project area streams, any additional sediment loading has the potential to increase TSS and turbidity in the receiving environment. Potential residual effects due to sedimentation and erosion have the greatest potential to occur during

periods of significant overland flow, such as freshet and rainfall events. However, planned disturbances in the Project Area are limited, and implementation of BMPs and mitigation measures as summarized in Section 6.7.9 and detailed in Environmental Management and Monitoring Plans; these , and will prevent substantial change of surface water quality near the proposed access corridor and other planned site upgrades. Further, water quality responses to run-off include increased concentrations of TSS but tend to be temporary and localized (Forman 1998).

6.7.8.3.2 Dust Deposition

Sedimentation/Erosion and dust deposition represent the primary pathways of interaction for the Project to Surface Water. In response to CEAA-2-36, CEAA-2-37 and NSE-2-130 (AMNS 2021) and included in Appendix F.9 (Evaluation of Potential Impacts from Metals COCs to Groundwater and Surface Water from Dust Deposition along the Haul Road), potential effects on surface water quality (and groundwater) from dust deposition were quantitively assessed by air dispersion modelling. Appendix F.9 presents the air dispersion model and associated results, including the quantitative evaluation of potential impacts to surface water from metals found in dust that may be deposited on surficial soil and surface water along the Haul Road for the Project. Table 6.7-41 summarizes the results of the air dispersion modelling relative to maximum annual dust deposition rates, in terms of total particulate, at the sensitive receptor locations and Haul Road sections where maximum dust deposition occurs.

Table 6.7-41: Maximum Predicted Annual Deposition Rates for Total Particulate, Haul Road

Sensitive Receptor ID and Description	Project Alone[(a)] (g/m^2-yr)	Cumulative Project and Nearby Projects[(a)] (g/m^2-yr)
R1 9 Beaver Dam Mine Road (Marlborough Property)	27.9	31.5
R2 4112 Highway 224 (Beaver Lake IR 17)	0.3	0.3
R3 4115 Highway 224 (Cottage on Crown land)	0.8	0.9
R4 3492 Highway 224 (Hobbs Property)	45.1	50.9
R5 3379 Highway 224 (McLeod Property)	6.0	6.7
R6 3373 Highway 224 (Smith Property)	5.0	5.6
R7 Tangier River (Deepwood Estates Property)	82.4	93.1
R8 Tangier River (Musqudoboit Lumber Co Ltd. Property/John Dickson Lease)	11.7	13.2
R9 5579 Mooseland Road (Lloy Property)	36.5	41.2
Road Section R1	227.6	257.2
Road Section R9	194.4	219.7
Road Section STP	224.5	253.7
Road Section East Corner	210.2	237.5

Notes: [(a)] Annual dust deposition rates correspond to 80% dust suppression. g/m^2-yr = grams per squared metres per year.

Modelling results indicated that highest maximum annual deposition rate along the Haul Road occurs at Road Section R1, and the maximum annual deposition rate for a sensitive receptor occurs at Sensitive Receptor R7, both of which correspond to the cumulative condition where the Haul Road is utilized for the Project as well as the nearby projects.

To assess the impact of dust deposition on downstream surface water bodies through surface water runoff, the maximum dust deposition rate at Road Section R1 for the cumulative condition (i.e., the Project as well as the nearby projects) also is assumed to occur over all 9 years of Haul Road use and is applied to estimate metals COCs concentrations in surface water runoff; complete details of modelling methodologies, including estimate of metal concentrations in soil leachate and surface water runoff, are

provided in Appendix F.9 (Evaluation of Potential Impacts from Metal Contaminants of Concern to Groundwater and Surface Water from Dust Deposition along the Haul Road).

Summary findings of dust deposition effects are presented in Table 6.7-42 and Table 6.7-43 and provide the estimated metals concentrations in in surface water runoff from Road Section R1, and in Ferry Lake surface water. Ferry Lake is located approximately 1.5 km southeast of the Haul Road and is the only surface waterbody that was identified as a potable water supply in the vicinity of the Haul road. Results indicate that concentrations are below applicable surface water quality guidelines/criteria.

Table 6.7-42: Estimated Maximum Soil Leachate and Surface Water Runoff Metals Contaminate of Concern Concentrations Due to Haul Road Dust Deposition at Sensitive Receptor R7 and Road Section R1

Contaminant of Concern	Maximum Leachable Soil Concentration at Time tD Sensitive Receptor R7 C_s (1) (mg/kg)	Maximum Leachable Soil Concentration at Time tD Road Section R1 C_s (1) (mg/kg)	Soil-water Partitioning Coefficient K_{ds}(2) (mL/g)	Maximum Soil Leachate Concentration C_w (3) (µg/L)	Maximum Soil Surface Water Runoff Concentration C_w (3) (µg/L)	Applicable Potable Groundwater Criteria		Applicable Potable Surface Water Criteria	
						(µg/L)	Source (4)	(µg/L)	Source (5)
Metals									
Aluminum	2.37E-02	6.52E-02	1.50E+03	1.58E-02	4.35E-02	20,000	c)	5	b)
Antimony	1.42E-05	3.91E-05	4.50E+01	3.14E-04	8.66E-04	6	a)	6	a)
Arsenic	2.08E-05	5.73E-05	2.90E+01	7.14E-04	1.97E-03	10	a)	5	b)
Barium	1.17E-04	3.23E-04	4.10E+01	2.85E-03	7.84E-03	1,000	a)	1,000	a)
Beryllium	3.73E-05	1.03E-04	7.90E+02	4.72E-05	1.30E-04	4	a)	4	a)
Boron	2.60E-05	7.16E-05	3.00E+00	8.26E-03	2.28E-02	5,000	a)	1,500	b)
Cadmium	2.13E-06	5.88E-06	7.50E+01	2.84E-05	7.82E-05	5	a)	0.09	b)
Chromium Total	1.47E-05	4.05E-05	1.90E+01	7.68E-04	2.11E-03	50	a)	50	a)
Cobalt	2.03E-06	5.61E-06	4.50E+01	4.51E-05	1.24E-04	10	a)	10	a)
Copper	1.32E-05	3.65E-05	3.50E+01	3.77E-04	1.04E-03	1,000	a)	2	b)
Iron	4.55E-04	1.25E-03	2.50E+01	1.81E-02	4.98E-02	300	a)	300	b)
Lead	2.07E-06	5.71E-06	9.00E+02	2.30E-06	6.34E-06	5	b)	1	b)
Magnesium	7.55E-03	2.08E-02	4.50E+00	1.63E+00	4.48E+00	None Required	b)	None Required	b)
Manganese	2.85E-04	7.86E-04	6.50E+01	4.38E-03	1.21E-02	50	a)	50	a)
Mercury	1.09E-07	3.00E-07	3.30E+03	3.30E-08	9.10E-08	1	a)	0.026	b)
Molybdenum	3.61E-05	9.94E-05	2.00E+01	1.79E-03	4.94E-03	70	a)	70	a)
Nickel	1.44E-05	3.96E-05	6.50E+01	2.21E-04	6.08E-04	100	a)	25	b)
Selenium	6.39E-06	1.76E-05	5.00E+00	1.24E-03	3.42E-03	10	a)	1	b)
Silver	3.33E-07	9.17E-07	8.30E+00	3.94E-05	1.09E-04	100	a)	0.25	b)
Strontium	4.32E-04	1.19E-03	3.50E+01	1.23E-02	3.39E-02	4,400	a)	4,400	a)
Thallium	4.16E-06	1.14E-05	7.10E+01	5.84E-05	1.61E-04	2	a)	0.8	b)
Vanadium	2.28E-04	6.28E-04	1.00E+03	2.28E-04	6.28E-04	6.2	a)	6.2	a)
Zinc	3.02E-04	8.32E-04	6.20E+01	4.86E-03	1.34E-02	5,000	a)	7	b)
Uranium	1.02E-05	2.80E-05	4.50E+02	2.26E-05	6.22E-05	20	b)	15	b)

Notes:

(1) From Table 4.

(2) From Table 2.

(3) Calculated using Equation 6.

(4) Potable groundwater criteria obtained from:

a) NSE, 2014: Environmental Quality Standards for Contaminated Sites, Rationale and Guidance Document, Tier 1 Environmental Quality Standards (EQS) for Potable Groundwater, April.

b) Health Canada, 2019: Guidelines for Canadian Drinking Water Quality, Summary Table, Maximum Acceptable Concentration (MAC), June.

c) USEPA, 2019: Tapwater Regional Screening Level, April (https://semspub.epa.gov/work/HQ/199432.pdf).

None Required - Magnesium is an essential nutrient.

(5) Potable surface water criteria obtained from:

a) NSE, 2014: Environmental Quality Standards for Contaminated Sites, Rationale and Guidance Document, Tier 1 Environmental Quality Standards (EQS) for Potable Groundwater, April.

b) CCME, 2020: Water Quality Guidelines for the Protection of Aquatic Life.

mg/kg = milligrams per kilograms; mL/g = millilitres per grams; µg/L= micrograms per litre.

Table 6.7-43: Estimated Average Annual Maximum Metals Contaminant of Concern Concentrations in Ferry Lake Surface Water

Contaminant of Concern	Total Direct Deposition COC Load to Ferry Lake L_{DEP} (1) (g/yr)	Average Annual Surface Water Runoff COC Load L_R (2) (g/yr)	Average Annual Soil Erosion COC Load L_E (3) (g/yr)	Total Average Annual COC Load to Ferry Lake L_T (4) (g/yr)	Fraction of Total COC Concentration in Water Column f_{wc} (5) (unitless)	Average Annual COC Concentration in Ferry Lake Surface Water C_{wtot} (6) (µg/L)	Applicable Potable Groundwater Criteria		Applicable Potable Surface Water Criteria	
							(µg/L)	Source (7)	(µg/L)	Source (8)
Metals										
Aluminum	8.70E+00	3.67E+00	1.59E+01	2.82E+01	3.69E-02	3.26E-01	20,000	c)	5	b)
Antimony	1.15E-02	7.32E-02	9.47E-03	9.41E-02	5.54E-01	7.23E-05	6	a)	6	a)
Arsenic	2.34E-02	1.66E-01	1.39E-02	2.04E-01	6.57E-01	1.32E-04	10	a)	5	b)
Barium	1.01E-01	6.63E-01	7.82E-02	8.42E-01	5.77E-01	6.21E-04	1,000	a)	1,000	a)
Beryllium	1.41E-02	1.10E-02	2.50E-02	5.00E-02	6.74E-02	3.16E-04	4	a)	4	a)
Boron	2.58E-01	1.93E+00	1.66E-02	2.20E+00	9.40E-01	9.96E-04	5,000	a)	1,500	b)
Cadmium	1.29E-03	6.61E-03	1.43E-03	9.33E-03	4.29E-01	9.27E-06	5	a)	0.09	b)
Chromium Total	2.42E-02	1.79E-01	9.77E-03	2.13E-01	7.43E-01	1.22E-04	50	a)	50	a)
Cobalt	1.64E-03	1.05E-02	1.36E-03	1.35E-02	5.54E-01	1.04E-05	10	a)	10	a)
Copper	1.28E-02	8.78E-02	8.84E-03	1.09E-01	6.14E-01	7.59E-05	1,000	a)	2	b)
Iron	5.82E-01	4.21E+00	3.03E-01	5.10E+00	6.89E-01	3.15E-03	300	a)	300	b)
Lead	7.77E-04	5.36E-04	1.39E-03	2.70E-03	5.97E-02	1.93E-05	5	b)	1	b)
Magnesium	5.07E+01	3.79E+02	4.90E+00	4.35E+02	9.17E-01	2.02E-01	None Required	b)	None Required	b)
Manganese	1.85E-01	1.02E+00	1.91E-01	1.40E+00	4.64E-01	1.28E-03	50	a)	50	a)
Mercury	1.29E-03	7.70E-06	7.31E-05	1.37E-03	1.74E-02	3.34E-05	1	a)	0.026	b)
Molybdenum	5.66E-02	4.17E-01	2.40E-02	4.98E-01	7.33E-01	2.89E-04	70	a)	70	a)
Nickel	9.32E-03	5.14E-02	9.61E-03	7.03E-02	4.64E-01	6.45E-05	100	a)	25	b)
Selenium	3.87E-02	2.89E-01	4.16E-03	3.32E-01	9.10E-01	1.55E-04	10	a)	1	b)
Silver	1.23E-03	9.19E-03	2.19E-04	1.06E-02	8.64E-01	5.24E-06	100	a)	0.25	b)
Strontium	4.19E-01	2.87E+00	2.89E-01	3.57E+00	6.14E-01	2.48E-03	4,400	a)	4,400	a)
Thallium	2.58E-03	1.36E-02	2.78E-03	1.90E-02	4.42E-01	1.83E-05	2	a)	0.8	b)
Vanadium	8.51E-02	5.31E-02	1.53E-01	2.91E-01	5.41E-02	2.29E-03	6.2	a)	6.2	a)
Zinc	2.01E-01	1.13E+00	2.02E-01	1.53E+00	4.75E-01	1.37E-03	5,000	a)	7	b)
Uranium	3.99E-03	5.26E-03	6.81E-03	1.61E-02	1.12E-01	6.10E-05	20	b)	15	b)

Notes:

(1) From Table 6.

(2) From Table 7.

(3) From Table 8.

(4) Calculated using Equation 7.

(5) Calculated using Equation 14.

(6) Calculated using Equation 13.

(7) Potable groundwater criteria obtained from:

a) NSE, 2014: Environmental Quality Standards for Contaminated Sites, Rationale and Guidance Document, Tier 1 Environmental Quality Standards (EQS) for Potable Groundwater, April.

b) Health Canada, 2019: Guidelines for Canadian Drinking Water Quality, Summary Table, Maximum Acceptable Concentration (MAC), June.

c) USEPA, 2019: Tapwater Regional Screening Level, April (https://semspub.epa.gov/work/HQ/199432.pdf).

None Required - Magnesium is an essential nutrient.

(8) Potable surface water criteria obtained from:

a) NSE, 2014: Environmental Quality Standards for Contaminated Sites, Rationale and Guidance Document, Tier 1 Environmental Quality Standards (EQS) for Potable Groundwater, April.

b) CCME, 2020: Water Quality Guidelines for the Protection of Aquatic Life

g/yr = grams per year; COC = contaminant of concern; µg/L= micrograms per litre.

Results indicate that the estimated metals COCs concentrations in at Sensitive Receptor R7, in surface water runoff from Road Section R1, and in Ferry Lake surface water are below the respective water quality criteria. As water quality criteria are defined by national and international entities as protective of the receiving environment and all water users, there are no anticipated effects to surface waters are a result of dusting and emission along the Haul Road.

6.7.8.4 Surface Water Effects: Touquoy Mine Site

The primary potential effect of the continued use of the Touquoy facility on surface water quality is the use of the exhausted open pit for tailings storage with possible seepage degrading surface water quality in receiving environments and the potential for accidents and malfunctions as described in Section 6.18.

Deposition of Beaver Dam Mine tailings in the exhausted Touquoy open pit will accelerate the time to naturally fill the pit and create a pit lake during reclamation. However, this does not change the environmental effects predicted for the reclamation and closure plans for the existing Touquoy Mine Site as it simply changes the total time for the pit to fill. Project effects are discussed further in the sections below.

6.7.8.4.1 Surface Water Quantity Modelling Results

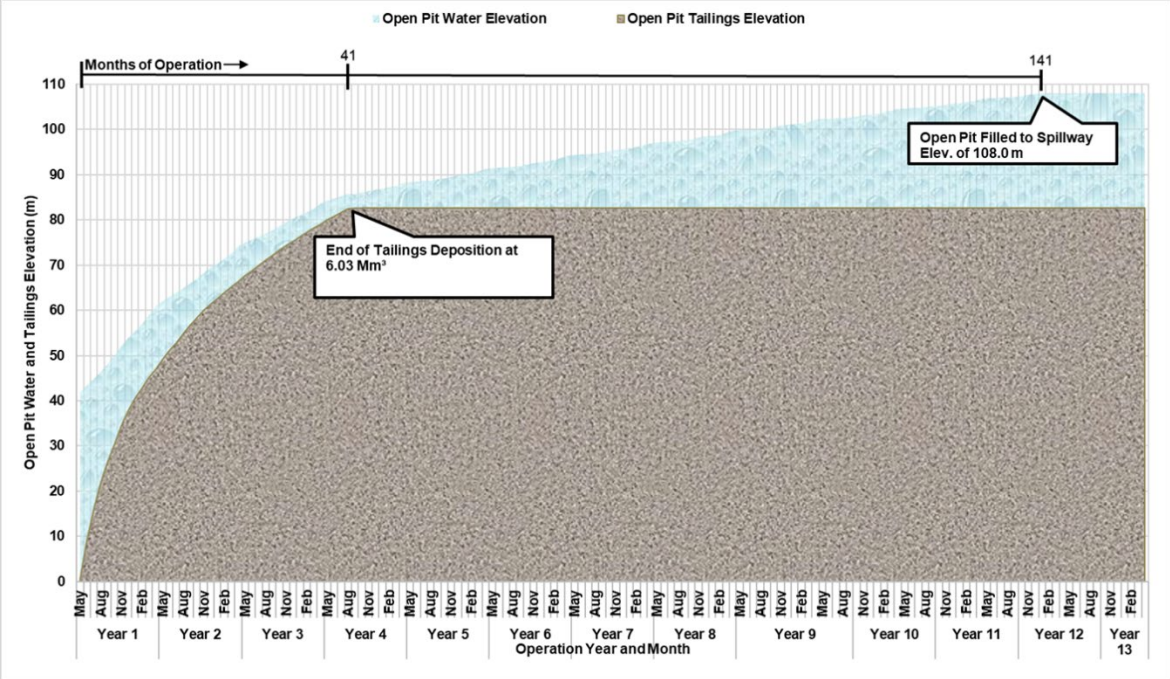
Accelerated Filling of the Pit

As originally planned in the approved Touquoy Gold Mine Project Reclamation Plan (Stantec 2017b), the inflow of groundwater, surface flow and precipitation into the pit will naturally create a lake upon closure of the site. No change to this method is planned to follow the deposition of Beaver Dam tailings, except that the time to fill the pond is accelerated given the decrease in available volume taken by the tailings.

Based on a three-dimensional model of the Touquoy ore body presented in the water and tailings management plan (Appendix F.7 [Touquoy Integrated Water and Tailings Management Plan]), the total storage capacity of the exhausted open pit at the maximum surface water elevation of 108 m CGVD2013 is estimated at 8.962 Mm^3. The water balance model predicted the amount of water and tailings stored in the pit until the pit was filled to 108 m CGVD2013. Based on results of the water balance model and the derived elevation storage relationship, tailings will be deposited in the open pit for a total of 41 months reaching an elevation in the pit of 93.2 m CGVD2013. This amounts to approximately 14.8 m of water cover above the tailings, assuming the spillway invert elevation of 108 m CGVD2013. The water balance model simulated that it would take an additional 100 months or a total of 141 months from commencement of operation to fill the pit to the spillway invert elevation. Figures 6.7-15 and 6.7-16 illustrate the predicted elevation and storage of tailings and water in the exhausted Touquoy open pit over the simulation period.

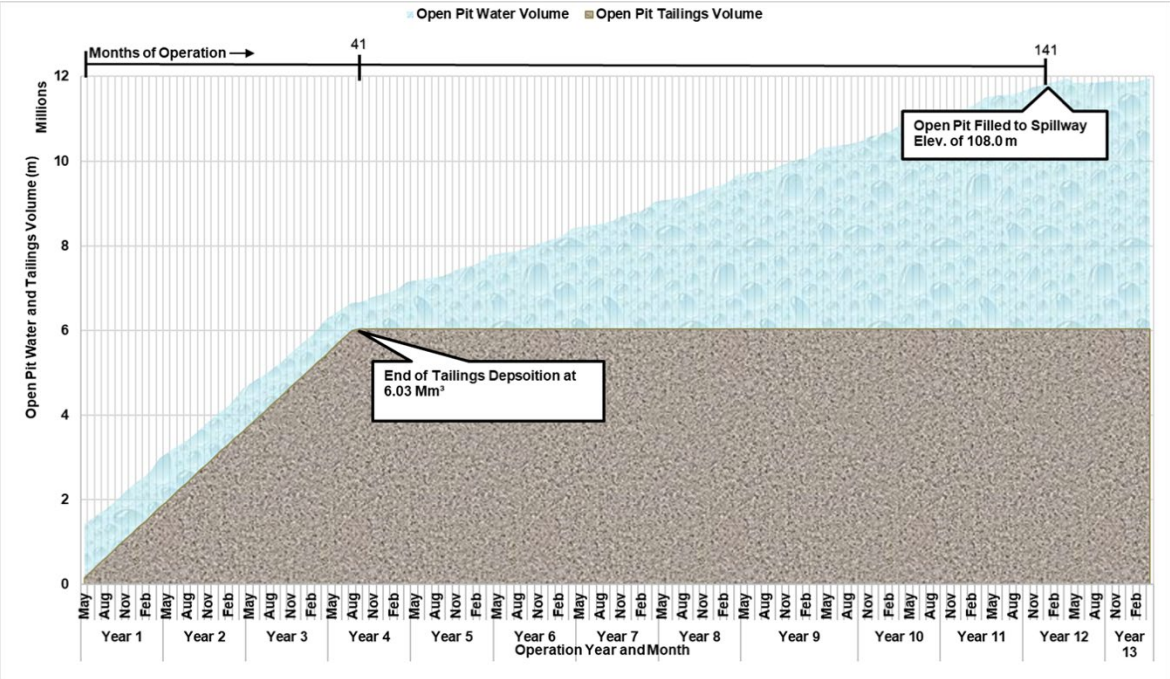
Initially, process water will be reclaimed at a rate of 8,960 m^3/d from the existing Touquoy TMF until surplus water storage in the pond is depleted. Based on results of the water balance model under climate normal conditions, three to five months of process water surplus will be available depending on the month of start-up. Subsequently, process water will be reclaimed from the exhausted Touquoy open pit at the same rate, recirculated as a closed loop through the mill facility during the remaining period of processing Beaver Dam ore at the Touquoy facility. As the current practice at Touquoy, this water management strategy reduces the quantity of mine contact water or the at the site and a lower demand on freshwater supplies.

Figure 6.7-15: Tailings and Water Elevation in the Exhausted Touquoy Open Pit



Source: Stantec 2021.

Figure 6.7-16: Tailings and Water Storage in the Exhausted Touquoy Open Pit



Source: Stantec 2021.

Extended Withdrawal from Scraggy Lake

As discussed above, process freshwater make-up requirements for Beaver Dam ore processing are similar to existing Touquoy operation. Freshwater make-up for the process is sourced from Scraggy Lake, as conducted under existing operations associated with processing the Touquoy ore. Additional make-up process water required in a dry year or to build a reservoir in case of a dry year will be sourced from effluent from the TMF treatment plant or Scraggy Lake, subject to NSE approval. Incremental effects to surface water quantity at Scraggy Lake is not expected, in the event water withdrawal is necessary.

Water Management in Open Pit

A spillway is proposed to be installed to prevent the pit lake from overtopping during refilling (NSE-2-197). The capacity of the spillway will be sized to accommodate the Canadian Dam Association inflow design flood and associated freeboard requirements for wind run-up and wave set-up and in consideration of DFO requirements. The spillway will discharge to a conveyance channel that outlets to Moose River, approximately 70 m downstream of the surface water monitoring station SW-2. As the predevelopment and post development catchment areas draining to the discharge location at Moose River are similar, Moose River is capable of handling the resultant flows.

A geotechnical investigation will be completed prior to the detailed design of the spillway to identify the overburden and bedrock materials that may be encountered during construction of the spillway. Any required erosion and scour protection of Moose River at the discharge location will be considered in design, as well as the roadway crossing. There are no changes in surface water management of the Touquoy pit catchment from tailings deposition in the TMF to tailings deposition in the open pit, with the exception of the timing to discharge to Moose River.

The footprint of the proposed spillway overlaps with an area of delineated historical tailings. The historical tailings encountered within the construction footprint for the spillway will be relocated to an historical tailings containment cell in the existing Touquoy TMF along with other excavated historical tailings prior to the closure of the containment cells. Blasting may be required to construct the proposed spillway. Blasting would be conducted in accordance with DFO guidelines for blasting near a watercourse. A culvert will be installed to facilitate the spillway under the road present in the proposed location of the spillway.

6.7.8.4.2 Surface Water Quality Modelling Results

Mill Process to Reduce Cyanide Concentrations in Tailings Slurry

Tailings will be subject to cyanide destruction at the process plant before flowing to the exhausted Touquoy pit. Based on water quality monitoring results at the Touquoy Mine Site for existing operation, cyanide destruction to cyanate is 99.5% effective (Lorax, 2018). Cyanate decomposes harmlessly. The majority of the residual cyanide reagent introduced to the tailings during ore processing will be degraded and hydrolyzed to carbon dioxide and ammonium during storage in the tailings pond. Similarly, this will be expected to occur for the tailings being stored in the Touquoy pit. Based on the efficiencies of cyanide destruction to cyanate (i.e., cyanide recovery) in the existing Touquoy TMF of 99.5%, there is no expectation that cyanide recovery will be an issue in processing of Beaver Dam ore. Potential failures related to cyanide recovery and proposed Touquoy pit disposal will be addressed in the Touquoy groundwater contingency plan as required in the Industrial Approval.

Degraded Pit Water Quality due to Tailings Deposition

Mill operation for Beaver Dam ore processing is planned to be consistent with Touquoy ore processing. A total of 7.84 Mt Beaver Dam ore will be processed at the existing Touquoy mill facility, extending operation at the Touquoy Mine Site for approximately an additional 41 months. Beaver Dam ore processing amounts to approximately 6.03 Mm^3 of tailings deposited sub-aqueously in the exhausted open pit. Deposition of tailings in the exhausted open pit is simulated to degrade the water quality in the pit compared to naturally filling of the pit as per the Touquoy reclamation plan (Stantec 2017b).

As presented in the technical report (Appendix F.8 Project Assimilative Capacity Study of Moose River - Touquoy Open Pit Discharge), the water quality model characterized this change in pit water quality in operation and reclamation. As described in the Geochemical Source Terms Update (Lorax, 2018) in Appendix E.3, water quality modelling considered the pore water quality in the tailings and the pit floor/ walls, the dilution from surface runoff and direct precipitation in the pit and the water quality of the mixture based on the geochemistry of the individual water quality parameters. For Beaver Dam, geochemical source term predictions were derived from upscaling of kinetic tests and Touquoy monitoring data, to represent the pore water quality of pit walls/floor in the water quality model. Pore water is expected to have elevated metal (e.g., arsenic, cobalt, copper), ammonia, nitrate and cyanide concentrations thus reducing pit lake water quality at the time of discharge. Results of the water quality model in the exhausted open pit over time for metals, ammonia, and cyanide parameters are presented in the technical report provided in Appendix F.8.

Based on the water balance model results (Appendix F.8), no water will be discharged from the exhausted Touquoy open pit until the pit reaches the spillway elevation in Year 12. This allows for many years of water treatment in the pit as a batch reactor with the objective of adjusting the pH to precipitate metals, potentially improving discharge criteria toward MDMER discharge criteria. As an additional benefit of the slow filling of the pit over time, the residence time and exposure to the atmosphere will increase, thus enhancing the natural UV degradation of cyanide and improving water quality in the pit lake.

The water quality in the Touquoy open pit will be monitored during the pit filling and as the pit level approaches the spillway elevation. The water quality will be compared to the MDMER discharge limits and will be treated as required to meet these limits. The MDMER discharge limits will decrease from the existing limits to those presented in Table 6.7-15 effective June 2, 2021. The discharge from the Touquoy Mine Site is anticipated to occur after this period, and therefore the lower MDMER limits will apply.

Change to Moose River Water Quality from Effluent Discharge and Groundwater Seepage

The water quality model of Moose River predicts the effluent concentrations under normal discharge from the Touquoy open pit combined with the groundwater seepage contributions in Moose River under the same climate conditions. Moose River will primarily be driven by climatic conditions, and April flows were selected in the modelling to represent a worst-case dilution ratio between the effluent discharge from the Touquoy open pit and Moose River. This results in conservatively higher estimates of mass loadings to the receiving environment from the Project.

It is important to note that the NS Tier 1 guideline of 5 µg/L (which is based on the CCME guideline), is for free cyanide. This guideline is not a relevant guideline to compare Total cyanide, SAD or even WAD forms of cyanide to, as it is based on the free ion, as opposed to bound forms of cyanide, which have far lower toxic potential. Based on the receiving environment predictions, WAD cyanide is approximately half of the Total Cyanide predicted concentration (0.0032 mg/L WAD, compared to 0.0074 mg/L Total). This implies that the half of the Total Cyanide prediction would be SAD, and hence, less likely to dissociate in the receiving environment (mean pH in receiving environment is 6.05). Predicted WAD concentrations in the receiving environment are below the NS Tier 1 guideline, indicating acceptable levels of risk to aquatic life. Based on this, risk to aquatic life are predicted to be low.

Predicted cobalt levels in the receiving environment (0.0011 mg/L) marginally exceed the new FEQG for cobalt (0.00078 mg/L), but are less than the NS Tier 1 cobalt value of 0.01 mg/L. The FEQG considers hardness as a modifying factor, but the SSD model developed by Environment Canada in this guideline setting approach is very conservative, and the data used in the assessment do not fit the selected model of the SSD in the lower quartile of the dataset well (Figure 1; ECCC, 2017). This results in the estimated HC5 value being considerably lower than it should be, relative to the toxicity dataset. This indicates that the selected guideline is over predicting toxicity of cobalt, and hence, the marginal exceedance is not considered to represent a concern, with respect to toxicity to aquatic species. Cobalt concentrations are predicted to decrease to 0.0010 mg/L by 120 m from the effluent discharge point (Appendix F.8, Table 10 [Project Assimilative Capacity Study of Moose River - Touquoy Open Pit Discharge]), which is 0.1 ppb above the guideline. Risks to aquatic life at this concentration are anticipated to be low (Appendix G.2).

If required during the Closure Phase, the water level in the Touquoy pit will be maintained through pumping to a water treatment plant at or beneath the permeable bedrock layer at 104 m elev. until water quality improves to meet discharge criteria. This low pit water level will provide more than adequate storage of the inflow design flood and freeboard as the lowest Touquoy pit level at surface is at 108 m elevation. As the Touquoy pit has approximately 14.8 m of water cover assuming a spillway invert of 108 m, the potential for settled tailings to be resuspended due to wind or wave action is unlikely with little potential of tailings deposited in the exhausted Touquoy pit to migrate to Moose River. This water cover over the deposited tailings will limit oxygen thus reducing metal leaching conditions and further improving water quality in the pit.

Based on the predictive modelling conducted, only Total cyanide and cobalt were predicted to exceed the selected benchmarks. For Total cyanide, the selected benchmark was the NS Tier 1 guideline, which is based on free cyanide, and hence not a relevant benchmark for comparison purposes. Based on the available toxicity data and predictions, Total cyanide is unlikely to be present in concentrations of concern to aquatic life. Cobalt predictions marginally exceed the new FEQG for cobalt (ECCC, 2017a), but do not exceed the NS Tier 1 guideline. The conservative nature of the SSD calculation within the FEQG for cobalt is potentially resulting in a biased low guideline, and based on comparisons to available toxicity data, cobalt at the predicted concentrations is not expected to result in adverse effects in aquatic life in the receiving environment.

As the pit water is planned to be treated to MDMER and any regulatory closure criteria or site-specific guidelines prior to discharge, the magnitude of the effect is expected to be negligible on Moose River quality and downstream tributaries. Discharge and seepage flow from the pit to Moose River during closure will be permanent and will occur regularly based on climate conditions. The change

on water quality of Moose River will be irreversible. The environmental effect is considered not significant after mitigation measures have been implemented.

Dilution of Pit Lake from Freshwater Make-up

Process freshwater make-up water requirements of approximately 5.8% of production or 503 m^3/d will be sourced from Scraggy Lake as per the existing NSE approval for Touquoy ore processing or other sources as directed in the NSE approval for Beaver Dam. Should additional process make-up water be required in a water reclaim deficit scenario than the Scraggy Lake supply will be supplemented with treated effluent from the existing Touquoy polishing pond. As surface water quality in the polishing pond meets effluent discharge criteria based on surface water quality results for Touquoy, the make-up water pumped to the open pit is not expected to degrade the pit lake quality and may benefit water quality through dilution.

6.7.9 Mitigation

Design and operation of surface water management infrastructure represents a key aspect of planned mitigation and management activities; surface water management infrastructure at the existing Touquoy mine and the proposed Beaver Dam Project have been developed to attain the following performance objectives:

1. minimize the amount of precipitation and runoff that comes into contact with potential contaminant sources during mine operations through surface water diversions;

2. avoid effects to surface water and downstream water users by collecting and capturing all potentially contaminated water for mine reuse (reclaim water) or directing to water treatment prior to offsite discharge; and

3. manage and control other non-contaminated surface water on the Project site.

A summary of planned mitigation and management measures are provided in Table 6.7-44 and the underlying sections. Complete details are presented in the Mine Water Management Plan, presented in Appendix P.4.

6.7.9.1 Water Treatment and Project Discharges

Predictive modelling for the Project (Section 6.7.8.2) indicated that, while concentrations for some parameters are anticipated to increase above baseline levels there are no exceedances of either CCME, NSE Tier 1 criteria. As water quality criteria are defined by national and international entities as protective of the receiving environment and all water users, there are no anticipated effects to surface waters are a result of discharges from the Project to the Killag River and so Water Treatment is not likely to be required.

However, in uppercase scenarios and predictions, modelling for the Project is suggestive of a need for water treatment for some parameters under these conditions. In response to IR2 issued by Canadian Environmental Assessment Agency and Nova Scotia Environment, water treatment for both EOM and PC is planned for the Project as a means to plan for and mitigate water quality if uppercase predictions were realized. Details for water management and planned water treatments are presented in the Mine Water Management Plan (Appendix P.4).

6.7.9.2 Sedimentation and Erosion

A draft Erosion and Sediment Control Plan (Appendix P.4 Mine Water Management Plan, Appendix C) will be implemented during construction and operation to mitigate the release of sediment from the mine site to the receiving surface water systems. A draft Erosion and Sediment Plan is included in Appendix P.4, Appendix C.

General strategies for erosion prevention are:

- minimizing clearing and grubbing dimensions during construction activities;
- controlling and directing runoff from disturbed areas by grading slopes and ditching;
- re-vegetating disturbed areas;
- limiting the length and steepness of bare, exposed slopes to minimize runoff energy;
- applying appropriate surface drainage techniques (e.g., ditch blocks, ditch surface lining, and rip-rap);
- stabilizing water diversion channels and ditches and protecting channel banks with rocks, gabions, or fibre mats; and
- protecting disturbed areas from water erosion and collecting surface water from disturbed areas for treatment, if required, to meet discharge standards prior to release.

Where soil erosion may still occur despite preventative measures, sediment control strategies may be implemented to capture sediments before they are released to the receiving environment. Sediment control measures may include installation of, for example:

- silt fences;
- weed-free straw bales;
- check dams;
- fabric-covered triangular dikes;
- gravel or sand-filled burlap bags;
- sedimentation ponds; and
- rip-rap along channels and ditches

Table 6.7-44: Mitigation Program for Surface Water Quantity and Quality

Mitigation Category	Project Phase	Mitigation Measure
Quality	C, O, CL	• Use of the following structures, as needed: • Silt fences • Silt curtains • Riprap • Check dams
	C, O, CL	• Limit exposed soil
	C, O	• Implement Erosion and Sediment Control Plan

Table 6.7-44: Mitigation Program for Surface Water Quality and Quantity (continued)

Mitigation Category	Project Phase	Mitigation Measure
	O, CL	• Segregate and manage waste rock with the potential for acid generation
	O	• Use adequately sized settling and containment ponds as required
	O	• Use flocculants and coagulants as required
	C, O	• Install perimeter ditches around site infrastructure
	O	• Provide appropriate settling time for suspended solids prior to discharge
	O	• Ensure pit water meets applicable regulatory quality criteria for discharge – otherwise treat water prior to discharge
	O	• Direct drainage ditches to designated settling ponds or other locations
	C, O	• Use above ground fuel storage tanks that meet applicable regulatory standards
	C, O	• Select appropriate type of explosive that will minimize nitrogen release to surface water and groundwater
	C, O	• Implement Surface Water Management Plan
	C, O	• Develop and implement an Emergency Response Spill Contingency Plan
	C, O	• Use clean, non-ore-bearing, non-watercourse derived and non-toxic materials for erosion control methods
	C, O, CL	• Sub-aqueous deposition of mine tailings to reduce/prevent oxides and leaching
	CL	• In the event of the potential for acid rock drainage and metal leaching, implement additional studies required to assess to actual risk and, as warranted, implement mitigative measures that will manage the source material and drainage effectively utilizing methods such as segregation and encapsulation
	C, O, CL, PC	• Minimize snow deposition into watercourses during snow removal activities
Quantity	C	• Construct drainage ditches and ponds to maintain natural flow directions when practical
	O	• Control release of settling ponds to mimic natural hydrograph, where practicable
	O	• Recycle site water for reuse wherever practical to reduce water withdrawal from lakes or streams
	O	• Recycled water must meet acceptable water quality criteria for its intended use

Notes: C = Construction; O – Operations; CL = Active Closure; m = metre; PA = Project Area.

6.7.10 Residual Effects and Significance

Table 6.7-45 presents a summary of the assessment of potential environmental effects on surface water quality. The assessment of residual effects incorporated mitigation and management plans for Project effects as included in the proposed Project design and described in Appendix P.4 (Mine Water Management Plan). However, the proposed mitigation cannot eliminate the Project-related residual effect on water quality, and the following residual effects were identified:

- change in concentrations of total and dissolved metals, anions, and nutrients, and conductivity in the receiving environment due to direct discharge, groundwater interactions and seepage, and ML/ARD;
- change in nutrient concentrations in the receiving environment due to nitrogen loading from explosives; and
- change in turbidity and TSS in the receiving environment due to erosion and sedimentation.

The following sections summarize the effects assessment for each project area (Section 6.7.8) and present the residual effect characterization as per the methodology outlined in Section 6.7.7.

6.7.10.1 Beaver Dam Mine

A summary of the predicted surface water quantity impacts, detailed above, of the mine are provided below:

- The potential effects on surface water quality from increased erosion and sedimentation are qualitatively assessed; potential residual effects from sedimentation and erosion are most likely to occur during the Construction and (active) Closure phases, when surface materials will likely be disturbed during construction or reclamation activities. As TSS loads are generally low in Project area streams, any additional sediment loading has the potential to increase TSS and turbidity in the receiving environment. Potential residual effects due to sedimentation and erosion have the greatest potential to occur during periods of significant overland flow, such as freshet and rainfall events. However, planned disturbances in the Project Area are limited, and implementation of BMPs and mitigation measures as summarized in Section 6.7.9 and detailed in Environmental Management and Monitoring Plans, and will prevent substantial change of surface water quality near the proposed access corridor and other planned site upgrades. Further, water quality responses to run-off include increased concentrations of TSS but tend to be temporary and localized (Forman 1998).
- The proposed development of the Beaver Dam Mine Site results in small increases in streamflow volume at the Killag River assessment point defined in the water balance analysis (Appendix A [Water Balance Analysis] of Appendix P.4 Mine Water Management Plan). The predicted increase in annual streamflow is 2.2% in EOM conditions and 1.1% in PC conditions. The small increases are a result of the change in land cover and the diversion away from the adjacent watersheds to the Killag River.
- There will be a 4.4% decrease in annual discharge from Crusher Lake due to the proposed water extraction to meet the domestic water demand. The proposed development results in a <1% increase in Crusher Lake discharge in PC conditions, and 18.3% and 13.7% decreases in Mud Lake discharge in EOM and PC conditions, respectively. The hydrologic impacts to Mud Lake are due to the placement stockpiles and influence of the open pit on groundwater flow patterns in the catchment.
- The proposed development results in a 1.1 to 1.2% and 5.7% reduction in annual streamflow volume at the Tent Brook and Cope Brook assessment points, respectively, in both EOM and PC conditions. The impacts to the Tent Brook system are considered to be minor. The impacts to the Cope Brook system are due to the placement of the waste rock stockpile in its baseline catchment.

A summary of the predicted surface water quality impacts of the mine are provided below:

- The results of the predictive water quality assessment demonstrate the need for treatment of the mine effluent water prior to discharge to the Killag River.
  - Nitrite (EOM) and cobalt and zinc (PC) have the potential to exceed CCME, background or site-specific guidelines within the Killag River at the near-field mixing zone locations and far-field mixing zone location.
- Treatment will occur, as required, prior to discharge into the receiving environment to ensure discharge meets MDMER regulations and concentrations in the Killag River do not exceed CCME or site-specific guidelines.
- It is unlikely ARD onset will occur during the operations phase (5 years). An engineered will be placed immediately following operations during active closure.
- At closure, the pit will be filled by diverting all surface site water to the pit, therefore submerging most of the exposed pit walls with water. This should eliminate most of the risk associated with pit wall runoff.
- Initial predictions indicate that it will take 20 to 30 years for half of the Beaver Dam Mine PAG waste rock to turn acidic.
- As part of the final closure plan, AMNS will develop and implement a Beaver Dam Mine draft ML/ARD Management Plan (draft plan is provided in Appendix E.5). This plan will determine the path forward for continued kinetic test work for Beaver Dam waste rock samples during operations and monitoring to determine if mitigation is required to manage potentially long-term acidic conditions associated with PAG waste rock at the Beaver Dam Mine Site.
- If this Plan confirms that acidic conditions are predicted during the closure phase, appropriate mitigation will be applied (refer to Section 6.7.9 for mitigation measures).

6.7.10.2 Haul Road

At the Haul Road, potential residual effects from sedimentation and erosion, as well as dusting/air deposition, are most likely to occur during the Construction and (active) Closure phases, when surface materials will likely be disturbed during construction or reclamation activities. As TSS loads are generally low in Project are streams, any additional sediment loading has the potential to increase TSS and turbidity in the receiving environment. Potential residual effects due to sedimentation and erosion have the greatest potential to occur during periods of significant overland flow, such as freshet and rainfall events. However, planned disturbances in the Project Area are limited, and implementation of BMPs and mitigation measures, summarized in Section 6.7.9 and detailed in Environmental Management and Monitoring Plans, will prevent substantial change of surface water quality near the proposed access corridor and other planned site upgrades. Further, water quality responses to run-off include increased concentrations of TSS but tend to be temporary and localized (Forman 1998).

6.7.10.3 Touquoy Mine Site

A summary of the predicted surface water quantity impacts, detailed above, of the mine are provided below:

The use of the exhausted Touquoy pit for tailings storages will result in the accelerated filling of the pit from that of the Touquoy reclamation plan.

- Tailings will be deposited in the open pit for a total of 37 months reaching an elevation in the pit of 90.5 m (CGVD 2013). This amounts to approximately 17.5 m of water cover over the deposited tailings based on a spillway elevation of 108 m CGVD 2013 and will limit oxygen, reduce metal leaching conditions and further improved water quality.
- No water will be discharged from the exhausted Touquoy open pit until the pit reaches the spillway elevation in Year 9.
- Water withdrawal from Scraggy Lake will require to be extended for an additional three years for processing Beaver Dam ore.

The use of the exhausted Touquoy pit for tailings storage of Beaver Dam tailings effect the receiving environment of Moose River through seepage and effluent discharge. As the pit lake is planned to be treated to MDMER limits and any regulatory closure criteria or site-specific guidelines prior to discharge, the magnitude of the effect is expected to be low to negligible on Moose River quality and downstream tributaries.

- The predicted receiving environment concentration of arsenic of 0.023 mg/L; risks to aquatic life associated with predicted arsenic concentrations are anticipated to be low.
- The aluminum concentration of 0.184 mg/L for aluminum is well with the natural variation of existing conditions of the Moose River; i.e., predicted below the 75th percentile receiver quality in Moose River.
- Concentrations of key parameters of interest (arsenic, cobalt, copper and nitrite) in groundwater were predicted in the model to meet CCME FAL/NSE EQS after mixing with Moose River 100 m downstream of the discharge point.

There are no further effects to surface water quality or quantity anticipated to be caused by the processing of ore and the management of tailings (exhausted pit) from the Beaver Dam Mine. Surface water quality and quantity will continue to be monitored over the life of the Touquoy facility as part of existing approval for the Touquoy mine life and the revised approval for the proposed extended life of the Touquoy site associated with processing of Beaver Dam ore.

The overall residual effect of the Project on surface water is assessed as not significant after mitigation measures have been implemented (Table 6.7-45). The moose river will be monitored as part of the EEM program to confirm impact predictions and if necessary adaptive management will be applied to the operation.

Table 6.7-45: Residual Environmental Effects for Surface Water Quantity and Surface Water Quality

Value Component (VC)	Project - VC Interactions	Mitigation and Compensation Measures	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Surface Water Quantity	Construction – Beaver Dam Mine Site and Haul Road	Project Design to evaluate hydrology patterns. Erosion and Sediment Control Measures	Low Minor changes from baseline conditions	Discrete Effects are confined to the PA (Beaver Dam Mine Site and Haul Road)	N/A	Short-Term	S VC interaction will occur at irregular intervals throughout construction phase	Reversible to Partially Reversible	Change in Water Quantity (baseflow, stream flow in Mud Lake and WC23, WC26 due to project development/construction of water management diversions etc.)	Not Significant
Surface Water Quality	Construction – Beaver Dam Mine Site and Haul Road (TSS and Dust Deposition)	Project Design to evaluate hydrology patterns. Erosion and Sediment Control Measures	Low Minor changes from baseline conditions	Discrete Effects are confined to the PA (Beaver Dam Mine Site and Haul Road)	N/A	Short-Term Effects can occur beyond 12 months and up to three years	S VC interaction will occur at irregular intervals throughout construction phase	R VC will recover to baseline conditions	Change in Water Quality Disturbance	Not Significant
Surface Water Quantity	Beaver Dam Mine Site (Crusher Lake, Killag River, Tent Brook)	Surface water from pit dewatering activities will be designed to discharge back into Cameron Flowage/Killag River at rates to mimic seasonal flows, where practicable.	Negligible to Low Minor changes from baseline conditions	Local Effect are confined to the near-field assessment area	N/A	Short-Term to Medium Term	R Effects will occur at regular intervals throughout operations	Reversible VC will recover to baseline conditions once project activities have been completed	Change in hydrology in Cameron Flowage/Killag River	Not Significant
	Beaver Dam Mine Site (Reduction in base flow to WC26 and WC23)	Predicted flow reduction. Monitoring to confirm, watercourse alteration permitting, fisheries authorization, if required	Low to High VC interaction Causes reduction in surface flow	Discrete Effects are confined to the Beaver Dam Mine Site	N/A	P VC interaction is permanent	C VC interaction will occur continuously	Irreversible While effect is reduced in PC, it is still measurable/ medium to high magnetite	Disturbance; impacts are due to the placement of stockpiles catchment	Not Significant
	Beaver Dam Mine Site (Mud Lake)	Predicted flow reduction. Monitoring to confirm.	Medium to High Resultant change is outside natural variations from baseline conditions	Discrete Effects are confined to the PA (Beaver Dam Mine Site)	N/A	Long Term	C VC interaction will occur continuously	Partially Reversible Effect decreases in PC phases	Disturbance	Not significant
Surface Water Quality	**Operations** – Beaver Dam Mine Site (Surface water quality of Killag River from effluent discharge through north settling pond and groundwater seepage)	Water Treatment at discharge (as required)	Low to Negligible Negligible change in water quality	Local Effect are confined to the near-field assessment area	N/A	Short-Term to medium term	R VC interaction will occur regularly	IR VC will not return to baseline condition	Change in water quality in the Killag	Not significant
	Operations Beaver Dam Mine Site and Haul Road (Release of non-mine-contact surface water to receiving waters resulting in reduction in water quality)	Erosion and Sediment Control Measures	Low to Negligible Minor change from baseline conditions	Local Effect are confined to the near-field assessment area	N/A	Short-Term to medium term	S VC interaction will occur sporadically	R VC will return to baseline conditions	Disturbance	Not Significant
	Closure – Beaver Dam Mine Site (Surface water quality of Killag River from pit from effluent discharge)	Water Treatment at discharge (as required)	Low to Negligible Negligible change in water quality	Local Effect are confined to the near-field assessment area	N/A	Short-Term to medium term	R VC interaction will occur regularly	Partially Reversible Effect decreases in PC phases	Disturbance	Not Significant
	Closure – Touquoy Mine Site (Storage of Beaver Dam tailings in the Touquoy open pit mine and surface water quality of Moose River from effluent discharge and groundwater seepage)	Treatment of water quality in pit as tailings are disposed in the open pit Water Treatment at discharge (as required) Continuation of the monitoring program that is currently underway at Touquoy since 2016	Low to Negligible Negligible change in water quality	Local Effect are confined to the near-field assessment area	N/A	Short-Term to medium term	R VC interaction will occur regularly	IR VC remains at the end of the activity	Disturbance	Not significant

Notes: See Section 6.7.7.2, Tables 6.7-19 and 6.7-20for definitions of the below characteristics.

Magnitude		Geographic Extent		Timing		Duration		Frequency		Reversibility	
N	Negligible	PA	Project Area	N/A	Not Applicable	ST	Short-Term	O	Once	R	Reversible
L	Low	LAA	Local Assessment Area	A	Applicable	MT	Medium-Term	S	Sporadic	IR	Irreversible
M	Moderate	RAA	Regional Assessment Area			LT	Long-Term	R	Regular	PR	Partially Reversible
H	High					P	Permanent	C	Continuous		

6.7.11 Proposed Compliance and Effects Monitoring Program

Surface water monitoring will be completed to verify the predicted environmental effects and the effectiveness of the mitigation measures for the surface water environment. Surface water monitoring will be completed to verify the predicted environmental effects and the effectiveness of the mitigation measures for the surface water environment. A draft Aquatic Effects Monitoring Program that includes Environmental Effects Monitoring (EEM) as defined under MDMER will be developed as part of the permitting process and submitted as part of the Industrial Approval application. The mitigations are outlined in Table 6.7-44.

This document will evolve through regulatory liaison, as well as public and Mi'kmaq of Nova Scotia engagement.

6.7.12 Summary of Residual Effects to Surface Water Quantity and Quality

Residual effects of the Project on Surface Water Quantity VC identified are characterized using standard criteria, including magnitude, geographical extent, duration, frequency, reversibility, and context of the effect (Table 6.7-45). Changes are assessed as Not Significant (Section 6.7.10).

Under the EOM scenarios, predicted near-field (North and East pond discharge) and far-field chemical concentrations in the base case and upper case are consistently below selected water quality benchmarks without water treatment, with the exception of nitrite, which exceeds the guideline only in the upper-case scenarios in three months/year. Under the PC scenarios, there is little difference between predicted chemical concentrations at near-field (pit lake discharge) and far-field locations for each assessment each case. In base case PC scenarios, all predicted constituent concentrations were consistently below selected water quality benchmarks. In the upper-case PC scenarios, both cobalt and zinc are predicted to exceed their respective guidelines in two months/year. Note, uppercase modelling scenarios are, by definition, of low likelihood. Thus, as water quality criteria are defined by national and international entities as protective of the receiving environment and all water users, there are no anticipated effects to surface waters as a result of discharges from the Project to the Killag River and water treatment during operations and posit closure phases is likely not required.

However, in response to IR2 issued by IAAC (CEAA 2019) and Nova Scotia Environment (NSE 2019), and as a result of ongoing water quality, water quantity and geochemical studies for the Project, water treatment for both EOM and PC is planned for the Project. Details for water management and evaluation of alternative water treatments are presented in Appendix P.4 Mine Water Management Plan (Appendix F.3 Water Treatment Assessment Post-closure). Note, the treatment system will be designed to ensure that all site effluent water meets MDMER and will reflect assimilation capacity of the receiving environment, such that any potential effects to the Surface Water Quality VC, and downstream water users, will be fully mitigated (Section 6.7.9).

Further details regarding characterization of Residual Effects as non-significant are summarized below by Project phase.

- During Construction:
  - Linear watercourses within the PA at the Beaver Dam Mine Site will be altered to support Project development.
  - Micro-sighting of infrastructure will reduce interactions with surface water features wherever possible.
  - Systems that will be altered to support Project construction are first order streams with limited fish habitat potential and low pH.
  - Haul Road upgrade and construction, with appropriate mitigation measures including proper culvert installation and erosion and sediment control measures, will have limited residual impact to linear watercourses along this route.

- During Operations:
  - With appropriate treatment of effluent discharge, the magnitude of the residual effect to the Killag River at the Beaver Dam Mine Site is considered negligible (within established criteria or background concentrations at the 100 m compliance point).
  - Effluent is predicted to be of neutral pH, limiting potential impact to Killag River.
  - Changes in flow to the Killag River from pit operations and dewatering have been predicted to be minimal.
  - There is a predicted alteration to WC5 relating to the operational water balance of the Beaver Dam Mine Site. Permitting is expected to be required to support this alteration.
  - Mud Lake will experience reductions in flow, which have been predicted to result in minimal impacts to fish.
- During Closure:
  - With appropriate treatment of effluent discharge, the magnitude of the residual effect to the Killag River at the Beaver Dam Mine Site is considered negligible (within established criteria or background concentrations at the 100 m compliance point).
  - Effluent is predicted to be of neutral pH, limiting potential impact to Killag River, a low pH river with current efforts to increase pH to support salmon restoration.
  - Considering water treatment, as required, for effluent discharge, the magnitude of the residual effect to the Moose River at the Touquoy Mine Site is considered negligible (within established criteria or background concentrations at the 100 m mixing zone).

Surface water monitoring will be completed to verify the predicted environmental effects and the effectiveness of the mitigation measures for the surface water environment. A draft Aquatic Effects Monitoring Program that includes Environmental Effects Monitoring (EEM) as defined under MDMER will be developed as part of the permitting process and submitted with the Industrial Approval application. The mitigations are outlined in Table 6.7-44.

This document will evolve through regulatory liaison, as well as public and Mi'kmaq of Nova Scotia engagement.

6.8 Wetlands

6.8.1 Introduction

6.8.1.1 Summary of Wetlands Before the Updates

In the 2019 Revised EIS (AMNS 2019), there were a total of 197 wetlands identified within the Beaver Dam Mine Site (n=81) and Haul Road (n=116), occupying a total of 123.2 hectares (ha). The identified wetlands were dominated by swamps, representing 65% of all wetland types within both the Beaver Dam Mine Site and Haul Road. Bog, fens, and marshes accounted for 6%, 3% and 3% of wetland habitat within the Bever Dam Mine Site and Haul Road, respectively. Thirteen percent of identified wetlands were complexes, largely composed of swamp, bog and fen habitat. Species at Risk (SAR) and Species of Conservation Interest (SOCI), evidence of or potential habitat were observed within identified wetlands and one WSS was identified (WL 29) through field assessments. Many wetlands were noted to have previously undergone direct or indirect disturbance as a result of timber harvesting, historic mining and/or road and trail networks.

Of the 123.2 ha of delineated wetland habitat, 22.1 ha within the Bever Dam Mine Site and 2.4 ha within the Haul Road was expected to be directly impacted by Project development. This impact area represents 18% of the identified wetland area. In total, 21 wetlands were proposed for complete alteration and 86 wetlands were proposed for partial alteration within the Beaver Dam Mine Site and Haul Road. Project development was anticipated to indirectly impact wetlands through groundwater drawdown and changes to catchment area hydrology.

6.8.1.2 Summary of Updates to Wetlands

As a result of Project Area (PA) modifications and continued infrastructure micro-siting since the Revised 2019 EIS (AMNS 2019), additional wetland habitat was delineated during the supplementary surveys. In addition, this section has been updated to reflect responses to Round 2, Information Requests (IR2) from Impact Assessment Agency of Canada (IAAC formerly the Canadian Assessment Agency of Canada [CEAA]) (CEAA 2019) and Nova Scotia Environment (NSE 20219).

A total of 236 wetlands (166.3 ha) were identified within the Beaver Dam Mine Site and Haul Road in the Updated 2021 EIS (AMNS 2021), which is an additional 43.1 ha of wetland habitat in comparison to the Revised 2019 EIS (AMNS 2019). The following wetlands are no longer located within the PA, due to Haul Road realignments and have been removed from the 2021 Updated EIS (i.e., WL130, 131, 132 and 180-199). There is no proportional change to wetland types observed within he Beaver Dam Mine Site and Haul Road, which continue to be dominated by swamps (67%). The Updated 2021 EIS (AMNS 2021) includes an expanded evaluation and discussion of wetlands with significant functions (IR2 NSE-2-178). Based on new assessment criteria and baseline surveys, six wetlands were identified as confirmed or possible Wetland of Special Significance (WSS) based on field evaluations.

Of the 166.3 ha of delineated wetland habitat, it is anticipated that 31.5 ha of wetland area will be directly impacted by the Project. This impact area represents 18% of the identified wetland area within the Beaver Dam Mine Site and Haul Road. A total of 108 wetlands are expected to be directly impacted, 34 of which are expected to be completely altered, and 74 of which are expected to be partially altered. The remaining 128 wetlands (54%) will not be directly altered. In comparison to the Revised 2019 EIS, the total area of direct wetland impact has increased by 30% (31.5 ha, previously 22.1 ha). This increase has occurred as the result of necessary Project changes to micro-site infrastructure away from fish bearing watercourses and the addition of an organics material stockpile that will be used for reclamation at closure. Modifications to the Haul Road alignment has resulted in a decrease in the total direct wetland impact area by 33%, 2.4 ha (AMNS 2019) to 1.6 ha (AMNS 2021). The updates assessment also includes an

expanded evaluation and discussion of indirect impacts to wetlands, through a revised assessment of groundwater interactions and changes to local catchment areas. Expected indirect wetland impact areas have been quantified (4.56 ha).

Project mitigation measures have been reassessed based on the new design, additional baseline surveys and updated effects assessment. A preliminary wetland monitoring plan is presented, along with a revised Preliminary Wetland Compensation Plan (Appendix H.3), which includes consideration of conservation allowances for observed SAR in response to IR2 CEAA-2-24 and CEAA-2-26.

Table 6.8-1: Updated Subsections from the 2019 Revised Environmental Impact Statement – Wetlands

2019 Revised EIS Submission (February 28, 2019)	Updated in 2021	Corresponding 2021 EIS Update Section Number	Reason for Update
-	-	6.8.1 Introduction	• New
6.8.1 Rationale for Valued Component Selection	No	6.8.2 Rationale for Valued Component Selection	-
6.8.2 Baseline Program Methodology	Yes	6.8.3 Baseline Program Methodology	• Addition of 2019/2020/2021 field surveys. • Additional survey areas as a result of PA modification for infrastructure micro-sitting. • Expanded discussion on WSS and wetlands with significant functions (IR2 NSE-2-178) • Response to IR2 NSE-2-01, NSE-2-174
6.8.3 Baseline Conditions	Yes	6.8.4 Baseline Conditions	• Present results from additional field surveys: • Additional survey areas as a result of PA modification for infrastructure micro-sitting. • Response to IR2 NSE-2-175, NSE-2-176, NSE-2-177, NSE-2-178
6.8.4 Consideration of Consultation and Engagement Results	No	6.8.5 Consideration of Engagement Results	-
6.8.5 Effects Assessment Methodology – **Boundaries**	Yes	6.8.6 Effects Assessment Methodology – **Boundaries**	• Adjusted PA description. • PA modification for infrastructure micro-sitting. • LAA was modified due to modified PA and improved interactions analysis
6.8.5 Effects Assessment Methodology – **Wetland Cumulative Effects Modeling**	Yes	6.8.6 Effects Assessment Methodology – **Wetland Cumulative Effects Modeling**	• Updated based on PA modification
6.8.5 Effects Assessment Methodology – **Thresholds for Determination of Significance**	Yes	6.8.6 Effects Assessment Methodology – **Thresholds for Determination of Significance**	• Updated significance threshold and magnitude assessment: • Reflect changes in VC baseline conditions and improve significance assessment criteria • Response to IR2 CEAA 2-02, NSE-2-09

Table 6.8-1: Updated Subsections from the 2019 Revised Environmental Impact Statement – Wetlands (continued)

2019 Revised EIS Submission (February 28, 2019)	Updated in 2021	Corresponding 2021 EIS Update Section Number	Reason for Update
6.8.6 Project Activities and Wetlands Interactions and Effects	Yes	6.8.7 Project Activities/Interactions with Wetlands	• Bolster discussion of direct and indirect impacts to fauna. Incorporated changes to assessment level and RAA. • Changes to project timelines • Updated results of Wetland CEA • Response to IR NSE-2-03, NSE-2-05, NSE-2-07, NSE-2-176, NSE-2-180, NSE-2-182a
6.8.7 Preferred Alternative Haul Road	Yes	Section removed	• The Preferred Alternative Haul Road is no longer being considered and has been removed from the Project Description (Section 2) and EIS
6.8.8 Mitigation and Monitoring	Yes	6.8.8 Avoidance and Mitigation	• Updated based on field survey results and changes to effects assessment • Response to IR2 NSE-2-06, NSE-2-181
6.8.9 Residual Effects and Significance	Yes	6.8.9 Residual Effects and Significance	• Updated based on field survey results and changes to significance threshold determination. • Change to magnitude determination • Reflect changes to significance threshold and magnitude assessment.
6.8.10 Proposed Compliance and Effects Monitoring Program	No	6.8.10 Proposed Compliance and Effects Monitoring Program	• Presents preliminary wetland monitoring plan • Revised Preliminary Wetland Compensation Plan (IR2 CEAA-2-24, CEAA-2-26) • Response to IR2 NSE-2-02, NSE-2-13

Notes: PA = Project Area; LAA = Local Assessment Area; RAA = Regional Assessment Area- = no update; IR2 = Round 2, Information Requests; CEAA = Canadian Environmental Assessment Agency; EIS = environmental impact statement; WSS = Wetland of Special Significance.

6.8.2 Rationale for Valued Component Selection

Wetlands were selected as a valued component due to their ecological value in providing habitat for aquatic species and rare plants, the importance of wetlands in the daily lives of terrestrial species, their capacity to store water, managing downstream flooding, improving water quality, and the recharge/discharge of groundwater aquifers. The socio-economic importance of wetlands from a recreational and resource perspective is also noted in the selection of wetlands as a valued component (Section 6.1.4 of the EIS Guidelines [CEAA 2016] and its potential interactions with Project activities).

In Nova Scotia, Wetlands are protected under the *Environment Act* and the Wetland Conservation Policy. The Nova Scotia. *Environment Act* defines a wetland as "*Land referred to as a marsh, swamp, fen, or bog that either periodically or permanently has water table at, near, or above the land surface or that is saturated with water, and sustains aquatic processes as indicated by the presence of poorly drained soils, hydrophytic vegetation, and biological activities adapted to wet conditions*".

6.8.3 Baseline Program Methodology

Methodology of wetland surveys within the Beaver Dam Mine Site and Haul Road are discussed below. Information pertaining to Touquoy Mine Site has been brought forward from the Environmental Assessment Registration Document (EARD) and Focus Report. Methods and results are summarized in subheadings within the applicable sections; however, the data is not being revaluated. For further information regarding Touquoy Mine Site, refer to the EARD (CRA 2007a) and Focus Report (CRA 2007b).

In the Revised 2019 EIS, the PA was modified to allow for the micro-siting of infrastructure, as described in the Project Description (Section 2). As a result, targeted wetland surveys were conducted within the modified portions of the Beaver Dam Mine Site and Haul Road in July/August 2019 and December 2020 to confirm and delineate additional wetland habitat. Additional wetland surveys were also conducted in January 2021 along the Haul Road where minor PA modifications were made to accommodate the detailed road design. Where wetland surveys were complete outside the growing season, this has been noted within the following Sections where appropriate.

6.8.3.1 Desktop Evaluation

A desktop review of available topographic maps, provincial databases, and aerial photography was completed to aid in the determination of wetland habitat in the PA. Mapped wetland areas were identified from the NSE Wetland Inventory Database. The Nova Scotia Topographic Database and the Nova Scotia Wet Areas Mapping (WAM) database were reviewed to identify potential un-mapped wetlands. The Wetland of Special Significance (WSS) geographic information system (GIS) predictive layer provided by NSE was consulted for the presence of expected and potential WSS within the PA.

6.8.3.2 Field Delineation

Following the initial desktop review, field surveys were completed within the Beaver Dam Mine Site from June to August 2015 and September 2018, and within the Haul Road from June to July 2016 (excluding the existing Mooseland Road portion). As a result of PA modifications, additional wetland surveys were conducted in the western and southeastern expansions of the Beaver Dam Mine Site and along modified portions of the Haul Road in July and August 2019. Further small adjustments to the PA resulted in three wetlands which were delineated and assessed outside of the growing season (December/January 2020/2021; noted in Appendix H.1). No impacts are expected to these wetlands. The remaining wetlands were delineations and assessments took place within the growing season (June 1 to September 30). Wetland characteristics and functional assessments can be completed sufficiently during any time of the growing season, as per consultation with NSE. Distribution and identification for priority species and accessibility for fish are considered and targeted species surveys were completed within identified wetland habitat to further support functional assessment. Seasonal considerations for each species assemblage within wetlands are described in their respective sections of this EIS (i.e., flow regimes and seasonality of fish movement in Section 6.9, seasonal avian surveys in Section 6.12). Targeted surveys were completed within the Beaver Dam Mine Site and Haul Road where mapped systems were present to confirm and delineate wetland habitat. Meandering transects were also completed across the Beaver Dam Mine Site and Haul Road to support efforts to delineate all wetlands present within the PA, beyond those identified in the available database resources.

Trained wetland delineators and evaluators completed all field surveys. Isolated wetlands that were obviously identified as <100 m^2 in the field were not delineated due to the minimum size requirement of a provincially regulated wetland (NSE 2011). However, if a wetland was near 100 m^2, or if the delineators were unsure of the size in the field, the wetland was delineated. Wetlands determined to be smaller than 100 m^2 post field evaluation were not included on figures nor were these small wetland areas considered for the effects' assessment.

Delineated wetlands that extended outside of the PA (for both the Beaver Dam Mine Site and the Haul Road) were only delineated to the PA boundary. Wetland habitat extending beyond the PA was evaluated through desktop resources to estimate wetland type, size, and broad wetland function, including provincial topographic datasets and aerial imagery. Details related to functional assessment methods for wetlands which extend outside of the PA boundary are described in Section 6.8.3.4.

Wetland delineation was conducted in accordance with the Corps of Engineers Wetland Delineation Manual (Environmental Laboratory, 1987) and the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region (United States Army Corps of Engineers, 2011). In each wetland, vegetation, hydrology, and soils data were recorded at both wetland and upland data points on either side of the wetland boundary in accordance with the Corps of Engineers Wetland Delineation Manual (Environmental Laboratory, 1987). Wetland types were determined using the Canadian Wetland Classification System (NWWG,1997).

Wetland boundaries were documented using an SXBlue II Global Positioning System (GPS) receiver unit capable of sub-metre accuracy with a handheld SXPad field computer. Any inlet and outlet streams or other features associated with each wetland present within the PA were marked during the delineation processes, as well as mapped within the boundaries of the wetland. Pink flagging tape was used to mark the boundaries of wetlands and blue flagging tape was used to mark the locations of associated watercourses.

In keeping with the Army Corps of Engineers methodologies for wetland delineation, three criteria are required in order for a wetland determination to be made:

- Presence of hydrophytic (water loving) vegetation;
- Presence of hydrologic conditions that result in periods of flooding, ponding, or saturation during the growing season; and
- Presence of hydric soils.

Hydrophytic vegetation is defined as the sum total of macrophytic plant life that occurs in areas where the frequency and duration of inundation or soil saturation produce permanent or periodically saturated soils of sufficient duration to exert a controlling influence on the plant species present (Environmental Laboratory, 1987). Hydrophytic vegetation should be the dominant plant type in wetland habitat (Environmental Laboratory, 1987).

Dominant plant species observed at each data point were classified according to their indicator status (probability of occurrence in wetlands) in accordance with the Nova Scotia Wetland Indicator Plant List (NSE 2011c). Further relevant information was reviewed in Flora of Nova Scotia (Roland, 1998).

If the majority (greater than 50%) of the dominant vegetation at a data point is classified as obligate (OBL), facultative wetland (FACW), or facultative (FAC) (excluding FAC-), then the location of the data point is considered to be dominated by hydrophytic vegetation. Wetland vegetation compositions for wetland types identified within the Beaver Dam Mine Site and Haul Road during field surveys have been described in Section 6.8.4.1.

A hydric soil is defined as a soil that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part (United States Department of Agriculture, 2003). Indicators that a hydric soil is present include soil colour (gleyed soils and soils with bright mottles and/or low matrix chroma), aquic or preaquic moisture regime, reducing soil conditions, sulfidic material (odour), soils listed on the hydric soils list, iron and manganese concretions, organic soils (histosols), histic epipedon, high organic content in surface layer in sandy soils, and organic streaking in sandy soils.

A soil pit was completed at each data point. These pits were excavated to a maximum depth of 50 cm or refusal. The soil in each pit was then examined for hydric soil indicators. The matrix colour and mottle colour (if present) of the soil were determined using the Munsell Soil Colour Charts.

Wetland habitat, by definition, either periodically or permanently, has a water table at, near, or above the land surface or is saturated with water. To be classified as a wetland, a site should have at least one primary indicator or two secondary indicators of wetland hydrology. Examples of primary indicators of wetland hydrology include watermarks, drift lines, sediment deposition, and water stained leaves. Examples of secondary indicators of wetland hydrology include oxidized root channels, dry season water table, and stunted or stressed plants.

Each area of expected wetland habitat was assessed for signs of hydrology through observations across the area and assessment of soil pits at each data point.

Further baseline field surveys were conducted in the Beaver Dam Mine Site and Haul Road to assess the suitability of wetland habitat for wetland specific species, especially SAR/SOCI. All surveys conducted for SAR and SOCI were completed in suitable habitat in the Beaver Dam Mine Site and Haul Road according to species-specific methodologies. Survey effort to support wetland identification and functional assessment was extensive and results in significant time on the landscape from early spring (high flow conditions to evaluate fish habitat and connectivity) to late fall across multiple years, in key habitat where presence of SAR and SOCI would be expected. This included, for instance, both early and late season botany surveys, and avian migration, breeding and overwintering surveys. Priority species were noted during the field programs and therefore, were assessed during all surveys conducted on the landscape. A summary of the biophysical surveys including, location, date, frequency and time of day (where applicable), is presented in IR2 NSE 2-01 (AMNS 2021). Further information on these baseline survey methods, and species observed, including date and time, can be found in Section 6.13 and Appendix K.1 (Master Species List [includes priority species]). Priority species were assessed in the Beaver Dam Mine Site and Haul Road, and wetland specific species lists will be generated if necessary, at the permitting phase. It should be noted that, while it was not possible to confirm a species' absence from the landscape, all care was taken to identify the presence of preferred habitat in the Beaver Dam Mine Site and Haul Road (Section 6.13 for further information). Where suitable habitat was observed for a SAR (particularly SAR fish and turtles), it was presumed to potentially be present, even if presence was not confirmed via observation of that species (or evidence thereof).

6.8.3.3 Wetlands of Special Significance

The Wetland Conservation Policy was developed by Nova Scotia Environment in 2011 and amended in 2019 (NSE 2019). Its mandate is to provide a framework for the conservation of wetlands. Furthermore, it provides a framework for the identification of Wetlands of Special Significance. According to NSE (2019, p.11-12), the following criteria define Wetlands of Special Significance:

- All salt marshes;
- Wetlands that are within or partially within a designated Ramsar site, Provincial Wildlife Management Area (Crown and Provincial lands only), Provincial Park, Nature Reserve, Wilderness Areas or lands owned or legally protected by non-government charitable conservation land trusts;
- Intact or restored wetlands that are project sites under the North American Waterfowl Management Plan and secured for conservation through the NS-EHJV;
- Wetlands known to support at-risk species as designated under the federal *Species at Risk Act* or the *Nova Scotia Endangered Species Act*; and
- etlands in designated protected water areas as described within Section 106 of the *Environment Act*.

The presence of a sessile or non-mobile (primarily flora) SAR within a delineated wetland triggers the determination of that wetland as a WSS. Mobile SAR have home ranges that may include wetlands within and beyond the PA, which may be used at various times of the year (i.e., used during the breeding season, but not at other times). Given the mobility of some species, an observation of a mobile SAR has not immediately designated these wetlands as WSS. The determination of WSS based on the observation a mobile species is determined on a species-specific and site-specific basis, considering the following factors:

- whether the species was observed within the wetland, and weather it was a current or historic observation (i.e., Atlantic Canada Conservation Data Centre [ACCDC]);
- whether suitable habitat is present within the wetland;
- what is the wetland habitat used for (i.e., does the habitat provided within the wetland provide necessary life functions (i.e., nesting or overwintering habitat); and
- the discreteness or specificity of habitat use by the mobile species (i.e., wood turtles have specific and discrete nest beach requirements, compared with the in-discrete and non-specific foraging habitat usage by mainland moose, for example).

Furthermore, the NS Wetland Conservation Policy states that the Province is in the process of developing a system for classifying additional wetlands or wetland types as WSS (NSE 2019). Among the wetland characteristics, functions and services to be considered during the process are whether the area:

- Supports a significant species or species assemblages (e.g., coastal plain flora);
- Supports high wildlife biodiversity;
- Has significant hydrologic value; or
- Has high social or cultural importance.

Currently, a province-wide framework for determination of WSS using Wetland Ecosystem Services Protocol - Atlantic Canada (WESP-AC) has not been developed. Current understanding is that the Province is in the process of identifying parameters for WSS within the WESP-AC framework. Through final implementation of WESP-AC, parameters may be established to help identify significance thresholds for functions listed above (i.e., significant hydrologic value).

NSE developed a WSS predictive GIS layer (September 2020, pers. comm., Ian Bryson, NSE Wetland Specialist), which overlies mapped wetlands with protected areas layers, and priority species observations from ACCDC, among other attributes. According to NSE, this WSS GIS layer is intended to be used as a planning tool, and its contents should be interpreted as potential WSS. The actual determination of WSS status is based on field verification of the parameters or considerations listed above.

This predictive layer was consulted during the desktop evaluation for wetlands prior to initial wetland delineations in 2016, and reconfirmed with the latest WSS layer, provided to MEL by Ian Bryson in September 2020. This predictive layer incorporates all rare species observations, regardless of the species' ranking, accuracy of the data points, observation date, and mobility of species. As such, it is used as a predictive tool only to support WSS determination.

Final determination of WSS will be completed at the permitting phase with guidance from NSE when the framework for determination of WSS has been developed or as directed by the regulator. Until the framework for WSS determination is available, AMNS will continue to engage with NSE and NSL&F to discuss WSS designation on a site-specific basis.

6.8.3.4 Wetland Functional Assessment

Wetland functional assessments were completed for each wetland using the NSE NovaWET 3.0 (2011d) wetland evaluation technique. At the time of baseline data collection, NovaWET was the primary functional assessment tool recommended for use in Nova Scotia by NSE. The WESP-AC method for functional assessment of wetland habitats was not calibrated for use in Nova Scotia. In 2016, a calibration study was completed to support NSE in the implementation of WESP-AC as the preferred functional assessment technique was completed. To date, WESP-AC has not been fully implemented as the preferred technique, and NovaWET is still recognized as an appropriate method for assessing wetland functions (NSE 2011d).

Field observations were made on wetland types, water flow path, dominant vegetation communities (and SAR/SOCI, if present), fish habitat potential and characterization, and wetland function. The evaluation of wetland function included gathering field and desktop information to support conclusions relating to wetland characteristics, condition and integrity of adjacent lands, identification of exceptional features, hydrologic condition and integrity, water quality, groundwater interactions, shoreline stabilization, plant community, fish and wildlife habitat and habitat integrity, and community use and value.

Where wetland habitat extended beyond the PA, a functional assessment is based on observations made within the PA, landscape position and connectivity observed via desktop review in portions of the wetland that extend beyond the PA boundary. Connectivity to other aquatic habitats (i.e., wetlands, watercourses, lakes and ponds) are an important component of any functional assessment. Where a wetland extended beyond the PA boundary but did not coincide with an NSE mapped wetland, provincial topographic datasets (i.e., NSE wetland inventory, local topography, Wet Area Mapping, flow accumulation, watercourses and waterbodies) and aerial imagery interpretation were used to identify the likely extents of wetland boundaries to support functional assessment conclusions. Approximate wetland area beyond the PA, estimated through this exercise, is presented in Table 6.8-2. Functional assessments are based on field observations within a defined study area, supplemented by desktop resources where appropriate.

Results of the NovaWET functional assessment are provided in Section 6.8.4.1. In addition, summaries specific to the Guidelines for Preparation of an Environmental Impact Statement, Beaver Dam Mine (CEAA 2016) specific to wetlands are discussed in this section.

6.8.3.5 Touquoy Mine Site

Wetlands were identified within Touquoy Mine Site as part of the EARD process via the NSL&F Wetlands Database and air photo interpretation. These wetlands were assessed in September 2006 and in the spring of 2007 (CRA 2007).

From 2015 to 2017 MEL biologists conducted further wetland surveys by delineating and completing functional assessments on additional wetlands within the Touquoy Mine Site as part of the wetland permitting process.

Additional wetland surveys were conducted along the Moose River, downstream of the proposed spillway, in October 2020 in response to IR2 NSE 2-176 (AMNS 2021). Results of these surveys are presented in Section 6.8.4.2.

6.8.4 Baseline Conditions

Updates to wetlands (total number, individual areas, etc.) reflected within this section are a result of additional surveys required by changes to the Beaver Dam Mine Site to incorporate the micro-siting of Project infrastructure (e.g., western waste rock stockpile and organic materials stockpile) and modifications to the Haul Road design, including the addition of a multiuse bypass road and the removal of the preferred alternative haul road option as described in the updated Project Description (Section 2).

Including the additional wetland habitat delineated during the supplementary surveys, a total of 236 freshwater wetlands were identified within the Beaver Dam Mine Site and Haul Road (excluding the existing Mooseland Road portion). Within the Beaver Dam Mine Site 117 wetlands were identified, and 121 wetlands were identified along the current Haul Road layout, with 2 wetlands (WL64 and WL66) located partially within each component. As a result of Haul Road modifications, the following wetlands are no longer located within the PA and have been removed from the EIS: WL130, 131, 132 and 180-199. A summary of wetland numbers, types, areas within the Beaver Dam Mine Site and Haul Road, and tertiary watershed locations are described in Table 6.8-2 and presented on Figures 6.8-1A to 6.8-1O.

Table 6.8-2: Wetland Delineation Summary Results

Wetland ID	Wetland Type	Wetland Area within PA (m^2)	Wetland Area beyond PA[a] (m^2)	Tertiary Watershed
Beaver Dam Mine Site				
1	complex: mixed wood treed bog, tall shrub bog, open low shrub bog	37,188	-	Tent Brook and Paul Brook
2	complex: coniferous treed bog, graminoid bog, low shrub bog, shrub bog	196,857	-	Tent Brook, Paul Brook, and Killag River
3	shrub bog	4,658	-	Killag River
4	complex: treed swamp/treed fen, mixed wood treed swamp	13,139	-	Killag River
5	mixed wood treed swamp	6,202	-	Killag River
6	mixed wood treed swamp	262	-	Killag River
7	cutover treed swamp	306	-	Killag River
8	complex: coniferous treed swamp, graminoid fen, low shrub fen, shrub swamp	16,603	-	Killag River
9	open bog	307	-	Paul Brook
10	low shrub fen	18,817	-	Killag River
11	complex: low shrub bog, mixed wood treed swamp	2,955	-	Killag River
12	complex: open mixed wood treed swamp, coniferous treed swamp	4,475	-	Killag River
13	complex: treed swamp, coniferous treed swamp	4,816	-	Killag River
14	complex: shrub bog, mixed wood treed swamp, low shrub fen	31,655	-	Killag River
15	graminoid fen	1,249	-	Killag River
16	open shrub swamp	3,670	-	Killag River

Table 6.8-2: Wetland Delineation Summary Results (continued)

Wetland ID	Wetland Type	Wetland Area within PA (m^2)	Wetland Area beyond PA[a] (m^2)	Tertiary Watershed
17[c]	complex: tall shrub swamp, coniferous treed bog	7,6341	181,113	Killag River
18	coniferous treed swamp	1,864	-	Killag River
19	shrub bog	11,428	-	Killag River
20	mixed wood treed fen	10,106	-	Killag River
21	mixed wood treed swamp	202	-	Paul Brook
22	mixed wood treed swamp	274	-	Paul Brook
23	coniferous treed swamp	419	-	Paul Brook
24	coniferous treed swamp	328	-	Paul Brook
25	coniferous treed swamp	1,416	-	Paul Brook
26	coniferous treed swamp	658	-	Paul Brook
27	mixed wood treed swamp	493	-	Paul Brook
28	coniferous treed swamp	222	-	Paul Brook
29[c]	complex: mixed wood treed swamp, low shrub fen, open bog, coniferous treed swamp, coniferous raised bog, graminoid fen	112,835	204,763	Paul Brook and Killag River
30	coniferous treed swamp	964	-	Paul Brook
31	coniferous treed swamp	10,473	-	Paul Brook and Killag River
32	coniferous treed swamp	120	-	Paul Brook
33	coniferous treed swamp	1,900	-	Paul Brook
34	mixed wood treed swamp	1,382	-	Killag River
35	coniferous treed swamp	3,376	-	Paul Brook and Killag River
36	coniferous treed swamp	916	-	Paul Brook
37	deciduous treed swamp	253	-	Paul Brook
38	coniferous treed swamp	388	-	Paul Brook and Killag River
39	coniferous treed swamp	1,857	-	Killag River
40	coniferous treed swamp	8,091	-	Killag River
41	graminoid marsh	910	-	Killag River
42	coniferous treed swamp	1,879	-	Killag River
43	mixed wood treed swamp	81	-	Killag River
44	coniferous treed bog	10,611	-	Killag River
45	coniferous treed swamp	295	-	Killag River
46	coniferous treed riverine swamp	754	-	Killag River
47	fresh water marsh	1,029	-	Killag River
48	coniferous treed swamp	2,876	-	Killag River
49	coniferous treed swamp	117	-	Killag River
50	coniferous tall shrub swamp	117	-	Killag River
51	mixed wood treed swamp	898	-	Killag River

Table 6.8-2: Wetland Delineation Summary Results (continued)

Wetland ID	Wetland Type	Wetland Area within PA (m^2)	Wetland Area beyond PA[a] (m^2)	Tertiary Watershed
52	coniferous treed swamp	1,620	-	Killag River
53	low shrub swamp	824	-	Killag River
54	coniferous treed bog	416	-	Paul Brook
55	mixed wood treed swamp	616	-	Killag River
56	complex: coniferous treed swamp, tall shrub swamp, low shrub bog, open water	16,276	-	Killag River
57	complex: coniferous treed swamp, deciduous treed swamp	88,717	-	Tent Brook and Killag River
58	deciduous treed swamp	581	-	Killag River
59	complex: coniferous treed swamp, emergent marsh, open water	65,304	-	Killag River
60	coniferous treed swamp	2,963	-	Killag River
61	complex: deciduous treed swamp, tall shrub swamp, open low shrub fen	25,982	-	Killag River
62	coniferous treed swamp	832	-	Killag River
63	coniferous treed swamp	486	-	Paul Brook
64	complex: low shrub bog, mixed wood treed swamp	42,047[2]	-	Tent Lake
66[c]	complex: graminoid fen, mixed wood treed swamp, high shrub fen	55,419.49[2]	485,495	Tent Lake
200	coniferous treed swamp	1,677	-	Killag River
201	mixed wood treed swamp	284	-	Killag River
202	coniferous treed swamp	571	-	Killag River
203	open bog	3,925	-	Killag River
204	coniferous treed swamp	8,295	-	Killag River
205	mixed wood treed swamp	45,975	-	Cope Brook
206[c]	shrub swamp	3,298	6,507	Killag River
207[c]	complex: mixed wood treed swamp, bog	86,450	553,032	Killag River
208	coniferous treed bog	6,478	-	Killag River
209	shrub bog	11,514	-	Killag River
210	coniferous treed bog	11,058	-	Killag River
211	coniferous treed swamp	10,474	-	Killag River
212	shrub swamp	13,987	-	Killag River
213	shrub swamp	992	-	Killag River
214	mixed wood swamp	6,041	-	Killag River
215	shrub swamp	16,447	-	Killag River
216	shrub swamp	1,397	-	Killag River
217[c]	coniferous treed swamp	5,230	7,783	Killag River

Table 6.8-2: Wetland Delineation Summary Results (continued)

Wetland ID	Wetland Type	Wetland Area within PA (m^2)	Wetland Area beyond PA[a] (m^2)	Tertiary Watershed
218	open bog	115	-	Tent Brook
219	complex: fen, mixed wood treed swamp	90,880	-	Tent Brook
220	coniferous treed fen	15,691	-	Cope Brook
221	mixed wood treed swamp	4,082	-	Cope Brook
222	coniferous treed swamp	7,788	-	Killag River and Cope Brook
223	coniferous treed swamp	475	-	Cope Brook
224	coniferous treed swamp	1,693	-	Cope Brook
225	coniferous treed swamp	235	-	Cope Brook
226	complex: coniferous swamp, bog	15,039	-	Cope Brook
227	mixed wood treed swamp	365	-	Cope Brook
228	coniferous treed bog	11,835	-	Killag River
229	coniferous treed swamp	4,644	-	Killag River
230	coniferous treed swamp	1,812	-	Killag River and Cope Brook
231[c]	coniferous treed swamp	4,808	1,669	Killag River
232	mixed wood treed swamp	875	-	Killag River and Cope Brook
233[c]	mixed wood treed swamp	8,025	1,085	Cope Brook
234	coniferous treed swamp	3,328	-	Cope Brook
235	mixed wood treed swamp	619	-	Cope Brook
236[c]	complex: swamp, bog	37,699	6,381	Cope Brook
237	coniferous treed swamp	429	-	Tent Brook
238[c]	deciduous treed swamp	4,685	3,324	Killag River
239	open bog	1,004	-	Killag River and Tent Brook
240[c]	mixed wood treed swamp	21,799	9,590	Killag River
241[c]	mixed wood treed swamp	821	478	Killag River
242[c]	mixed wood treed swamp	2,366	760	Killag River
243	mixed wood treed swamp	1,104	-	Killag River
244	coniferous treed swamp	131	-	Killag River
245	mixed wood treed swamp	1,864	-	Killag River
246	mixed wood treed swamp	8,871	-	Killag River
247	mixed wood treed swamp	9,371	-	Killag River and Tent Lake
248	mixed wood treed swamp	401	-	Killag River
249	mixed wood treed swamp	2,322	-	Tent Brook
257	shrub swamp	230	-	Killag River
258	shrub swamp	954	-	Tent Brook
Total Beaver Dam Mine Site Wetland Area		**1,411,567 m^2 (141.2 ha)**		

Table 6.8-2: Wetland Delineation Summary Results (continued)

Wetland ID	Wetland Type	Wetland Area within PA (m^2)	Wetland Area beyond PA[a] (m^2)	Tertiary Watershed
Haul Road (incl. bypass road)				
64[c]	complex: low shrub bog, mixed wood treed swamp	6,306[b]	3,128	Tent Brook
65	open bog	65	-	Tent Brook
66[c]	complex: graminoid fen, mixed wood treed swamp, high shrub fen	15,578[b]	574,882	Tent Brook
67[c]	complex: low shrub fen, tall shrub fen	1,535	574,882	Tent Brook
68[c]	complex: shrub fen, graminoid fen and mixed wood treed swamp	5,568	574,882	Tent Brook
69[c]	complex: shrub fen, graminoid fen, and mixed wood treed swamp	3,899	574,882	Tent Brook
70[c]	tall shrub swamp	613	1,512	Tent Brook
71	deciduous treed swamp	425	-	Keef Brook
72	deciduous treed swamp	1,471	-	Keef Brook
73[c]	complex: tall shrub swamp, tall shrub fen	27,091	15,010	Keef Brook
74[c]	complex: mixed wood treed swamp, fresh water marsh	12,339	17,437	Keef Brook
75	mixed wood treed swamp	144	-	Keef Brook
76[c]	complex: mixed wood treed swamp, open graminoid fen	10,406	8,045	Keef Brook
77[c]	mixed wood treed swamp	1,688	852	Keef Brook
78	mixed wood treed swamp	194	-	Keef Brook
79[c]	coniferous treed swamp	3,294	3,019	Keef Brook
80	coniferous treed bog	978	-	Keef Brook
81	tall shrub swamp	154	-	Keef Brook
82	mixed wood treed swamp	616	-	Keef Brook
83[c]	mixed wood treed swamp	529	2,188	Keef Brook
84[c]	low shrub swamp	695	1,431	Keef Brook
85	low shrub swamp	322	-	Keef Brook
86[c]	mixed wood treed swamp	4,607	1,511	Keef Brook
87[c]	open bog	362	3,086	Keef Brook
88[c]	tall shrub swamp	409	226	Keef Brook
89[c]	treed swamp	6,170	8,927	Keef Brook
90[c]	mixed wood treed swamp	4,495	9,277	Keef Brook
91[c]	mixed wood treed swamp	1,060	414	Keef Brook
92[c]	mixed wood treed swamp	1,943	37,214	Keef Brook
93	graminoid marsh	166	-	Keef Brook
94[c]	mixed wood treed swamp	1,693	991	Keef Brook
95[c]	mixed wood treed swamp	263	138	Keef Brook

Table 6.8-2: Wetland Delineation Summary Results (continued)

Wetland ID	Wetland Type	Wetland Area within PA (m^2)	Wetland Area beyond PA[a] (m^2)	Tertiary Watershed
96[c]	mixed wood treed swamp	861	1,180	Keef Brook
97	mixed wood treed swamp	107	-	Keef Brook
98[c]	mixed wood treed swamp	1,540	967	Jack Lowe Brook
99[c]	mixed wood treed swamp	694	540	Jack Lowe Brook
100	shrub swamp	1,582	-	Jack Lowe Brook
101	cutover swamp	219	-	Jack Lowe Brook
102	complex; mixed wood treed bog, mixed wood treed swamp	5,439	-	Jack Lowe Brook
103	low shrub bog	455	-	Jack Lowe Brook
104	low shrub swamp	102	-	Jack Lowe Brook
105	low shrub bog	284	-	Jack Lowe Brook
106[c]	low shrub bog	1,701	850	Jack Lowe Brook
107	coniferous treed swamp	186	-	Little River
108	tall shrub swamp	183	-	Little River
109	coniferous treed swamp	1,606	-	Little River and Jack Lowe Brook
110	shrub bog	3,353	-	Little River
111[c]	mixed wood treed swamp	1,060	2,216	Little River
112[c]	mixed wood treed swamp	3,595	2,913	Little River
113	mixed wood treed swamp	2,782	-	Little River
114	coniferous treed swamp	242	-	Little River
115[c]	mixed wood treed swamp	582	490	Little River
116	coniferous treed swamp	892	-	Little River
117	coniferous treed swamp	147	-	Little River
118	coniferous treed swamp	428	-	Little River
119	coniferous treed swamp	328	-	Little River
120	low shrub swamp	115	-	Little River
121	coniferous treed swamp	866	-	Little River
122	coniferous treed swamp	200	-	Little River
123	mixed wood treed swamp	818	-	Little River
124[c]	mixed wood treed swamp	528	418	Little River
125	mixed wood treed swamp	344	-	Little River
126	mixed wood treed swamp	63	-	Little River
127[c]	treed bog	185	17,002	Little River
128	tall shrub bog	409	-	Little River
129	treed bog	2,006	-	Little River
133	low shrub bog	102	-	Little River
134	treed swamp	398	-	Little River
135[c]	shrub fen	1,227	9,284	Little River

Table 6.8-2: Wetland Delineation Summary Results (continued)

Wetland ID	Wetland Type	Wetland Area within PA (m^2)	Wetland Area beyond PA[a] (m^2)	Tertiary Watershed
136	mixed wood treed swamp	522	-	Little River
137[c]	mixed wood treed swamp	2,404	4,032	Little River
138	shrub bog	1,521	-	Little River
139	tall shrub bog	106	-	Little River
140	treed bog	230	-	Little River
141	high shrub bog	60	-	Little River
142	low shrub bog	342	-	Little River
143	complex: graminoid bog, deciduous treed swamp	527	-	Little River
144[c]	tall shrub fen	2,034	672	Little River
145[c]	low shrub bog	1,462	3,026	Little River
146[c]	complex: graminoid fen, mixed wood treed swamp	2,265	2,696	Little River
147[c]	complex: low shrub bog, mixed wood treed swamp	2,708	2,061	Little River
148[c]	low shrub bog	9,221	64,070	Little River
149[c]	low shrub bog	1,835	857	Little River
150	marsh	145	-	Little River
151[c]	tall shrub bog	2,827	653	Little River
152[c]	cutover mixed wood swamp	2,275	5,520	Little River
153[c]	shrub swamp	2,416	1,135	Little River
154[c]	open bog	1,927	69	Little River
155[c]	mixed wood treed swamp	540	406	Little River
156[c]	shrub bog	14,745	272,320	Little River and Sandy Pond
157[c]	complex: shrub fen, shrub swamp	7,006	57,089	Little River and Sandy Pond
158	shrub swamp	575	-	Sandy Pond
159[c]	mixed wood treed swamp	1,995	34,340	Sandy Pond
160	marsh	1,237	-	Sandy Pond
161	mixed wood treed swamp	1,618	14,809	Sandy Pond
162[c]	mixed wood treed swamp	1,756	440	Sandy Pond
163[c]	cutover swamp	1,107	199	Sandy Pond
164[c]	mixed wood treed swamp	3,320	14,719	Sandy Pond
165[c]	mixed wood treed swamp	1,623	760	Sandy Pond
166	shrub swamp	68	-	Sandy Pond
167[c]	mixed wood treed swamp	875	74	Sandy Pond
168[c]	open bog	664	2,202	Sandy Pond
169[c]	mixed wood treed swamp	607	785	Sandy Pond
170[c]	mixed wood treed swamp	1,893	12,748	Sandy Pond
171[c]	mixed wood treed swamp	4,329	119,985	Morgan River

Table 6.8-2: Wetland Delineation Summary Results (continued)

Wetland ID	Wetland Type	Wetland Area within PA (m^2)	Wetland Area beyond PA[a] (m^2)	Tertiary Watershed
172	mixed wood treed swamp	229	-	Morgan River
173[c]	mixed wood treed swamp	4,814	10,815	Morgan River
174[c]	mixed wood treed swamp	2,649	6,608	Morgan River
175[c]	shrub swamp	632	534	Morgan River
176[c]	mixed wood treed swamp	446	565	Morgan River
177[c]	shrub swamp	808	1,341	Morgan River
178[c]	mixed wood treed swamp	4,385	6,652	Morgan River
179[c]	mixed wood treed swamp	3,376	808	Morgan River
250	coniferous treed swamp	656	-	Morgan River
251[c]	mixed wood treed swamp	1,462	9,223	Lake Alma
252[c]	coniferous treed fen	391	260	Lake Alma
253[c]	coniferous treed fen	404	3,985	Lake Alma
254[c]	coniferous treed swamp	104	390	Lake Alma
255[c]	shrub swamp	716	99	Lake Alma
256[c]	coniferous treed swamp	205	1,747	Lake Alma
259[c]	coniferous treed swamp	162	201	Keef Brook
Total Haul Road Wetland Area		**250,930 m^2 (25.1 ha)**		
Total Wetland Area		**1,662,496 m^2 (166.3 ha)**		
% Total Beaver Dam Mine Site Area (592 ha)		**24%**		
% Total Haul Road Area (189 ha)		**13%**		

Notes: [a] Approximate wetland area that extends beyond the PA, were applicable. Area is estimated through desktop review.

[b] Wetland area is partially within the Beaver Dam Mine Site and Haul Road.

[c] Wetland extends beyond the PA boundaries. Total size is estimated. m^2 = squared metre.

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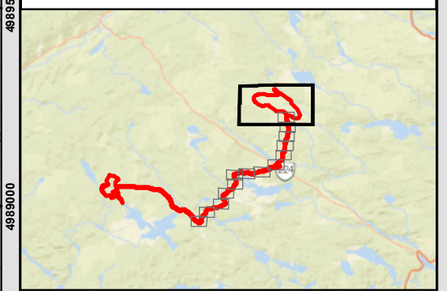
FIGURE 6.8-1 A

Beaver Dam Mine Project

Field Delineated Wetlands: Beaver Dam Mine Site and Haul Road

- Field Delineated Watercourses
- NSTDB Mapped Watercourses
- Local Road
- Dry Weather / Seasonal Road
- Track
- Field Delineated Wetlands
- NSE Wetlands
- Proposed Infrastructure
- Project Area



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Projection: Transverse Mercator
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Units: Meter

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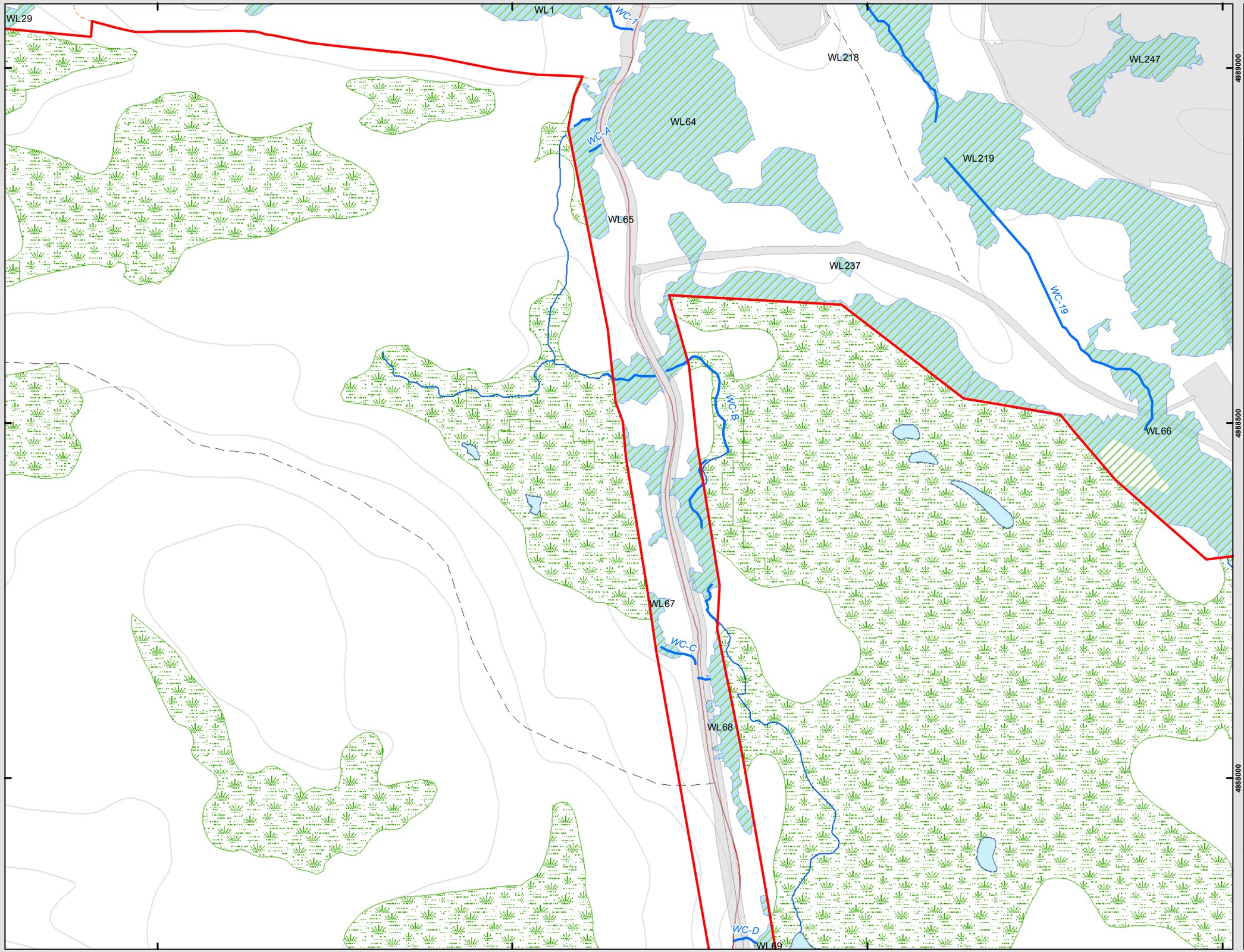

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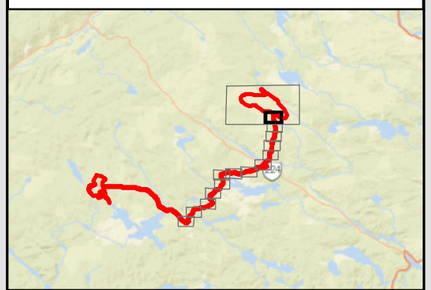
FIGURE 6.8-1 B

Beaver Dam Mine Project

Field Delineated Wetlands: Beaver Dam Mine Site and Haul Road

- Field Delineated Watercourses
- NSTDB Mapped Watercourses
- Local Road
- Dry Weather / Seasonal Road
- Track
- Field Delineated Wetlands
- NSE Wetlands
- Proposed Infrastructure
- Project Area



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Units: Meter

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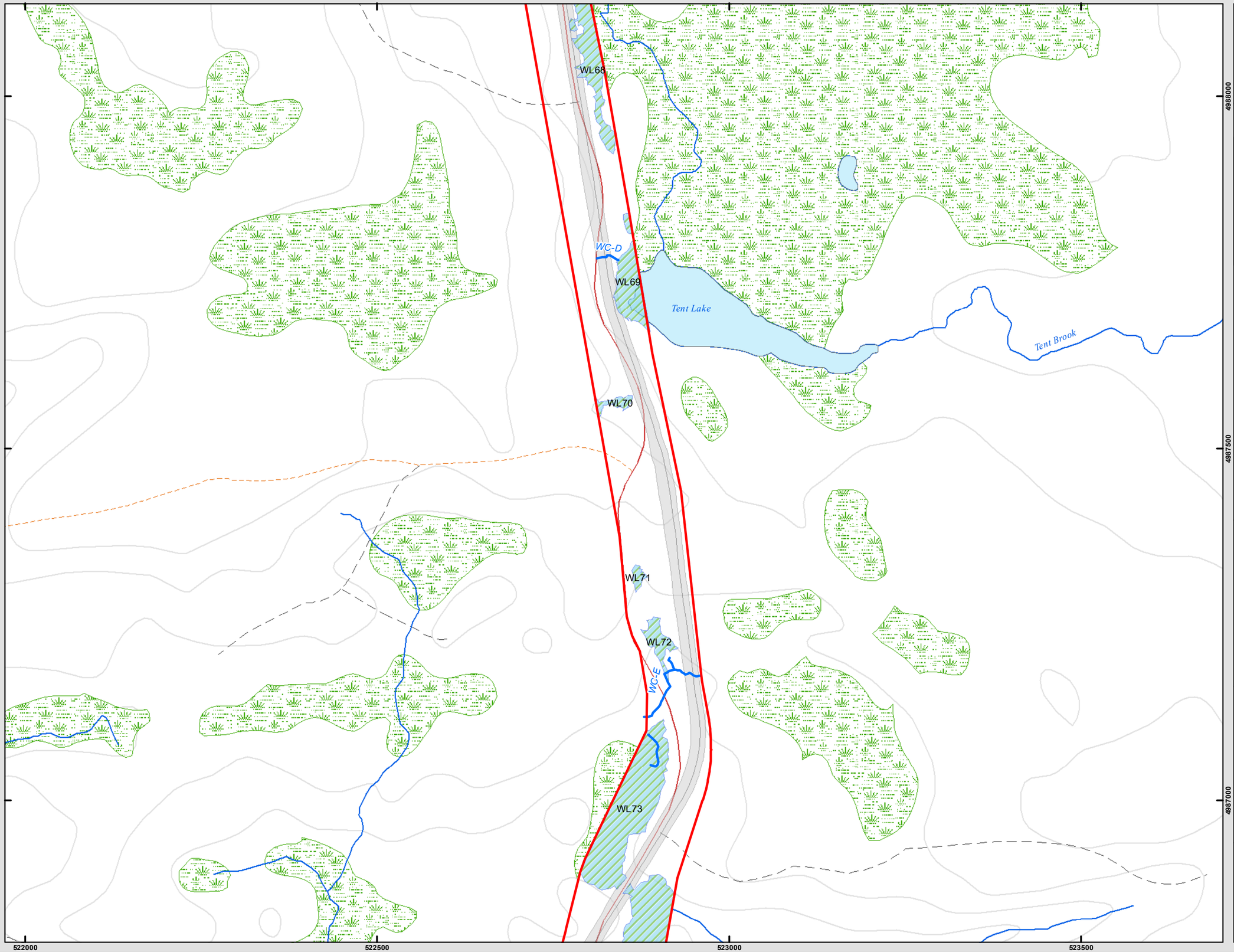

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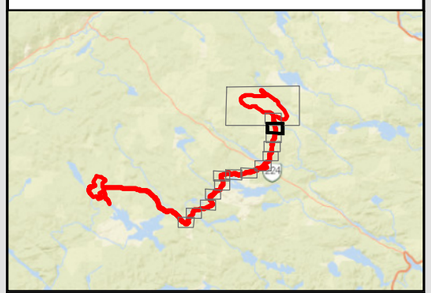
FIGURE 6.8-1 C

Beaver Dam Mine Project

Field Delineated Wetlands: Beaver Dam Mine Site and Haul Road

- Field Delineated Watercourses
- NSTDB Mapped Watercourses
- Local Road
- Dry Weather / Seasonal Road
- Track
- Field Delineated Wetlands
- NSE Wetlands
- Proposed Infrastructure
- Project Area



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Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

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1:5,000 Scale when printed @ 11" x 17"

Drawn By: AS
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Date: 2021-05-24

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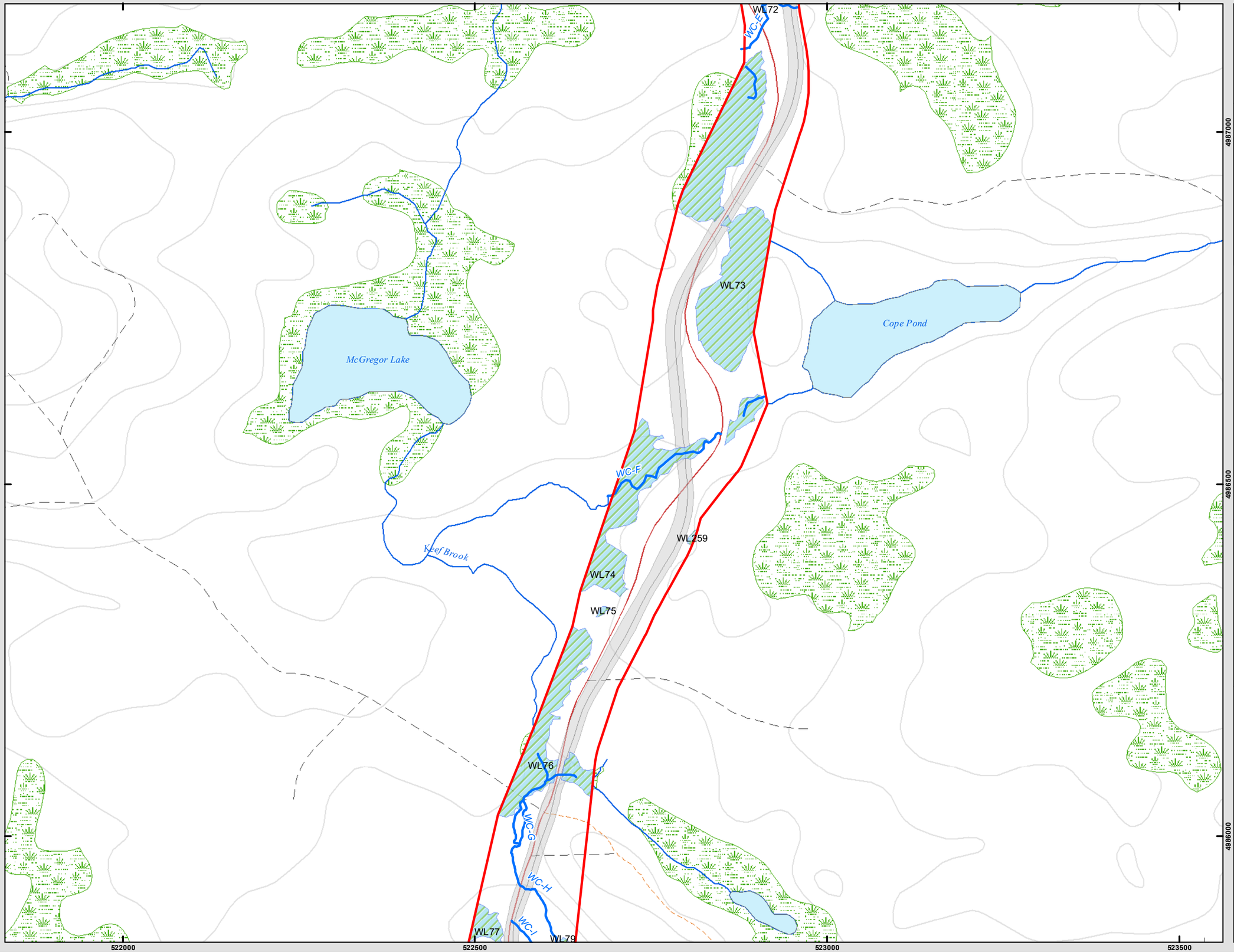
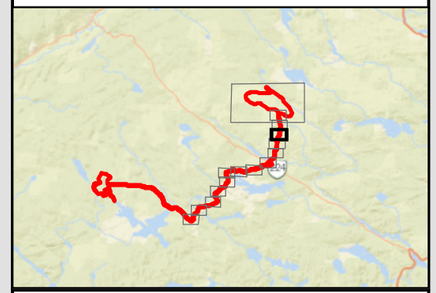
FIGURE 6.8-1 D

Beaver Dam Mine Project

Field Delineated Wetlands: Beaver Dam Mine Site and Haul Road



- Field Delineated Watercourses
- NSTDB Mapped Watercourses
- Local Road
- Dry Weather / Seasonal Road
- Track
- Field Delineated Wetlands
- NSE Wetlands
- Proposed Infrastructure
- Project Area



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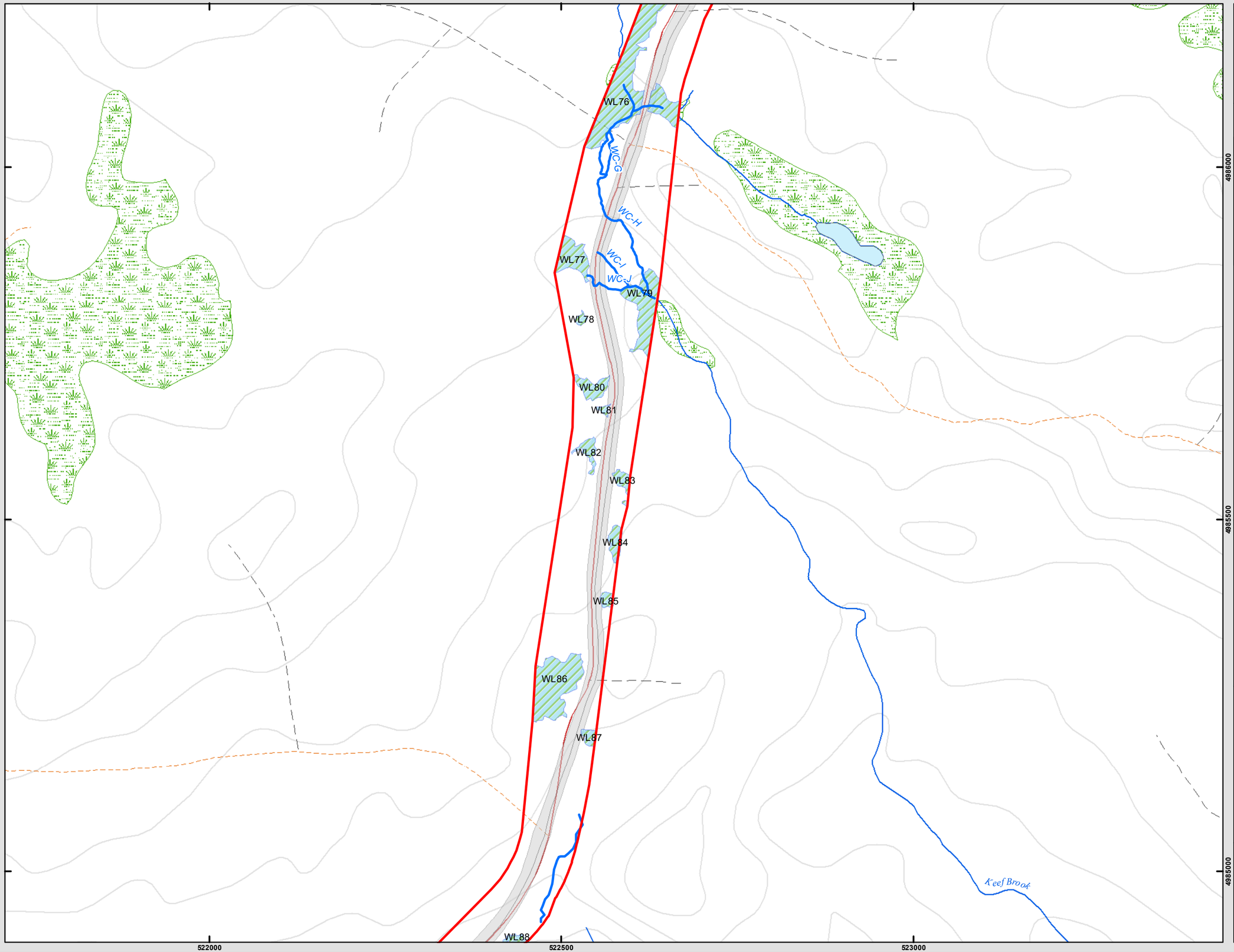

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FIGURE 6.8-1 E

Beaver Dam Mine Project

Field Delineated Wetlands: Beaver Dam Mine Site and Haul Road

- Field Delineated Watercourses
- NSTDB Mapped Watercourses
- Local Road
- Dry Weather / Seasonal Road
- Track
- Field Delineated Wetlands
- NSE Wetlands
- Proposed Infrastructure
- Project Area

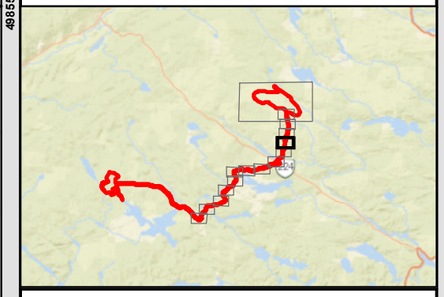

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FIGURE 6.8-1 F

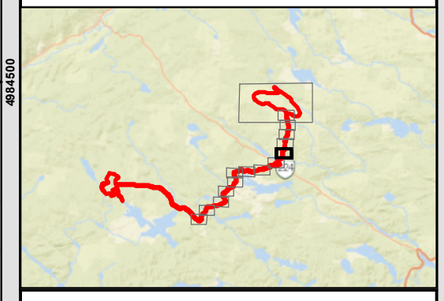
Beaver Dam Mine Project

Field Delineated Wetlands: Beaver Dam Mine Site and Haul Road

WL86
WL87
WL88
WL89
WL90
WL91
WL92
WL93
WL94
WL95
WL96
WL97
WC-K
WC-L
WC-M
WC-N
Keef Brook
West River Sheet Harbour

4985000
4984500
4984000
522000
522500
523000

- Field Delineated Watercourses
- NSTDB Mapped Watercourses
- Local Road
- Dry Weather / Seasonal Road
- Track
- Field Delineated Wetlands
- NSE Wetlands
- Proposed Infrastructure
- Project Area



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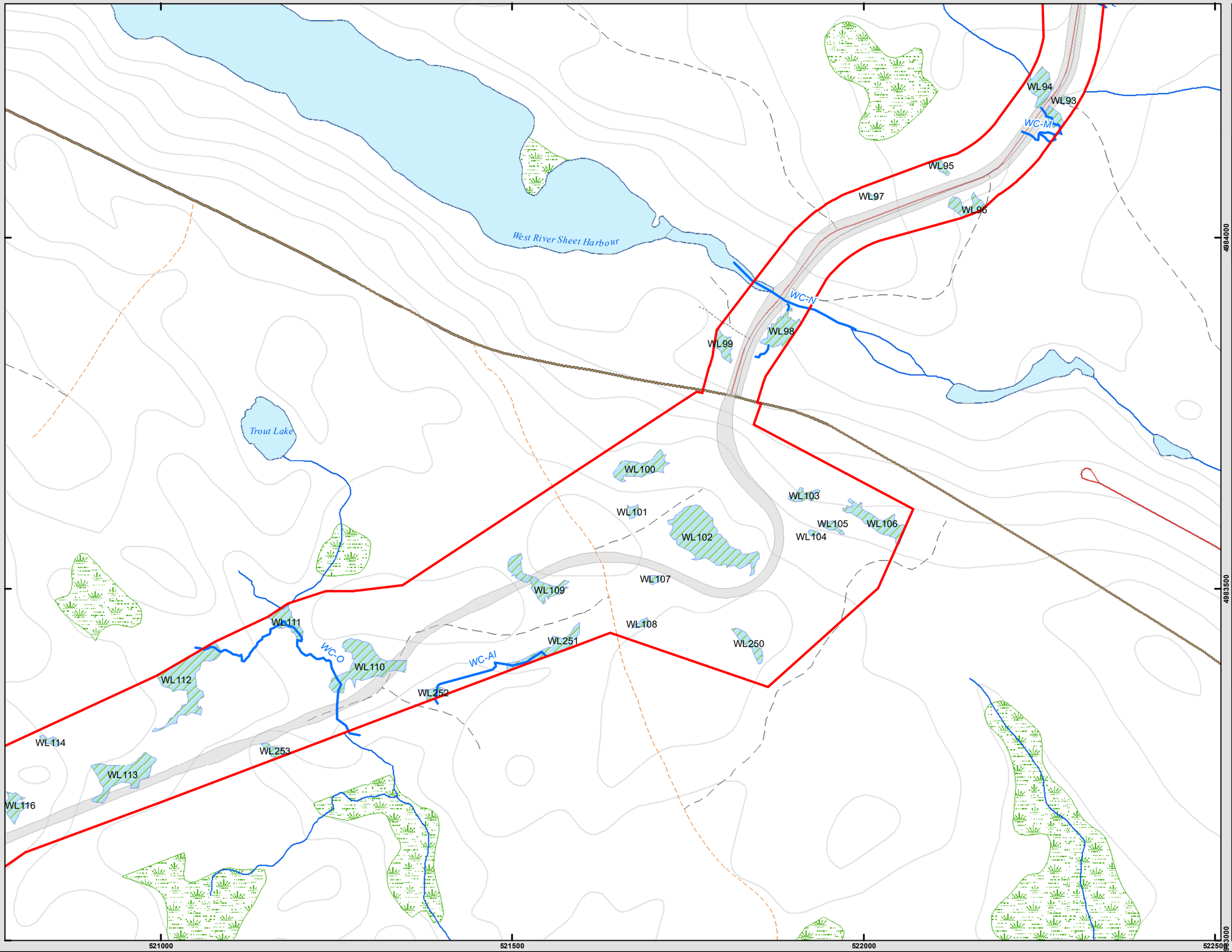

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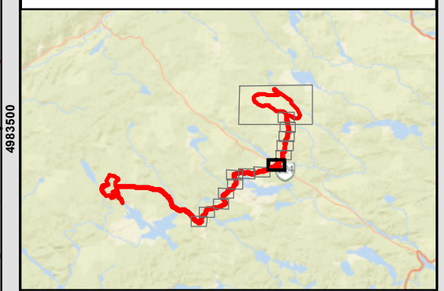
FIGURE 6.8-1 G

Beaver Dam Mine Project

Field Delineated Wetlands: Beaver Dam Mine Site and Haul Road

- Field Delineated Watercourses
- NSTDB Mapped Watercourses
- Collector Road
- Local Road
- Dry Weather / Seasonal Road
- Diveways (>300 m)
- Track
- Field Delineated Wetlands
- NSE Wetlands
- Proposed Infrastructure
- Project Area



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Units: Meter

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FIGURE 6.8-1 H

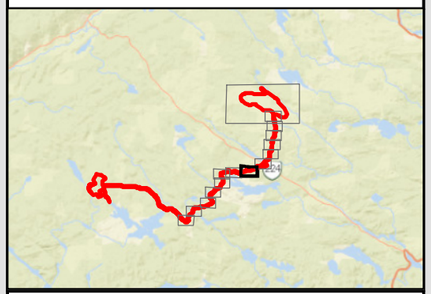
Beaver Dam Mine Project

Field Delineated Wetlands: Beaver Dam Mine Site and Haul Road

WC-O
WC-P
WL112
WL113
WL114
WL115
WL116
WL117
WL118
WL119
WL120
WL121
WL122
WL123
WL124
WL125
WL126
WL254
WL255
WL256

4983500
4983000
4982500
519500
520000
520500
521000

- Field Delineated Watercourses
- NSTDB Mapped Watercourses
- Dry Weather / Seasonal Road
- Track
- Field Delineated Wetlands
- NSE Wetlands
- Proposed Infrastructure
- Project Area



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

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1:5,000 Scale when printed @ 11" x 17"

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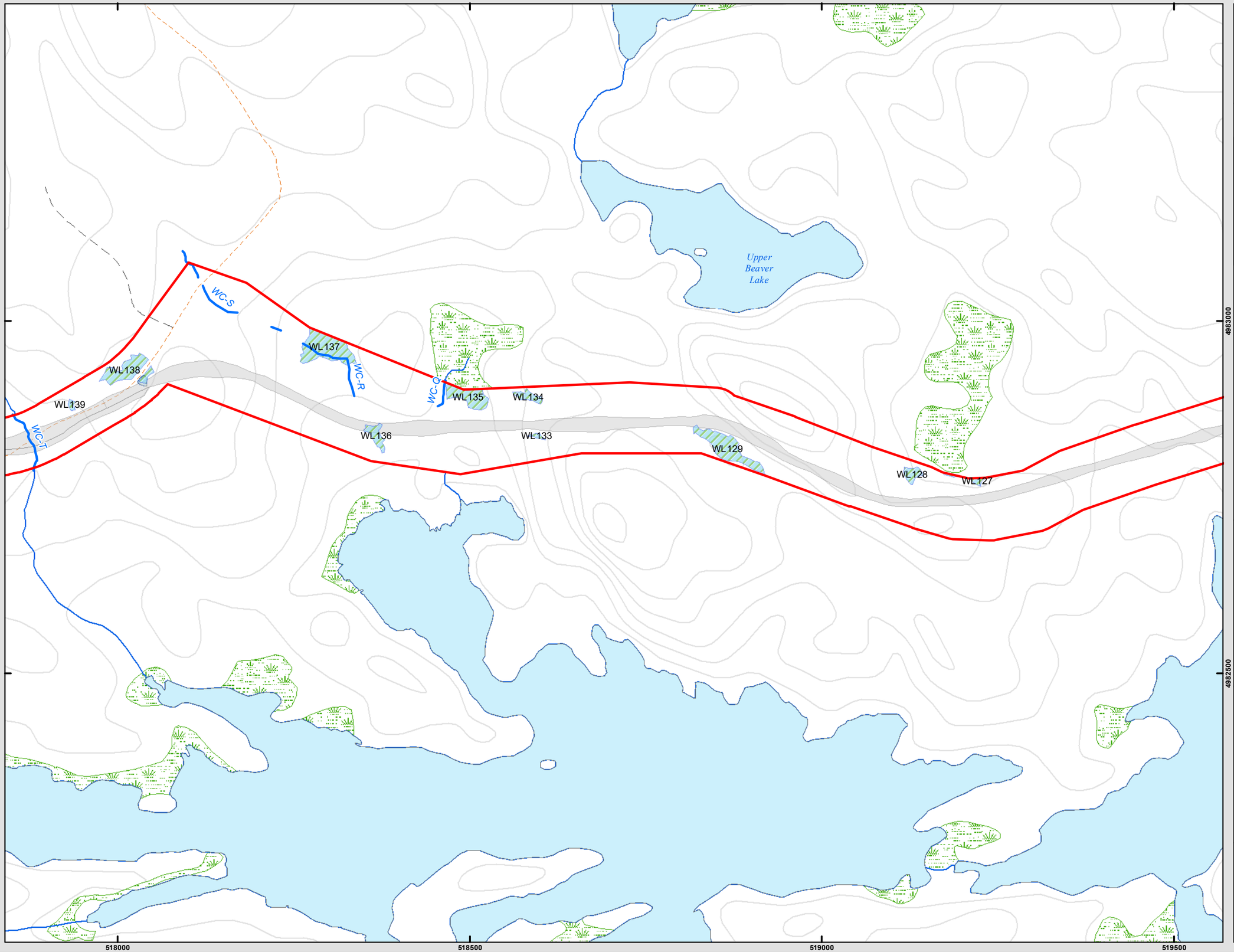

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FIGURE 6.8-1 |

Beaver Dam Mine Project

Field Delineated Wetlands: Beaver Dam Mine Site and Haul Road

- Field Delineated Watercourses
- NSTDB Mapped Watercourses
- Dry Weather / Seasonal Road
- Track
- Field Delineated Wetlands
- NSE Wetlands
- Proposed Infrastructure
- Project Area

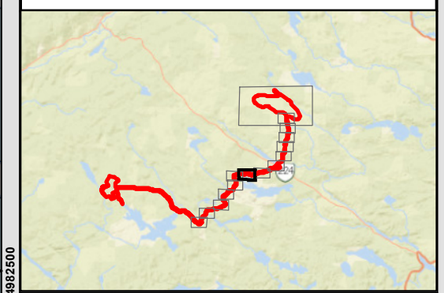

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FIGURE 6.8-1 J

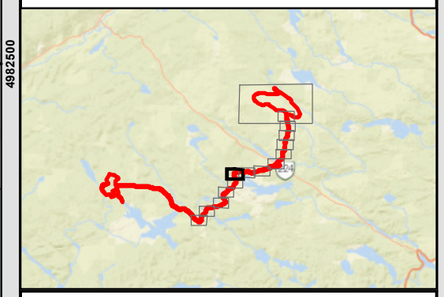
Beaver Dam Mine Project

Field Delineated Wetlands: Beaver Dam Mine Site and Haul Road

WL137
WL138
WL139
WL140
WL136
WL141
WL142
WL143
WL144
WL145
WC-S
WC-R
WC-T
WC-U
WC-V
WC-W
WC-X
WC-Y

4983000
4982500
4982000
517000
517500
518000

- Field Delineated Watercourses
- NSTDB Mapped Watercourses
- Dry Weather / Seasonal Road
- Track
- Field Delineated Wetlands
- NSE Wetlands
- Proposed Infrastructure
- Project Area



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Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

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1:5,000 Scale when printed @ 11" x 17"

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Document Name: BD_EIS_Figure6-8-XBD and HR Wetlands

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FIGURE 6.8-1 K

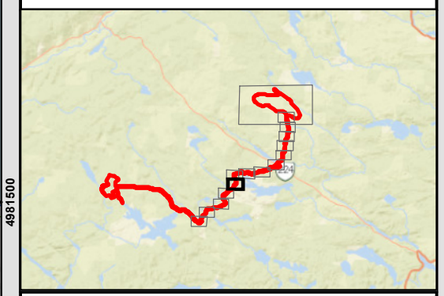
Beaver Dam Mine Project

Field Delineated Wetlands: Beaver Dam Mine Site and Haul Road

WC-W
WC-X
WC-Y
WC-Z
WL142
WL143
WL144
WL145
WL146
WL147
WL148
WL149
WL150
WL151
WL152
WL153
WL154
WL155
WL156
Otter Lake Brook

4982000
4981500
517000
517500
518000

- Field Delineated Watercourses
- NSTDB Mapped Watercourses
- Dry Weather / Seasonal Road
- Track
- Field Delineated Wetlands
- NSE Wetlands
- Proposed Infrastructure
- Project Area



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Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 62.5 125 250 m

1:5,000 Scale when printed @ 11" x 17"

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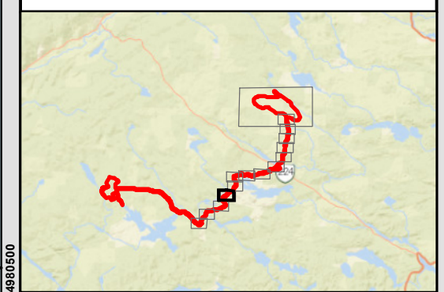
FIGURE 6.8-1 L

Beaver Dam Mine Project

Field Delineated Wetlands: Beaver Dam Mine Site and Haul Road

WL153
WL154
WL155
WL156
WL157
WL158
Quiet Lake Brook
Upper Kidney Lake
4981000
4980500
516000
516500
517000

- NSTDB Mapped Watercourses
- Dry Weather / Seasonal Road
- Track
- Field Delineated Wetlands
- NSE Wetlands
- Proposed Infrastructure
- Project Area



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Datum: North American 1983 CSRS
Units: Meter

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1:5,000 Scale when printed @ 11" x 17"

Drawn By: AS
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Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

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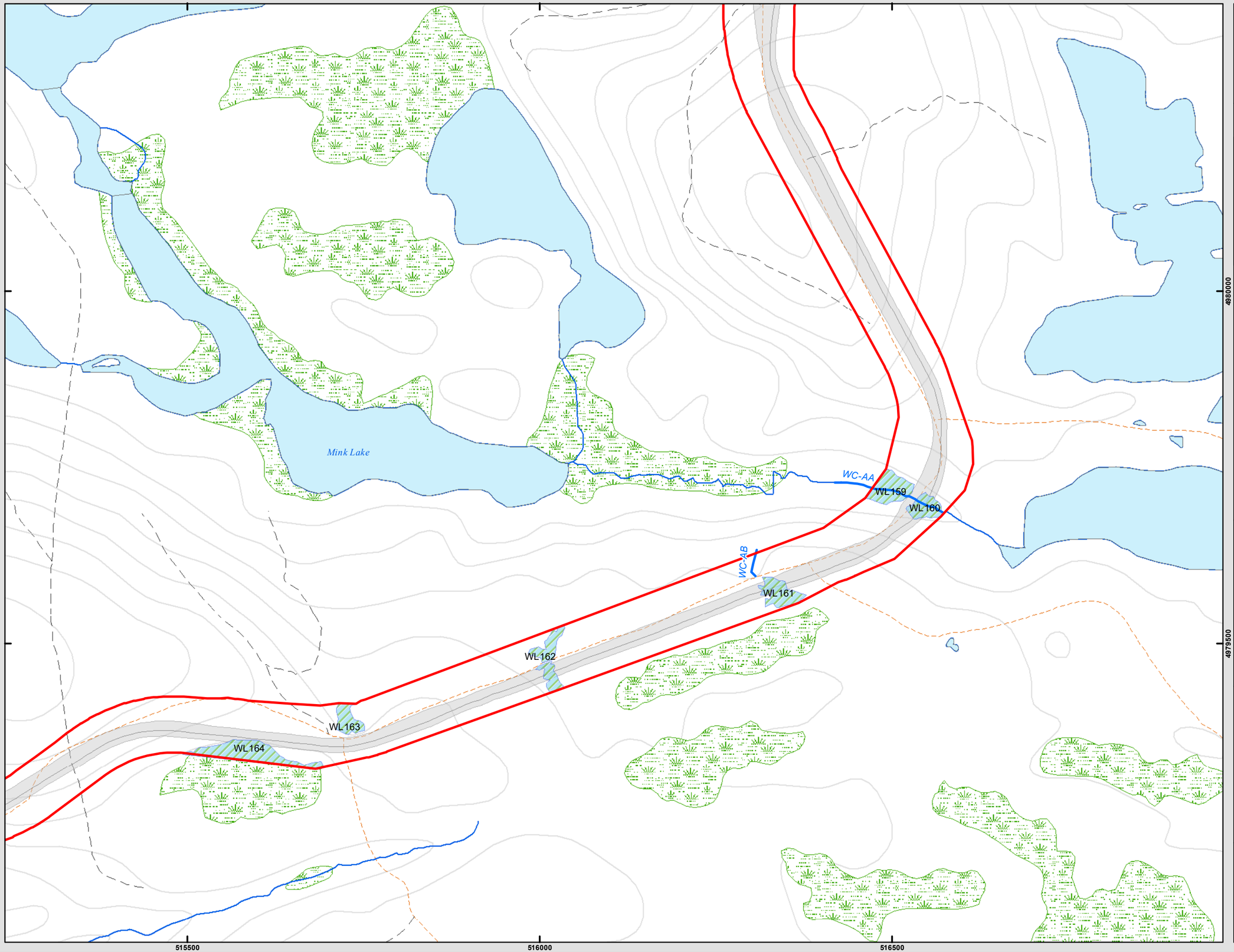
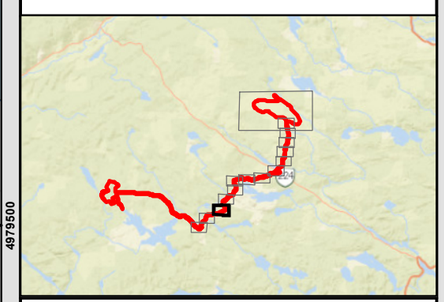
FIGURE 6.8-1 M

Beaver Dam Mine Project

Field Delineated Wetlands: Beaver Dam Mine Site and Haul Road



- Field Delineated Watercourses
- NSTDB Mapped Watercourses
- Dry Weather / Seasonal Road
- Track
- Field Delineated Wetlands
- NSE Wetlands
- Proposed Infrastructure
- Project Area



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Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 62.5 125 250 m

1:5,000 Scale when printed @ 11" x 17"

Drawn By: AS
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Date: 2021-05-24

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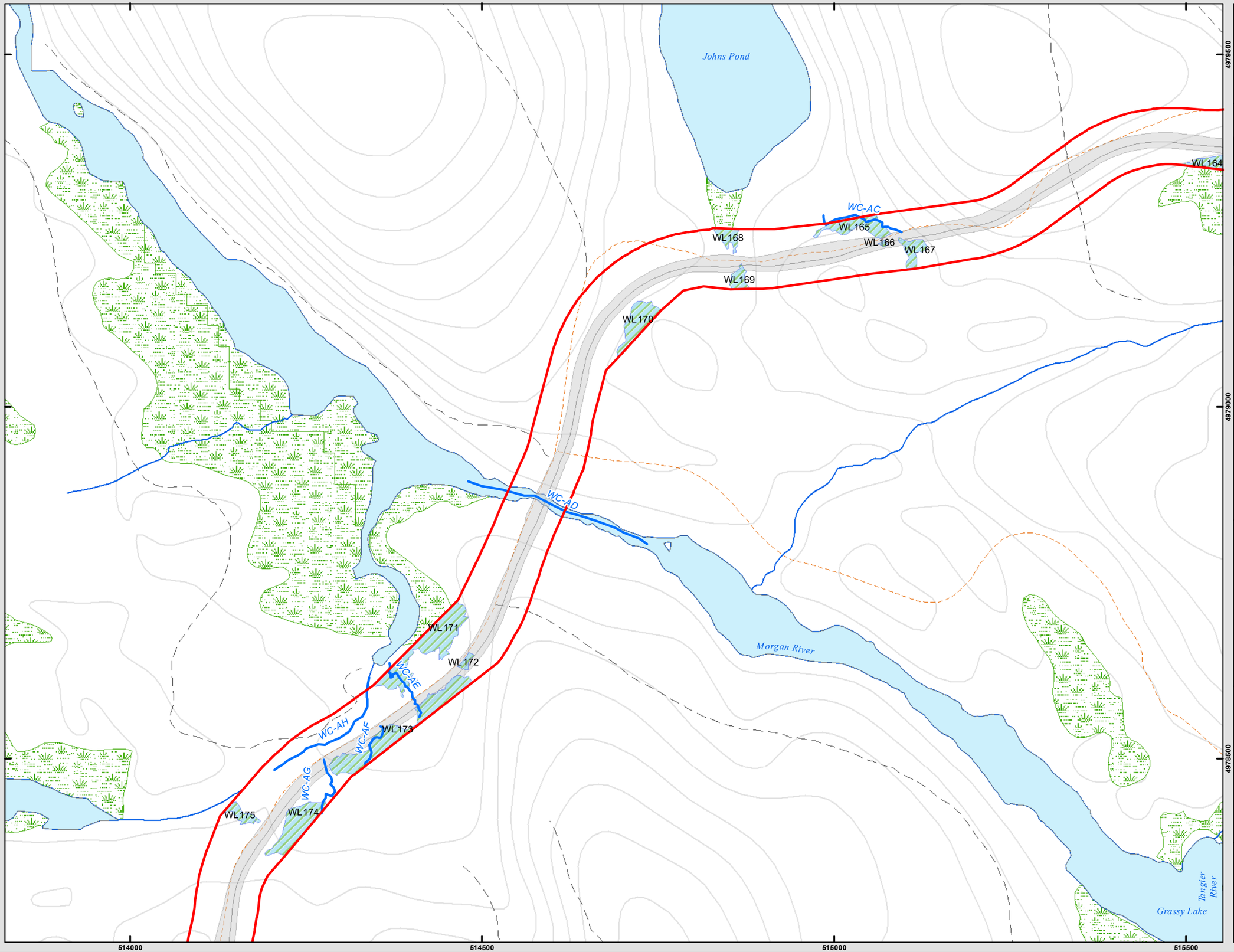

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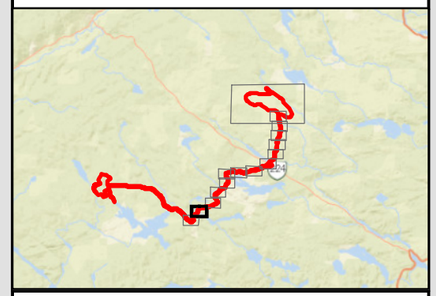
FIGURE 6.8-1 N

Beaver Dam Mine Project

Field Delineated Wetlands: Beaver Dam Mine Site and Haul Road

- Field Delineated Watercourses
- NSTDB Mapped Watercourses
- Dry Weather / Seasonal Road
- Track
- Field Delineated Wetlands
- NSE Wetlands
- Proposed Infrastructure
- Project Area



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Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 62.5 125 250 m

1:5,000 Scale when printed @ 11" x 17"

Drawn By: AS
Reviewed By:LP

Date: 2021-05-24

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Document Name: BD_EIS_Figure6-8-XBD and HR Wetlands

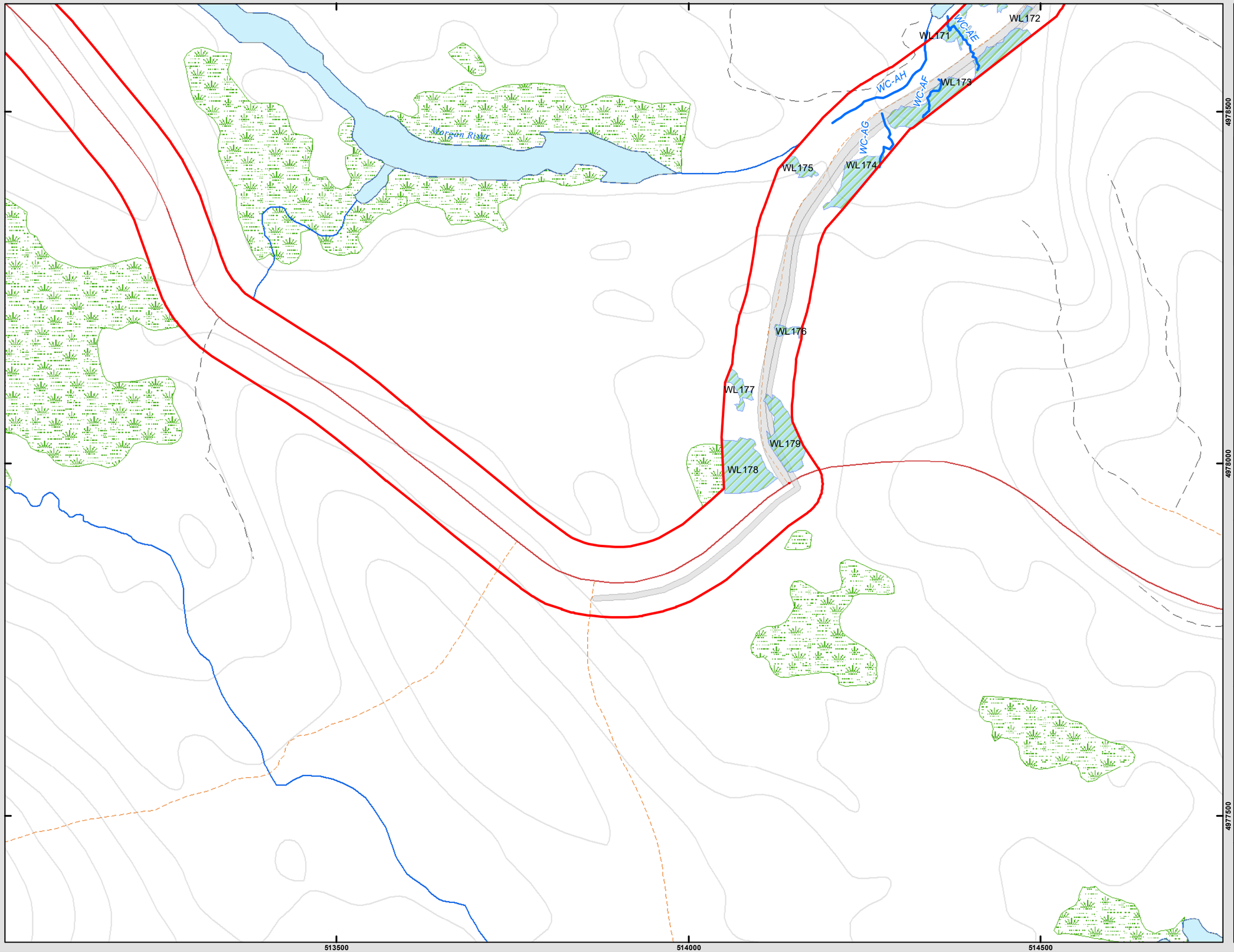

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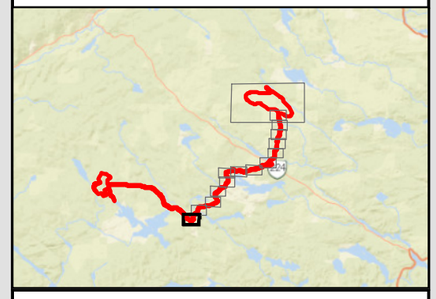
FIGURE 6.8-1 O

Beaver Dam Mine Project

Field Delineated Wetlands: Beaver Dam Mine Site and Haul Road

- Field Delineated Watercourses
- NSTDB Mapped Watercourses
- Local Road
- Dry Weather / Seasonal Road
- Track
- Field Delineated Wetlands
- NSE Wetlands
- Proposed Infrastructure
- Project Area



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 62.5 125 250 m

1:5,000 Scale when printed @ 11" x 17"

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Document Name: BD_EIS_Figure6-8-XBD and HR Wetlands

In total the 236 delineated wetlands occupy 166 ha and represent 24% and 13% of the Beaver Dam Mine Site and Haul Road (excluding Mooseland Road) areas, respectively (Table 6.8-2). It is important to note that open water within delineated wetland boundaries that could not be classified as an open water wetland as per the Canadian Wetland Classification System definition (NWWG 1997) has been removed from the calculation of wetland area (i.e., anthropogenically created waterbodies from historic mining operations (WL59)). This habitat is discussed specifically relating to watercourses and fish habitat (Section 6.9).

In the Beaver Dam Mine Site, hydrologic flow within wetlands is generally divided north and south where the Killag River tertiary watershed abuts the Cope Brook, Paul Brook and Tent Brook tertiary watersheds (Section 6.7.4 Water Quantity Baseline Conditions, Figure 6.7-4 and Appendix G.4 Physical Characterization of Watercourses). Larger wetland complexes straddle watershed boundaries (notably WL1, 2, 29, 35, 57, 222 and 247) and act as primary water sources for downgradient wetlands, watercourses and waterbodies. Wetlands 1 and 2 exist as bog complexes, which intercept and store precipitation and small scale water seepage from surrounding land prior to draining via additional aquatic features to the north and south. As is typical of these habitats in Nova Scotia, bogs located at higher elevation have the ability to source water to more than one tertiary watershed. In this case, water flows northward into the Killag River watershed and southward to the Tent Brook watershed. The same can be said for Wetlands 29 and 57, which also exist as complexes (albeit with a larger swamp component) and outflow northward toward into the Killag River watershed and southward into Paul Brook and Tent Brook tertiary watersheds, respectively.

As water drains northward through the Beaver Dam Mine Site, it does so via predominantly swamp habitat, often associated with watercourses or small-scale surface channelization (i.e., throughflow function). While intermixed with a scattering of isolated wetlands, swamps dominate the central portions the Killag River tertiary watershed and act as either mechanisms to drain water northward from the larger wetland complexes in the south, or in the case of isolated wetlands, form in small topographically defined basin formations. The major receptors of water within the Beaver Dam Mine Site are initially Crusher Lake, with Mud Lake and Cameron Flowage ultimately receiving most water prior to it draining offsite to the southeast. Larger riparian swamp wetlands (e.g., WL17 and 61) border Mud Lake and Cameron Flowage, intercepting water prior to releasing it into the water bodies.

Wetlands located in the headwaters of the Cope Brook, Paul Brook, and Tent Brook watersheds supply water to a lesser extent and shuttle water out of the Beaver Dam Mine Site more rapidly, whereby Wetlands 205, 29 and 66 are the primary outflows for the Cope Brook, Paul Brook, and Tent Brook watersheds, respectively. The remaining wetlands identified within these watersheds are primarily isolated in nature or support throughflow. Many provide groundwater recharge capacities rather than act as a source of surface water discharge to lower lying features.

Due to its length and intersection with six separate tertiary watersheds, wetlands along the Haul Road vary between outflow wetlands located at headwater locations, throughflow wetlands that drain water toward lower reaches of the watersheds, or receiving water wetlands in lower portions of the watershed. As is typical of the Nova Scotia landscape, however, smaller isolated wetlands were also identified along the length of the Haul Road, in all watersheds.

6.8.4.1 Functional Assessment Results

The NovaWET functional evaluation technique consists of 11 major sections associated with key wetland functions as listed below:

- Watershed Characteristics;
- Wetland Characterization;
- Condition and Integrity of Adjacent Land;
- Identification of Exceptional Features;

- Hydrologic Condition and Integrity;
- Water Quality;
- Groundwater Interactions;
- Shoreline Stabilization and Integrity;
- Plant Community;
- Fish and Wildlife Habitat and Integrity; and
- Community Use/Value

Each section contains questions specific to a function that supports the assessor in determining to what degree the wetland provides significant functions (SF). NovaWET continues to identify critical wetland functions that are often unique or rare or associated with higher risk to the watershed if lost. The Wetland Functional Assessment Summary Table included in Appendix H.1 provides the results of the SF determination for all wetlands within the Beaver Dam Mine Site and Haul Road. Critical SF functions are highlighted red.

Additional details for each wetland, including functional summary sheets, plant lists, photographs, and data sheets were recorded during field evaluations, but have not been included in this document due to the volume of data (236 wetlands within the Beaver Dam Mine Site and the Haul Road). These data are available upon request.

The following sections provide results of the NovaWET functional assessment.

6.8.4.1.1 Watershed Characteristics

The functional assessments conducted for the 236 wetlands located within the Beaver Dam Mine Site and the Haul Road determined that the overall watershed condition of the nine relevant tertiary watersheds is in a relatively unaltered state. Urban/commercial development is not present within the watersheds and, therefore, existing roads account for the impervious surfaces calculated within the watershed evaluation, resulting in a range of 0% to 0.62%, with the higher percentages being along the existing Haul Road. Therefore, condition is classified as low. Wetland habitat cover ranges from 3.40% to 22.19% of the total land area of the watersheds. Four of the watersheds provide a high ability to contribute to floodwater protection (<10% wetland cover), three of which comprise the Haul Road and one comprised the Beaver Dam Mine Site. Moderate floodwater protection (10% to 20% wetland cover) is afforded by four watersheds, of which two comprise the Beaver Dam Mine Site and two comprise the Haul Road. One watershed provides low floodwater protection (>20% wetland cover) and comprises the Beaver Dam Mine Site. Watershed evaluation results are presented in Table 6.8-3.

Most buffer areas surrounding the wetlands are highly vegetated. These wetlands and buffers generally offer high quality wildlife habitat and good water quality functions. Forestry activity was documented in habitat along the Haul Road and is also present surrounding the Beaver Dam Mine Site. Ninety-five percent of all wetlands assessed were determined to provide moderate-high plant community integrity with a diversity of species generally composed primarily of native species characteristic of the wetland type.

Table 6.8-3: Detailed Watershed Evaluation Results

Tertiary Watershed	Watershed Number	Project Area Component	Describe Watershed Condition (% impervious surface)	Percent Wetland Cover (%)	Total Watershed Area (ha)	Total Wetland Area (ha)	Road Surface Length (m)	Road Area (ha) (6.5 m wide)
Killag River	1EM-2-D	Beaver Dam Mine Site	0.00	12.52	6,727.78	842.11	0	0
Cope Brook	1EM-2-J	Beaver Dam Mine Site	0.00	8.8	1,204.99	106.05	0	0
Paul Brook	1EM-2-H	Beaver Dam Mine Site	0.00	22.19	871.12	193.31	0	0
Tent Brook	1EM-2-F	Beaver Dam Mine Site /Haul Road	0.00	16.43	1,086.9	178.53	0	0
Keef Brook	1EM-2-G	Haul Road	0.00	6.22	1,214.2	75.55	0	0
Jake Lowe Brook	1EM-2-N	Haul Road	0.62	3.40	1,416.73	48.1	13,434	8.7321
Little River	1EM-2-P	Haul Road	0.00	7.27	5,041.43	366.35	363	0.23595
Sandy Pond	1EL-2-C	Haul Road	0.04	10.57	5,117.9	540.81	3317	2.15605
Morgan River	1EL-2-H	Haul Road	0.00	16.84	3,111.17	523.95	0	0

Notes: % = percent; ha = hectares; m = meters.

6.8.4.1.2 Wetland Characteristics

The majority of individual wetlands (not including multi-wetland complexes) identified within the Beaver Dam Mine Site and Haul Road were classified as swamps and account for 68% and 64% of all wetlands, respectively. Swamps identified in the PA are consistent with swamp habitats observed throughout the province and are predominantly coniferous or mixed-wood treed swamps. A smaller proportion of shrub swamps were observed. Collectively swamps account for 22% of the total wetland area. Seventy-eight percent of delineated swamps are isolated, 14% support throughflow, 8% are in a headwater or outflow position and 1% receives inflow but lack a clear outflow. Some swamps may be classified into multiple hydrologic flow paths due to their size or position on the landscape.

The vegetation communities of swamps within the Beaver Dam Mine Site and Haul Road are coniferous dominated and characterized by a diverse herbaceous layer, with a variety of graminoids, ferns, and forbs. The most common herbaceous species in swamps are three-seeded sedge (*Carex trisperma),* cinnamon fern (*Osmundastrum cinnamomeum)*, and sheep laurel (*Kalmia angustifolia)*. Coniferous treed swamps are characterized by a prominent tree layer which is largely composed of black spruce (*Picea mariana*), tamarack (*Larix laricina*), and balsam fir (*Abies balsamea*). Mixed-wood treed swamps within the Beaver Dam Mine Site and Haul Road are also characterized by these species, and additionally include deciduous species, frequently red maple (*Acer rubrum)* and yellow birch (*Betula alleghaniensis)*. Shrub swamps are typically dominated by speckled alder (*Alnus incana)* and common softwood and hardwood species less than 8 cm diameter at breast height. The tree layer in shrub swamps is considerably reduced from those of treed swamps, while in some shrub swamps, particularly alder-dominated shrub swamps, the tree layer is completely absent.

Bogs, not including complexes with multiple wetland types, account for 15% of all wetlands within the Beaver Dam Mine Site and Haul Road, and 19% of the total wetland area. The largest wetland delineated within the Beaver Dam Mine Site or Haul Road is Wetland 2, a 20 ha bog complex within the south-central portion of the Beaver Dam Mine Site. Treed bogs are typically dominated by coniferous species, namely black spruce and tamarack. Low shrub bogs, whose tree layers are sparse or absent, are characterized by ericaceous shrubs like leatherleaf (*Chamaedaphne calyculata*), sheep laurel, and Labrador tea (*Rhododendron groenlandicum),* which are adapted to the acidic and nutrient poor soils indicative of bogs. Herbaceous layer diversity within bogs is greatly reduced from that of swamps.

Three percent of the identified wetlands within the Beaver Dam Mine Site and Haul Road are fens, not including complexes with multiple wetland types, and account for 3% of the total wetland area. This is likely an under-representative proportion, however, as many of the large wetland complexes are dominated by fen wetland types. Fens within the Beaver Dam Mine Site and Haul Road include graminoid, shrub, and to a lesser extent, treed fens. Graminoid fens tend to establish where the water table within the wetland is at or above the surface. The most commonly observed, dominant graminoid species in fens were tussock sedge (Carex stricta), leather leaf (*Chamaedaphne calyculata*) and bluejoint reed grass (Calamagrostis canadensis). Shrubs, in the form of speckled alder, black spruce, tamarack, and sweet gale (Myrica gale) are the dominant stratum in drier fens with a lower water table. Trees, when present, include black spruce, tamarack, balsam fir and red maple.

Marshes account for 2% of all wetlands within the Beaver Dam Mine Site and Haul Road (not including multi-wetland complexes), but only 0.2% of the total wetland area. Marsh vegetation predominantly comprises emergent aquatic macrophytes; these are plants that are rooted in shallow water but emerge above the water's surface. Common emergent vegetation includes bluejoint reed grass, woolgrass (*Scirpus cyperinus*), American manna grass (*Glyceria grandis*),and northern long sedge (*Carex folliculata*). The marsh shrub layer has a similar species composition to that of fens, though this stratum, along with the tree layer, are typically restricted to the edges of wetland. Tree species in marshes are limited and similar to those found in fens.

There are 30 wetland complexes (13% of all wetlands) that account for 56% of the total wetland area within the Beaver Dam Mine Site and Haul Road. These complexes comprise of a combination of swamp, bog, fen and, to a lesser extent, marsh wetland types, many of which extended beyond the PA boundaries.

Table 6.9-4 outlines the wetland types identified throughout the Beaver Dam Mine Site and Haul Road, including those identified during additional surveys.

Table 6.8-4: Summary of Wetland Types and Aerial Extent within the Beaver Dam Mine Site and Haul Road

Wetland Type	Beaver Dam Mine Site	Haul Road
Wetland Complex		
Number of Wetlands	18	13
Wetland Area	82.4 ha	10.1 ha
% of total wetlands identified within each PA component	15%	11%
Treed or Shrub Swamps		
Number of Wetlands	81	78
Wetland Area	27.1 ha	10.0 ha
% of total wetlands identified within each PA component	69%	64%
Bogs		
Number of Wetlands	12	23
Wetland Area	26.9 ha	4.5 ha
% of total wetlands identified within each PA component	10%	19%
Fens		
Number of Wetlands	4	4
Wetland Area	4.6 ha	0.4 ha
% of total wetlands identified within each PA component	3%	3%
Marshes		
Number of Wetlands	2	3
Wetland Area	0.2 ha	0.2 ha
% of total wetlands identified within each PA component	2%	2%
Total Number of Wetlands[(a)]	**117**	**121**

Note: [(a)] WL64 and WL66 are partially located within the Beaver Dam Mine Site and Haul Road. % = percent; PA = Project Area.

The average size of wetlands within the Beaver Dam Mine Site is approximately 1 ha. The wetlands identified in southern portions of the Beaver Dam Mine Site are in headwater positions within their respective tertiary watersheds, which are all within the West River Sheet Harbour Secondary Watershed. Many of these wetlands are sources of surface water for first order stream formation within their respective tertiary watersheds. Wetlands within the northern half of the Beaver Dam Mine Site, however, are centrally located within the Killag River tertiary watershed and therefore, predominantly act as throughflow features.

The vast majority of wetland habitat identified within the Haul Road was partially delineated, with wetland habitat extending beyond the PA boundaries. Wetlands within the Haul Road are located within six tertiary watersheds and range from wetlands in headwater positions to wetlands near, or at the bottom of watersheds. Detailed biophysical wetland information for each delineated wetland including wetland type, dominant vegetation, soil and hydrological conditions is provided in a Wetland Characterization Table in Appendix H.2.

Table 6.8-5 summarizes functional wetland information used as part of the functional assessment analysis throughout this chapter, including those identified during the 2019 surveys. Table 6.8-5 also presents baseline wetland conditions and stressors (e.g., altered hydrology, forestry impacts, historic tailings). Tailings from historic mining operations were assessed and mapped within the Beaver Dam Mine Site, through soil test pit and water quality analysis, as part of the surveys that have been undertaken to document the geochemistry at the Beaver Dam mine site in areas that indicated historic mining activity (Appendix E.6 [Phase I - Environmental Site Assessment], Appendix E.7 [Limited Phase II - Environmental Site Assessment] and Appendix E.8 [Extended Phase II - Environmental Site Assessment]). This assessment noted elevated levels of arsenic, exceeding NSE Tier 1 Environmental Quality Standards. An assessment of impacts from historic tailings is provided in Section 6.5. These reports were reviewed with consideration of wetland interactions. Where applicable, historical tailings with arsenic impacted soil have been included as a potential stressor. Wetlands within or near mapped areas of historic tailings with arsenic impacted soil are identified in Table 6.8-5. There are a total eight wetlands (WL8, 14, 56, 59, 60, 61, 210 and 216) that occur in areas where historic tailings or tailings that have been reworked into soils. During construction and dewatering stage of the project water will be directed towards the north settling pond for treatment prior to discharge, which is described in the Project Description (Section 2) and in the Mine Water Management Plan (Appendix P.4). Historic tailings impacted soils will be temporarily stored on site before being moved off-site to the Touquoy Mine Site Tailings Management Facility (TMF). The management of historic tailings is described in Appendix E.9 (draft Historic Tailings and Waste Rock Management Plan).

Table 6.8-5: Wetland Functional Information

Wetland ID	Wetland Type	Wetland Size (m^2)	Landscape Position	Landform	Hydrologic Flow Path	Hydrologic Regime	Watercourse Association	Standing Water % Cover in Wetland	Adjacent Upland Land Use	Stressors	Wetland Hydrology Altered?
Beaver Dam Mine Site											
1	complex: Mixed wood treed bog, tall shrub bog, open low shrub bog	37,188	Terrene	Basin	Outflow-Headwater	Permanently saturated	No	<5%	Forested	None	No
2	coniferous treed bog, graminoid bog, shrub bog	196,857	Terrene	Basin	Outflow-Headwater	Permanently saturated	Stream	0%	Forested	None	No
3	shrub bog	4658	Terrene	Basin	Isolated	Permanently Saturated	No	50%	Forested	None	No
4	complex: Treed swamp/ treed fen, mixed wood treed swamp	13,139	Terrene	Basin	Throughflow	Permanently Saturated, Seasonally Flooded	Stream	20%	Forested	None	No
5	mixed wood treed swamp	6,202	Terrene	Basin	Outflow-Headwater	Permanently saturated	No	5%	Forested	None	No
6	mixed wood treed swamp	262	Terrene	Basin	Isolated	Seasonally saturated	No	0%	Forested	ATV trails	Old skidder tracks
7	cut treed swamp	306	Terrene	Basin	Isolated	Seasonally flooded/ Permanently saturated	No	<5%	Forested	Trails	No
8	complex: Coniferous treed swamp, graminoid fen, low shrub fen, shrub swamp	16,603	Lentic lake	Basin	Bidirectional- non-tidal /Throughflow	Permanently saturated	Lake	30%	Forested	Cabin, historic tailings	Outlet man-made (constructed lake)
9	open bog	307	Terrene	Basin	Isolated	Seasonally flooded/ Permanently saturated	No	5%	Forested/ Roads	Infill at outlet	Drainage, ditching, and outlet adjustment
10	low shrub fen	18,817	Lentic lake	Basin	Bidirectional- non-tidal	Permanently saturated	Lake	50%	Forested	None	No
11	complex: low shrub bog, mixed wood treed swamp	2,955	Lotic Stream (ephemeral)	Basin	Throughflow	Permanently saturated	No	5%	Forested	None	No
12	complex: Open mixed wood treed swamp, coniferous treed swamp	4,475	Terrene	Basin	Isolated	Seasonally saturated	No	0%	Forested	None, but some rutting and an old clearing	No
13	complex: Treed swamp, coniferous treed swamp	4,816	Terrene	Basin	Throughflow	Seasonally flooded/ Permanently saturated	No	20%	Forested	Dam at outlet	Dam at outlet
14	complex: Shrub bog, Mixed wood treed swamp, low shrub fen	31,655	Terrene/Lotic Stream	Basin	Throughflow	Permanently saturated	Streams	8%	Forested/ Road	Historic tailings	No
15	graminoid fen	1,249	Lentic Pond	Basin	Outflow	Permanently saturated	Stream/Pond	20%	Forested	Access trail	Pond is man-made
16	open shrub swamp	3,670	Terrene	Basin	Outflow-Headwater (inferred)	Permanently saturated	No	<5%	Forested	None	No
17	complex: Tall shrub swamp, coniferous treed bog	76,341	Lentic lake	Basin	Bidirectional- non-tidal/ throughflow	Permanently Saturated, Permanently Flooded	Stream/Lake	40%	Forested	None	No
18	coniferous treed swamp	1,864	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested	Access trail	No
19	shrub bog	11,428	Terrene	Basin	Isolated	Permanently saturated	No	1%	Forested	Clear-cut	No
20	mixed wood treed fen	10,106	Terrene/Lotic Stream	Basin	Throughflow	Permanently flooded/ Permanently saturated	Stream	25%	Forested/ Road/ Trail	Culverts	Outlet has a culvert
21	mixed wood treed swamp	202	Terrene	Basin	Isolated	Seasonally saturated	No	0%	Forested	Ruts	Surface
22	mixed wood treed swamp	274	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested	None	No
23	coniferous treed swamp	419	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested/ Clear-cut	None	No
24	coniferous treed swamp	328	Terrene	Basin	Isolated	Permanently Saturated	No	0%	Forested/ Clear-cut	Clear-cut	No
25	coniferous treed swamp	1,416	Terrene	Basin	Isolated	Permanently saturated	No	1-2%	Forested	Logging	No
26	coniferous treed swamp	658	Terrene	Basin	Isolated	Permanently flooded	No	100%	Forested	Excess water level - potentially road runoff, but source unknown	No
27	mixed wood treed swamp	493	Terrene	Basin	Outflow-Headwater	Permanently saturated	Stream	5%	Forested	None	No
28	coniferous treed swamp	222	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested	Logging	No

Table 6.8-5: Wetland Functional Information (continued)

Wetland ID	Wetland Type	Wetland Size (m^2)	Landscape Position	Landform	Hydrologic Flow Path	Hydrologic Regime	Watercourse Association	Standing Water % Cover in Wetland	Adjacent Upland Land Use	Stressors	Wetland Hydrology Altered?
29	complex: Mixed wood treed swamp, low shrub fen, open bog, coniferous treed swamp, coniferous raised bog, graminoid fen	112,835	Lentic lake	Basin	Outflow-Headwater (northern extent) Throughflow (southeastern extent)	Permanently flooded/ Permanently saturated	Lake/ Stream	25%	Forested	Very little	Trenched inlet
30	coniferous treed swamp	964	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested	None	No
31	coniferous treed swamp	10,473	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested	None	No
32	coniferous treed swamp	120	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested	None	No
33	coniferous treed swamp	1,900	Lotic Stream	Basin	Throughflow	Permanently saturated	No	5%	Forested	Trenching	Ditching
34	mixed wood treed swamp	1,382	Terrene	Basin	Isolated	Permanently Saturated	No	0%	Forested/ Clear-cut	Rutting	No
35	coniferous treed swamp	3,376	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested	Road	Road/ Culvert
36	coniferous treed swamp	916	Terrene	Slope	Isolated	Permanently saturated	No	0%	Forested	None	No
37	deciduous treed swamp	253	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested	Old skidder ruts	Surface
38	coniferous treed swamp	388	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested	None	No
39	coniferous treed swamp	1,857	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested	Forest harvest	No
40	coniferous treed swamp	8,091	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested	None	No
41	graminoid marsh	910	Terrene	Basin	Isolated	Seasonally saturated	No	0%	Forested/ Road	None	Unknown; evidence of fluctuation
42	coniferous treed swamp	1,879	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested	Historic logging/ rutting	No
43	mixed wood treed swamp	81	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested/ Logged	None	No
44	coniferous treed bog	10,611	Terrene	Basin	Throughflow	Permanently flooded	No	90%	Forested	Dead and dying woody debris	Beaver dam
45	coniferous treed swamp	295	Terrene	Basin	Isolated	Permanently saturated	No	<5%	Forested	None	No
46	coniferous treed riverine swamp	754	Lotic Stream	Basin	Throughflow	Permanently saturated	Stream	0%	Forested	None	No
47	fresh water marsh	1,029	Terrene	Basin	Isolated	Permanently flooded	No	80%	Forested	Dead and dying woody plants	No
48	coniferous treed swamp	2,876	Terrene	Basin	Throughflow	Seasonally flooded	Stream	0%	Forested/ Road	Dead and dying woody debris	Ditching and abandoned beaver impoundment
49	coniferous treed swamp	117	Terrene	Basin	Isolated	Permanently saturated	No	5%	Forested	None	No
50	coniferous tall shrub swamp	117	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested	None	No
51	mixed wood treed swamp	898	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested	None	No
52	coniferous treed swamp	1,620	Terrene	Basin	Throughflow	Seasonally saturated	Stream	0%	Forested	Dead and dying plants/ Blowdown	No
53	low shrub swamp	824	Terrene	Basin	Outflow-Headwater	Permanently saturated	Stream	<5%	Forested/ Clear-cut	None	No
54	coniferous treed bog	416	Lotic	Basin	Isolated	Permanently saturated	No	0%	Forested/ Road	Road	Road
55	mixed wood treed swamp	616	Terrene	Basin	Isolated	Seasonally flooded/ Permanently saturated	No	0%	Forested	Dead and dying woody plants	Ditching into wetland
56	complex: Coniferous treed swamp, tall shrub swamp, low shrub bog, open water	16,276	Terrene	Basin	Throughflow	Permanently flooded/ Permanently saturated	Streams	5%	Forested/ Trails/ Road	Ditching, roads, some infill, historic tailings	Ditching
57	complex: Coniferous treed swamp, deciduous treed swamp	88,717	Terrene	Basin	Outflow-Headwater	Seasonally saturated/ Permanently saturated	Stream	0%	Forested	None	No
58	deciduous treed swamp	581	Terrene	Slope	Isolated	Permanently saturated	No	0%	Forested	None	No

Table 6.8-5: Wetland Functional Information (continued)

Wetland ID	Wetland Type	Wetland Size (m^2)	Landscape Position	Landform	Hydrologic Flow Path	Hydrologic Regime	Watercourse Association	Standing Water % Cover in Wetland	Adjacent Upland Land Use	Stressors	Wetland Hydrology Altered?
59	complex: coniferous treed swamp, emergent marsh, open water	65,304	Terrene	Basin	Throughflow	Permanently flooded/ Permanently saturated	Streams	70%	Forested/ Roads	Drill pads, cutting, roads, flooding, beaver dam, dead/dying woody plants, historic tailings	Ditching, dam and culvert
60	coniferous treed swamp	2,963	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested	Clear cut, historic tailings	No
61	complex: Deciduous treed swamp, tall shrub swamp, open low shrub fen	25,982	Lentic lake	Basin	Throughflow/Bidirectional-non-tidal	Permanently flooded/ Permanently saturated	Lake	20%	Forested/ Tailings	Historic tailings	No
62	coniferous treed swamp	832	Lentic lake	Basin	Bidirectional- non - tidal	Permanently saturated	Lake	0%	Forested/ Cameron Flowage	None	No
63	coniferous treed swamp	486	Terrene	Basin	Isolated	Permanently Saturated	No	0%	Forested	No	No
64	complex: low shrub bog, mixed wood treed swamp	42,047	Terrene	Basin	Throughflow	Permanently flooded	No	40%	Forested/ Road	Road	Road
66	complex: graminoid fen, mixed wood treed swamp, high shrub fen	55,419.49	Terrene	Basin	Throughflow	Permanently flooded	Stream	65%	Forested/ Road	None	Road
200	coniferous treed swamp	1,677	Terrene	Basin	Isolated	Seasonally Saturated	No	0%	Forested	None	No
201	mixed wood swamp	284	Terrene	Basin	Isolated	Permanently Saturated	No	0%	Forested	None	No
202	coniferous treed swamp	571	Terrene	Basin	Isolated	Permanently Saturated	No	0%	Forested	None	No
203	open bog	3,925	Terrene	Basin	Isolated	Permanently Saturated	No	0%	Forested/ Road	Road	Ditching
204	coniferous treed swamp	8,295	Terrene	Basin	Isolated	Seasonally Saturated	No	0%	Forested/ Road	Road	Ditching
205	mixed wood swamp	45,975	Terrene	Basin	Inflow - Drainage	Permanently Saturated	No	0%	Forested/ Road/ Logged	Road/ Logging	Ditching
206	shrub swamp	3,298	Lotic Stream	Basin	Throughflow	Permanently Saturated	Stream	2%	Forested/ Logged	Logging	No
207	complex: mixed wood treed swamp, bog	86,450	Terrene	Basin	Outflow	Permanently Saturated	Stream	4%	Forested/ Logged	Logging	No
208	coniferous bog	6,478	Terrene	Basin	Isolated	Permanently Saturated	No	3%	Forested	None	No
209	shrub bog	11,514	Terrene	Basin	Isolated	Permanently Saturated	No	0%	Forested	None	No
210	coniferous bog	11,058	Lotic Stream	Basin	Inflow - Stream, Drainage	Permanently Saturated	Stream	10%	Forested/ Logged	Historic tailings	No
211	coniferous treed swamp	10,474	Terrene	Basin	Isolated	Permanently Saturated	No	0%	Forested	None	No
212	shrub swamp	13,987	Terrene	Basin	Isolated	Permanently Saturated	No	0%	Forested/ Road	Road	No
213	shrub swamp	992	Terrene	Basin	Isolated	Permanently Saturated	No	0%	Forested/ Road	None	No
214	mixed wood swamp	6,041	Terrene	Basin	Isolated	Permanently Saturated	No	0%	Forested/ Road	Road	No
215	shrub swamp	16,447	Lotic Stream	Basin	Outflow	Permanently Saturated	Stream	0%	Forested/ Logged	None	No
216	shrub swamp	1,397	Terrene	Basin	Isolated	Permanently Saturated	No	0%	Forested/ Road	Road, historic tailings	Ditching/access road
217	coniferous treed swamp	5,230	Lotic Stream	Basin	Throughflow	Permanently Saturated	Stream	1%	Forested	None	No
218	open bog	115	Terrene	Basin	Isolated	Permanently saturated	No	40%	Forested/ Road	Forestry	No
219	complex: fen, mixed wood treed swamp	90,880	Stream Floodplain	Basin	Outflow	Permanently saturated	Stream	0%	Forested/ Logged	None	No
220	coniferous treed fen	15,691	Terrene	Basin	Outflow	Permanently saturated	Stream	0%	Forested/ Road	Forestry	Road
221	mixed wood treed swamp	4,082	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested	None	No
222	coniferous treed swamp	7,788	Terrene	Basin	Isolated	Permanently saturated	no	0%	Forested/ Road	None	No
223	coniferous treed swamp	475	Terrene	Basin	Isolated	Permanently saturated	no	10%	Forested	None	No
224	coniferous treed swamp	1,693	Terrene	Basin	Isolated	Permanently saturated	no	0%	Forested	None	No
225	coniferous treed swamp	235	Terrene	Basin	Isolated	Permanently saturated	no	0%	Forested	None	No
226	complex: coniferous swamp, bog	15,039	Terrene	Basin	Isolated	Permanently saturated	no	0%	Forested/ Logged	None	No
227	mixed wood treed swamp	365	Terrene	Basin	Throughflow (via drainage)	Permanently saturated	no	0%	Forested/ Logged	Forestry	No

Table 6.8-5: Wetland Functional Information (continued)

Wetland ID	Wetland Type	Wetland Size (m^2)	Landscape Position	Landform	Hydrologic Flow Path	Hydrologic Regime	Watercourse Association	Standing Water % Cover in Wetland	Adjacent Upland Land Use	Stressors	Wetland Hydrology Altered?
228	coniferous treed bog	11,835	Terrene	Basin	Isolated	Permanently saturated	no	0%	Forested	None	No
229	coniferous treed swamp	4,644	Terrene	Basin	Isolated	Permanently saturated	no	0%	Forested	Forestry	No
230	coniferous treed swamp	1,812	Terrene	Basin	Isolated	Permanently saturated	no	0%	Forested	None	No
231	coniferous treed swamp	4,808	Terrene	Basin	Inflow (via drainage)	Permanently saturated	no	0%	Forested	Forestry	No
232	mixed wood treed swamp	875	Terrene	Basin	Isolated	Permanently saturated	no	0%	Forested	Forestry	No
233	mixed wood treed swamp	8,025	Terrene	Sloped Basin	Isolated	Permanently saturated	no	0%	Forested/ Logged	Forestry	No
234	coniferous treed swamp	3,328	Terrene	Basin	Isolated	Permanently saturated	no	0%	Forested	None	No
235	mixed wood treed swamp	619	Terrene	Basin	Isolated	Permanently saturated	no	0%	Forested/ Road	Forestry	No
236	complex: swamp, bog	37,699	Terrene	Flat	Isolated	Permanently saturated	yes	0%	Forested	None	No
237	coniferous treed swamp	429	Terrene	Sloped Basin	Throughflow (via drainage)	Permanently saturated	no	0%	Forested	None	No
238	deciduous treed swamp	4,685	Terrene	Sloped	Isolated	Permanently saturated	no	0%	Forested	None	No
239	open bog	1,004	Terrene	Basin	Isolated	Permanently saturated	no	0%	Forested	None	No
240	mixed wood treed swamp	21,799	Terrene	Sloped	Isolated	Permanently saturated	no	0%	Forested/ Logged	None	No
241	mixed wood treed swamp	821	Terrene	Basin	Isolated	Permanently saturated	no	0%	Forested	None	No
242	mixed wood treed swamp	2,366	Terrene	Sloped Basin	Isolated	Permanently saturated	no	0%	Forested	None	No
243	mixed wood treed swamp	1,104	Terrene	Sloped Basin	Isolated	Permanently saturated	no	0%	Forested	None	No
244	coniferous treed swamp	131	Terrene	Sloped Basin	Isolated	Permanently saturated	no	0%	Forested	None	No
245	mixed wood treed swamp	1,864	Terrene	Sloped	Isolated	Permanently saturated	no	5%	Forested	None	No
246	mixed wood treed swamp	8,871	Terrene	Sloped Basin	Isolated	Permanently saturated	no	5%	Forested/ Logged	None	No
247	mixed wood treed swamp	9,371	Terrene	Sloped Basin	Isolated	Permanently saturated	no	0%	Forested	None	No
248	mixed wood treed swamp	401	Terrene	Basin	Isolated	Permanently saturated	no	0%	Forested	None	No
249	mixed wood treed swamp	2,322	Terrene	Basin	Isolated	Permanently saturated	no	0%	Forested	None	No
257	shrub swamp	230	Terrene	Flat	Isolated	Permanently saturated	no	10%	Forested/ Road	Road	Ditching/access road
258	shrub swamp	954	Terrene	Basin	Isolated	Permanently saturated	no	0%	Forested/ Logged	Forestry	No
Haul Road											
64	complex: low shrub bog, mixed wood treed swamp	6,306	Terrene	Basin	Throughflow	Permanently flooded	No	40%	Forested/ Road	Road	Road
65	open bog	65	Terrene	Basin	Isolated	Seasonally saturated	No	0%	Forested/ Road	Road	Road
66	complex: graminoid fen, mixed wood treed swamp, high shrub fen	15,578	Terrene	Basin	Throughflow	Permanently flooded	Stream	65%	Forested/ Road	None	Road
67	complex: low shrub fen, tall shrub fen	1,535	Terrene	Basin	Outflow	Permanently saturated	No	20%	Forested/ Road	None	No
68	complex: shrub fen, graminoid fen and mixed wood treed swamp	5,568	Terrene	Basin	Throughflow	Seasonally saturated	No	10%	Forested/ Road	None	No
69	complex: Shrub fen, graminoid fen and mixed wood treed swamp	3,899	Lentic	Basin	Throughflow (inferred from wet areas mapping)	Permanently saturated	Stream	5%	Forested/ Road	None	No
70	tall shrub swamp	613	Terrene	Basin	Isolated (inferred)	Permanently saturated	No	20%	Forested/ Road	None	No
71	deciduous treed swamp	425	Terrene	Basin	Isolated	Seasonally saturated	No	0%	Forested/ Road	None	No
72	deciduous treed swamp	1,471	Terrene	Basin	Outflow	Seasonally saturated	No	0%	Forested/ Road	None	Road
73	Complex: tall shrub swamp, tall shrub fen	27,091	Terrene	Basin	Throughflow	Permanently saturated	No	10%	Forested/ Road	None	No
74	Complex: Mixed wood treed swamp, fresh water marsh	12,339	Terrene	Basin	Throughflow	Permanently flooded	Stream	15%	Forested/ Road	None	Road/ Tree fall

Table 6.8-5: Wetland Functional Information (continued)

Wetland ID	Wetland Type	Wetland Size (m^2)	Landscape Position	Landform	Hydrologic Flow Path	Hydrologic Regime	Watercourse Association	Standing Water % Cover in Wetland	Adjacent Upland Land Use	Stressors	Wetland Hydrology Altered?
75	mixed wood treed swamp	144	Terrene	Basin	Isolated	Seasonally saturated	No	1%	Forested/ Road	None	No
76	Complex: mixed wood treed swamp, open graminoid fen	10,406	Lotic	Basin	Throughflow	Permanently flooded/ Permanently saturated	Stream	2%	Forested/ Road	Roads, culverts, and garbage	Roads and culverts (2)
77	mixed wood treed swamp	1,688	Terrene	Basin	Throughflow (inferred)	Permanently saturated	No	0%	Forested/ Road	None	Road
78	mixed wood treed swamp	194	Terrene	Basin	Isolated	Seasonally saturated	No	0%	Forested/ Road	None	No
79	coniferous treed swamp	3,294	Terrene	Basin	Throughflow	Permanently saturated	Stream	0%	Forested/ Road/ Trail	None	Road, bridge, and culverts
80	coniferous bog	978	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested/ Road/ Cut block	None	Road
81	tall shrub swamp	154	Terrene	Basin	Isolated	Permanently saturated	No	20%	Forested/ Road	None	No
82	mixed wood treed swamp	616	Terrene	Basin	Isolated	Permanently saturated	No	1%	Forested/ Road	None	No
83	mixed wood treed swamp	529	Terrene	Basin	Isolated (inferred)	Permanently saturated	No	0%	Forested	None	Ditching
84	low shrub swamp	695	Terrene	Basin	Isolated (inferred)	Seasonally saturated	No	0%	Forested/ Road/ Cut block	Rutting/ Clear-cut	Old cut block
85	low shrub swamp	322	Terrene	Basin	Isolated (inferred)	Seasonally saturated	No	0%	Forested/ Road	None	No
86	mixed wood swamp	4,607	Terrene	Basin	Isolated (inferred)	Permanently saturated	No	0%	Forested/ Road	None	No
87	open bog	362	Terrene	Basin	Isolated (inferred)	Permanently saturated	No	5%	Forested/ Road	Rutting/ Clear-cut	No
88	tall shrub swamp	409	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested	Rutting	Rutting
89	treed swamp	6,170	Terrene	Basin	Isolated (inferred)	Permanently saturated	No	0%	Forested	Rutting	No
90	mixed wood treed swamp	4,495	Terrene	Basin	Outflow (inferred)	Permanently saturated	No	1%	Forested	Logging road/ Ditching	Ditching
91	mixed wood treed swamp	1,060	Terrene	Basin	Isolated (inferred)	Permanently saturated	No	1%	Forested	None	Ditching
92	mixed wood treed swamp	1,943	Terrene	Basin	Throughflow	Permanently saturated	No	1%	Forested	None	Water passes beneath upland into ditch and joins with WC
93	graminoid marsh	166	Terrene	Basin	Isolated	Permanently flooded	No	90%	Forested/ Road	None	Altered by road
94	mixed wood treed swamp	1,693	Lotic	Basin	Throughflow	Permanently flooded/ Permanently saturated	Stream	20%	Forested/ Road	None	Ditching
95	mixed wood treed swamp	263	Terrene	Basin	Isolated	Permanently saturated	No	2%	Forested	None	No
96	mixed wood treed swamp	861	Terrene	Basin	Isolated (inferred)	Permanently saturated	No	0%	Forested	None	No
97	mixed wood treed swamp	107	Terrene	Basin	Isolated	Permanently saturated	No	30%	Forested/ Road	None	Surface
98	mixed wood treed swamp	1,540	Terrene	Basin	Throughflow	Permanently flooded/ Permanently saturated	Stream	20%	Forested/ Road	None	No
99	mixed wood treed swamp	694	Terrene	Basin	Isolated	Permanently saturated	No	3%	Forested/ Road	None	Cut block
100	shrub swamp	1,582	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested	None	Old clearing
101	clear cut swamp	219	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested	None	Cut block
102	Complex; mixed wood treed bog, mixed wood treed swamp	5,439	Terrene	Basin	Isolated	Permanently saturated	No	15%	Forested/ Road/ Cut block	None	No
103	low shrub bog	455	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested/ Impervious	None	Cut block
104	low shrub swamp	102	Hillslope	Basin	Isolated	Permanently saturated	No	0%	Forested	None	Old cut block
105	low shrub bog	284	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested	None	Cut block
106	low shrub bog	1,701	Terrene	Basin	Isolated (inferred)	Permanently saturated	No	0%	Forested/ Impervious	None	Old cut block
107	coniferous treed swamp	186	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested	None	No
108	tall shrub swamp	183	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested	None	No
109	coniferous treed swamp	1,606	Terrene	Basin	Isolated	Permanently saturated	No	1%	Forested/ Road/ Cut block	Old cut block	No

Table 6.8-5: Wetland Functional Information (continued)

Wetland ID	Wetland Type	Wetland Size (m^2)	Landscape Position	Landform	Hydrologic Flow Path	Hydrologic Regime	Watercourse Association	Standing Water % Cover in Wetland	Adjacent Upland Land Use	Stressors	Wetland Hydrology Altered?
110	shrub bog	912	Terrene	Basin	Isolated	Permanently saturated	No	1%	Forested	None	No
111	mixed wood swamp	1,060	Lotic	Basin	Throughflow	Permanently saturated	Stream	5%	Forested	None	No
112	mixed wood swamp	3,595	Terrene	Basin	Outflow-Headwater	Permanently saturated	Stream	8%	Forested	None	No
113	mixed wood treed swamp	1,940	Terrene	Basin	Isolated (inferred)	Permanently saturated	No	3%	Forested	None	No
114	coniferous swamp	242	Terrene	Basin	Isolated	Permanently saturated	No	<5%	Forested	None	No
115	mixed wood treed swamp	582	Terrene	Basin	Isolated (inferred)	Permanently saturated	No	2%	Forested	None	No
116	coniferous swamp	892	Terrene	Basin	Isolated	Seasonally saturated	No	0%	Forested	None	No
117	coniferous swamp	147	Terrene	Basin	Isolated	Seasonally saturated	No	4%	Forested	None	No
118	coniferous swamp	428	Terrene	Basin	Isolated	Permanently saturated	No	2%	Forested	None	No
119	coniferous treed swamp	328	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested	None	No
120	low shrub swamp	115	Terrene	Basin	Isolated	Seasonally saturated	No	0%	Forested	None	No
121	coniferous swamp	466	Terrene	Basin	Isolated	Seasonally saturated	No	0%	Forested	None	No
122	coniferous treed swamp	200	Terrene	Basin	Isolated	Seasonally saturated	No	0%	Forested	None	No
123	mixed wood treed swamp	818	Terrene	Basin	Isolated	Seasonally saturated	No	2%	Forested	None	No
124	mixed wood treed swamp	528	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested	None	No
125	mixed wood treed swamp	344	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested	None	No
126	mixed wood treed swamp	63	Terrene	Basin	Isolated	Seasonally saturated	No	0%	Forested	None	No
127	treed bog	185	Terrene	Basin	Outflow (inferred from wet areas mapping)	Permanently saturated	No	5%	Forested	None	No
128	tall shrub bog	409	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested	None	No
129	treed bog	2,006	Terrene	Basin	Isolated	Permanently saturated	No	2%	Forested	None	No
133	low shrub bog	102	Terrene	Basin	Isolated	Permanently saturated	No	5%	Forested	None	No
134	treed swamp	398	Terrene	Basin	Isolated	Seasonally saturated	No	5%	Forested	None	No
135	shrub fen	1,227	Terrene	Basin	Throughflow	Permanently saturated	Stream	0%	Forested	None	No
136	mixed wood treed swamp	522	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested	None	No
137	mixed wood treed swamp	2,404	Terrene	Basin	Throughflow	Permanently saturated	Stream	5%	Forested	None	No
138	shrub bog	1,521	Terrene	Basin	Isolated	Permanently saturated	No	20%	Forested/ Road	None	Road
139	tall shrub bog	106	Terrene	Basin	Isolated	Permanently flooded	No	28%	Forested/ Road	None	Road
140	treed bog	230	Terrene	Basin	Isolated	Seasonally saturated	No	0%	Forested/ Road	None	No
141	tall shrub bog	60	Terrene	Basin	Isolated	Permanently flooded	No	40%	Forested/ Road	None	Road
142	low shrub bog	342	Lotic	Basin	Throughflow	Permanently saturated	Stream	2%	Forested/ Road/ Clearing	None	Road
143	Complex: graminoid bog, deciduous treed swamp	527	Lotic	Basin	Throughflow	Permanently saturated	Stream	45%	Forested/ Road	None	No
144	tall shrub fen	2,034	Terrene	Basin	Throughflow	Permanently saturated	Stream	10%	Forested/ Road	None	Road
145	low shrub bog	1,462	Terrene	Basin	Isolated (inferred)	Permanently saturated	No	0%	Forested/ Road	Road	No
146	Complex: graminoid fen, mixed wood treed swamp	2,265	Terrene	Basin	Outflow	Permanently flooded	Stream/Pond	75%	Forested/ Road	None	Road restricting outflow
147	Complex: low shrub bog, mixed wood treed swamp	2,708	Terrene	Basin	Outflow (inferred)	Permanently saturated	No	5%	Forested/ Road	None	No
148	low shrub bog	9,221	Terrene	Basin	Throughflow	Permanently saturated	No	5%	Forested/ Road	Rutting/ Road	No

Table 6.8-5: Wetland Functional Information (continued)

Wetland ID	Wetland Type	Wetland Size (m^2)	Landscape Position	Landform	Hydrologic Flow Path	Hydrologic Regime	Watercourse Association	Standing Water % Cover in Wetland	Adjacent Upland Land Use	Stressors	Wetland Hydrology Altered?
149	low shrub bog	1,835	Terrene	Basin	Isolated (inferred)	Permanently saturated	No	6%	Forested/ Road	Rutting/ Road	Impoundment of water near road
150	marsh	145	Terrene	Basin	Isolated	Permanently flooded	No	95%	Forested/ Road	Road	No
151	tall shrub bog	2,827	Terrene	Basin	Isolated	Permanently saturated	No	2%	Forested/ Road	Road	No
152	clear cut mixed wood swamp	2,275	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested	Skidder tracks/ Clear-cut	No
153	shrub swamp	2,416	Terrene	Basin	Outflow (inferred)	Permanently saturated	No	5%	Forested	None	No
154	open bog	1,927	Terrene	Basin	Outflow (inferred)	Permanently flooded/ Permanently saturated	No	30%	Forested/ Road	Road	No
155	mixed wood treed swamp	540	Terrene	Basin	Isolated	Temporarily flooded/ Permanently saturated	No	20%	Forested	Road	No
156	shrub bog	14,745	Terrene	Basin	Outflow/headwater (inferred)	Permanently saturated	No	1%	Forested/ Road	Road	No
157	Complex: shrub fen, shrub swamp	7,006	Lentic	Basin	Throughflow (inferred from wet areas mapping)	Permanently saturated	No	1%	Forested/ Road	Road	No
158	shrub swamp	575	Terrene	Basin	Isolated	Permanently flooded/ Permanently saturated	No	15%	Forested/ Road	Road	Road
159	mixed wood treed swamp	1,995	Lotic Stream	Basin	Throughflow	Permanently flooded/ Permanently saturated	Stream	15%	Forested/ Road	Road	Beaver dam at outlet
160	freshwater marsh	1,237	Lotic Stream	Basin	Throughflow	Permanently flooded/ Permanently saturated	Stream	60%	Forested/ Road	None	No
161	mixed wood swamp	1,618	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested	Rutting	Ditching
162	mixed wood treed swamp	1,756	Terrene	Basin	Isolated	Permanently saturated	No	5%	Forested	None	Road
163	clear cut swamp	1,107	Terrene	Basin	Isolated	Permanently saturated	No	10%	Forested/ Road	Clear-cut/ Rutting	Rutting
164	mixed wood treed swamp	3,320	Terrene	Basin	Isolated (inferred)	Permanently saturated	No	1%	Forested/ Road	None	No
165	mixed wood treed swamp	1,623	Lotic	Basin	Throughflow	Temporarily Flooded/ Permanently Saturated	Stream	10%	Forested	Road	Input from ditching
166	shrub swamp	68	Terrene	Basin	Isolated	Permanently saturated	No	0%	Forested/ Road	Road	Ditching
167	mixed wood treed swamp	875	Terrene	Basin	Isolated	Permanently saturated	No	3%	Forested/ Road	Road	No
168	Open bog	664	Terrene	Basin	Bidirectional-non-tidal	Permanently saturated	Pond	75%	Forested/ Road	None	No
169	mixed wood treed swamp	607	Terrene	Basin	Isolated (inferred)	Permanently saturated	No	2%	Forested/ Road	Log pile	Culvert at outlet
170	mixed wood treed swamp	1,893	Terrene	Basin	Isolated (inferred)	Permanently saturated	No	0%	Forested	None	No
171	mixed wood treed swamp	4,329	Riverine	Basin	Throughflow	Permanently saturated	Stream and River (inferred)	10%	Forested/ Road	None	No
172	mixed wood treed swamp	229	Terrene	Basin	Isolated	Temporarily flooded/ Permanently saturated	No	5%	Forested/ Road	Rutting/ Clear-cut	Ditching
173	mixed wood treed swamp	4,814	Lotic	Basin	Throughflow	Permanently saturated	Stream	10%	Forested	Skidder tracks	No
174	mixed wood treed swamp	2,649	Terrene	Basin	Outflow	Permanently saturated	Stream	5%	Forested	None	No
175	shrub swamp	632	Terrene	Basin	Outflow (inferred)	Seasonally flooded	No	5%	Forested/ Road	Skidder tracks	No
176	mixed wood treed swamp	446	Terrene	Basin	Isolated (inferred)	Permanently saturated	No	0%	Forested	None	No
177	shrub swamp	808	Terrene	Basin	Isolated (inferred)	Seasonally flooded	No	70%	Forested/ Road	Road	No
178	mixed wood treed swamp	4,385	Terrene	Basin	Isolated (inferred)	Temporarily flooded	No	40%	Forested/ Road	Garbage	Roads
179	mixed wood treed swamp	3,376	Terrene	Basin	Isolated	Seasonally flooded/ Permanently saturated	No	5%	Forested/ Road	None	No

Table 6.8-5: Wetland Functional Information (continued)

Wetland ID	Wetland Type	Wetland Size (m^2)	Landscape Position	Landform	Hydrologic Flow Path	Hydrologic Regime	Watercourse Association	Standing Water % Cover in Wetland	Adjacent Upland Land Use	Stressors	Wetland Hydrology Altered?
250	coniferous treed swamp	404	Terrene	Basin	Outflow	Permanently saturated	No	0%	Forested	None	No
251	mixed wood treed swamp	104	Stream Entrenched	Basin	Outflow	Seasonally flooded/ Permanently saturated	Stream	1%	Forested	None	No
252*	coniferous treed fen	716	Stream Entrenched	Basin	Throughflow	Seasonally flooded/ Permanently saturated	Stream	5%	Forested	None	No
253	coniferous treed fen	205	Stream Floodplain	Basin	Throughflow	Seasonally flooded/ Permanently saturated	Stream	2%	Forested	None	No
254	coniferous treed swamp	6,644	Terrene	Sloped	Isolated	Permanently saturated	No	0%	Forested	None	No
255	shrub swamp	65	Terrene	Flat	Isolated	Temporarily flooded/ Permanently saturated	No	0%	Forested	None	No
256	coniferous treed swamp	15,423	Terrene	Sloped Basin	Isolated	Permanently saturated	No	0%	Forested	None	No
259	coniferous treed swamp	162	Terrene	Flat	Isolated	Seasonally flooded/ Permanently saturated	No	0%	Forested	Clear-cut	Old cut block

6.8.4.1.3 Identification of Exceptional Features

NovaWET 3.0 defines Expectational Features as a potential WSS, significant fish habitat, federally or provincially listed species in or near the wetland, restored or protected wetlands, calcareous fens, cedar, black ash or large floodplain swamps, wetlands in a public water supply, floodplains upstream/within a populated area or wetlands within a Federal/Provincial/Municipal Area of Interest.

The NSE predictive WSS GIS layer was consulted during the desktop evaluation for wetlands prior to initial wetland delineations in 2016, and reconfirmed with the latest WSS layer, provided to MEL by Ian Bryson (Wetland Specialist, NSE) in September 2020. As part of the wetland functional assessment, along with a review of the predictive WSS layer, each wetland in the Beaver Dam Mine Site and Haul Road was reviewed to determine its potential as a WSS. The WSS qualifications are defined and described (Section 6.8.3.3).

Figures 6.8-1A to 6.8-1O indicate the proximity of the wetlands identified within the Beaver Dam Mine Site and Haul Road to: Ramsar Sites; Provincial Wildlife Management Areas (Crown and Provincial lands only); Provincial Parks; Nature Reserves; Wilderness Areas; Lands owned or legally protected by non-governmental charitable conservation land trusts; intact or restored wetlands under the North American Waterfowl Management Plan; and protected water areas. No wetlands within the Beaver Dam Mine Site and Haul Road are present within any of these special habitats, shown on the above-noted figures.

Nova Scotia Environment Predicted Wetlands of Special Significance

A review of the NSE predictive WSS layer identified seven potential WSS within the Beaver Dam Mine Site and Haul Road, Wetlands 1, 29, 61, 64, 178, 205 and 220. Wetlands 205 and 220 were delineated during 2019 wetland surveys.

The predictive WSS layer does not consider the temporal scale of the observation, or the mobility of the species documented. As such, this layer is to be used as a predictive tool. Where predicted due to the presence of a priority species, the WSS designation may be dependent on the mobility of the species, it's confirmed or historic presence (i.e., ACCDC) and the presence of habitat to support critical life functions of that species. Sessile or non-mobile priority species (i.e., lichen or vascular flora) may trigger WSS designation. This may include species without legal protection under SARA or NSESA (i.e., designation of Special Concern or Vulnerable, respectively), such as blue felt lichen (SARA/COSEWIC Special Concern, NSESA Vulnerable). WSS evaluation criteria are presented in Section 6.8.3.3. Additional consultation with NSE will occur during the permitting process to confirm WSS designation.

Wetland 1 is identified as a potential WSS by NSE due to a blue felt lichen observation in 2015 (ACCDC, 2021), which was confirmed by the Project Team. This observation was located within the NSE mapped wetland, however; upon field delineation of the wetland, it was determined that the observation is located outside of the wetland area. No blue felt lichen has been observed within Wetland 1 and was therefore not determined a WSS.

Wetland 29 is identified as a potential WSS by NSE due to the historic presence of multiple observations of boreal felt lichen (*Erioderma pedicellatum)* (listed as Endangered by SARA/COSEWIC/NSESA) in 2013 (ACCDC, 2021; pers.comm. Charles Sangster, NSE). Three locations of boreal felt lichen were confirmed during field surveys within Wetland 29 on May 8, 2015, as discussed in Section 6.13.4.3 and shown on Figure 6.13-2. However, its location is beyond the PA and as such, impacts are not expected as a result of the Project. A follow up survey conducted in the fall of 2016 determined that all three thalli were no longer present. This absence was reconfirmed on December 4, 2017. Infrastructure micro-siting has increased the distance between Project infrastructure and Wetland 29 (wetland and phorophyte critical function zone) as per the Amended Recovery Strategy for

boreal felt lichen (ECCC, 2018). Wetland 29 was identified as a WSS based on historical presence of boreal felt lichen discussed above under Identification of Exceptional Features.

Wetland 61, located within the Beaver Dam Mie Site along the Cameron Flowage, is identified as a potential WSS by NSE due to the presence of lichen SOCI (e.g., blistered jellyskin lichen) and blue felt lichen within proximity to, but not within, the wetland boundary (within 100 m; pers. comm. Kimberley George, NSLF). Upon field delineation of the wetland, it was confirmed that there were no observations of lichen SAR within the wetland. As a result, Wetland 61 was not determined a WSS.

Wetland 64, which exists where the proposed Haul Road meets the Beaver Dam Mine Site, is identified as a potential WSS by NSE due to the historical presence of Canada warbler (pers.comm. Kimberley George, NSLF; ACCDC, 2021). ACCDC also notes observations of olive-sided flycatcher and rusty blackbird within the wetland. Possible breeding/nesting by an olive-sided flycatcher was noted in 2009 (pers. comm. Charles Sangster, NSE). Although suitable breeding habitat for the olive-sided flycatcher is present within Wetland 64, neither this species nor rusty blackbird or Canada warbler were observed during the breeding bird surveys completed during appropriate breeding periods (i.e., June 13 and 25, 2016 and July 3 and 13, 2019). As a result, Wetland 64 was not determined a WSS.

While the aforementioned species were not observed in Wetland 64, a pair of greater yellowlegs and possible breeding activity was observed (pair and probable nesting displayed). Species-specific mitigation measures for greater yellowlegs are presented within Section 6.8.9.

Wetland 178 is located along the Haul Road, where the proposed new road meets Mooseland Road. It is identified as a potential WSS by NSE due to the historic presence of Canada warbler, observed in 2015 (ACCDC, 2021). While Canada warbler habitat is present in Wetland 178, the historic observations lays beyond the field delineated wetland extent and Canada warbler were not observed during the breeding bird surveys within this area, completed during appropriate breeding periods (i.e., June 13 and 25, 2016). As a result, Wetland 178 was not determined a WSS.

Both Wetlands 205 and WL 220 are identified as potential WSS due to the historical presence of rusty blackbird (*Euphagus carolinus*). The ACCDC (2021) identifies the observation of a rusty blackbird along the road in between these two wetlands on June 15, 2010 (Appendix I.1), which are located under the proposed non-acid generating (NAG) waste rock stockpile. The observation notes that two juvenile birds were observed, which confirms that breeding occurred in that location in 2010. The point represents the location from which the birds were recorded and not necessarily the precise location. One rusty blackbird was observed incidentally in Fall 2014 near an avian point count location to the north of the Beaver Dam Mine Site (BD-PC15). No rusty blackbirds were observed within the Beaver Dam Mine Site or Haul Road since this survey. Detailed avifauna SAR and SOCI data are presented in Section 6.13. Rusty blackbirds build nests within 3 m of the ground in short conifer trees near or over water (Landbird SAR, 2018). Portions of Wetlands 205 and 220 contain potential rusty blackbird breeding habitat, both of which contain discontinuous patches of open water. Given the high site fidelity of this species, returning to the same breeding location year after year (Landbird SAR, 2018), and ongoing fieldwork within the area since 2010, it is unlikely that the presence of rusty blackbirds in and around Wetlands 205 and 220 would not have been detected. Extensive field work was conducted in these wetlands in July 2019 and within Watercourse 21, which runs between the two wetlands, in August, November and December 2019 as a result of fish and fish habitat surveys (Section 6.9). Neither rusty blackbird nor sign of the species was observed in any of these surveys. It is possible that breeding rusty blackbirds have relocated. As a result, Wetlands 205 and 220 were not determined a WSS.

Wetlands with Observed Species at Risk

Wetlands with observed SAR and the presence of suitable species-specific habitat are indicated in Table 6.8-6. Species in bold have legal protection under SARA or the NSESA (Endangered or Threatened), while others do not have legal protection but are listed as species of Special Concern or Vulnerable).

Table 6.8-6: Wetlands with Observed Species at Risk

Wetland ID and Type	Observed SAR and Ranks	Direct Wetland Alteration Proposed and Type of Alteration?	Suitable Habitat Present (Y/N)
WL4 - complex: treed swamp/ treed fen, mixed wood treed swamp	Blue Felt Lichen (SARA/COSEWIC SC, NSESA V, S3)	No	Y
WL8-complex: coniferous treed swamp, graminoid fen, low shrub fen, shrub swamp	**Olive-sided flycatcher** (SARA/COSEWIC T, NSESA T, S2B)	No	Y
WL14-complex: shrub bog, mixed wood treed swamp, low shrub fen	**Olive-sided flycatcher** (SARA/COSEWIC T, NSESA T, S2B)	Yes, Partial	Y
	Blue Felt Lichen (SARA/COSEWIC SC, NSESA V, S3)	Yes, Partial	Y
WL17-complex: tall shrub swamp, coniferous treed bog	Blue Felt Lichen (SARA/COSEWIC SC, NSESA V, S3)	Yes, Partial	Y
WL29-complex: mixed wood treed swamp, low shrub fen, open bog, coniferous treed swamp, coniferous raised bog, graminoid fen	**Canada warbler** (SARA/COSEWIC T, NSESA E, S3B)	No	Y
	Boreal Felt Lichen[(a)] (SARA/COSEWIC E, NSESA E, S1)	No	Y
WL51-mixed wood treed swamp	**Olive-sided flycatcher** (SARA/COSEWIC T, NSESA T, S2B)	No	Y
WL53-low shrub swamp	**Chimney swift** (SARA/COSEWIC T, NSESA E, S2B S1M)	No	N
WL56-complex: coniferous treed swamp, tall shrub swamp, low shrub bog	**Mainland Moose** (NSESA E, S1)	Yes, Complete	Y
WL57-complex: coniferous treed swamp, deciduous treed swamp	**Canada warbler** (SARA/COSEWIC T, NSESA E, S3B)	Yes, Partial	Y
WL59- complex: coniferous treed swamp, emergent marsh, open water	Snapping Turtle (SARA/COSEWIC SC, NSESA V, S3)	Yes, Complete	Y (nesting specific habitat is outside wetland)
WL66-complex: graminoid fen, mixed wood treed swamp, high shrub fen	**Canada warbler** (SARA/COSEWIC T, NSESA E, S3B)	Yes, Partial	Y
WL71-deciduous treed swamp	**Canada warbler** (SARA/COSEWIC T, NSESA E, S3B)	No	Y
WL72-deciduous treed swamp	**Canada warbler** (SARA/COSEWIC T, NSESA E, S3B)	No	Y
WL76-complex: mixed wood treed swamp, open graminoid fen	**Canada warbler** (SARA/COSEWIC T, NSESA E, S3B)	Yes, Partial	Y
WL89-treed swamp	**Barn swallow** (SARA/COSEWIC T, NSESA E, S2S3B)	Yes, Partial	N
WL148-low shrub bog	**Canada warbler** (SARA/COSEWIC T, NSESA E, S3B)	Yes, Partial	Y

Table 6.8-6: Wetlands with Observed Species at Risk (continued)

Wetland ID and Type	Observed SAR and Ranks	Direct Wetland Alteration Proposed and Type of Alteration?	Suitable Habitat Present (Y/N)
WL156-shrub bog	**Olive-sided flycatcher** (SARA/COSEWIC T, NSESA T, S2B)	Yes, Partial	N
WL157-complex: shrub fen, shrub swamp	**Olive-sided flycatcher** (SARA/COSEWIC T, NSESA T, S2B)	Yes, Partial	N
WL173-mixed wood treed swamp	**Canada warbler** (SARA/COSEWIC T, NSESA E, S3B)	Yes, Partial	Y
WL 205-complex: fen, soft wood treed swamp	**Canada warbler** (SARA/COSEWIC T, NSESA E, S3B)	Yes, Partial	Y
	Blue Felt Lichen (SARA/COSEWIC SC, NSESA V, S3)	Yes, Partial	Y
WL206-shrub swamp	**Mainland Moose**[(b)] (NSESA E, S1)	No	N
WL210-coniferous bog	**Mainland Moose** (NSESA E, S1)	No	N
WL219-complex: fen, mixed wood treed swamp	**Canada warbler** (SARA/COSEWIC T, NSESA E, S3B)	Yes, Partial	Y
WL229-swamp	**Olive-sided flycatcher** (SARA/COSEWIC T, NSESA T, S2B)	Yes, Complete	Y

Notes: [(a)] Boreal felt lichen observed in portion of Wetland 29 beyond the PA. Wetland 29 is part of the defined boreal felt lichen critical habitat area.

[(b)] Mainland moose tracks observed adjacent to WL206 beyond the PA.

SAR = Species at Risk; Y/N = Yes/No; WL = wetland; WSS = wetlands of special significance; ID = identification; SARA = *Species at Risk Act*; COSEWIC = Committee on the Status of Endangered Wildlife in Canada (SC = special concern; T = threatened; E = endangered); NSESA = *Nova Scotia Endangered Species Act* (E = endangered; T = threatened; V = vulnerable); S = s-rank (sub-national); S1 = critically imperilled; S2 = imperilled; S3 = vulnerable; S4 = apparently secure; S5 = secure; S#S# = range rank; S2B = Imperilled breeding; S3B = vulnerable breeding; S5B = secure breeding; S3N = vulnerable nonbreeding; S3S4M = vulnerable/apparently secure migrant; S3S4B = vulnerable/apparently secure breeding.

Blue felt lichen (SARA/COSEWIC Special Concern, NSESA Vulnerable) is the only SAR flora species observed within wetlands in the PA. Blue felt lichen was observed in four wetlands (WL 4, 14, 17 and 205) and is typically found in swamps or on the edges of wetland complexes growing on mature red maple. Suitable habitat for blue felt lichen within wetlands is scattered throughout the Beaver Dam Mine Site and Haul Road. Wetland 29, which contains occurrences of boreal felt lichen (SARA/COSEWIC/NSESA Endangered) beyond the PA. As such, Wetlands 4, 14, 17, 29 and 205 are identified as a WSS.

One female snapping turtle and nest was observed on June 27, 2019 on a berm adjacent to Wetland 59 within the Beaver Dam Mine Site. Snapping turtles are ranked as Special Concern by SARA and COSEWIC and Vulnerable by the NSESA. This anthropogenic feature (gravel berm created during historic mining operations) provides suitable nesting habitat for this species. Due to the mobility of the species, Wetland 59 was evaluated as a possible WSS.

Mainland moose tracks were observed in Wetland 210, adjacent to Wetland 206 (beyond the PA) and approximately 20 m north of Wetland 56, during dedicated moose surveys (May 24, 2015) and incidentally (September 9, 2014). These wetlands are located at the northern extent of the Beaver Dam Mine Site. Mainland moose are ranked as Endangered by the NSESA (no SARA/COSEWIC designation). Mainland moose forage for aquatic vegetation within wetlands during the summer. Wetland 56 was the only observation location assessed to have suitable habitat for foraging activities (i.e., anthropogenic open water features). It should be noted that a local Mooseland resident that frequents areas in and around the haul road had indicated that they had

observed mainland moose in the area in previous years (Appendix A.4a and A.5). Considering to the mobility of mainland moose and the presence of other unimpacted foraging habitat within the Beaver Dam Mine Site and Haul Road (e.g., wetlands surrounding Crusher Lake and Mud Lake), and Local Assessment Area (LAA) and Regional Assessment Area (RAA) (Section 6.8.7.2). Wetlands 56, 206 and 210 were not determined to be WSS.

Considering the above determinations, Figure 6.8-2A (Section 6.8.4.1.11) shows the location of field identified and potential WSS in relation to proposed infrastructure. Habitat quality present within the above identified wetlands is presented in Section 6.8.4.1.7. Priority species are discussed further in Section 6.13.

6.8.4.1.4 Hydrologic Condition and Integrity

The significance of this wetland function is determined by evaluating a wetlands' ability to manage water. Landscape and wetland characteristics, such as position in the landscape, connectivity to watercourses, evidence of water detention in the wetland, and vegetation composition and density, combine to determine the capacity of the wetlands to hold water, retard flows and hence maintain downstream flood potential.

The vast majority of all wetlands in the Beaver Dam Mine Site and Haul Road are either natural, or have been somewhat modified by historical timber harvesting, access roads, or lie adjacent to the existing roads. The NovaWET evaluation determined that the majority of assessed wetlands (80 within the Beaver Dam Mine Site (68%) and 91 within the Haul Road (75%)) provide a high ability to detain surface water, reducing downstream peak flows and aiding in flood mitigation. To a lesser extent, some wetlands has been determined important for maintaining stream flows (19 within the Beaver Dam Mine Site (19%) and 18 within the Haul Road (15%)).

6.8.4.1.5 Water Quality

The surrounding landscape condition, as well as wetland characteristics determine a wetland's ability to provide water quality functions. The NovaWET evaluation technique ranks wetlands whose source water contains sediment or contamination as higher than wetlands whose source water is pristine. Vegetative density and the position of the wetland on the landscape also help to determine how a wetland ranks in this category.

The NovaWET evaluation determined that 108 wetlands within the Beaver Dam Mine Site (92%) and 103 wetlands within the Haul Road (85%) contribute to water quality in downstream resources.

6.8.4.1.6 Groundwater Interactions

The NovaWET evaluation technique includes groundwater recharge/discharge determination. While this is difficult to determine by visual inspection alone, it has been included in this section and is further discussed in the Groundwater Quality and Quantity (Section 6.6).

Within a groundwater discharge wetland, the hydraulic gradient is upwards, receiving groundwater inputs from underlying soils. A recharge wetland has a downward hydraulic gradient, supplying water from the surface to underlying soils. Typically, groundwater discharge maintains high water tables within the wetland, whereas recharge sites replenish aquifers (Siegela 1988).

Landscape characteristics that are likely to indicate recharge wetlands include (NovaWET 3.0):

- Geographically isolated wetlands that contain all water entering them;

- Mineral soils and/or a lack of restrictive sub-surface components that may prevent the downward movement of water and recharge potential;
- Surrounding upland soils that prevent the downward movement of water (e.g., clays, shallow bedrock);
- Lack of outlet or restricted outlets, inflow wetlands, and lentic wetlands; and
- Land sloped away from a wetland (e.g., wetlands that are elevated in the watershed or near a watershed divide).

Within the Beaver Dam Mine Site and Haul Road, approximately 70% of wetlands are isolated or inflow wetlands, which provide potential groundwater recharge. Other wetlands contain watercourses or drainage channels that drain water toward the various waterbodies within and surrounding the Beaver Dam Mine Site and Haul Road. Outflow and throughflow wetlands (approximately 30%) are more likely to act as groundwater discharge sites. As discussed in Section 6.5.4 (Geology, Soil, and Sediment Qualty Baseline Conditions) underlying bedrock l conditions within the Beaver Dam Mine Site (and the general region) are comprised of greywacke and slate, and as a result of their impermeability and poorly jointed rocks, act as a confining layer. As a result, water sources to these wetlands are primarily via precipitation, snow melt, and surface water inputs (i.e., watercourses, runoff/sheet flow).

The relative percentage of recharge and discharge wetlands along the Haul Road and within the Beaver Dam Mine Site are similar. There is a slightly greater proportion of throughflow and outflow wetlands along the Haul Road.

6.8.4.1.7 Fish and Wildlife Habitat Integrity

Results of the NovaWET evaluation determined that nine wetlands within the Beaver Dam Mine (8%) and 10 within the Haul Road (8%) provide high functional significance for wildlife and fish habitat. The determination of high significance was afforded to these wetlands as a result of the wetlands' association with potential fish passage via connected watercourses, provision of fish habitat, and access to open water habitat for migratory birds.

Mainland moose (NSESA Endangered) tracks were observed in Wetland 210, adjacent to Wetland 206 (beyond the PA) and approximately 20 m north of Wetland 56, during dedicated moose surveys (May 24, 2015) and incidentally (September 9, 2014; Figure 6.13-1A). Mainland moose use wetlands to access submerged and emergent aquatic vegetation during summer and often seek out streams, ponds, and shorelines of lakes to escape heat and insects (e.g., wetlands surrounding Crusher Lake and Mud Lake) (NSDNR, 2007). Although not directly observed, wetlands identified within the Beaver Dam Mine Site and Haul Road provide potential habitat for priority wildlife species (e.g., Maritime shrew (S3) and the rock vole (S2)) which have been documented within 5 km of the PA). The fisher (*Martes pennanti* (S2)) is a largely nocturnal hunter with large home ranges and elusive behavior.

One female snapping turtle (SARA/COSEWIC Special Concern, NSESA Vulnerable), and nest was observed on June 27, 2019 on a berm adjacent to Wetland 59 within the Beaver Dam Mine Site. (Figure 6.13-1A). Previously, there was one incidental observation, outside field surveys, of this species along the Mooseland Road section of the Haul Road and two observations within the vicinity of the Touquoy Mine Site (Figure 6.13-1G). This species requires wetland habitat as part of its life cycle activities, specifically for overwintering. Wetlands within the Beaver Dam Mine Site and Haul Road which provide suitable habitat for snapping turtle include Wetlands 8, 10, 14, 17, 29, 44, 56, 59, 61, 64, 66, 68, 69, 159, 168, 171, and 207. These wetlands provide standing water to a depth exceeding 0.5 m and muddy substrate (e.g., lentic and lotic wetlands and wetlands with open water features), which provide potential overwintering habitat.

Twenty-nine of the wetlands in the Beaver Dam Mine Site (25%) have been determined to provide life cycle supporting habitat for fish species or provide other habitat support to fish (e.g., riparian vegetation, water quality, buffer functions) as a result of their

association with watercourses. Twenty-five of the wetlands identified in the Haul Road (20%) provide these functions. Priority fish species (American eel and brook trout) or their habitat were identified within Wetlands 8, 10, 17, 44 and 59. Details on fish species observed and their use of wetland habitat is described in Section 6.9 (Fish and Fish Habitat).

Multiple priority avifauna species were identified within and in close proximity to wetlands during dedicated avifauna surveys and via incidental sightings during field assessments completed throughout the Beaver Dam Mine Site and Haul Road. In addition, focused avifauna surveys were completed in many other habitat types and locations that do not constitute wetland habitat. A full list of priority avifauna species observed within the Beaver Dam Mine Site and Haul Road is provided in Section 6.13.5.4 The list was narrowed down to priority avifauna species that were identified at survey locations within, and directly adjacent to, wetland habitat, and that use wetlands as part of their preferred breeding habitat. These species are listed in Table 6.8-7, together with the preferred wetland habitat.

Priority species are discussed further in Section 6.13.

Table 6.8-7: Observed Bird Priority Species and Wetland Habitat Association

Bird Species	Preferred Wetland Habitat
Eastern wood-pewee	Wooded habitat, in riverside habitat
Canada warbler	Wet forests, riparian shrub forests
Rusty blackbird	Wet forests including fens, bogs, swamps and beaver pond
Spotted sandpiper	Semi-open area near shoreline of ponds, lakes, river and streams
Greater yellowlegs	Muskeg, wet bogs, marshes
Wilson's snipe	Wet, marsh, bogs, fens alder and willow swamps, wet meadows
Northern harrier	Nest on ground in grassland and wetland vegetation- marshes
Yellow-bellied flycatcher	Boreal coniferous forests and peatlands, bogs, swamps and muskeg
Tennessee warbler	Bogs, swamps and forests
Olive-sided flycatcher	Conifer forests near meadows and ponds

The NovaWET evaluation determined that at least one SAR bird was identified at point count locations within or directly adjacent to seven wetlands in the Beaver Dam Mine Site and 12 wetlands within the Haul Road. At least one SOCI bird was identified at point count locations within or directly adjacent to 13 wetlands in the Beaver Dam Mine Site and 25 wetlands within or adjacent to wetlands within the Haul Road. It should be noted, however, that these observations are based on detection points (e.g., point count locations) and do not specify whether the bird identified is using, or how it might be using, the wetland habitat as its preferred habitat.

6.8.4.1.8 Shoreline Stabilization and Integrity

The NovaWET evaluation technique ranks wetlands based on their ability to stabilize and provide stabilizing support to shorelines via their association with a watercourse (stream, lake, pond, etc.) or tidal feature (estuary, ocean). Other factors that determine the significance a wetland may play in providing these functions include vegetation characteristics (e.g., density, widths, species type, streambank colonization), but also the characteristics of the waterbody to which the wetland is adjacent (e.g., subjected to wave action, high flows, and other erosive forces).

Ten wetlands within the Beaver Dam Mine Site (9%) and seven within the Haul Road (6%) were determined to provide a high functional significance to shoreline stabilization.

6.8.4.1.9 Plant Community

None of the plant communities found in these wetlands were found to be regionally or provincially rare in either the Beaver Dam Mine Site or the Haul Road. As discussed in previous sections, wetlands present within the Beaver Dam Mine Site and Haul Road include treed and shrub swamps, bog, fen, marsh, and complexes of these wetland types. Wetland vegetation composition within all wetland habitats is typical to those existing in similar habitat throughout the province. Treed and shrub swamps are predominantly coniferous or mixed wood, with lesser amounts of deciduous swamp occurring. Bog habitats vary between low and high shrub bogs to treed bogs. Fen habitat predominantly comprises low shrubs or exist entirely as graminoid features. The few marsh habitats identified consist entirely of graminoid vegetation.

Table 6.8-8 provides the dominant species supported by each wetland habitat type found within the Beaver Dam Mine Site and Haul Road. Dominant vegetation per wetland is provided in the Wetland Characterization Table (Appendix H.2).

Table 6.8-8: Dominant Vegetation Supported by Wetland Habitat within the Project Area

Wetland Habitat Type	Dominant Species Supported
Treed and Shrub Swamps	Balsam fir, black and red spruce, red maple, yellow birch, mountain holly, cinnamon fern, three-seeded sedge, Canada bunchberry, bristly dewberry.
Shrub and Treed Bogs	Tamarack, black spruce, balsam fir, speckled alder, balsam fir, sheep laurel, Labrador tea, leatherleaf, cinnamon fern, bog fern, three-seeded sedge.
Graminoid and shrub Fen	Red maple, black spruce, tamarack, wild raisin, common winterberry, Atlantic sedge, bog cranberry, royal fern.
Graminoid Marsh	Bluejoint reed grass, harlequin blue flag, tussock's sedge, Common woolly bulrush, Canada manna grass.

Overall plant integrity within wetlands was determined via the NovaWET process by evaluating specific vegetative characteristics within wetlands identified during the study. Characteristics include presence of invasive or exotic species, extent of disturbances, vegetative density, and the presence of rare or endangered species (priority species).

The evaluation concluded that 34 wetlands within Beaver Dam Mine Site (29%) wetlands and 25 wetlands within the Haul Road (21%) were rated as comprising a highly significant diversity of species, whereas are also rated as such.

Six wetlands (WL 4, 12, 14, 17, 29, and 33) comprise at least one priority plant species (vascular and non-vascular) within the Beaver Dam Mine Site and eight wetlands (WL 80, 115, 129, 135, 137, 147, 157 and 161) comprise priority plant species in the Haul Road. Wetland 29, which contains boreal felt lichen (SARA/COSEWIC/NSESA Endangered), is the only wetland with a federally listed SAR observation. While the historical boreal felt lichen observations were not observed in most recent surveys in 2016 and 2017 (Section 6.13.4.3) and were located beyond the PA boundary, the wetland extends into the Beaver Dam Mine Site and is identified as critical/core habitat (NSE, 2020; ECCC, 2018). As such, Wetland 29 is identified as a WSS (Section 6.8.4.1.3). As per the ECCC Amended Recovery Strategy (2018) and NSE Adopted Recovery Plan (2020) for boreal felt lichen, the micro-siting and division of the waste rock stockpile has removed Project infrastructure from WL29 and the larger defined boreal felt lichen critical habitat area. Therefore, impacts to this species as a result of Project activities are not expected.

The overall integrity and quality of plants has been determined to be high in 46 of the wetlands identified in the Beaver Dam Mine Site (39%) and in 58 within the Haul Road (48%). Vegetation and habitat integrity remain moderate to high in the majority of wetlands despite disturbances in land surrounding the wetlands within Beaver Dam Mine Site and Haul Road (i.e., historic mining, timber harvesting, trail/road networks).

Priority species are discussed further in Section 6.13.

6.8.4.1.10 Community Use/Value

Community use and value of wetlands include, among others, access and visibility for humans to complete activities such as hunting, recreational, wildlife viewing, plant and berry gathering, fishing, etc.

The NovaWET evaluation determined that the majority of wetlands identified in the Beaver Dam Mine Site and Haul Road provide a low functional significance for community use and value, largely as a result of their inaccessibility. None of the wetlands have been determined to provide high value for community use in either the Beaver Dam Mine Site or the Haul Road.

6.8.4.1.11 Summary of Functional Assessment

Table 6.8-9 presents a summary of wetlands assessed to support critical functions (highlighted red in Appendix H.1) or contain a significant attribute, based on NovaWet SF groups. Specific SFs which identify unique or rare qualities described in Section 6.8.4.1.3 were selected to narrow the scope to wetlands observed to support significant functions or SAR/SOCI. Bolded wetlands provide multiple significant functions and are shown on Figures 6.8-2A to 6.8-2E.

Table 6.8-9: Summary of Wetlands with High Functional Significance

Significant Function (NovaWet SF)	Wetlands with High Functional Significance	
	Beaver Dam Mine Site	Haul Road
Floodplain Association (SF11)	WL **217**	n/a
Drinking Water Protected Area (SF10)	n/a	n/a
Groundwater Recharge (SF19)	WL 7, 18, 55, 58, 209, 221, **222**, 230, 232, 257, 258	WL 70, 84, **85**, **88**, 163, 172, 175, 176, 178, **179**, 250, 252, 253, 254, 255, 256
Shoreline Stabilization and Integrity (SF21)	WL **4**, **8**, **10**, **14**, **17**, **29**, 44, 48, **61**, **66**	WL **66**, 69, 74, **76**, 79, **157**, **171**
Fish and Wildlife SAR/SOCI (SF27)	WL 2, **8**, **10**, **14,** 16, **17**, 19, 29, 42, 51, 53, 54, 56, 57, **59**, **61**, **64**, **66**, **205**, 206, 210, **217**, 218, 219, 229, 233, 246	WL **66**, 71, **76**, **85**, **88**, 89, 98, 110, 113, **129**, 136, 142, 143, 148, 151, 156, **157**, 164, 165, 168, **173**, 177, **179**
Flora SAR/SOCI and Significant Community (SF9, 22, 25)	WL **4**, **10**, 12, **14**, **17**, **29**, 33, **64**, **205**, 212, 220, **222**	WL 80, 115, 127, **129**, 135, 137, 147, **157**
Social and Cultural Importance (SF6, 8, 12, 29)	WL **61**	WL **171**, **173**, 174
Field Identified WSS[(a)]	WL **4, 14, 17, 29, 59, 205**	n/a

Note: [(a)] Identified and potential WSS as presented in Section 6.8.4.1.3.

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FIGURE 6.8-2 A

Beaver Dam Mine Project

Potential Wetlands of Special Significance

- Local Road
- Dry Weather / Seasonal Road
- Track
- Field Delineated Watercourses
- NSTDB Mapped Watercourses
- Field Identified Wetlands of Special Significance
- Potential Wetlands of Special Significance
- Other Wetlands with Multiple SFs
- NSE Predicted Wetlands of Special Significance
- Field Delineated Wetlands
- Open Water
- NSE Wetlands
- Proposed Infrastructure
- Project Area

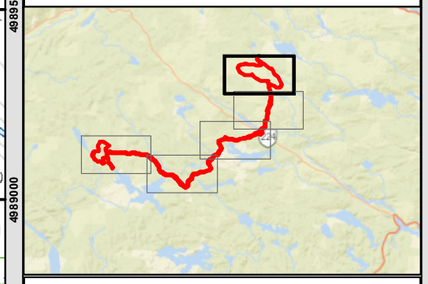

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FIGURE 6.8-2 B

Beaver Dam Mine Project

Potential Wetlands of Special Significance

- Collector Road
- Local Road
- Dry Weather / Seasonal Road
- Diveways (>300 m)
- Track
- Field Delineated Watercourses
- NSTDB Mapped Watercourses
- Other Wetlands with Multiple SFs
- Field Delineated Wetlands
- Open Water
- NSE Wetlands
- Proposed Infrastructure
- Project Area

Coordinate System: NAD 1983 CSRS UTM Zone 20N
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FIGURE 6.8-2 C

Beaver Dam Mine Project

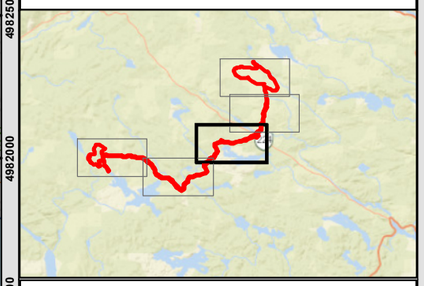
Potential Wetlands of Special Significance

Lower Beaver Lake
River Lake
West River Sheet Harbour
Middle Beaver Lake
Trout Lake
Upper Beaver Lake
WL129
WL8
Curry Lake
Otter Lake Brook
Blackie Lake
Lake Alma
Grassy Lake
WL157
Upper Kidney Lake
Lower Kidney Lake

4985000
4984500
4984000
4983500
4983000
4982500
4982000
4981500
4981000
4980500

516000 516500 517000 517500 518000 518500 519000 519500 520000 520500 521000 521500 522000 522500

- Collector Road
- Local Road
- Dry Weather / Seasonal Road
- Diveways (>300 m)
- Track
- Field Delineated Watercourses
- NSTDB Mapped Watercourses
- Other Wetlands with Multiple SFs
- Field Delineated Wetlands
- Open Water
- NSE Wetlands
- Proposed Infrastructure
- Project Area



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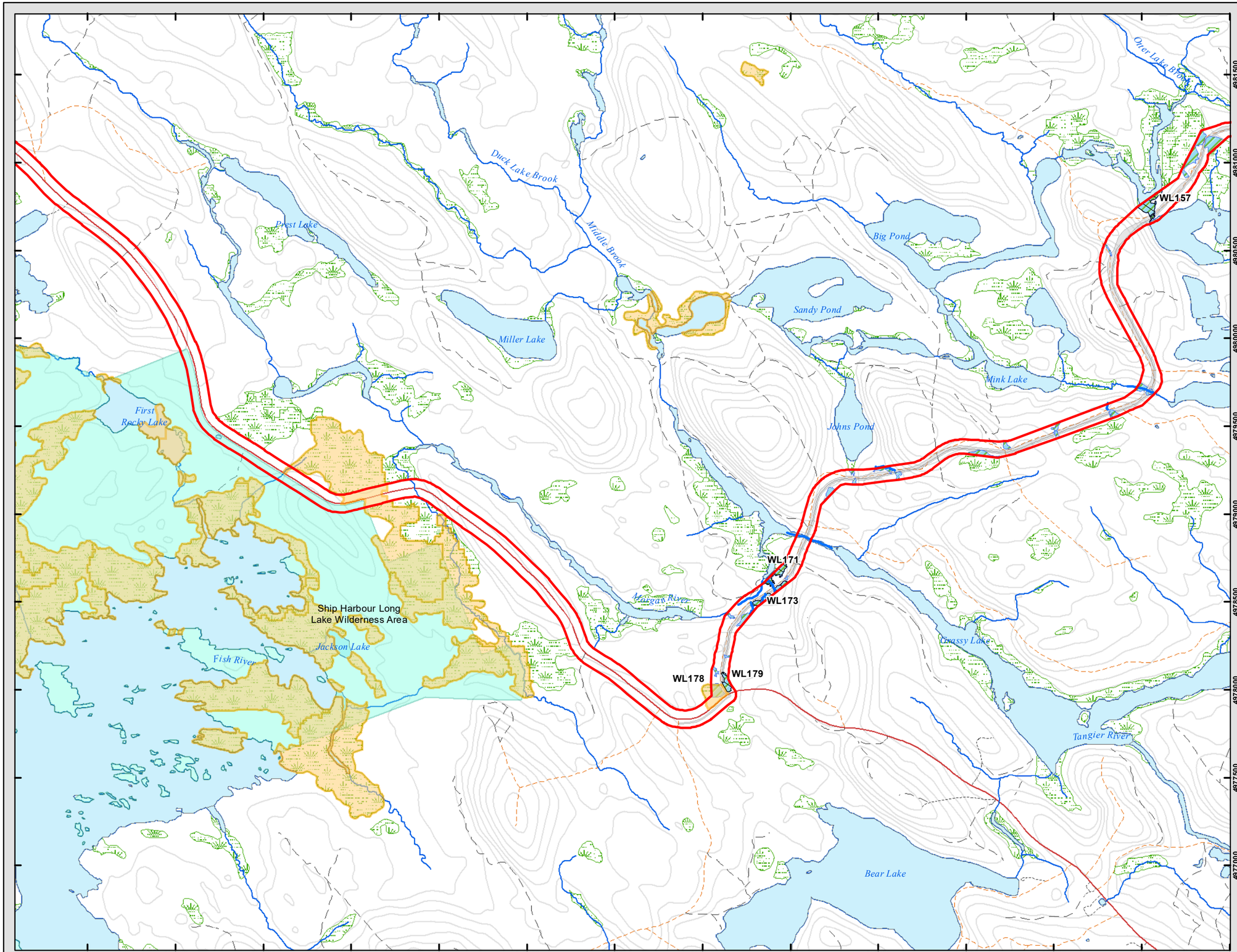

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FIGURE 6.8-2 D

Beaver Dam Mine Project

Potential Wetlands of Special Significance

- Local Road
- Dry Weather / Seasonal Road
- Diveways (>300 m)
- Track
- Field Delineated Watercourses
- NSTDB Mapped Watercourses
- Other Wetlands with Multiple SFs
- NSE Predicted Wetlands of Special Significance
- Field Delineated Wetlands
- Open Water
- NSE Wetlands
- Proposed Infrastructure
- Wilderness Area
- Project Area

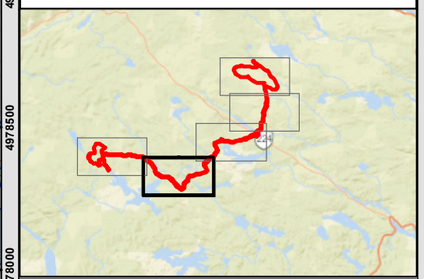

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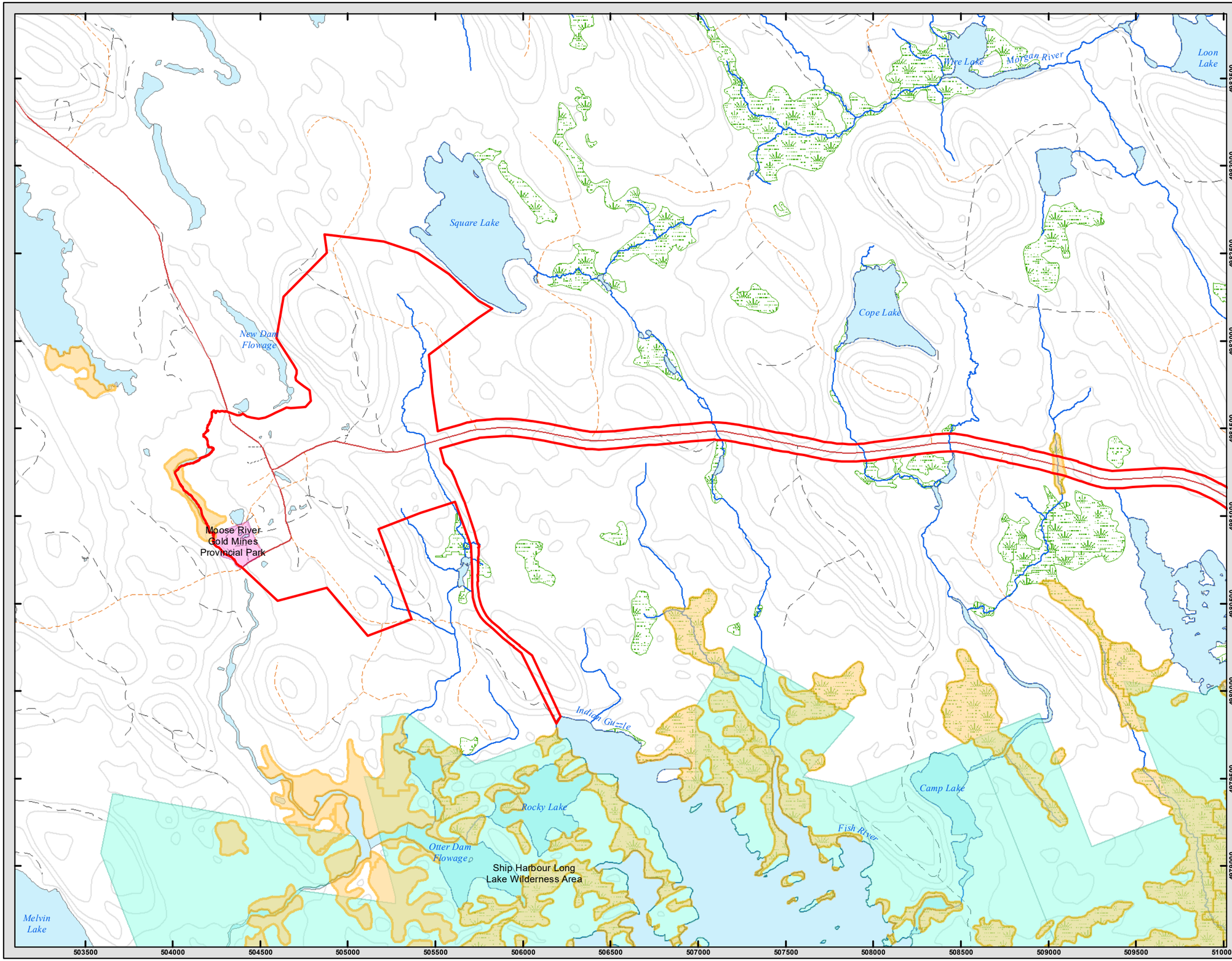
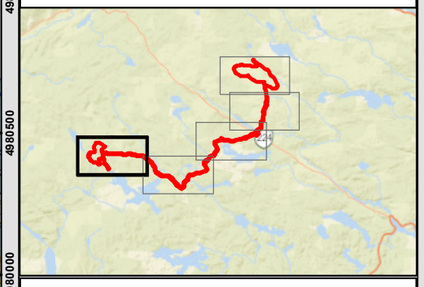
FIGURE 6.8-2 E

Beaver Dam Mine Project

Potential Wetlands of Special Significance



- Local Road
- Dry Weather / Seasonal Road
- Diveways (>300 m)
- Track
- NSTDB Mapped Watercourses
- NSE Predicted Wetlands of Special Significance
- NSE Wetlands
- Proposed Infrastructure
- Wilderness Area
- Provincial Park
- Project Area



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6.8.4.2 Touquoy Mine Site

Six wetlands were identified within the Touquoy Mine Site in 2006 as part of the EARD process, five of which were assessed. One of these wetlands was deemed to not be affected from Project development and therefore was not evaluated (CRA 2007a).

A total of 52 wetlands were identified within the Touquoy Mine Site (including the western bypass road) during field studies by MEL biologists from 2015 to 2017. These wetlands were identified for wetland permitting process and functional assessments were completed to support permitting. Evaluation will be limited to riparian wetlands along Moose River, downstream of the discharge location, to confirm potential indirect impacts from the Beaver Dam Mine Project during pit filling and deposition of tailings, and during the post closure phase when the pit is full, and a surface water connection is re-established to the Moose River. The baseline condition of the pit for the purpose of this assessment is considered at full draw down, at the time when Beaver Dam Mine Project tailings would commence deposition into the pit. Potential impacts to wetlands associated with pit drawn down during Touquoy operations and closure are considered as part of the Touquoy Gold Project EARD and subsequent permitting.

The Touquoy Mine Site is currently operational. The use of the Touquoy Mine Site for the processing of Beaver Dam ore and tailings management (exhausted pit) will not involve modification to the current footprint or new disturbances to wetlands during the construction and operations phase.

At post-closure and once water quality in the Touquoy Mine Site open pit meets MDMER discharge criteria, water surplus will be released into Moose River via a spillway. Wetland surveys, in the context of the Beaver Dam Mine Project, were conducted in along the Moose River, in response to IR2 NSE 2-176 (AMNS 2021). Surveys were conducted up to 200 m downstream of the proposed discharge point, considering the predicted mixing zone from the spillway (100 m from discharge location, Appendix F.8 [Beaver Dam Gold Project Assimilative Capacity Study of Moose River – Touquoy Pit Discharge]). The survey was focused to approximately 50 m east and west of the river to capture potential indirect impacts to wetland hydrology adjacent to the Moose River, focusing on riparian wetlands with direct hydrologic connectivity.

One wetland was observed along the eastern side the Moose River (within 20 m), beginning approximately 60 m south of the proposed discharge point (Figure 6.8-3). This wetland was delineated and characterized in October 2020 and again in April 2021, to assess its connectivity with the Moose River. The wetland is a 0.17 ha shrub dominated swamp, generally located at a higher elevation that the adjacent Moose River, separated by an upland berm along the majority of its western boundary. Overland flow from the adjacent upland was observed as the primary hydrologic input. Flow was observed from the wetland through a drainage feature to the Moose River. While no bidirectional flow, from the river to the wetland, was observed during either visit (October or April), it was noted that the southern portion of the wetland may have periodic connectivity with the Moose River, due to elevation and vegetation composition. However, hydrologic connectivity was not observed during high flow in April, which indicates that bidirectional connectivity is limited to extreme high flow events.

Potential bidirectional flow was observed beyond the 100 m mixing zone. As water quality will meet MDMER at discharge, and CCME/NSE Tier I/background concentrations or site-specific water quality objective at the end of the mixing zone in the Moose River, indirect impact analyses for riparian wetlands were limited to water quantity.

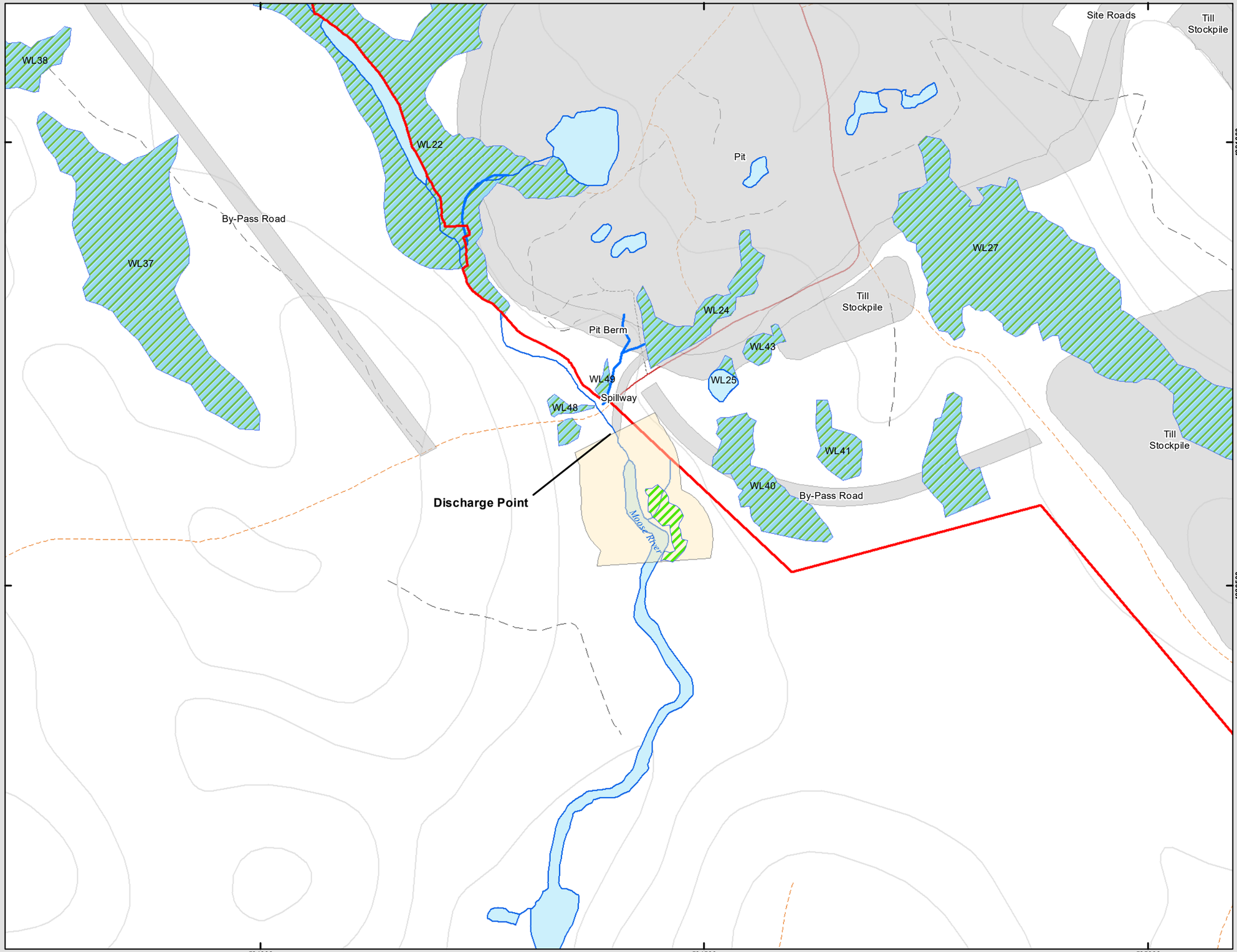

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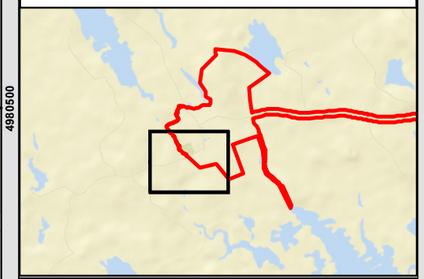
FIGURE 6.8-3

Beaver Dam Mine Project

Wetlands in Proximity to Moose River Discharge

- Field Delineated Watercourses
- NSTDB Mapped Watercourses
- Local Road
- Dry Weather / Seasonal Road
- Diveways (>300 m)
- Track
- Field Identified Wetlands: Moose River
- Field Delineated Wetlands
- NSE Wetlands (None Identified)
- Open Water
- Moose River Wetland Study Area
- Touquoy Infrastructure Layout
- Project Area



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6.8.5 Considerations of Engagement Results

Key issues raised during public consultation and Mi'kmaq engagement relating to wetlands include direct impacts during construction activities at the Beaver Dam Mine Site and during Haul Road construction, as well as potential indirect effects from Project activities. Overall potential effects on habitat loss from direct and indirect wetland impacts was cited as a concern, including potential effects to use by Mi'kmaq peoples for hunting, fishing, trapping, and gathering.

The results of the public and Mi'kmaq engagement have been updated and considered in the environmental effects assessment (Section 3 and Section 4), including AMNS's commitments on mitigation and monitoring measures as well as broader commitment for ongoing public and Mi'kmaq engagement (Section 9 and Section 10).

6.8.6 Effects Assessment Methodology

6.8.6.1 Boundaries

6.8.6.1.1 Spatial Boundaries

The spatial boundaries used for the assessment of Project effects to wetlands is described below.

The PA (Section 5.5, Figure 5.5-1) consists of the three project components; Beaver Dam Mine Site, Touquoy Mine Site, and the Haul Road and extends from Marinette to Moose River Gold Mines, Halifax County, NS. The Beaver Dam Mine Site is located at the eastern end of the Beaver Dam Mines Road. The Haul Road spans from the Beaver Dam Mine Site to Moose River Gold Mines, where the Touquoy Mine Site [processing and exhausted pit (to be used to dispose Beaver Dam tailings)] is located. The PA has changed as a result of the expansion of the Beaver Dam Mine Site to accommodate micro-siting of mine infrastructure and ongoing modifications to the Haul Road design, as described in Section 2 (Project Description). These changes have been captured under the existing and additional desktop and field evaluations.

The LAA consists tertiary watersheds which intersect each component of the Project (Section 6.7, Figures 6.7-4 and 6.7-11). The LAA boundaries were defined considering the maximum expected extent of direct and indirect impacts to the aquatic environment as well as the location of Project activities across all PA components. The LAA surrounding the Touquoy Mine Site incorporates the Moose River to the west, and only includes the portion of the Square Lake watershed which interacts with the PA. No Project related aquatic effects are expected in the headwater portions of these watersheds. The lakes and watercourses that are included as part of the baseline programs and/or predictions of effects are located within the LAA boundary. The list below identifies tertiary watershed boundaries intersected by each component of the Project. The LAA is defined as the collection of all tertiary watersheds listed below:

- Beaver Dam Mine Site:
  - Portion of Killag River (1EM-2-D);
  - Tent Brook (1EM-2-F);
  - Paul Brook (1EM-2-H); and
  - Cope Brook (1EM-2-J).

- Haul Road:
  - Tent Brook (1EM-2-F);
  - Keef Brook (1EM-2-G);
  - Jack Lowe Brook (1EM-2-N);
  - Little River (1EM-2-P);
  - Portion of Sandy Pond (1EL-2-C), downstream of Otter Lake Brook and upstream of Ferry Lake; and
  - Portion of Morgan River (1EL-2-H), downstream of Morgan River.
- Touquoy Mine Site:
  - Portion of Moose River (1EL-5-P), upstream od the Moose River;
  - Westernmost portion of Square Lake (1EL-5-M); and
  - Portion of Scraggy Lake (1EL-5-N), upstream of Rocky Lake.

The RAA (Section 6.7, Figures 6.7-4 and 6.7-11) encompasses the three secondary watersheds that the PA is located within. These watersheds are:

- West River Sheet Harbour secondary watershed (1EM-2, incorporating the Beaver Dam Mine Site and Haul Road);
- Tangier River secondary watershed (1EL-2, incorporating the Haul Road); and
- Fish River-Lake Charlotte secondary watershed (1EL-5, which incorporates the Touquoy Mine Site).

The RAA is broader than expected Project impacts and considers other project boundaries as per the cumulative effects assessment methodology. As the Project has the potential to cause direct and indirect effects to fish and fish habitat outside of the PA, the LAA is the appropriate boundary for evaluation of this VC.

Assessment of wetlands will be completed in consideration of the LAA as the primary spatial boundary. All spatial boundaries will help to identify the direct or indirect impacts to flora and habitat and the effects of the Project on distribution and abundance of these species.

The PA, LAA and RAA were refined for the wetland cumulative effects assessment modelling exercise as discussed in Section 6.8.7.2.

6.8.6.1.2 Temporal Boundaries

The temporal boundaries used for the assessment of effects to wetlands are the construction phase, operational phase, active closure phase, and post-closure phase.

6.8.6.1.3 Technical Boundaries

No technical boundaries were identified for the effects assessment of wetlands.

6.8.6.1.4 Administrative Boundaries

Administrative boundaries for the protection and conservation of wetland habitat in Nova Scotia include the Nova Scotia Wetland Conservation Policy (2011b), the *Environmental Goals and Sustainable Prosperity Act* (EGSPA 2007) and the *Environment Act* (1994) and its' Activities Designation Regulations (1995).

Further wetland protection is provided on a federal level by the Federal Policy of Wetland Conservation (1991).

6.8.6.2 Wetland Cumulative Effects Modeling

A wetland cumulative effects modelling assessment was completed for wetlands losses associated with the Beaver Dam Mine Site. The modelling exercise was updated in order to capture modifications in the PA, LAA and proposed infrastructure footprints.

As stated in Section 6.8.4.1, wetland functional assessment was completed for each observed wetland within the Beaver Dam Mine Site and Haul Road using the NSE NovaWET 3.0 wetland evaluation technique. NovaWET 3.0 is a tool to evaluate individual wetland functions only and does not evaluate wetland functional loss, either individually or cumulative loss of multiple wetlands within any spatial watershed boundary (sub-drainage basin, tertiary or larger watershed). As such, the purpose of the wetland cumulative effects assessment is to evaluate the spatial cumulative effects associated with the loss of wetlands as a result of developing the Beaver Dam Mine Site.

Through completion of a modelling exercise, wetland loss (including loss of wetland function metrics) has been extrapolated to examine potential cumulative effects spatially.

The wetland cumulative effects modelling assessment was completed by establishing individual wetland function "metrics" and evaluating them as indicators of potential wetland function loss. The following metrics were established based on species observations within Beaver Dam Mine Site and Haul Road and known species use of wetland habitat, in alignment with IR2 CEAA-2-24 (AMNS 2021):

- Wetland Area;
- Loss of Wetland Habitat Function including:
  - Moose: mainland moose;
  - Turtles: snapping turtle; and
  - Birds: Canada warbler, olive-sided flycatcher, and rusty blackbird.

Spatial Boundaries

The spatial boundaries used for the assessment of cumulative effects of wetland loss (area and habitat function metrics) vary depending on the wetland function metric being evaluated. Table 6.8-10 provides the spatial boundaries evaluated as part of the wetland cumulative effects modelling:

Table 6.8-10: Wetland Cumulative Effects Spatial Boundaries

Function Metric	Spatial Boundary Assessed	Spatial Boundary Description
Wetland Area	PA	Beaver Dam Mine Site
	LAA	The LAA for wetlands, as described in Section 6.8.6.1. Portions of downstream aquatic habitats and headwaters where appropriate, depending on project activities, up to the maximum size of the tertiary watershed(s)
	RAA	The secondary watershed that the PA is located within (i.e., the West River Sheet Harbour secondary watershed)
Mainland Moose, Snapping Turtle, Rusty Blackbird, Canada Warbler, Olive-sided Flycatcher	PA	Beaver Dam Mine Site
	LAA	The LAA for wetlands, as described in Section 6.8.6.1. Portions of downstream aquatic habitats and headwaters where appropriate, depending on project activities, up to the maximum size of the tertiary watershed(s)
	RAA	Not assessed

6.8.6.2.1 Methods

Wetlands play countless roles in the maintenance of a healthy ecosystem. Among other functions, wetlands improve water quality, control floods, regulate water temperature, retain nutrients, and provide habitat for aquatic and terrestrial species. In order to evaluate the cumulative effects of wetland loss and their associated functions, modelling was completed based on the development of the following wetland function metrics:

- Wetland Area: A larger wetland, or larger frequency of wetlands and area in a given spatial boundary is likely to provide more wetland functions than a smaller wetland, or lesser frequency of wetlands and area in a given spatial boundary. Therefore, for the purposes of the wetland cumulative effects modelling assessment, wetland area has been analyzed as an indicator of potential wetland function loss. In order to effectively determine the loss of wetland area (and potential wetland function loss) the modelling quantified the area of wetland habitat directly impacted by mine development and its associated infrastructure, and compared it to predicted wetland area present in the LAA and RAA. This analysis enabled the potential wetland functions loss (based on the wetland area metric), to be made within the spatial boundaries assessed.
- Loss of Wetland Habitat Function: loss of wetland habitat function was evaluated by considering the loss of habitat provision for specific wildlife species that typically use wetlands for their survival and lifecycle tendencies. The three habitat metrics used were: moose habitat, turtle habitat, and bird habitat. These were evaluated using the following species and their requirements:
  - Moose: mainland moose;
  - Turtles: snapping turtle; and
  - Birds: Canada warbler, olive-sided flycatcher, and rusty blackbird.

These species chosen are SAR (mainland moose, NSESA Endangered; olive-sided flycatcher, SARA Threatened; Canada warbler, SARA Threatened, NSESA Endangered; rusty blackbird, SARA Special Concern, NSESA Endangered and snapping turtle, SARA Special Concern, NSESA Vulnerable) that are known to use a variety of wetland habitat types for critical biological functions, and had either been identified within the Beaver Dam Mine Site and Haul Road during field surveys or have potential to be present in the Beaver Dam Mine Site and Haul Road based on habitat provision or confirmed observations of the species in close proximity to the Beaver Dam Mine Site.

It should be noted that while the DNR forestry GIS layer does contain information on Canada warbler habitat (i.e., dense, deciduous shrub), it is derived from 1:12,500 aerial photographs and lacks the ability to appropriately distinguish suitable habitat for this species. Therefore, modeling was not possible for Canada warbler within the LAA. As such, Canada warbler was removed from the model exercise associated with the LAA so as not to bias the outcome. Canada warbler habitat was however determined for the Beaver Dam Mine Site based on data collected during field programs in combination with desktop resources.

The wetland function metrics were assessed within the spatial and temporal boundaries outlined in Table 6.8-11. In addition, the method of analysis performed on each wetland function metric is provided. For the purposes of this evaluation, Year 0 is considered "prior to any mine development activities" and Year 5 is considered "the completion of mine development" (i.e., complete wetland alteration and at maximum operational footprint/activity).

Table 6.8-11: Wetland Cumulative Effects Temporal Boundaries

Function Metric	Spatial Boundary Assessed	Temporal Boundary Assessed	Method of Data Analysis
Wetland Area	PA	Between Year 0 and Year 5	A comparison between wetland area prior to mine development within the Beaver Dam Mine Site, and wetland area at completion of mine development within the Beaver Dam Mine Site.
	LAA	Year 0	Wetland area within LAA and RAA is not expected to change as a result of the Beaver Dam Mine Site; therefore, a comparison of wetland area at Year 5 within the Beaver Dam Mine Site, to predicted wetland area within the LAA and RA at Year 0 will be made.
	RAA	Year 0	
Mainland Moose, Snapping Turtle, Rusty Blackbird, Canada Warbler, Olive-sided Flycatcher	PA	Between Year 0 and Year 5	A comparison between predicted species' wetland habitat prior to mine development within the Beaver Dam Mine Site, and predicted species' wetland habitat at completion of mine development within the Beaver Dam Mine Site.
	LAA	Year 0	A comparison of predicted species' wetland habitat at Year 5 within the Beaver Dam Mine Site, to predicted species' wetland habitat within the LAA at Year 0 will be made. Canada warbler comparison not possible due to insufficient GIS data.
	RAA	Year 0	Impact at RAA extent not considered likely.

Although not considered a quantifiable determination of potential wetland functional loss as a result of the Project, the analysis described in Table 6.8-12 and 6.8-13, provides the ability to extrapolate important wetland functional metrics, and assess their potential loss as a result of developing the Beaver Dam Mine Site.

It is recognized that wetlands play important water quality and purification functions, however, as a result of the general water management measures being implemented for the mine development, water quality has not been included in this analysis. Refer to Section 6.7, for a detailed description of the potential effects to water quality as a result of mine development, and methods that will be employed to ensure environmental standards are met.

Table 6.8-12: Metrics and Associated GIS Layers used in the Cumulative Effects Assessment – Wetlands Loss

Wetland Loss						
Metric	Value	Reference for Habitat Selection	Project Area		LAA/RAA	
			GIS Layer	Attributes Used	GIS Layer	Attributes Used
Wetland area	Area of all wetlands	Nova Scotia Wetland Evaluation Technique (Version 3.0, September 2011)	Field delineated wetlands	All wetlands	All NSE database wetland types (also used for RAA)	All wetlands

Notes: RAA = Regional Assessment Area; LAA = Local Assessment Area; GIS = geographic information system; NSE = Nova Scotia Environment.

Table 6.8-13: Metrics and Associated GIS Layers used in Cumulative Effects Assessment – Loss of Wetlands Function

Loss of Wetland Function							
Metric	Biological Requirement	Habitat that provides for the Biological Requirement	Reference for Habitat Selection	Project Area		LAA/RAA	
				GIS Layer	Attributes Used	GIS Layer	Attributes Used
Mainland moose	Foraging and thermoregulation	Wetlands with access to aquatic vegetation	Action Plan for the Recovery of Eastern Moose (*Alces alces americana*) in Mainland Nova Scotia (Nova Scotia Department of Natural Resources, 2007) and Status Report on The Eastern Moose (*Alces americana* Clinton) in Mainland Nova Scotia (Parker, 2003)	Field delineated wetlands	Wetlands containing or adjacent to open water. Wetlands with potential habitat (as per field assessment)	NSE wetlands database layer	Wetlands containing or adjacent to open water
				NSE waterbodies	Waterbodies (i.e., lakes, standing water, ponds) adjacent to wetlands	NSE waterbody database layer	Waterbodies (i.e. lakes, standing water, ponds) adjacent to wetlands
				DNR Forestry	Beaver flowage queried as non-forested area that is or has been occupied by beavers	DNR Forestry	Beaver flowage queried as non-forested area that is or has been occupied by beavers
				Visual aerial inspection	Visual inspection of aerial imagery to identify open waterbodies (i.e. lakes, standing water, ponds)	Visual aerial inspection	Visual inspection of aerial imagery to identify open waterbodies (i.e. lakes, standing water, ponds)

Table 6.8-13: Metrics and Associated GIS Layers used in Cumulative Effects Assessment – Loss of Wetlands Function (continued)

Loss of Wetland Function							
Metric	Biological Requirement	Habitat that provides for the Biological Requirement	Reference for Habitat Selection	Project Area		LAA/RAA	
				GIS Layer	Attributes Used	GIS Layer	Attributes Used
Snapping turtle	Thermoregulation, hibernation	Floodplains, riparian wetlands, shallow open water wetlands or portions of such wetlands within 200 m of a watercourse or shallow open water	Management Plan for the Snapping Turtle (*Chelydra serpentina*) in Canada (Environment and Climate Change Canada, 2016)	Field delineated wetlands	Floodplains, riparian wetlands, shallow open water wetlands or portions of such wetlands within 200 m of a watercourse or shallow open water wetlands with potential turtle habitat (as per field assessment)	NSE wetland database layer	Floodplains, riparian wetlands, shallow open water wetlands or portions of such wetlands within 200 m of a watercourse or shallow open water
				Field delineated watercourses	Areas within 200 m of watercourses with potential turtle habitat (as per field assessment)	NSE watercourse database layer	Watercourses adjacent to wetlands
				NSE waterbody database layer	Areas within 200 m of waterbodies with potential turtle habitat (as per field assessment)	NSE waterbody database layer	Waterbodies (i.e., lakes, standing water, ponds) adjacent to wetlands
				Visual aerial inspection	Visual inspection of aerial imagery to identify floodplains, riparian wetlands, and shallow open water	Visual aerial inspection	Visual inspection of aerial imagery to identify floodplains, riparian wetlands, and shallow open water
Canada warbler (CAWA)	Breeding	Forested wetland with dense, deciduous shrub layer	Recovery Strategy for the Canada Warbler (*Cardellina candensis*) in Canada (Environment Canada, 2016)	Field delineated wetlands	Swamps with a dense, deciduous shrub layer and wetlands where CAWA were observed (as per field assessment)	Data unavailable	

Table 6.8-13: Metrics and Associated GIS Layers used in Cumulative Effects Assessment – Loss of Wetlands Function (continued)

Loss of Wetland Function							
Metric	Biological Requirement	Habitat that provides for the Biological Requirement	Reference for Habitat Selection	Project Area		LAA/RAA	
				GIS Layer	Attributes Used	GIS Layer	Attributes Used
Olive-sided flycatcher (OSFL)	Breeding	Open wetlands with tall snags and portions of coniferous dominant riparian wetlands that are adjacent to and within 50 m of a watercourse or waterbody	Recovery Strategy for the Olive-sided Flycatcher (*Contopus cooperi*) in Canada (Environment Canada, 2016)	Field delineated wetlands	Open wetlands (bogs, fens, complexes containing bogs and fens) likely to have tall snags as per field notes, portions of coniferous dominant riparian wetlands that are adjacent to and within 50 m of a watercourse or waterbody, and wetlands where OSFL were observed (as per field assessment)	NSE wetland database layer	Bogs, fens
				Field delineated watercourses	Watercourses adjacent to coniferous dominant wetlands	NSE watercourse database layer	Watercourses adjacent to coniferous dominant wetlands
				NSE waterbody database layer	Waterbodies (i.e., lakes, standing water, ponds) adjacent to coniferous dominant wetlands	NSE waterbody database layer	Waterbodies (i.e., lakes, standing water, ponds) adjacent to coniferous dominant wetlands
				Visual aerial inspection	Visual inspection of aerial imagery to identify open wetlands (i.e., bogs, fens)	DNR Forestry	Coniferous dominated forest, queried as the main species type being one of the following: balsam fir, black spruce, other softwood, red spruce, eastern larch, unclassified softwood, or red & black spruce
						Visual aerial inspection	Visual inspection of aerial imagery to identify open wetlands (i.e., bogs, fens)

Table 6.8-13: Metrics and Associated GIS Layers used in Cumulative Effects Assessment – Loss of Wetlands Function (continued)

Loss of Wetland Function							
Metric	Biological Requirement	Habitat that provides for the Biological Requirement	Reference for Habitat Selection	Project Area		LAA/RAA	
				GIS Layer	Attributes Used	GIS Layer	Attributes Used
Rusty blackbird (RUBL)	Breeding	Portion of coniferous dominant riparian wetlands that are adjacent to and within 50 m of a watercourse or waterbody	Management Plan for the Rusty Blackbird (*Euphagus carolinus*) in Canada (Environment Canada, 2014); and personal communication with Dr. Cynthia Staicer (October 23, 2018)	Field delineated wetlands	Coniferous dominant treed wetlands adjacent to a watercourse or waterbody (i.e., lake, pond)	NSE wetlands	Wetlands adjacent to or within 50 m of a watercourse or waterbody
				McCallum delineated watercourses	Watercourses adjacent to coniferous dominant treed wetlands	DNR Forestry	Coniferous dominated forest, queried as the main species type being one of the following: balsam fir, black spruce, other softwood, red spruce, eastern larch, unclassified softwood, or red and black spruce
				Visual aerial inspection	Visual inspection of aerial imagery to identify wetlands adjacent to watercourses or waterbodies (i.e., lake, pond)	Visual aerial inspection	Visual inspection of aerial imagery to identify wetlands adjacent to watercourses or waterbodies (i.e., lake, pond)

Notes: RAA = Regional Assessment Area; LAA = Local Assessment Area; GIS = geographic information system.

Each of the wetland function metrics being evaluated in the cumulative effects wetland modelling exercise required the gathering of datasets which could be used digitally to compare to each other. The metric "Wetland Area" involved the combined collection of desktop and field wetland data. Conversely, the wetland function metrics for Moose, Turtle and Birds wetland habitats required a comprehensive desktop review to identify predicted important habitats for each of the species being evaluated, as well as habitat data collected during field surveys. Based on scientific literature, important wetland habitats were defined as those that support biological requirements for species survival. Determination of these important habitats supported the development of the datasets required for the cumulative effects model. The datasets used for the metrics being evaluated in the model within each spatial boundary are provided in Tables 6.8-12 and 6.8-13.

Once compiled, the datasets listed in Table 6.8-13 were arithmetically overlaid for each wetland function metric using ArcGIS (ArcMap version 10.4.1) at each geographic scale to create a habitat suitability layer at Year 0. The Beaver Dam Mine Site was also analyzed at Year 5. Interactions between wetlands generally, and the predicted suitable habitats created to model loss of wetland function metrics was achieved by overlaying the Beaver Dam Mine and its associated infrastructure footprint with the developed layers. Direct impacts to the developed layers were clipped out to calculate the predicted losses.

By modeling the impact of the Beaver Dam Mine Site and its associated infrastructure on wetland area and the predicted suitable wetland habitat for moose, turtles, and birds, the extent of impact was determined and potential loss of these wetland function metrics could be assessed.

Results of this process are provided in Section 6.8.4.1.

6.8.6.2.2 Modelling Limitations and Assumptions

The wetland cumulative effects modelling was developed to better understand the potential cumulative effect of wetland area and wetland function metric loss geographically, and over time. In order to produce a reasonable method to address this issue that falls within the realistic parameters of evaluating potential effects associated with the Beaver Dam Mine Project, there were multiple limitations and assumptions built into the modelling process. The following information provides a discussion of these limitations and assumptions, and their impact on the outcome of the assessment.

Certain assumptions were made in the selection of the four wetland function metrics. Initially, they were chosen to represent various wetland characteristics that can play an important role in determining a wetland's function. Wetlands play numerous roles in an ecosystem, and it is difficult to narrow those functions down for the purposes of a modelling exercise. However, for the purpose of this modelling exercise it was necessary to do so. The four wetland function metrics were assessed using available data layers. The biological requirements, habitat descriptions, and representative data layers were chosen using scientific information from peer-reviewed papers, government documents and/or conversations with specialists. To the best of our knowledge, they depict an accurate snapshot of the wetland habitat used by each species modelled. Limitations were observed when it came to compiling available data, for example, Canada Warbler, which use a dense, deciduous shrub layer, was not able to be modeled given the lack of available data. When creating this layer, it was determined that the available GIS datasets narrowed the search too much, resulting in an overly conservative selection of suitable wetland habitat. Furthermore, all GIS layers used are limited by the accuracy and precision of the publicly available data from which they came. For all metrics, field assessments and ground truthing in the PA resulted in more accurate data. When comparing this level of detail to the LAA and RAA, where data is far less accurate and less precise, the analysis is underestimated at these larger geographic scales. The analysis performed at the LAA and RAA levels underrepresent predicted suitable wetland habitat, making the comparative area of impacted suitable wetland habitat in the Beaver Dam Mine Site less than the results of the modelling exercise suggests.

In the context of meeting the objectives of the wetland cumulative effects modelling exercise, the modeling methods were developed to get the best possible analysis of cumulative effects. However, given the current resources and limitations in available data, a protracted model was not able to be produced. Instead, the study aimed to qualitatively show the cumulative effects of the project footprint on wetlands and metrics of their function within the LAA/RAA and over the life of the active mine (5 years) where possible within the Beaver Dam Mine Site. The mine footprint was used in the model to show area of impact. There are certain limitations around this, as it does not accurately show the potential indirect impacts to upgradient and downgradient wetland habitats. The impacted area assessed only includes the portion of the wetland directly beneath the Beaver Dam Mine infrastructure footprint, when in reality there could be impacts to other extents of the remaining wetland.

Lastly, for the purposes of this modeling exercise the study was not able to predict the future changes within the LAA and RAA and how those changes may affect wetland habitat and functions.

6.8.6.3 Thresholds for Determination of Significance

A significant adverse effect from the Project on wetlands is defined as:

- an effect that results in an unmitigated or uncompensated net loss of wetland habitat as defined under the NSE Wetland Conservation Policy, and its associated no-net loss policy; or
- an effect to wetlands that is likely to cause a permanent loss of >10% wetland habitat for a SAR species identified in the PA within the LAA, which is defined by the tertiary watershed boundary.

The area of wetland loss within the PA relative to the area of all NSE mapped wetland habitat available within the LAA was used to determine magnitude. This assessment is completed recognizing the fact that wetland habitat outside of the PA is underrepresented by provincial wetland databases. **Given this assumption, the percent of wetland alteration within the Beaver Dam Mine Site and Haul Road is conservatively high, as these area calculations are based on field verified wetland boundaries.**

The following logic was applied to assess the magnitude of a predicted change in wetland habitat as it relates to the cumulative effects methodology and conclusions:

- Negligible – loss of <1% of NSE mapped wetlands in the LAA;
- Low – loss of 1 to 10% of NSE mapped wetlands in the LAA, and no direct or indirect impact to an identified WSS;
- Moderate – loss of 1 to 10% of NSE mapped wetlands in the LAA and direct or indirect impact to an identified WSS; and
- High – greater than 10% loss of NSE mapped wetlands in the LAA.

The timing of residual effects for wetland habitats considers when the residual environmental effect is expected to occur, considering seasonal aspects. The duration of residual effects considers the time frame over which the effects are likely to last, ranging from short-term to permanent. The frequency of residual effects considers the rate of recurrence of the effects, ranging from once to continuous. The reversibility of residual effects considers the time required for wetland habitat to recover to baseline conditions, or whether the changes to wetland habitat, if identified, are permanent.

6.8.7 Project Activities/Interactions with Wetlands

During review of Project activities and their expected direct and potential indirect effects to wetlands, it was determined that wetland alteration authorization would be required to allow for development of the Project. Alternative locations for Project infrastructure were considered, where practicable, focusing specifically on reducing impacts to wetland habitat. The effects of the Project on wetlands were determined considering the effects of the project on groundwater and surface water.

Potential interaction between Project activities and wetland habitat within the Beaver Dam Mine Site and Haul Road are outlined in Tables 6.8-14 and 6.8-15 below.

Table 6.8-14: Potential Project Activities/Interactions with Wetlands at Beaver Dam Mine Site

Project Phase	Duration	Project Interactions
Construction	1 year	• Clearing, grubbing, and grading in preparation of construction • Rock blasting in preparation of construction (e.g., pre-stripping) • Topsoil, till and waste rock from site preparation transport and storage • Watercourse and wetland alteration in preparation of construction, including open pit dewatering • Surface infrastructure installation and construction • General waste management • Collection ditches and settling pond construction • Local traffic bypass road construction • Mine Site road construction • Culvert and bridge upgrades and construction • Invasive species introduction or spread • Environmental monitoring;
Operation	5 years	Drilling and rock blasting to access and extract ore • Management of waste rock produced from crushing and preparing ore for transport • Till and waste rock from site preparation transport and storage • Open pit dewatering, interaction between groundwater drawdown and wetlands; • Alteration of surface water hydrology (i.e. ditching of site surface water runoff and surface mine pumped water) and surface water management; • Site maintenance • Treatment of site surface water runoff and surface mine pumped water • General waste management • Petroleum products management • Dust management • Culvert and bridge maintenance • Invasive species introduction or spread • Environmental monitoring
Active Closure	2 years	• Site reclamation • General waste management • Water treatment and management • Environmental monitoring
Post-closure	10+ years (monitoring)[(a)]	• Water treatment and management • Environmental monitoring

Note: [(a)] Post-closure wetlands monitoring will be determined based on monitoring and discussions with regulators.

Table 6.8-15: Potential Project Activities/Interactions with Wetlands along the Haul Road

Project Phase	Duration	Project Interactions
Construction	1 year	• Clearing, grubbing, and grading in preparation of construction • Rock blasting in preparation of construction • Watercourse and wetland alteration in preparation of construction • Haul Road construction and upgrades • Auxiliary infrastructure installation and construction • Local traffic bypass road construction • Culvert and bridge upgrades and construction • Environmental monitoring • Invasive species introduction or spread • General waste management
Operation	5 years	• Haul Road maintenance and repairs; • Dust management • Petroleum products management; • Environmental monitoring • Invasive species introduction or spread • General waste management.
Active Closure	2 years	• N/A[a]
Post-closure	10+ years (monitoring)[b]	• N/A

Notes: [a] Decommissioning and Reclamation of the Haul Road is not expected. The Haul Road will be returned to owner for forestry industry.
[b] Post-closure wetlands monitoring will be determined based on monitoring and discussions with regulators.
N/A = not applicable.

6.8.7.1 Beaver Dam Mine Site and Haul Road Wetland Impacts

Development of the Beaver Dam Mine Site and Haul Road will cause direct and indirect impacts to wetlands mostly during the construction phase of the Project. Direct impacts will be associated with clearing, grubbing, infilling, and development of the Project and its associated infrastructure. Development of the Beaver Dam Mine Site will account for the greatest direct impact to wetland habitat. Direct impacts along the Haul Road, will include upgrading of the road (e.g., widening) and new construction of a 4 km road section (Section 2, Figure 2.3-1). Indirect impacts are a by-product of direct impacts associated with construction activities, as well as potential indirect impacts to wetlands from mine operations (dewatering, blasting, and accidents). Table 6.8-16 provides general impact types and a description of various direct and indirect examples by which these may occur as a result of Project activities. No direct wetland impacts are proposed outside of the PA.

In 2019, the PA was modified to allow for the micro-siting of infrastructure, as described in Section 2. The waste rock stockpiles have been relocated twice to avoid impacts to fish and wetland habitat. There continues to be ongoing refinement of the Project design to avoid direct and indirect impacts to wetlands. During the wetland alteration permitting phase, additional micro-siting of infrastructure (i.e., road alignment and other supporting infrastructure) will occur where practicable to avoid wetland impacts, and infrastructure-specific buffers will be added to wetland impact areas where necessary.

Table 6.8-16: Direct and Indirect Wetland Impacts

Impact Type	Direct Impact	Project Phase	Indirect Impact	Project Phase
Alteration of Wetland Hydrology: If the hydrological regime of a wetland is altered, the vegetation, character, and function of the wetland also have potential to change.	Complete dewatering (removing wetland), infilling or flooding of a wetland to facilitate Project development resulting in conversion from wetland to upland habitat.	C	Hydrologically connected upstream wetlands may also be at risk of indirect impacts as a result of downstream alteration activities (e.g., water outflow changes, land elevation changes, blasting, etc. causing dewatering). Inadvertent damming of up-gradient wetlands from construction related infrastructure (e.g., roads with lack of flow through infrastructure).	C, CL
	Alteration of hydrological inputs and outputs into partially altered wetlands has the potential to alter remaining (undeveloped) wetland habitat.	C, O, CL	Removal of on-site outflow and throughflow wetland habitat has the potential to alter the localized hydrology in downgradient wetlands.	C
			Hydrological changes can affect the use of the wetland by wildlife as habitat.	C
			Blasting adjacent to wetlands has the potential to alter subsurface water flows, especially in fractured rock. This activity has the potential to increase or decrease subsurface hydrological flow to adjacent wetland habitats and can precipitate drier (dewatering) or wetter conditions in those habitats.	C, O
			Groundwater drawdown will reduce groundwater inputs to specific wetlands causing dryer conditions (14 intact wetlands within the predicted radius of influence).	O, CL
			Changes to catchment areas and resultant flow reduction will reduce water inputs to specific wetlands causing dryer conditions.	C, O, CL
Alteration of Water Quality:	Removal (alteration) of wetland from the landscape leading to reduced or no water supply to downgradient aquatic receivers (e.g., streams, additional wetlands, and lakes).	C, O, CL	Alteration of the wetlands increases the risk of downgradient sedimentation.	C, O, CL
			The effects of increased sedimentation as a result of up-gradient activities (e.g., earth moving, removal of vegetation, soil stockpiling) has the capacity to suffocate existing plant life and increase nutrient levels in downgradient wetlands. Dust created as a result of construction activities can have a similar impact.	C, O, CL
			Runoff from acid producing rock exposed during construction and operations activities has the potential for negatively altering water quality within downgradient wetland habitat.	C, O, CL
Vegetative and Habitat Integrity:	Extensive ground works, including activities such as blasting in and adjacent to wetlands has the potential to destabilize land surfaces and the root zone of vegetative areas, including wetland buffers.	C, CL	Introduction of invasive species can occur indirectly into wetlands when equipment or people enter the wetlands or via runoff or dust from the roads. Introduction of mine and Haul Road traffic during construction and operation can elevate this risk. Invasive species, such as purple loosestrife (*Lythrum salicaria*), can severely degrade wetland habitat and function. No purple loosestrife was noted during field surveys in the Beaver Dam Mine Site or Haul Road.	C, O, CL
	Loss of vegetative cover decreases wildlife habitat availability and also has the potential to reduce natural surface water drainage.	C	Dust accumulation on vegetation can smother and stress the plants. The dust can also provide minerals and nutrients into the wetland habitat.	C, O, CL
	Seeds and roots of invasive species can be transferred from construction equipment, transportation vehicles, or workers into adjacent wetland habitat during construction and operational activities.	C, O, CL		
Malfunctions and Accidents: Accidental spills of contaminants in up-grade work areas has the potential to drain into down-gradient wetlands, and can cause negative impact to wetland function, and potential use of the habitat by wildlife.				C, O, CL

Notes: C = Construction Phase; O = Operation and Maintenance Phase; CL = Active Closure.

6.8.7.1.1 Direct Wetland Impacts

Expected direct impact extent to wetlands, as a result of Project activities during the temporal lifetime of the Project, are presented in Table 6.8-17 for the Beaver Dam Mine Site and Table 6.8-18 for the Haul Road. Indirect hydrological wetland impacts to adjacent wetlands within the PA that may be expected as a result of the Project are discussed separately. Only wetlands where expected direct habitat alteration is expected are included in these tables. All estimated direct impact areas have been updated base on the 2019 PA and infrastructure modifications.

Type of direct impact is categorized as either partial or complete. Where a partial alteration is proposed, in some cases, remaining portions of a wetland may not be maintained in a natural condition or function and is thus considered a complete alteration. Therefore, a wetland is considered completely altered when 100% of the wetland is directly impacted by Project development or the remaining wetland area will not be self-sufficient. It was also determined that if portions of wetland habitat are not likely to maintain a natural condition (i.e., a portion remains between two drainage ditches), the direct alteration area has been expanded to include wetland fragments which lie outside of proposed infrastructure. Each wetland proposed for alteration is assessed on a case-by-case basis. When determining alteration extent, the hydrologic regime, wetland type and morphology, alteration type, indirect effects (e.g., edge effects) and particularly the relative size of the wetland compared to alteration area are considered. Predicted alteration extent will be refined at the permitting stage.

Table 6.8-17: Direct Wetland Impacts (Aerial Extent and % Change) within the Beaver Dam Mine Site

Wetland ID	Wetland Area[(a)] (m^2)	Estimated Direct Impact Area (m^2)	Percent Area Impacted	Infrastructure Impacts	Alteration Type[(b)]
5	6,202	1,292	20.83%	Mine Road and Collection Ditch around PAG Stockpile	P
10	18,817	3,565	18.95%	Low Grade Stockpile, Collection Ditch	P
14	**31,655**	**2,953**	**9.33%**	**Mine Road and Collection Ditch**	**P**
17	**76,341**	**5,967**	**7.82%**	**Open Pit, Mine Road, Collection Ditch**	**P**
18	1,864	1,864	100.00%	Settling Pond, Collection Ditch	C
19	11,428	1,836	16.07%	Mine Road and Collection Ditch	P
20	10,106	1,173	11.61%	Mine Road and Collection Ditch	P
31	10,473	3,003	28.67%	Low Grade Stockpile, Collection Ditch	P
34	1,382	305	22.03%	Mine Road and Collection Ditch	P
55	616	616	100.00%	Open Pit, Mine Road, Collection Ditch	C
56	16,276	16,276	100.00%	Open Pit	C
57	88,717	11,805	13.31%	Mine Road, Collection Ditch, Crusher Pad	P
58	581	581	100.00%	Till Stockpile	C
59	65,304	65,304	100.00%	Open Pit, Mine Road, Topsoil Stockpile, Collection Ditch	C
60	2,963	2,963	100.00%	Topsoil Stockpile	C
61	25,982	2,166	9.00%	Open Pit, Mine Road, Collection Ditch, Water Intake Pump	P
66	55,419	1,066	1.92%	Bypass Road, Collection Ditch	P
201	284	284	100.00%	Low Grade Stockpile	C
203	3,925	3,925	100.00%	Low Grade Stockpile, Collection Ditch	C

Table 6.8-17: Expected Direct Wetland Impacts within the Beaver Dam Mine Site (continued)

Wetland ID	Wetland Area[(a)] (m^2)	Estimated Direct Impact Area (m^2)	Percent Area Impacted	Infrastructure Impacts	Alteration Type[(b)]
205	**45,975**	**31,997**	**69.60%**	**NAG Stockpile, Collection Ditch**	**P**
208	6,478	6,478	100.00%	NAG Stockpile	C
209	11,514	11,514	100.00%	NAG Stockpile	C
211	10,474	10,474	100.00%	NAG Stockpile, Low Grade Stockpile, Collection Ditch	C
212	13,987	13,987	100.00%	NAG Stockpile, Low Grade Stockpile, Collection Ditch	C
213	992	992	100.00%	Mine Road, Collection Ditch	C
214	6,041	2,000	33.10%	Low Grade Stockpile, Collection Ditch	P
215	16,447	2,577	15.67%	NAG Stockpile, Collection Ditch	P
216	1,397	318	22.78%	Mine Road	P
217	5,230	153	2.92%	Collection Ditch	P
219	90,880	14,007	15.41%	Organic Material Stockpile, Collection Ditch	P
220	15,691	15,691	100.00%	NAG Stockpile	C
221	4,082	4,082	100.00%	NAG Stockpile	C
222	7,788	7,788	100.00%	NAG Stockpile	C
223	475	475	100.00%	NAG Stockpile, Collection Ditch	C
224	1,693	1,693	100.00%	NAG Stockpile	C
225	235	235	100.00%	NAG Stockpile	C
226	15,039	15,039	100.00%	NAG Stockpile, Collection Ditch	C
227	365	365	100.00%	NAG Stockpile	C
228	11,835	3,609	30.50%	NAG Stockpile, Collection Ditch	P
229	4,644	4,644	100.00%	NAG Stockpile	C
230	1,812	1,812	100.00%	NAG Stockpile	C
231	4,808	19	0.40%	Collection Ditch	P
234	3,328	501	15.05%	NAG Stockpile, Collection Ditch	P
235	619	619	100.00%	NAG Stockpile	C
239	1,004	1,004	100.00%	Organic Material Stockpile	C
245	1,864	1,864	100.00%	Organic Material Stockpile, Collection Ditch	C
246	8,871	8,871	100.00%	Organic Material Stockpile	C
247	9,371	9,371	100.00%	Organic Material Stockpile	C
248	401	401	100.00%	Organic Material Stockpile	C
249	2,322	2,322	100.00%	Organic Material Stockpile	C
Total	**733,997 m^2 (73.4 ha)**	**302.020 m^2 (30.2 ha)**	**Total complete wetland alterations**		**30**
			Total partial wetland alterations		**20**

Notes: WSS are in **bold**. Impacts to these wetlands are discussed in Section 6.8.4.1.3.

(a) Wetland area within the PA.

(b) P – Partial habitat loss of wetland. C – Complete habitat loss of wetland.

m^2 = square metre; ha = hectares; NAG = non- acid generating; PAG = potentially acid generating.

Table 6.8-18: Expected Direct Wetland Impacts along the Haul Road

Wetland ID	Wetland Area[a] (m^2)	Estimated Direct Impact Area (m^2)	Percent Area Impacted	Infrastructure Impacts[b]	Alteration Type[c]
64	48,353[d]	49	0.10%	Haul Road	P
66	15,578	729	4.68%	Haul Road	P
68	5,568	285	5.11%	Haul Road	P
69	3,899	150	3.85%	Haul Road	P
73	27,091	185	0.68%	Haul Road	P
74	12,339	364	2.95%	Haul Road	P
76	10,406	398	3.83%	Haul Road	P
80	978	5	0.51%	Haul Road	P
81	154	41	26.84%	Haul Road	P
83	529	11	2.04%	Haul Road	P
85	322	10	2.95%	Haul Road	P
87	362	19	5.11%	Haul Road	P
89	6,170	78	1.26%	Haul Road	P
90	4,495	0	0.01%	Haul Road	P
91	1,060	121	11.38%	Haul Road	P
93	166	4	2.22%	Haul Road	P
94	1,693	195	11.53%	Haul Road	P
109	1,606	144	8.99%	Haul Road (new construction)	P
110	3,353	500	14.91%	Haul Road (new construction)	P
113	2,782	280	10.06%	Haul Road (new construction)	P
121	866	203	23.44%	Haul Road (new construction)	P
122	200	200	100.00%	Haul Road (new construction)	C
123	818	211	25.81%	Haul Road (new construction)	P
125	344	4	1.14%	Haul Road (new construction)	P
129	2,006	15	0.72%	Haul Road (new construction)	P
136	522	223	42.62%	Haul Road (new construction)	P
138	1,521	195	12.82%	Haul Road (new construction)	P
142	342	342	100.00%	Haul Road	C
143	527	184	34.90%	Haul Road	P
144	2,034	586	28.80%	Haul Road	P
145	1,462	322	22.00%	Haul Road	P
146	2,265	106	4.69%	Haul Road	P
147	2,708	400	14.77%	Haul Road	P
148	9,221	1,247	13.53%	Haul Road	P
149	1,835	168	9.16%	Haul Road	P
150	145	145	100.00%	Haul Road	C
151	2,827	220	7.78%	Haul Road	P
152	2,275	5	0.20%	Haul Road	P

Table 6.8-18: Expected Direct Wetland Impacts along the Haul Road (continued)

Wetland ID	Wetland Area[(a)] (m^2)	Estimated Direct Impact Area (m^2)	Percent Area Impacted	Infrastructure Impacts[(b)]	Alteration Type[(c)]
153	2,416	251	10.38%	Haul Road	P
154	1,927	177	9.17%	Haul Road	P
155	540	88	16.38%	Haul Road	P
156	14,745	1,151	7.81%	Haul Road	P
157	7,006	714	10.20%	Haul Road	P
158	575	87	15.13%	Haul Road	P
159	1,995	7	0.33%	Haul Road	P
160	1,237	836	67.59%	Haul Road	P
161	1,618	676	41.76%	Haul Road	P
162	1,756	408	23.24%	Haul Road	P
164	3,320	244	7.36%	Haul Road	P
165	1,623	55	3.40%	Haul Road	P
166	68	68	100.00%	Haul Road	C
167	875	173	19.73%	Haul Road	P
169	607	58	9.47%	Haul Road	P
172	229	229	100.00%	Haul Road	C
173	4,814	1,308	27.17%	Haul Road	P
174	2,649	9	0.33%	Haul Road	P
176	446	178	39.92%	Haul Road	P
179	3,376	796	23.57%	Haul Road	P
Total	**231,383 m^2 (23.1 ha)**	**15,795 m^2 (1.6 ha)**	**Total complete wetland alterations**		**5**
			Total partial wetland alterations		**53**

Notes: [(a)] Wetland area within the PA.
[(b)] Haul Road upgrade, unless otherwise specified. Includes bypass roads, where applicable.
[(c)] P – Partial habitat loss of wetland. C – Complete habitat loss of wetland.
[(d)] Area is inclusive of both Haul Road and Beaver Dam Mine Site portions of WL64. Both are potentially impacted by Haul Road development.
m^2 = square metre; ha = hectares; NAG = non- acid generating; PAG = potentially acid generating.

As presented in Table 6.8-17, within the Beaver Dam Mine Site, 30 wetlands will be completely altered, and 20 wetlands will be partially altered as a result of Project infrastructure and development. As presented in Table 6.8-18, along the Haul Road, 5 wetlands will be completely altered, and 53 wetlands will be partially altered as a result of new road construction and upgrading activities. Of the 236 wetlands identified within the Beaver Dam Mine Site and Haul Road, a total of 108 wetlands are expected to be directly impacted to support Project development, 35 of which are expected to be completely altered, and 73 of which are expected to be partially altered (Table 6.8-19). The remaining 128 wetlands will not be directly altered.

In total, it is anticipated that 31.8 ha of wetland area will be directly impacted by the Project (Table 6.8-19). Within the Beaver Dam Mine Site and Haul Road, 41% and 7% of the total wetland area, respectively, is expected to be directly impacted (partially or completely). Thirty-three percent of the total wetland area within the Beaver Dam Mine Site and Haul Road is expected to be directly impacted.

Table 6.8-19: Total Expected Direct Wetland Impacts within the Beaver Dam Mine Site and Haul Road

PA Component	Total Wetland Area (m^2)	Total Estimated Direct Impact Area (m^2)	Percent Area Impacted	Complete Alteration	Partial Alteration
Beaver Dam Mine Site	733,997 m^2 (73.4 ha)	302,020 m^2 (30.2 ha)	41%	30	20
Haul Road [(a)]	231,383 m^2 (23.1 ha)	15,795 m^2 (1.6 ha)	7%	5	53
Total	965,380 m^2 (96.5 ha)	**317,815 m^2 (31.8 ha)**	**33%**	**35**	**73**

Notes: [(a)] Haul Road upgrade, unless otherwise specified. Includes bypass roads, where applicable.
m^2 = square metre; ha = hectares; NAG = non- acid generating; PAG = potentially acid generating

Modifications from the original Project design (Beaver Dam Mine Project – EIS, 2017) has maintained a similar total area of direct wetland impact within the Beaver Dam Mine Site and Haul Road (<1% change). However, in comparison to the Beaver Dam Mine Project – Revised EIS (February 2019), the total area of direct wetland impact has increased by 30% (previously 22.1 ha). This increase has occurred as the result of necessary Project changes to micro-site infrastructure off fish bearing watercourses (Section 2) and the addition of the organics material stockpile for reclamation purposes. However, due to further refinement and micro-siting of the Haul Road, the total direct wetland impact area has decreased by 33% from 2.4 ha (Beaver Dam Mine Project – Revised EIS, February 2019) to 1.6 ha. This decrease in Haul Road impact area includes the addition of new proposed bypass roads.

Infrastructure has been planned to avoid wetland impacts wherever practicable and considering other environmental and engineering constrains. During the wetland alteration permitting phase, additional micro-siting of infrastructure (i.e., road alignment and other supporting infrastructure) will occur where practicable to avoid wetland impacts, and infrastructure-specific buffers will be added to wetland impact areas where necessary. The impacts of the Project on fish and fish habitat within wetlands is discussed is Section 6.9.7. Wetland area that is accessible to fish is directly accounted for in the draft Fish Habitat Offset Plan (Appendix J.3).

The Beaver Dam Mine Site and Haul Road are dominated by isolated or inflow wetlands, which provide potential groundwater recharge. Removal of recharge wetlands from the landscape removes the ability for water to be collected, stored, and fed into underlying aquifers. However, once other water loss factors such as evapotranspiration have been accounted for, the loss of smaller recharge wetlands (e.g., isolated features lacking an outlet and/or lentic wetlands located adjacent to lakes) is not expected to affect groundwater levels on a landscape level. Based on the proposed Project design within the Beaver Dam Mine Site, many small, isolated, recharge wetlands will be completely altered as a result of Project infrastructure. Of note, however, is the limited size of these wetlands in comparison with other, non-isolated wetlands present within the Beaver Dam Mine Site. It is not anticipated that alteration of the smaller isolated wetlands will bear critical impact to groundwater recharge capacity, especially at a more regional scale (i.e., secondary watershed level). Existing hydrologic connectivity will be maintained through many throughflow and inflow wetlands, within the Beaver Dam Mine Site and Haul Road. Most large headwater recharge wetlands, such as Wetland 2 and 29, will be avoided by Project development. For these reasons, direct wetland alteration associated with the Project is not expected to alter groundwater recharge capacity.

Direct Impacts to Wetlands of Special Significance

As described in Section 6.8.4.1.3, a total of five wetlands (WL 4, 14, 17, 29 and 205), were identified WSS based on the presence of blue felt lichen (SARA/COSEWIC Special Concern, NSESA Vulnerable) and boreal felt lichen (SARA/COSEWIC/NSESA Endangered). Wetland 59 was assessed as a possible WSS based the presence of a nesting snapping turtle ((SARA/COSEWIC Special Concern, NSESA Vulnerable) and suitable habitat. Wetlands 4 and 29 will be avoided by Project infrastructure completely. Wetland 59 will be completely altered and was unable to be avoided due to the placement of the open pit. Wetlands 14, 17 and 205 will be partially impacted by Beaver Dam Mine Site infrastructure.

The impacted areas of these Wetlands 14 and 17 do not contain occurrences of blue felt lichen. A mine road will bisect the western end of Wetland 14. The blue felt lichen occurrences are within the eastern side of this Wetland 14 and there is no planned development within 100 m of these occurrences. Wetland 205 will be partially directly impacted by the NAG waste rock stockpile, including the area that contains one occurrence of blue felt lichen. As avoidance of this wetland is not practicable (Section 6.8.8.1), translocation of the blue felt lichen (detailed in Appendix P.6 [Preliminary Lichen Mitigation and Monitoring Plan]) is proposed, to mitigate impact to this species.

Measures to avoid, mitigate and compensate effects to WSS are provided in Sections 6.8.8.1 and 6.8.8.2.

As described in Section 6.8.4.1.3, the bolded wetlands in Table 6.9-20 have been assessed to support multiple unique or rare attributes, and therefore, may provide, or have the potential to provide, multiple significant functions. These wetlands, including the field-evaluated identified and potential WSS (bolded), are presented in Table 6.8-20, with expected direct impact area (i.e., direct habitat alteration) as a result of Project activities.

Table 6.8-20: Direct Impacts to Wetlands with Multiple Significant Functions

Wetland ID	Project Area Component	Wetland Area[(a)] (m^2)	Estimated Direct Impact Area (m^2)	Direct Impact Type[(b)]
4	**Beaver Dam Mine Site**	**13,139**	**0**	**-**
8	Beaver Dam Mine Site	16,603	0	-
10	Beaver Dam Mine Site	18,817	3,565	P
14	**Beaver Dam Mine Site**	**31,655**	2,953	**P**
17	**Beaver Dam Mine Site**	**76,341**	5,967	**P**
29	**Beaver Dam Mine Site**	**112,835**	**0**	**-**
59	**Beaver Dam Mine Site**	**28,233**	**28,233**	**C**
61	Beaver Dam Mine Site	1,618	676	P
64	Beaver Dam Mine Site / Haul Road	48,353	49	P
66	Beaver Dam Mine Site / Haul Road	70,998	1,795	P
76	Haul Road	10,406	398	P
85	Haul Road	322	10	P
88	Haul Road	409	0	-
129	Haul Road	2,006	15	P
157	Haul Road	7,006	714	P
171	Haul Road	4,329	0	-
173	Haul Road	4,814	1,308	P
179	Haul Road	3,376	796	P

Table 6.8-20: Direct Impacts to Wetlands with Multiple Significant Functions (continued)

Wetland ID	Project Area Component	Wetland Area[(a)] (m^2)	Estimated Direct Impact Area (m^2)	Direct Impact Type[(b)]	
205	**Beaver Dam Mine Site**	**45,975**	**31,997**	**P**	
217	Beaver Dam Mine Site	5,230	153	P	
222	Beaver Dam Mine Site	7,788	7,788	C	
Total		**510,253 m^2 (51.0 ha)**	**86,417 m^2 (8.6 ha)**	**No proposed alteration**	**5**
				Partial alterations	**14**
				Complete alterations	**2**

Notes: Identified and potential WSS are in **bold**.

(a) Wetland area within the PA.

(b) P – Partial habitat loss of wetland. C – Complete habitat loss of wetland.

6.8.7.1.2 Potential Indirect Wetland Impacts

Indirect impacts are described as changes to wetland condition that may occur due to the Project, where wetland habitat is not directly lost, but is changed as the result of the Project (i.e., wetting or drying of wetlands). Indirect impacts may occur as a result of unintended wetting or drying of wetlands due to Project development (such as groundwater drawdown, or loss of surface water flow within local catchment areas). Estimates of potential indirect impacts are provided herein, however it should be noted that these estimates represent the maximum potential impact as a worst-case scenario. Reasonable indirect impacts of the Project will be determined at the permitting phase and through monitoring programs. Mechanisms to reduce the potential for wetland impacts from accidents and malfunctions will be addressed and discussed in Section 6.18.

Groundwater Interactions

Indirect impacts to wetlands by groundwater drawdown near the Beaver Dam Mine open pit is expected to occur. When assessing indirect effects to wetlands from groundwater drawdown, the end of mine (EOM) and post-closure (PC) simulations under the modeled conditions with the greatest drawdown extent to use as a conservative, worse-case approach (Section 6.6.7.1 and Appendix F.5 Hydrogeologic Modelling Report). Modeled groundwater drawdown at EOM ranges from 10 to 15 m closest to the pit to 0.1 m at the extent of the predicted drawdown area (Section 6.6 (Groundwater), Figure 6.6-11 for dry conditions and Figure 6.6-13 for wet conditions). Project related drawdown up to 1 m is expected to extent up to 905 m from the Beaver Dam Mine pit, at EOM and PC. However, isolated pockets of groundwater drawdown between 0.1 to 0.5 m are predicted up to 1,700 m from pit. The drawdown area is presented on Figure 6.6-15 for the Beaver Dam Mine Site.

Wetlands regularly undergo seasonal Relative Groundwater Depth (RGWD) fluctuations in response to variability in annual precipitation (magnitude and frequency), evapotranspiration, and climactic trends. Geographically isolated wetlands have been reported to have seasonal fluctuations ranging as high as ±20 cm (Keddy 2010). Keddy (2010) also found that wetlands associated with lakes and watercourses were found to have seasonal variability as high as ± 1.5 m. The US Army Corp (2009) stipulates that wetland hydrology is defined as saturation of soils 20 cm below the surface or groundwater levels within 30 cm of the surface for a period of two consecutive weeks in the growing season (June through September). Therefore, wetland conditions and functions can persist despite natural RGWD variability.

The stability, size and function of wetlands is primarily controlled by hydrological processes (Carter, 1996; Price, 2005, Tiner 2005). Drawdown caused by mining can affect all wetlands that have direct groundwater connectivity (discharge and recharge wetlands), which generally includes most wetlands with the exception of those systems disconnected from local groundwater flow systems (e.g., perched wetlands, some raised bogs). Drawdown can change the hydroperiod of a wetland and reduce water levels which

can cause an adverse effect on wetland function (Mortellaro et al. 1995). Effects include dryer conditions, change in flow direction (lateral and vertical), changes to vegetation, and changes to wildlife habitat (e.g., fish and amphibians).

Large wetland systems within the groundwater drawdown area around the open pit at the Beaver Dam Mine Site that have large area of standing water (e.g., WL17, riparian wetlands along Cameron Flowage) and defined surface water inputs are less likely to be affected by drawdown. Conversely, the impact to dryer, more marginal wetlands are likely to be more severe. If wetlands become dryer, organic soils can subside, and plants may become stressed. Many wetland plants, however, can survive periodic dry conditions and reproduce under altered hydrologic conditions. Loss of groundwater can also convert discharge wetlands into recharge wetlands which in turn can reduce surface water supplies and levels down gradient (Tiner 2005). Changes in surface water quantity can affect downstream wetlands, watercourses and waterbodies that receive surface water inputs, as discussed above, as well as fish and fish habitat (Section 6.9).

There are 22 wetlands which interact with the operations and post-closure drawdown for dry and wet conditions (Figure 6.8-4A, Figure 6.6-11 for dry conditions and Figure 6.6-13 for wet conditions). Of these 22 wetlands, seven will be completely altered from Project development and were not carried forward in this analysis. The remaining 12 wetlands within the drawdown area may vary from being partially altered to unaltered from direct Project development. A summary of wetlands within the drawdown area is presented in Table 6.8-21 and below:

- Complete direct alterations from infrastructure are proposed for seven wetlands. As these will be completely altered, they have not been considered in the evaluation of indirect effects from groundwater drawdown.
  - WL55, 56, 58, 59, 60, 212 and 245.
- Partial direct alterations are proposed for eight wetlands, with the unaltered portion falling within the drawdown area. The unaltered portion of these wetlands have been considered in the evaluation of indirect effects from groundwater drawdown.
  - WL5, 17, 19, 20, 34, 57, 61, 216, 217.
- These five wetlands are considered in the evaluation as indirect effects from groundwater drawdown.
  - WL62, 238, and 240.

There are 12 intact or partially intact wetlands that may be affected from groundwater drawdown. The likelihood of groundwater interactions within wetland habitat increases with increasing proximity to the pit, wetland type, groundwater connectivity and source and flow direction (i.e., upward (discharge) or downward (recharge) gradient). These functions have been determined through the NovaWet functional assessment, summarized in Table 6.8-5. Intact or partially intact wetlands (or portions of) that are predicted to be affected by groundwater drawdown ranges between 0.1 to 5 m during operations (Figure 6.8-4A and Table 6.8-21). Simulated drawdown is generally less than 10 cm outside of the PA, with the exception of the area between the till stockpiles and Cameron Flowage where the maximum drawdown reaches approximately 1 m beyond the PA (Appendix F.5).

Table 6.8-21: Intact Wetlands within the Simulated Groundwater Drawdown Area

Wetland	Total Wetland Area (m^2)	Groundwater Drawdown Area Effect	Simulated Drawdown (m)	Wetland Groundwater Interaction	Potential for Groundwater Indirect Effects
5	6,202	Partial	0.1 to 0.5	Discharge	No
17	76,341	Partial	0.1 to 2.0	Discharge	Yes
19	11,428	Partial	0.1 to 1.0	No GW Interaction	No
20	101,006	Partial	0.1 to 1.0	Discharge	Yes
34	1,382	Complete	2.0 to 5.0	Recharge	Yes
57	88,717	Partial	0.1 to 1.0	Discharge/Recharge	Yes
61	25,809	Partial	0.1 to 5.0	Discharge	Yes
62	832	Partial	0.1 to 0.5	Discharge	No
216	1,397	Complete	1.0 to 2.0	Recharge	Yes
217	5,230	Complete	0.5 to 1.0	Discharge	Yes
238	4,685	Partial	0.1 to 0.5	Recharge	No
240	21,799	Partial	0.1	Recharge	No

Notes: m^2 = square metre; m = metre.

Based on their overlap with the groundwater drawdown area (PC and EOM) and groundwater interactions (i.e., discharge or recharge) seven of the 12 wetlands are expected to experience potential indirect impacts from groundwater drawdown, through operations and/or at post-closure (Table 6.8-21). While the maximum extent of groundwater drawdown at PC is similar to the EOM simulation, the PC drawdown gradient decreases substantially around the pit following closure (Section 6.6, Figures 6.6-11 to 6.6-14). At PC, intact wetland habitat within the 0.5 m groundwater drawdown may experience indirect groundwater impacts from a permanent hydrologic shift as a result of the Project. While wetland water table fluctuations of 40 cm are naturally observed (Keddy 2010), a permanent water table decrease of 0.5 m.

All wetland habitat within the 0.5 m PC groundwater drawdown area is proposed for either partial or complete direct impact through Project infrastructure. The 0.5 m PC groundwater drawdown area is predicted to interact with intact portions of Wetlands 17, 34, 57, 61, 216 and 217. A 0.5 m groundwater drawdown is only expected to impact portions of Wetland 20 that will already be directly impacted by infrastructure, and therefore no further indirect impacts from groundwater drawdown are expected.

To assess the indirect effects of groundwater level change at PC in intact wetlands, wetlands that have direct interactions with groundwater (i.e., wetlands where groundwater is the primary hydrologic source) were identified. Groundwater inputs to wetlands were determined using their topography, wetland type, absence of inflow/through flow, presence of deep organic soils, and the presence of the water table near the soil surface and surface saturation. Wetlands with known or expected groundwater influence are expected to be impacted to a greater extent by groundwater drawdown (compared with those driven by surface water).

Of the six wetlands expected to experience groundwater impacts, Wetlands 17, 61 and 217 have direct connectivity with surface water features and/or are large wetland complexes with multiple hydrologic inputs, which are anticipated to mitigate adverse effects of groundwater drawdown. Wetlands associated with lakes and watercourses can naturally experience larger seasonal variability in water table levels (± 1.5 m, Keddy 2010). However, intact portions of Wetland 61 (approximately 3%) are expected to experience a groundwater drawdown greater than 2.0 m at EOM. This drawdown will decrease to less than 1.0 m at PC. As Wetland 61 is a riparian system directly connected to Cameron Flowage, which is not expected to experience a flow reduction during operations or at PC (Appendix F.5 Hydrogeologic Modelling Report), groundwater drawdown impacts are predicted to be mitigated by surface

water inputs. Nevertheless, Wetland 61 is proposed for monitoring due to its proximity to the open pit, partial direct impacts and potential groundwater impacts.

While Wetland 57 is a discharge headwater wetland and is more vulnerable to changes in groundwater levels, the majority of the intact portion of Wetland 57 is within the 0.1 m of groundwater drawdown (EOM and PC). As a result, it is anticipated that Project related groundwater impacts within this wetland will be within natural variability. Where drawdown is expected to exceed 0.1 m, monitoring of Wetland 57 is proposed.

Wetlands 34 and 216 were assessed to be the most at risk of indirect groundwater impacts (excluding those that will be completely directly impacted by infrastructure or where groundwater drawdown is limited to the directly impacted portion) and are anticipated to experience indirect effects from groundwater drawdown. Wetlands 34 and 216 are isolated swamps without persistent surface water inputs and are predicted to experience groundwater drawdowns of 1.0 to 5.0 m at PC. Conservatively, it is estimated that the full areas of Wetland 34 and 216 will be potentially impacted from groundwater drawdown (0.28 ha).

Monitoring of potential indirect groundwater impacts will be conducted to verify the accuracy of the predicted environmental effects and the effectiveness of mitigation measures and is described in Section 6.8.10. Wetlands where groundwater drawdown effects are anticipated (i.e., WL34 and 216), or compounded with other direct and indirect effects, will be prioritized during wetland monitoring. Further consultation regarding indirect effects and monitoring with NSE will occur through the wetland permitting process.

Local Catchment Area Flow Reduction

Potential for downgradient, indirect wetland impacts can be expected throughout the Beaver Dam Mine Site and Haul Road as a result of up-gradient hydrological alteration. Primarily, the alteration of hydrological conditions in up-gradient wetlands, watercourses and local watershed catchments to manage site contact water, will affect natural inflows, outflows and hydroperiod characteristics in contiguous wetland systems. In addition, where up-gradient alteration is occurring, but a direct hydrological flow is being maintained, potential exists for indirect impacts to downgradient water quality conditions.

To identify the effects of the Project on local flow regimes and associated habitats, each local catchment area (LCA) in which infrastructure is proposed was assessed within the Beaver Dam Mine Site based on catchment areas presented in Section 6.7.4 and Appendix A (Water Balance Analysis) of Appendix P.4 (Mine Water Management Plan). The construction of site infrastructure will require construction of collector ditches surrounding facilities such as stockpiles. These collector ditches convey all mine site contact water to site water management facilities for treatment prior to release to the environment. The construction of collector ditches surrounding site infrastructure essentially diverts water away from local surface water features within each relevant catchment or diverts water from one catchment to another. This can have an indirect effect on wetland habitat at the local catchment area (LCA). The effects of the Project on surface water quality and quantity at the regional watershed level and the LCA scale are described in detail in Section 6.7.

Alterations of hydrology within each LCA (i.e., changes to surface and baseline flow) may result in indirect impacts to wetlands. Wetlands within each identified LCA were evaluated, excluding those with expected complete direct impact and those that may be entirely influenced by predicted groundwater drawdown (i.e., entirely within the groundwater drawdown area) as described in Section 6.7. A list of all remaining wetland habitats was developed per LCA, to allow for evaluation of potential indirect impacts from flow reduction in each LCA. Table 6.8-22 shows all associated wetlands (or portions of) within the respective LCA. Reduction in flow in each LCA affects each wetland differently, depending on that wetlands' location in the catchment area, and the proposed direct effects of Project infrastructure. Water source, watercourse/waterbody association, magnitude of predicted flow change, and position both in the LCA and relative position to proposed infrastructure were considered to determine wetlands with potential

indirect impacts to reduced flow. Wetlands located upgradient of the proposed infrastructure are not considered for LCA area or flow reductions. Bolded wetlands in Table 6.8-22 have been conservatively assessed for potential indirect impacts based on changes to flow.

Table 6.8-22: Local Catchment Area Decrease from Project Development

Local Catchment Area	Associated Wetlands[(a)]	Percent Change in Annual Flow[(b)]
Cameron Flowage/Killag River	WL57, 61, 238, 240, 241, 242, 243, 244	+2.8% (EOM), -2.2% (PC)
Mud Lake (WC27)	WL14, 16, 17, 204, 206, 207, **210, 215**, 257	-18.1% (EOM), -13.6% (PC)*
Tent Brook	WL57, 64, 66, 218, 219, 237, 258	-1.1% (EOM), -1.2% (PC)
WC26 (north of NAG)	WL207, 228, **231**	-22.2% (EOM), -17.5% (PC)*
WC23 (south of NAG)	WL**205**, 226, 236	-15.2% (EOM and PC)*

Notes: [(a)] Wetlands (or portions of) downgradient of development.

[(b)] Change in total flow (surface runoff and baseflow), based on LCA assessment location (Appendix A [Water Balance Analysis] of Appendix P.4 [Mine Water Management Plan]).

* LCAs with >10% change in flow were assessed for indirect impacts to wetlands. LCAs with <10% change in flow were not expected to impact wetland hydrology.

Mud Lake is expected to experience a reduction in LCA and total flow as a result of Project infrastructure (waste rock stockpiles, open pit, mine roads, surface water management). A maximum 5 cm decrease is lake levels is expected at Mud Lake. Due to PA modifications and micro-siting the waste rock stockpiles, infrastructure has been removed from the headwaters of the Mud Lake LCA. Therefore, downgradient watercourses and wetlands (i.e., WL4, 8, 10, 11, 14, 17 and 20) will no longer be affected by the resultant up-gradient flow reductions. However, there are still wetlands and watercourses downgradient of the current proposed development. Anticipating that hydrologic connectivity is maintained across the mine road between the up and down gradient sides of Watercourse 5 and Wetland 14, indirect impacts of reduced flow are not expected within connected down gradient systems. The up-gradient portion of Wetland 215 is proposed to have partial direct impacts from construction of the NAG waste rock stockpile. Wetland 215 is directly connected to Wetland 210 through Watercourse 15. It is predicted that the anticipated reduced LCA and total flow rate of 14-18% will potentially result in indirect effects to intact portions of Wetlands 210 and 215 from LCA reduction (2.4 ha).

Within the WC26 LCA, Wetlands 207 (in part), 228 and 231 are located downgradient of proposed development (waste rock stockpiles, surface water management). Wetland 207 is a large headwater wetland complex, including bog, partially located within the Mud Lake LCA. Wetland 228 is a hydrologically isolated bog. As such, neither is anticipated to be indirectly impacted by LCA and flow reduction. Wetland 231 is proposed to have partial direct impact from construction of a setting pond and surrounding site ditches. While direct impacts are limited, Wetland 231 is a swamp which receives inflow through up-gradient drainage. As a result of the reduced LCA and total flow rate of 18 to 22%, it is predicted that the intact portions of Wetland 231 will be potentially impacted from LCA reduction (0.48 ha).

The NAG waste rock stockpile impacts the headwater portion of the WC23 LCA. While Wetlands 226 is partially directly impacted by the waste rock stockpile, it is an isolated wetland (a portion of which is bog) with no defined up-gradient surface water connectivity. Wetland 226 is a swamp/bog complex and thus has limited surface water inputs. It is not anticipated either of these wetlands will be indirectly impacted by LCA and flow reduction. The headwater portion of Wetlands 205 is proposed to have partial direct impacts from construction of the NAG waste rock stockpile. The anticipated reduced LCA and total flow rate of 15% could potentially result in indirect effects to these wetlands. As a result, it is conservatively estimated the intact portion of Wetlands 205 will be potentially impacted from LCA reduction (1.4 ha).

The total flow decrease in the Tent Brook LCA is predicted to be <1.5%. As such, not indirect impacts to wetlands within this LCA are expected as a result. Similarly, the small predicted change in streamflow within the Cameron Flowage/Killag River (±2 to 3%) is expected to have negligible impacts to the wetlands within the Killag River LCA.

Potential also exists for up-gradient hydrological alteration as a result of downgradient hydrological alteration. Examples include altered outflow (i.e., faster or slower outflows due to drainage infrastructure), causing either dewatering (drying hydrological trend) or flooding conditions in up-gradient wetlands. Within the Beaver Dam Mine Site, this this is considered a possibility in the southern portions of Wetland 57.

Conservatively, it is estimated that the full areas of Wetland 205, 210, 215 and 231 will be potentially impacted from impacts to LCA and surface flow reduction (4.28 ha).

The potential for indirect wetland impacts as a result of upgrading and new construction of the proposed Haul Road exists. However, due to the limited alteration footprint to up-gradient wetlands from Haul Road infrastructure and standard road construction mitigation methods that will be employed as part of the construction process, downgradient, indirect impacts are not expected. Current culvert placement may support wetlands conditions that were not present prior to road construction. Where road constriction has caused persistent altered hydrology, this may result in permanent changes to wetland function, size and/or type. Ensuring current watercourse crossing standards are met, the Project will endeavor to not draining wetlands that have been established/naturalized based on old culverts. Upgrades to culverts should maintain current wetland hydrology to avoid indirect impacts, while also considering operational requirements, safety, and fish passage. This will be addressed during the detailed design phase.

Monitoring of potential indirect impacts will be conducted to verify the accuracy of the predicted environmental effects and the effectiveness of mitigation measures and is described in Section 6.7. Wetland where flow reduction effects are anticipated (i.e., WL205, 210, 215 and 231), or compounded with other direct and indirect effects, will be prioritized during wetland monitoring. Further consultation regarding indirect effects and monitoring with NSE will occur through the wetland permitting process.

6.8.7.1.3 Summary of Direct and Indirect Impacts to Wetlands

Direct and potentially indirect losses of wetlands will occur as the result of Project development. Project infrastructure development will result in direct loss of wetlands. All wetland losses will require wetland compensation under the Nova Scotia Wetland Conservation Policy. In addition, loss of wetlands accessible to fish are accounted for in the draft Fish Habitat Offset Plan (Appendix J.3) and discussed in Section 6.9.

Overall, changes in hydrology (i.e., reduced flow, groundwater drawdown) due to the placement of Project infrastructure has the potential to affect the functionality of wetlands. On-going detailed infrastructure design will be completed to minimize these impacts. This will be completed at the permitting level. Targeted monitoring for wetlands will also be conducted to verify the accuracy of the predicted environmental effects and the effectiveness of mitigation measures. Refer to Section 6.8.10 for details associated with wetland monitoring, and the Preliminary Wetland Compensation Plan (Appendix H.3) for further information.

As is consistent with alteration to all wetlands associated with the Project, protection and viability of connected, unaltered areas of wetland habitat are considered as part of the provincial wetland alteration process. Design of suitable hydrological connectivity structures (e.g., culverts), implementation of a Project EPP and planned mitigation measures, such as erosion prevention and sediment control, will be employed to ensure that avoidable indirect impacts to upstream or downstream wetlands will not occur as a result of the activities associated with the Project. In addition, post-construction monitoring, including invasive species

monitoring, will be completed as discussed in Section 6.8.10. A comprehensive wetland monitoring program will be developed to meet the requirements of wetland alteration permits issued for direct and indirect wetland alterations associated with the Project.

Furthermore, as part of the design process associated with the new Haul Road, the proponent has committed to identifying culverts that require maintenance and removing or upgrading them where appropriate. As previously discussed, the detailed design phase will consider the established/naturalized wetland conditions, endeavoring to not alter existing hydrology during culvert upgrades.

To support the effects assessment, conservative impact scenarios were employed to determining total direct and potential indirect impacts to wetlands as described in previous sections. Two primary pathways for indirect impacts have been considered in this evaluation of potential indirect effects: groundwater drawdown, and changes to local catchment areas. These have been brought forward and summarized in Table 6.8-23. The maximum extent of potential indirect impact to wetlands as a result of the Project is predicted to be 4.56 ha. As described throughout Section 6.8.7.1.1, these indirect effects are only considered as potential at this point, rather than confirmed alteration areas. During the permitting phase of this Project, a detailed wetland monitoring program will be developed, guided by considerations listed in the table below and the detailed design of the Project infrastructure and water management systems, to verify and confirm the extent of any indirect impacts to wetlands.

Table 6.8-23: Summary of Potential Indirect Impacts of the Project on Wetlands

Indirect Impact Pathway	Considerations	Reasonable Worst-cast Scenario Impact Area
Groundwater drawdown	Simulated groundwater drawdown used to assess potential indirect impacts to wetlands based on predicted permanent changes to groundwater levels post-closure. Wetlands included: WL34 and 216	0.28 ha
Reduction in flow based on infrastructure construction in the LCAs	The reduction in flow per LCA was considered, along with the relative positioning of wetlands, watercourses and surface flow pathways. Wetlands included: WL205, 210, 215 and 231	4.28 ha
Maximum extent of potential indirect effects to wetlands:		**4.56 ha**

Notes: LCA = local catchment area; ha = hectares.

In summary, the proposed direct alteration area to wetlands in the Beaver Dam Mine Site and Haul Road is 31.8 ha, representing 33% of the delineated wetland area in these PA components, and 4% of the wetland area in the LAA. The maximum potential indirect impacts of the project on wetlands, considering groundwater drawdown and LCA flow reduction, is predicted to be 4.56 ha, representing 5% of the delineated wetland area in the Beaver Dam Mine Site and Haul Road, and 0.6% of the wetlands in the LAA. The combined expected direct impact and potential indirect impact wetland area is 36.4 ha, 38% of delineated wetlands in the Beaver Dam Mine Site and Haul Road (Figures 6.8-4A to 6.8-4O). It is anticipated that the actual indirect impacts to wetlands will be substantially lower, given the conservative assessment approach and suite of mitigation measures proposed.

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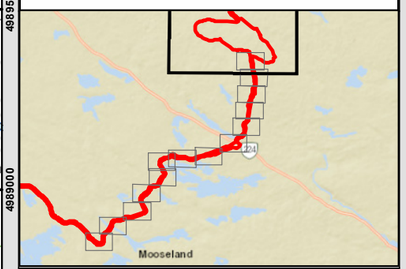
FIGURE 6.8-4A

Beaver Dam Mine Project

Anticipated Wetland Impact Areas by Type

Wetlands Potentially Affected by Groundwater Drawdown

- Field Delineated Watercourses
- NSTDB Mapped Watercourses
- Local Road
- Dry Weather / Seasonal Road
- Track
- Direct Impacts: Haul Road
- Direct Impacts: Beaver Dam Mine Site
- Potential Groundwater Drawndown
- Potential Flow Reduction
- Open Water
- Field Delineated Wetlands
- NSE Wetlands
- Proposed Infrastructure
- Project Area



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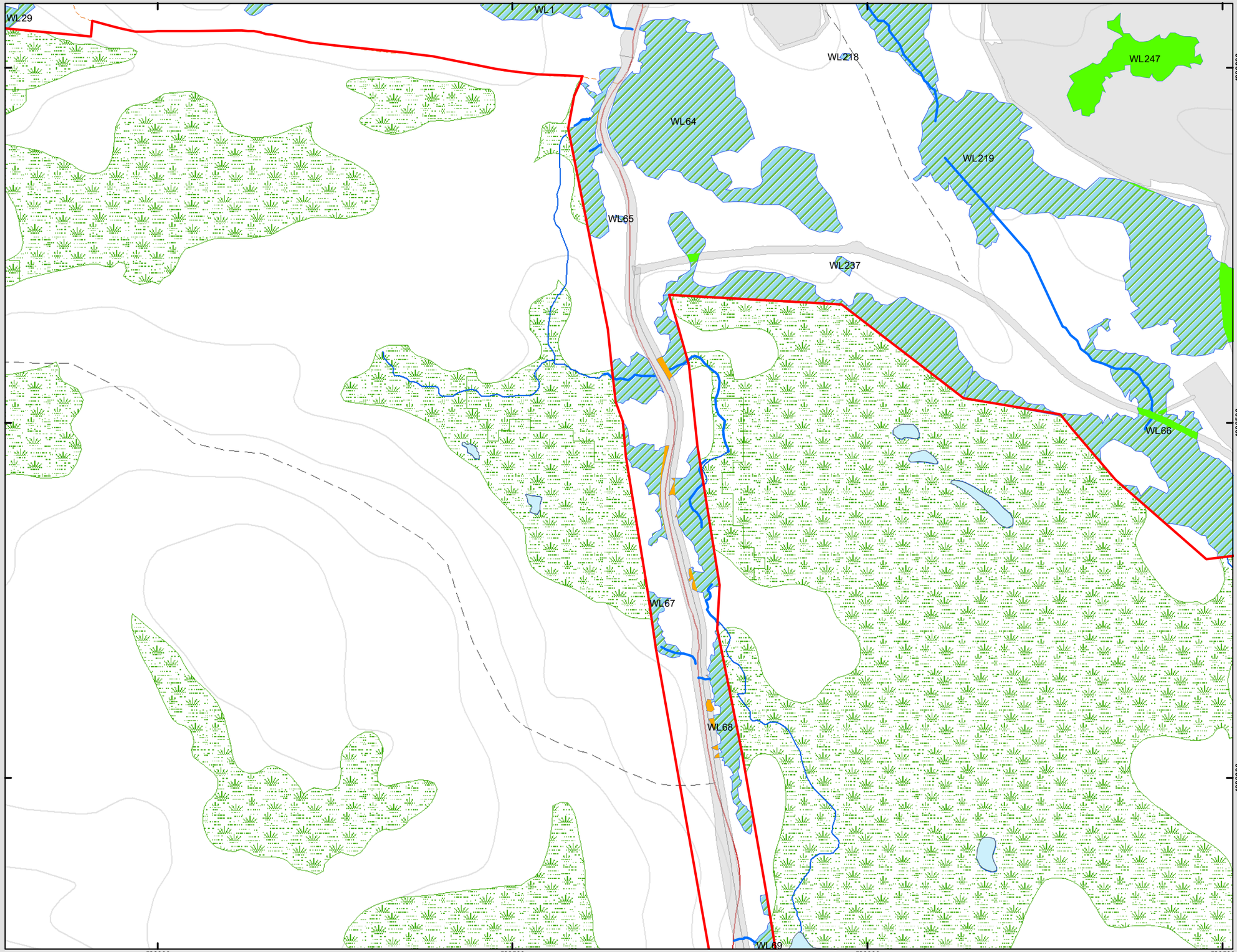

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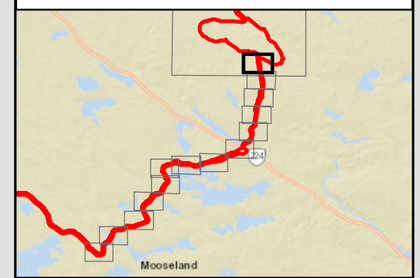
FIGURE 6.8-4B

Beaver Dam Mine Project

Anticipated Wetland Impact Areas by Type

- Field Delineated Watercourses
- NSTDB Mapped Watercourses
- Local Road
- Dry Weather / Seasonal Road
- Track
- Direct Impacts: Haul Road
- Direct Impacts: Beaver Dam Mine Site
- Open Water
- Field Delineated Wetlands
- NSE Wetlands
- Proposed Infrastructure
- Project Area



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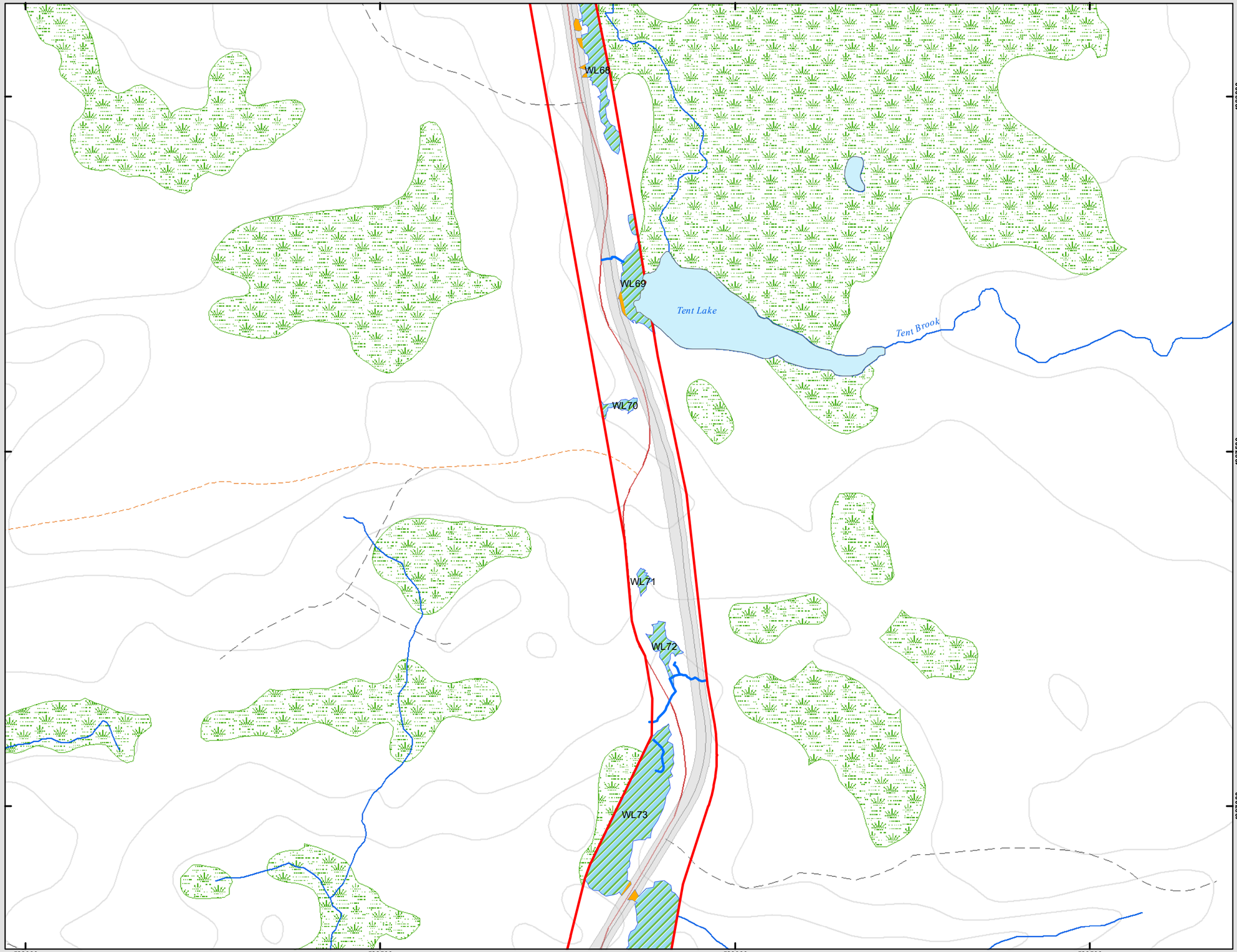

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FIGURE 6.8-4C

Beaver Dam Mine Project

Anticipated Wetland Impact Areas by Type

- Field Delineated Watercourses
- NSTDB Mapped Watercourses
- Local Road
- Dry Weather / Seasonal Road
- Track
- Direct Impacts: Haul Road
- Open Water
- Field Delineated Wetlands
- NSE Wetlands
- Project Area

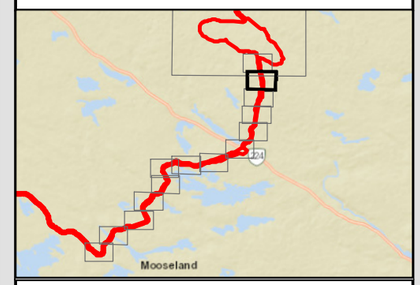

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FIGURE 6.8-4D

Beaver Dam Mine Project

Anticipated Wetland Impact Areas by Type

WL72
WL73
WL74
WL75
WL76
WL77
WL79
WL259
McGregor Lake
Cope Pond
Keef Brook

- Field Delineated Watercourses
- NSTDB Mapped Watercourses
- Local Road
- Dry Weather / Seasonal Road
- Track
- Direct Impacts: Haul Road
- Open Water
- Field Delineated Wetlands
- NSE Wetlands
- Project Area

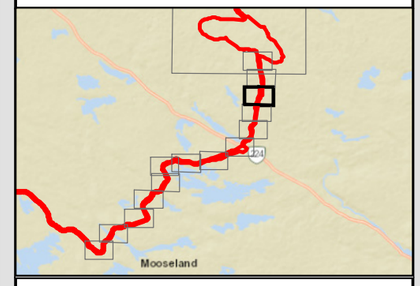

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FIGURE 6.8-4E

Beaver Dam Mine Project

Anticipated Wetland Impact Areas by Type

WL76
WL77
WL79
WL78
WL80
WL81
WL82
WL83
WL84
WL85
WL86
WL87
WL88

Keef Brook

4986000
4985500
4985000

522000
522500
523000

- Field Delineated Watercourses
- NSTDB Mapped Watercourses
- Local Road
- Dry Weather / Seasonal Road
- Track
- Direct Impacts: Haul Road
- Open Water
- Field Delineated Wetlands
- NSE Wetlands
- Project Area

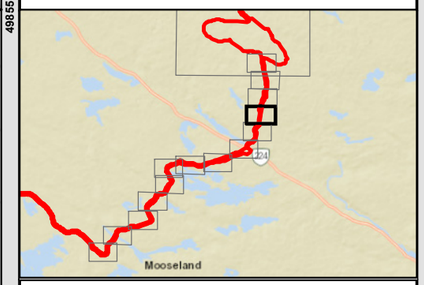

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FIGURE 6.8-4F

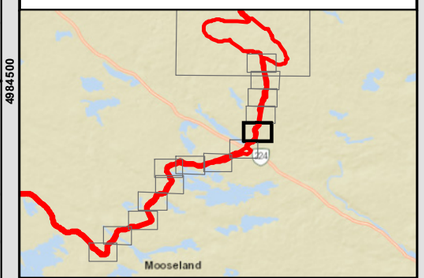
Beaver Dam Mine Project

Anticipated Wetland Impact Areas by Type

WL86
WL87
WL88
WL89
WL90
WL91
WL92
WL93
WL94
WL95
WL96
WL97

Keef Brook
West River Sheet Harbour

Field Delineated Watercourses
NSTDB Mapped Watercourses
Local Road
Dry Weather / Seasonal Road
Track
Direct Impacts: Haul Road
Open Water
Field Delineated Wetlands
NSE Wetlands
Project Area



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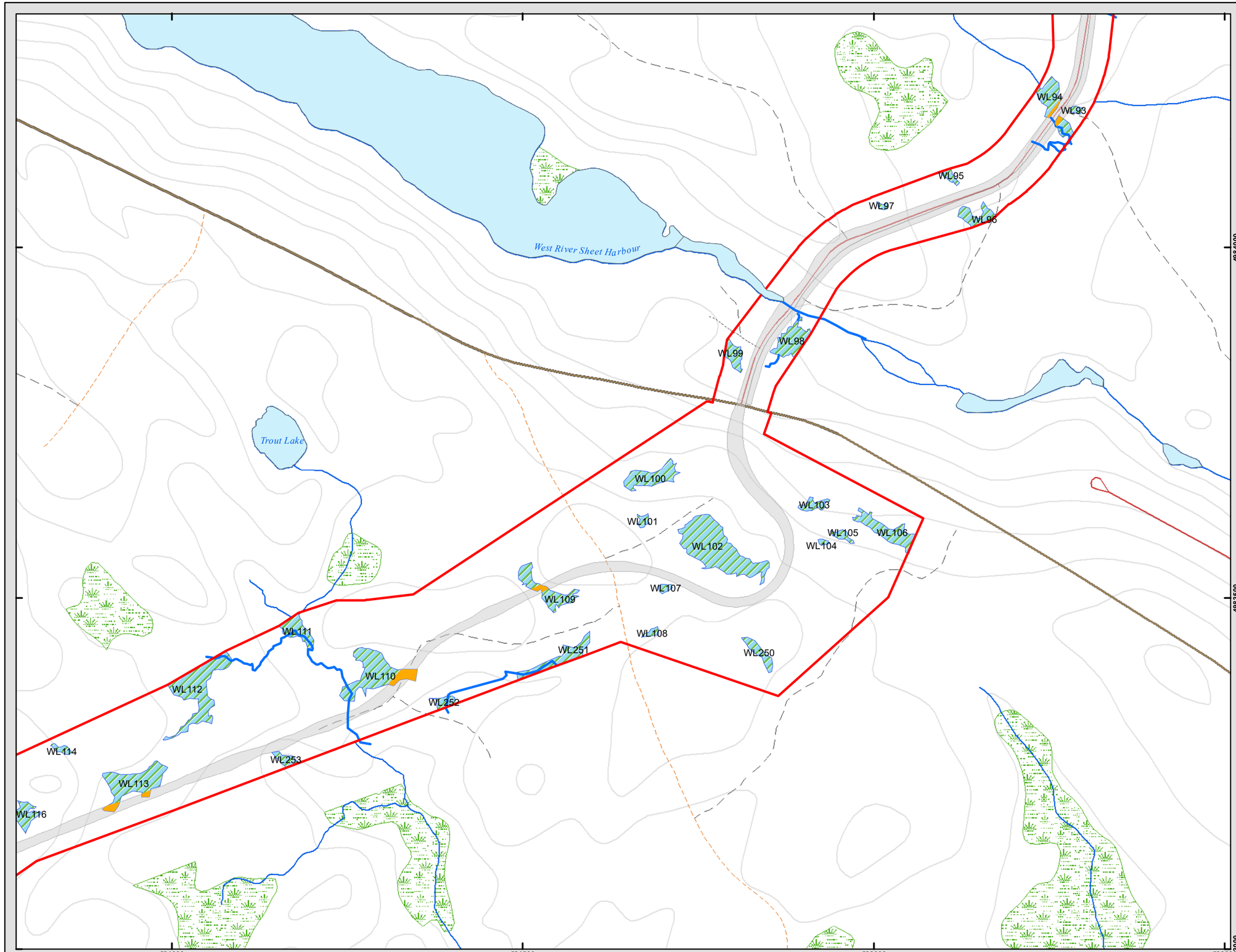

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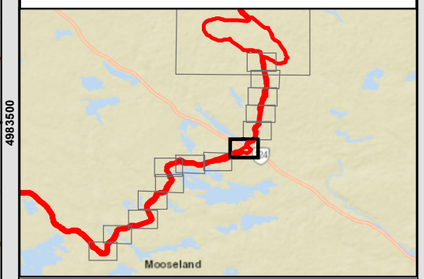
FIGURE 6.8-4G

Beaver Dam Mine Project

Anticipated Wetland Impact Areas by Type

- Field Delineated Watercourses
- NSTDB Mapped Watercourses
- Collector Road
- Local Road
- Dry Weather / Seasonal Road
- Diveways (>300 m)
- Track
- Direct Impacts: Haul Road
- Open Water
- Field Delineated Wetlands
- NSE Wetlands
- Project Area



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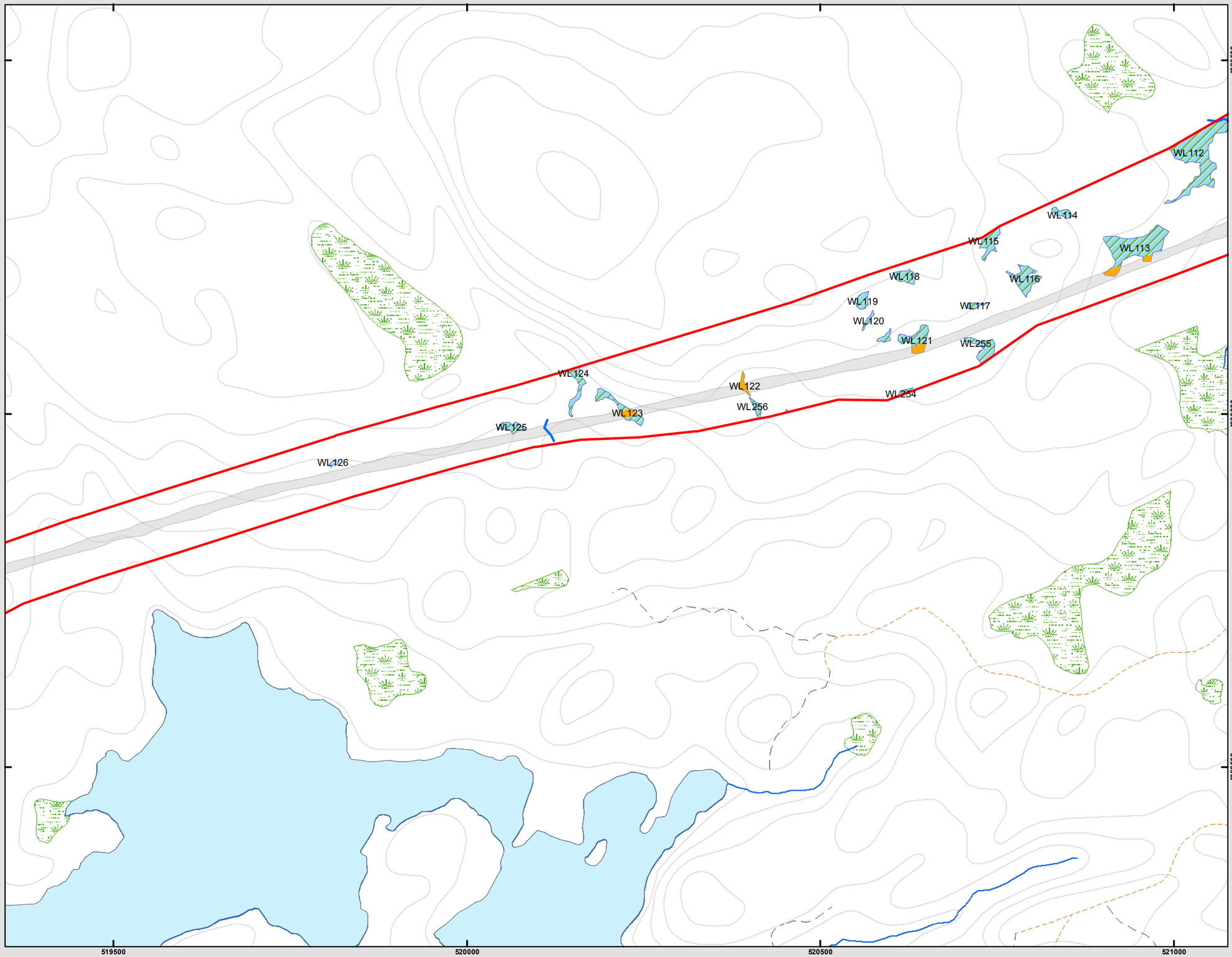

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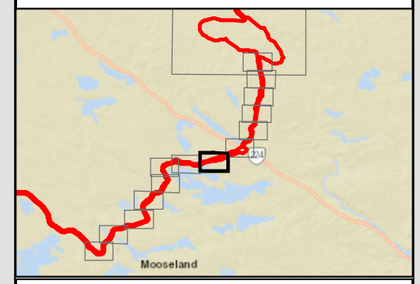
FIGURE 6.8-4H

Beaver Dam Mine Project

Anticipated Wetland Impact Areas by Type

- Field Delineated Watercourses
- NSTDB Mapped Watercourses
- Dry Weather / Seasonal Road
- Track
- Direct Impacts: Haul Road
- Open Water
- Field Delineated Wetlands
- NSE Wetlands
- Project Area



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Units: Meter

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1:5,000 Scale when printed @ 11" x 17"

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Document Name: BD_EIS_Figure6-8-XWetlandImpacts

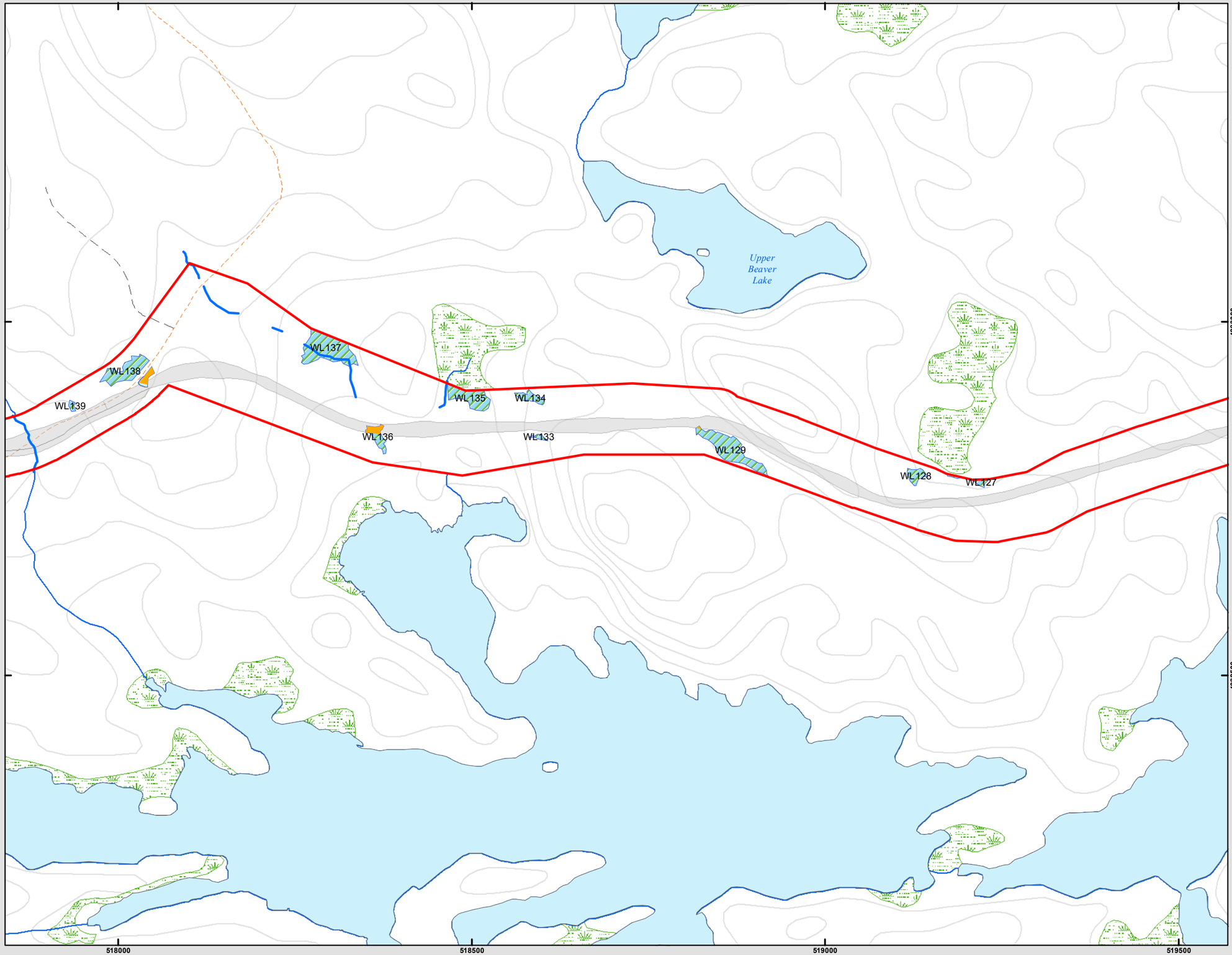

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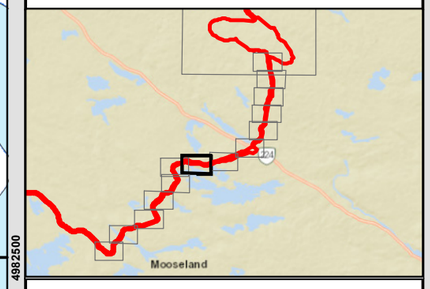
FIGURE 6.8-4

Beaver Dam Mine Project

Anticipated Wetland Impact Areas by Type

- Field Delineated Watercourses
- NSTDB Mapped Watercourses
- Dry Weather / Seasonal Road
- Track
- Direct Impacts: Haul Road
- Open Water
- Field Delineated Wetlands
- NSE Wetlands
- Project Area



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Units: Meter

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Document Name: BD_EIS_Figure6-8-XWetlandImpacts

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FIGURE 6.8-4J

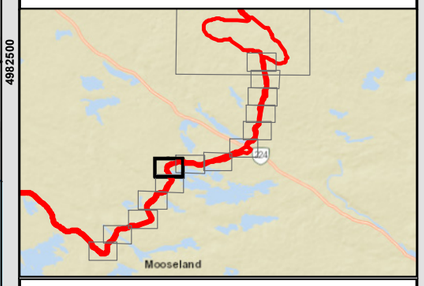
Beaver Dam Mine Project

Anticipated Wetland Impact Areas by Type

WL137
WL138
WL139
WL140
WL136
WL141
WL142
WL143
WL144
WL145

4983000
4982500
4982000
517000
517500
518000

- Field Delineated Watercourses
- NSTDB Mapped Watercourses
- Dry Weather / Seasonal Road
- Track
- Direct Impacts: Haul Road
- Open Water
- Field Delineated Wetlands
- NSE Wetlands
- Project Area



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Document Name: BD_EIS_Figure6-8-XWetlandImpacts

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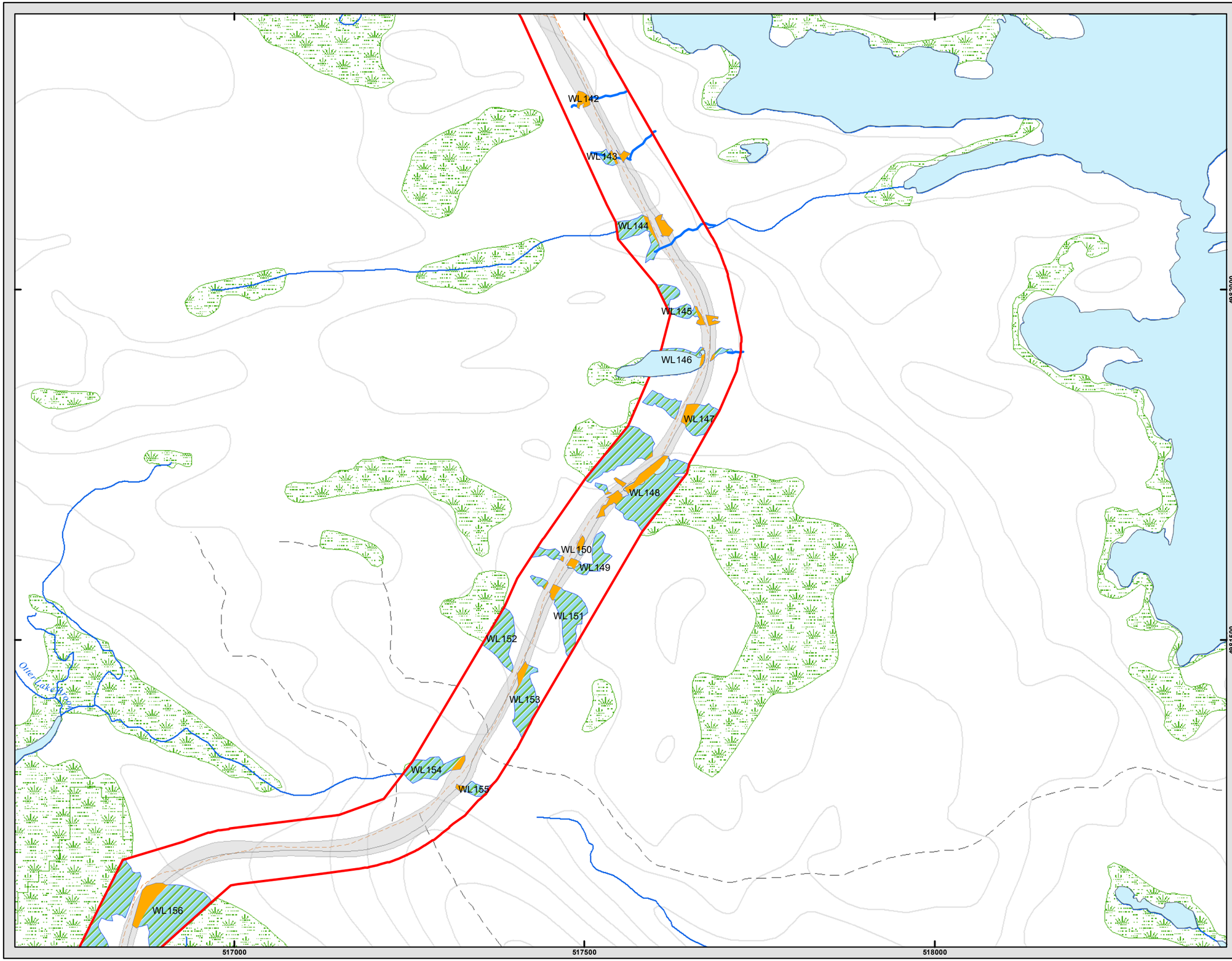
FIGURE 6.8-4K

Beaver Dam Mine Project

Anticipated Wetland Impact Areas by Type



- Field Delineated Watercourses
- NSTDB Mapped Watercourses
- Dry Weather / Seasonal Road
- Track
- Direct Impacts: Haul Road
- Open Water
- Field Delineated Wetlands
- NSE Wetlands
- Project Area

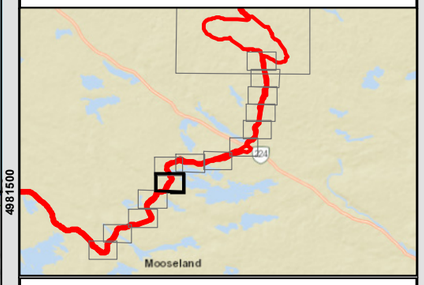


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FIGURE 6.8-4L

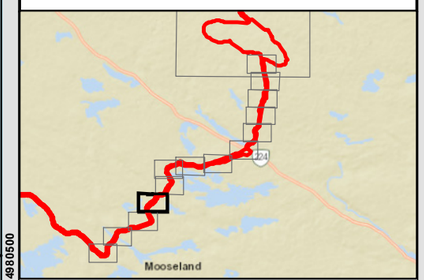
Beaver Dam Mine Project

Anticipated Wetland Impact Areas by Type

WL153
WL154
WL155
WL156
WL157
WL158
Upper Kidney Lake
Upper Lake Brook

4981000
4980500
516000
516500
517000

- NSTDB Mapped Watercourses
- Dry Weather / Seasonal Road
- Track
- Direct Impacts: Haul Road
- Open Water
- Field Delineated Wetlands
- NSE Wetlands
- Project Area



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Units: Meter

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FIGURE 6.8-4M

Beaver Dam Mine Project

Anticipated Wetland Impact Areas by Type

Mink Lake

WL159

WL160

WL161

WL162

WL163

WL164

4980000

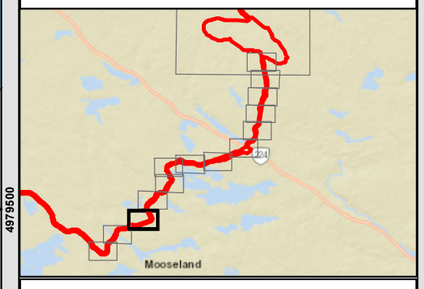
4979500

515500

516000

516500

- Field Delineated Watercourses
- NSTDB Mapped Watercourses
- Dry Weather / Seasonal Road
- Track
- Direct Impacts: Haul Road
- Open Water
- Field Delineated Wetlands
- NSE Wetlands
- Project Area



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Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

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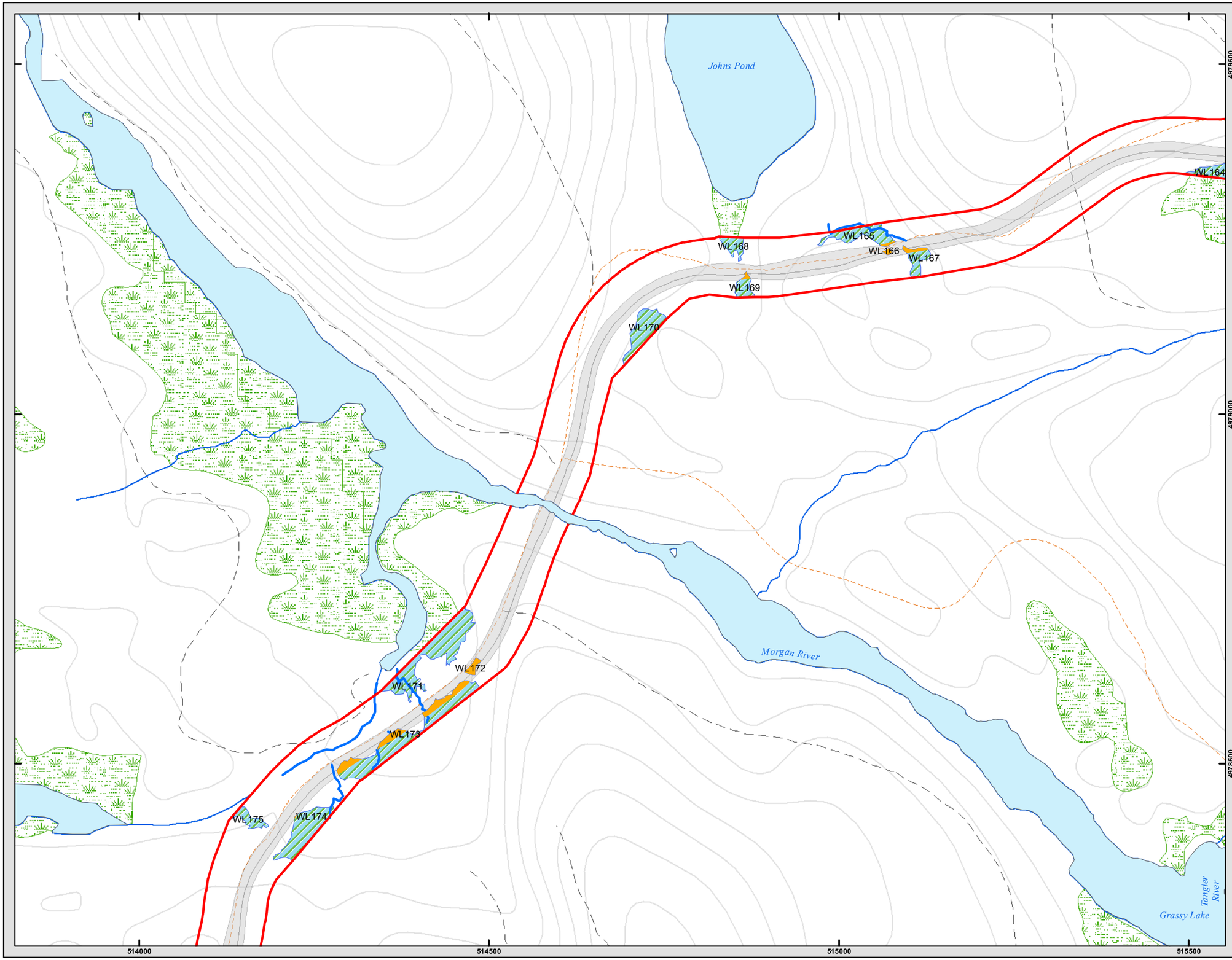
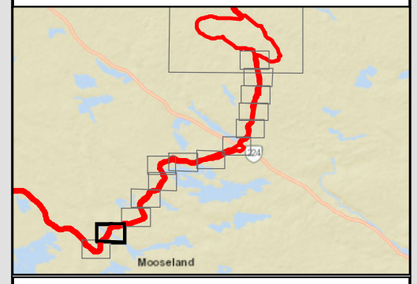
FIGURE 6.8-4N

Beaver Dam Mine Project

Anticipated Wetland Impact Areas by Type



- Field Delineated Watercourses
- NSTDB Mapped Watercourses
- Dry Weather / Seasonal Road
- Track
- Direct Impacts: Haul Road
- Open Water
- Field Delineated Wetlands
- NSE Wetlands
- Project Area



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Document Name: BD_EIS_Figure6-8-XWetlandImpacts

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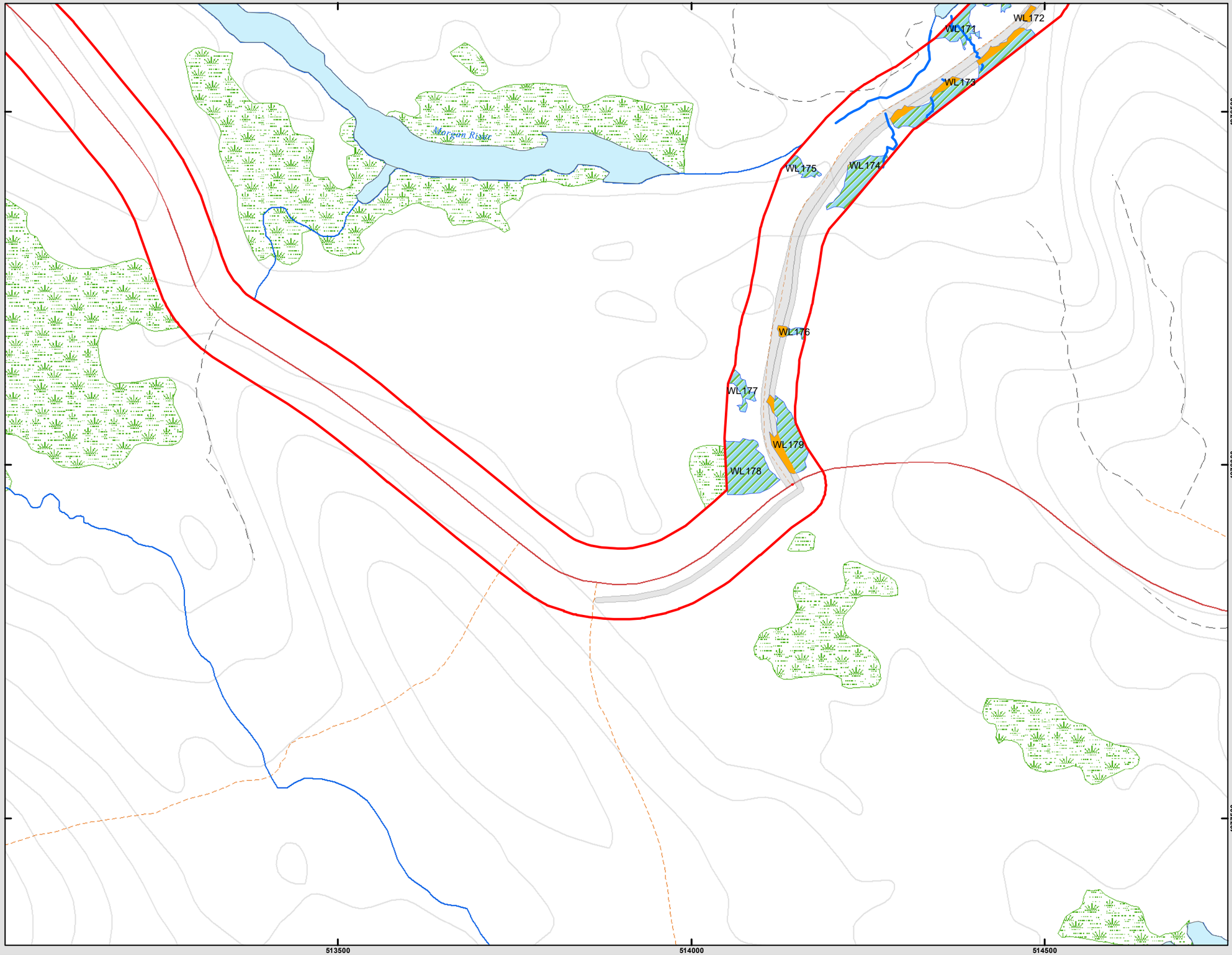
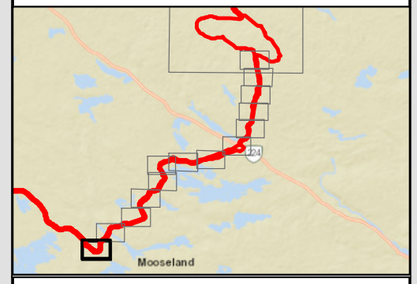
FIGURE 6.8-4O

Beaver Dam Mine Project

Anticipated Wetland Impact Areas by Type



- Field Delineated Watercourses
- NSTDB Mapped Watercourses
- Local Road
- Dry Weather / Seasonal Road
- Track
- Direct Impacts: Haul Road
- Open Water
- Field Delineated Wetlands
- NSE Wetlands
- Project Area



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Document Name: BD_EIS_Figure6-8-XWetlandImpacts

6.8.7.1.4 Touquoy Mine Site

The Touquoy Mine Site is currently operational. The use of the Touquoy Mine Site for the processing of Beaver Dam ore and tailings management (exhausted pit) will not involve modification to the current footprint or further impacts to wetlands. No discharge events to the wetlands in the receiving environment, are planned during operations. The exhausted pit has the capacity to store all mine tailings until scheduled release post-closure. Moving the existing tailings pipeline from the permitted TMF to direct water to the exhausted pit will occur within the disturbed footprint of the permitted Touquoy Project and will not result in additional impacts to wetlands. Potential interaction between Project activities and wetland habitat within the Touquoy Mine Site are outlined in Table 6.8-24 below.

Table 6.8-24: Potential Project Activities/Interactions with Wetlands at the Touquoy Mine Site

Project Phase	Duration	Project Interactions
Construction	1 year	• N/A
Operation	5 years	• General waste management • Invasive species introduction or spread • Environmental monitoring
Active Closure	2 years	• Environmental monitoring
Post-closure	10+ years (monitoring)[(a)]	• Post closure interaction with discharge from Touquoy Mine Site pit to Moose River riparian wetlands (IR2 NSE 2-176)

Note: [(a)] Post-closure wetlands monitoring will be determined based on monitoring and discussions with regulators.
N/A = not applicable.

At post closure and once water quality in the Touquoy Mine Site open pit meets MDMER discharge criteria, water surplus will be released into Moose River via a spillway. The spillway is proposed to be installed at elevation of 108 m to prevent the pit from overtopping. The spillway will discharge to a conveyance channel that outlets to Moose River. With the addition of Beaver Mine Site deposits, under climate normal conditions the average predicted monthly open pit overflow into Moose River varies seasonally from 0.9 L/s in July to 44.2 L/s in April. The average effluent flow rate is 13.9 L/s (Appendix F.8 Beaver Dam Gold Project Assimilative Capacity Study of Moose River – Touquoy Pit Discharge). Additionally, through the completion of a groundwater model it was determined that, under full pit conditions, the average daily seepage from the Touquoy Mine Site open pit to the Moose River is predicted to be 258 m^3/day, or 3.0 L/s (Appendix F.8 Beaver Dam Gold Project Assimilative Capacity Study of Moose River – Touquoy Pit Discharge).

The average monthly flow of the Moose River, in August when flows are lowest, is 38,880 m^3/day, or 450 L/s (Appendix F.8 Beaver Dam Gold Project Assimilative Capacity Study of Moose River – Touquoy Pit Discharge). The predicted increase in flow from both open pit overflow and groundwater seepage is 3.76% of the average August Moose River flow (when flows are lowest). Due to the topographic setting and limited bi-directional hydrological connectivity of the assessed wetland adjacent to the Moose River (Section 6.8.3.5), no indirect impacts to wetlands are expected from this minor increase in flow.

Project operations and trucking of ore from the Beaver Dam Mine Site to the Touquoy Mine Site, along the Haul Road, has the potential to spread invasive species. Invasive species are currently monitored at the Touquoy Mine Site during the existing wetland monitoring program (IR2 NSE 2-181).

Therefore, with the exception of the above and continued potential for accidents and malfunctions and environmental monitoring, there are no direct or indirect effects to wetlands anticipated from the Project at the Touquoy Mine Site during the construction and operations phases. For further information regarding Touquoy Mine Site and wetland interactions, refer to the EARD (CRA 2007a)

and Focus Report (CRA 2007b). Wetland mitigations and monitoring are presented in Sections 6.8.8.1 and 6.8.8.2 and will be further addressed as part of the permitting process.

6.8.7.2 Wetland Cumulative Effects Modelling Results

The Wetland Cumulative Effects Modelling exercise was completed to support the determination of wetland effects associated with the Beaver Dam Mine Site and its associated infrastructure. The modeling exercise was completed across the three spatial boundaries noted in Section 6.8.6. Results presented herein reflected updates to the modeling exercise in order to capture changes in the PA, LAA and proposed infrastructure footprints.

The modelling has enabled a determination of the following to be made:

- The extent of wetland area loss at the PA (i.e., Beaver Dam Mine Site), LAA, and RAA at Year 0 (i.e., prior to any mine development activities) and Year 5 (i.e., completion of mine development /complete wetland alteration).
- The extent of predicted mainland moose, snapping turtle, olive-sided flycatcher and rusty blackbird wetland habitat within the PA (i.e., Beaver Dam Mine Site) and LAA at Year 0.
- The extent of Canada warbler habitat loss within the PA (i.e., Beaver Dam Mine Site) between Year 0 and Year 5.
- The extent of predicted mainland moose, snapping turtle, olive-sided flycatcher and rusty blackbird loss in the PA (i.e., Beaver Dam Mine Site) between Year 0 and Year 5.

When reviewing the results of the modelling in the following tables, the reader is reminded of the limitations associated with the modelling completed in the LAA and RAA. The analysis performed within the LAA and RAA spatial boundaries underrepresent predicted suitable wetland habitat. As such, the comparative area of impacted suitable wetland habitat in the Beaver Dam Mine Site is expected to be less than the results of the modelling exercise suggest.

6.8.7.2.1 Modeling Results

Results of the modelling exercise are provided below:

- Wetlands:
  - PA: There is 137.3 ha of wetland area within the Beaver Dam Mine Site at Year 0. Following Project development (Year 5), 27.6 ha or 22% of the Beaver Dam Mine Site wetland area will be altered.
  - LAA: There is 759.9 ha of wetland area within the LAA at Year 0. Following Project development (Year 5), 4% of the LAA wetland area will be altered.
  - RAA: There is 2,772.09 ha of wetland area within the RAA at Year 0. Following Project development (Year 5), 0.01% of the RAA wetland area will be altered.
- Mainland Moose:
  - PA: Of the 137.3 ha of wetland area within the Beaver Dam Mine Site, 56.8 ha or 41% of this area supports Mainland moose habitat at Year 0. Following Project development (Year 5), 10.1 ha or 18% of the Beaver Dam Mine Site habitat will be altered.
  - LAA: Of the 759.9 ha of wetland area within the LAA, 436.5 ha or 57% of this area supports Mainland moose habitat at Year 0. Following Project development (Year 5), 2% of the LAA habitat will be altered.

  - RAA: Not assessed.
- Snapping Turtle:
  - PA: Of the 137.3 ha of wetland area within the Beaver Dam Mine Site, 83.3 ha 60% of this area supports snapping turtle habitat. Following Project development, 10.6 ha or 13% of the Beaver Dam Mine Site habitat will be altered.
  - LAA: Of the 759.9 ha of wetland area within the LAA, 492.0 ha or 65% of this area supports snapping turtle habitat at Year 0. Following Project development (Year 5), 2% of the LAA habitat will be altered.
  - RAA: Not assessed.
- Canada Warbler:
  - PA: Of the 137.3 ha of wetland area within the Beaver Dam Mine Site, 93.5 ha or 68% of this area supports Canada warbler habitat. Following Project development, 15.1 ha or 16% of the Beaver Dam Mine Site habitat will be altered.
  - LAA: Not assessed.
  - RAA: Not assessed.
- Olive-sided flycatcher:
  - PA: Of the 137.3 ha of wetland area within the Beaver Dam Mine Site, 108.6 ha or 79% of this area supports olive-side flycatcher habitat. Following Project development, 15.4 ha or 14% of the Beaver Dam Mine Site habitat will be altered.
  - LAA: Of the 759.9 ha of wetland area within the LAA, 584.8 ha or 77% of this area supports olive-side flycatcher habitat at Year 0. Following Project development (Year 5), 3% of the LAA habitat will be altered.
  - RAA: Not assessed.
- Rusty blackbird:
  - PA: Of the 137.3 ha of wetland area within the Beaver Dam Mine Site, 26.4 ha or 19% of this area supports rusty blackbird habitat. Following Project development, 4.3 ha or 16% of the Beaver Dam Mine Site habitat will be altered.
  - LAA: Of the 759.9 ha of wetland area within the LAA, 251.0 ha or 33% of this area supports rusty blackbird habitat at Year 0. Following Project development (Year 5), 2% of the LAA habitat will be altered.
  - RAA: Not assessed.

6.8.7.2.2 Discussion

Using a combination of field data and desktop resources, the wetland cumulative effects modelling exercise has provided an ability for four wetland function metrics to be predicted within the PA, LAA and RAA. The potential loss of the wetland function metrics post Beaver Dam Mine development has also been evaluated. Development of a predictive future model was beyond the scope and resources available at the time of writing. However, a qualitative approach to assessing the future cumulative effects of the Project on wetland function (by way of evaluating the wetland function metrics) was possible and is discussed below.

The direct and indirect impacts on wetlands within the Beaver Dam Mine Site will affect the functional abilities of these wetlands (i.e., water quality, water storage capacity, regulation of water temperature, nutrient retention, and provision of wildlife habitat among others) during the Project, and into the future. The mitigation and monitoring actions described in Section 6.8.8 will lessen these impacts and help ensure the integrity of wetlands beyond the Beaver Dam Mine Site remain viable.

As discussed in Section 6.8.6.1, direct wetland area loss is expected as a result of the Beaver Dam Mine Project. The loss of wetland area will result in changes to all wetland functions (including the metrics discussed above). For example, loss of wetland area would reduce water storage capacity, and could lead to increased risk of flooding in downstream environments. However, despite the loss of wetland area and thus its function within the Beaver Dam Mine Site, modeling results suggest that when compared to the LAA and RAA wetland area being lost as a result of the Project is 3.5% of the modelled LAA wetland area, and 0.01% of the modelled RAA area.

Four wildlife species metrics were also evaluated as part of the modelling exercise, the results of which can be used to highlight other potential wetland functional losses, as a result of the Beaver Dam Mine Project. The wildlife species metrics evaluated were; mainland moose habitat, snapping turtle habitat, olive-sided flycatcher habitat, rusty blackbird habitat and Canada warbler habitat.

Mainland Moose are a generalist species: instead of occupying a narrow niche they use a variety of habitats. Evidence of moose was observed within the Beaver Dam Mine Site (tracks). As previously discussed, Moose use wetlands with access to aquatic vegetation, a component which was used to model potential wetland habitat within the modeling exercise. However, they have also been found to use large clear-cuts for forage, although this habitat forage availability for moose in a cleared forest doesn't peak until 7 to 15 years after cutting (Snaith and Beazley, 2004). Impact on moose wetland habitat is expected within the Beaver Dam Mine Site and Haul Road as a result of wetland loss, however clearing of vegetation as a result of the Project may eventually provide new habitat for moose, post re-generation in the future. The provision of thermoregulation from mature stands is also required for Moose (Snaith and Beazley, 2004). Within the Beaver Dam Mine Site and Haul Road, there is the potential for direct and indirect impact to wetlands comprising moose habitat, and which could provide the thermoregulation characteristics which moose require. However, moose in Nova Scotia generally prefer areas with few or no roads, which already exist within the PA. While moose have been observed in and near wetlands within the Beaver Dam Mine Site (both during field surveys and according to the ACCDC report), the existing roads extending through the PA reduces the extent of suitable moose habitat The modeling exercise determined that the loss of potential moose wetland habitat within the Beaver Dam Mine Site is 18% which; represents 2% of the predicted suitable moose wetland habitat in the LAA.

Snapping turtle wetland habitat is expected to be impacted by the Project. As it relates to wetlands, snapping turtles prefer muddy sites–in deep anoxic mud in marshy areas for overwintering, and rocky slow-moving streams for mating (COSEWIC 2008). It should be noted, that snapping turtles are one of the more aquatic turtle species and rarely move more than 200 m from water. Snapping turtle was observed within the PA during field surveys and recorded as being present within 16 km of the Project in the ACCDC report. The species has high site fidelity – they will return to the same nesting and overwintering locations year after year (COSEWIC, 2007; Environment and Climate Change Canada, 2016; Pulsifer, pers. comm. 2018). The modelling exercise suggests that loss of suitable turtle habitat within the Beaver Dam Mine Site between Year 0 and Year 5 equates to a 13% loss, which represents approximately 2% of the total available suitable habitat in the LAA.

The potential for impact to migratory bird wetland habitat is expected as a result of the Beaver Dam Mine Project. Three bird species were modelled as part of the cumulative effects assessment: Canada warbler, olive-sided flycatcher, and rusty blackbird. These species were all observed within the Beaver Dam Mine Site and Haul Road during field surveys and recorded as being present within 5 km of the Project in the ACCDC report. The lack of publicly available habitat data for Canada warbler (i.e., dense, deciduous shrub), modeling was not available within the LAA. Canada warbler habitat was however determined for the Beaver Dam Mine Site based on data collected during field programs in combination with desktop resources. The other two birds did have available wetland habitat data layers and were modelled at the LAA spatial extent. Research has shown that some species respond positively to forestry practices and may return to a logged area once the activity is over, especially if it has created open patches that allow for foraging. A study in Alberta showed that the abundance of alder flycatchers, a species with similar foraging requirements to olive-sided flycatcher, increased in a previously cut area (Tittler et al., 2001). Additionally, rusty blackbirds can

also tolerate forestry activities as long has their habitat of coniferous dominant trees of varied heights near waterbodies is maintained (pers. comm. C. Staicer 2018). While forestry is different from the development of a Mine Site, similar activities will be occurring (i.e., forest clearing, transport of large trucks, and disturbance of aquatic features). It is therefore feasible to consider that new habitats suitable to support these birds will be created in the future. The modelling exercise determined that potential habitat loss for the Canada warbler, olive-sided flycatcher and rusty blackbird within the Beaver Dam Mine Site between Year 0 (pre-mine development) and Year 5 (post mine development) was 16%, 14% and 16% respectively. The modelling also determined that the predicted suitable wetland habitat loss within the Beaver Dam Mine Site post mine development, in comparison to the predicted habitat within the LAA (pre-mine development) for the olive-sided flycatcher and the rusty blackbird is 3% and 2% respectively.

Development of the Beaver Dam Mine Site will have cumulative effects on wetland loss and wetland functions. For the purpose of the modelling exercise, wetland function loss is represented by four wetland function metrics: wetland area and habitat provision for moose, turtles, and birds which will be impacted during the construction activities and mine operations.

The modelling exercise has shown that wetland alteration within the Beaver Dam Mine Site is expected to result in a loss of wetland function metrics ranging between 13 to 20% (when comparing pre and post mine development). However, when compared to the LAA, these changes represent smaller percentages of predicted wetland area ranging between 1 to 4%, when comparing Beaver Dam Mine Site wetland loss (post mine development) to the LAA (pre-mine development).

In conjunction with the mitigation and monitoring steps (as described in Section 6.8.7), this assessment results in the determination that the Project will result in adverse effects to wetlands, however these effects are not anticipate to be significant with respect to loss of wetland function and magnitude in comparison to the LAA.

6.8.8 Avoidance and Mitigation

6.8.8.1 Wetland Avoidance

Due to the location in which the proposed activity can be performed (the location of the pit is fixed by geology), the extent to which the proposed Project can be manipulated to avoid impacts to wetland habitat is limited. Through the iterative Project design, infrastructure has been relocated (e.g., stockpiles have been split) to reduce wetland impact and continued detailed design may still be possible to further reduce wetland alteration. The NAG waste rock stockpile location has been relocated west to avoid the large headwater Wetlands 1 and 2. Infrastructure has been relocated from the contributing area to Crusher Lake, and its contributing watercourses. Wetland 2 is no longer impacted by predicted groundwater drawdown. The Project design evaluation and process is described in Section 2 (Project Description).

The preliminary Haul Road design has been based on following the existing footprint of the Beaver Dam Mines Road and the Moose River Cross Road to reduce overall wetland impact and habitat fragmentation. Depending on local topography and landcover, road upgrades will be required to improve sight lines, turning radii, road width, etc. One 4 km section of new road is planned between Highway 224 and Moose River Cross Road (Section 2, Figure 2.3-1). Two sections of new multiuse bypass road, parallel to the Haul Road, are also planned to maintain safe road conditions for local vehicle and ATV traffic (Section 3, Figure 3.3-2. However, wetland avoidance is a key consideration during planning and engineering upgrades and new sections of road, where practicable. Wetland avoidance, landscape conditions, locations of watercourses, sight lines, and safety, will be key planning factors during the detailed engineering for the Haul Road and bypass roads.

Of the five wetlands (WL 4, 14, 17, 29 and 205) assessed as WSS (Section 6.8.4.1.3), three WSS are proposed for partial or complete alteration as the result of the Project (WL14, 17, 205). Direct impacts to Wetlands 4 and 29 were avoided. Previous

impacts to Wetland 4 were eliminated due to the micro-siting and division of the waste rock stockpile. While nearly the entirety of Wetland 4 is situated beyond the groundwater drawdown area, changes to its hydrological connectivity with Wetland 5, may be observed (Section 6.8.7.1.1). However, a consequential alteration to hydrology, and thus indirect effects are not anticipated within Wetland 4. No direct or indirect effects (i.e., groundwater drawdown and flow alteration) are anticipated to impact Wetland 29. Additionally, the boreal felt lichen occurrences observed during field surveys are located in an extent of Wetland 29 that exists beyond the southern Beaver Dam Mine Site boundary, and as such is not expected to be impacted as a result of Project activities. The micro-siting and division of the waste rock stockpile has further increased the distance of Project infrastructure to Wetland 29. No Project infrastructure is situated within the defined Boreal Felt Lichen Critical Habitat Area (NSLF, 2020).

Impacts to Wetland 14 and 17 have been minimized where practicable. However, direct and indirect impacts to Wetland 17 are unavoidable due to ore location and resultant pit placement. Moving the north settling pond outlet channel to the south of the topsoil pile specifically to avoid lichen and wetland habitat was considered, however, it had to be maintained it in its current location to mitigate groundwater drawdown in Cameron Flowage. Further impacts were limited through detailed Project design, such as strategic settling pond, topsoil stockpile and mine road placement. As a result, the directly impacted areas of Wetlands 14 and 17 do not contain occurrences of blue felt lichen. However, where Project infrastructure is located within the 100 m setback of blue felt lichen occurrences in Wetland 17, translocation of these occurrences is proposed, as per the Preliminary Lichen Mitigation and Monitoring Plan (Appendix P.4). Furthermore, the blue felt lichen occurrences in Wetland 17 are located with the groundwater drawdown area and therefore indirect hydrological impacts are possible. There is no planned development or indirect effects anticipated within 100 m of the blue felt lichen occurrences within Wetland 14.

Wetland 205 will be partial impacted by the NAG waste rock stockpile, including the area that contains one occurrence of blue felt lichen, and a decrease in LCA. A detailed alternatives assessment has led to the current placement of the NAG waste rock stockpile and this infrastructure has been placed in consideration of all valued components and minimization of overall impact. Therefore, avoidance of this wetland is not practicable. Translocation of the blue felt lichen occurrence (Appendix P.4) is proposed, which will mitigate the impact to this species.

The predictive NSE WSS database indicates that Wetland 61, 64, 178, 205 and 220 may exists as a possible WSS due to historical presence of mobile species and potential habitat for mobile and non-mobile species, as discussed in Section 6.8.4.1.3. Wetlands 61, 205 and 220 will be partially or completely altered through direct and indirect impacts. Wetlands 64 and 178 have been previously impacted by pre-existing road infrastructure, and it is not anticipated that these wetlands will be further direct impacted as a result of Haul Road upgrades during the construction phase. Wetlands 64 and 178 will be impacted by increased traffic during Project operations. Detailed Haul Road design will consider species use of Wetland 64 and 178 (e.g., greater yellowlegs). New bypass roads have been micro-sited to avoid both wetlands and, as a result of PA and infrastructure modifications, a waterline has been rerouted and will no longer discharge into Wetland 64, avoiding resultant changes in hydrology.

While avoidance and minimization of Project impacts was attempted wherever practicable, as discussed in Section 6.8.4.1.3, it is not anticipated that these wetlands will be classified as WSS because the SAR species observed are mobile and similar suitable habitat is present within the PA, LAA and RAA. Other wetlands within the Beaver Dam Mine Site and Haul Road do not contain other critical wetland functions that necessitate avoidance (e.g., significant fish habitat, presence of critical wildlife habitat, groundwater recharge ability, etc.). Where identified or potential WSS could not be avoided, these wetlands will be prioritized during wetland monitoring (Section 6.8.10).

Efforts will be made during the detailed design process to avoid as much wetland habitat as possible. Infrastructure that may offer more flexibility in this regard includes the detailed design of the Haul Road upgrade alignment, mine roads, water diversion channels, settling ponds, and stockpile areas. Further regulatory consultation will occur with NSE and details associated with micro-sighting and final wetland alteration requirements will be confirmed at the wetland alteration permitting stage of this Project.

6.8.8.2 Wetland Mitigation

To mitigate and reduce overall loss of function of wetland habitat, the actions provided in Table 6.8-25 will be implemented by the Proponent within wetlands where direct impacts and potential indirect impacts to wetland habitat are expected. Mitigation measures will be confirmed through monitoring requirements, as described the Preliminary Wetland Compensation Plan (Appendix H.3), which will be refined at the permitting stage through the Industrial Approval. The Proponent will apply for approval to alter wetlands from NSE and will abide by all site-specific conditions of that approval, which will specify the timing windows in which alterations are permitted.

Table 6.8-25: Mitigation for Wetlands

Project Phase	Mitigation Measure
Construction, Operation, Closure	Complete pre-construction site meetings for all relevant staff/contractors related to working around wetlands and watercourses to minimize unauthorized disturbance, such as the introduction of invasive species
	Implement Erosion and Sediment Control Plan and measures to ensure site runoff is not directed towards wetlands to ensure habitat integrity and existing drainage patterns are maintained (Appendix C of Appendix P.4 [Mine Water Management Plan])
	Maintain pre-construction hydrological flows through wetland habitats and partially altered wetlands, wherever practicable
	Topsoil will be salvaged and stored for use in site restoration where practicable.
	Re-vegetate slopes adjacent to wetlands, using native seed mixes, to limit erosion and sediment release
	Implement the Preliminary Wetland Compensation Plan (Appendix H.3), as refined through the permitting process.
Construction	Ensure all wetlands are visually delineated (e.g., flagged)
	Complete detailed design of Haul Road and micro-siting of Beaver Dam Mine Site infrastructure to avoid or minimize impacts to wetlands
	Implement construction methods that reduce the potential to drain or flood surrounding wetlands
	Acquire and adhere to wetland alteration permits
	Detailed culvert design of upgraded/replaced culverts to maintain current hydrology and necessary fish passage.
	Translocation of blue felt lichen and monitoring of lichen SAR where direct and indirect impacts are expected to occur as per the Preliminary Lichen Mitigation and Monitoring Plan (Appendix P.6)
	Complete work within Wetland 64 outside of the breeding season in consideration of greater yellowlegs observations and probable breeding habitat.
Construction, Operation	Direct runoff through natural vegetation, wherever practicable
	Minimize erosion of wetland soils by limiting flow velocities by means of hydraulic dissipation techniques
	Minimize the rutting of wetland habitat by limiting the use of machinery within wetland habitat and use of swamp mats/corduroy bridges as required
	Conduct vegetation management (cutting and clearing) in or near wetlands and watercourses in accordance with applicable guidelines
	Employ measures to reduce the spread of invasive species (particularly by vehicles) into wetlands and retain habitat integrity Inspect vehicles regularly, particularly vehicles arriving from outside the PA. If necessary, cleaning will be undertaken at a designated cleaning station, away from wetlands and watercourses.
Closure	Compensate for permanent loss of wetland function through implementation of the Preliminary Wetland Compensation Plan, subject to NSE approval (Appendix H.3)
	Review and consider alternatives to traditional hydroseeding methods to advance vegetation re-establishment and reclamation methods
Post-Closure	Follow monitoring requirements in wetland alteration permits and final Wetland Monitoring Plan (to be completed at permitting stage).

In addition, the Proponent is committed to engaging in wetland compensation activities for the wetland loss associated with the Project as required by the provincial wetland alteration process. A Preliminary Wetland Compensation Plan has been developed and can be found in Appendix H.3. This Plan includes the following options for compensation, prepared in consultation with ECCC, NSL&F and NSE:

- On-the-ground restoration opportunities to meet a minimum 2:1 ratio and to be completed in a watershed near the Project area to the extent practicable;
- Wetland restoration opportunities within the Beaver Dam Mine Site will be considered where practicable;
- Translocation of blue felt lichen from WSS WL17, where direct and indirect effects are expected (as described in Appendix H.3);
- Other secondary forms of compensation that ECCC and NSE consider valuable to support the wetland conservation program in Nova Scotia;
- Collaboration with local community groups and the Mi'kmaq of Nova Scotia to the extent possible; and
- Inclusion of a conservation allowance in the Preliminary Wetland Compensation Plan to address restoration of equivalent habitat for wildlife SAR (Appendix H.3).

6.8.9 Residual Effects and Significance

The predicted residual environmental effects of Project development and production on wetlands are assessed to be adverse, but not significant. Direct impacts to wetlands as a result of Project construction were assessed to be moderate (Section 6.8.6.3) based on a 3.5% loss of wetland habitat within the LAA, as calculated by the CEA (Section 6.8.7.2). Indirect wetland impacts anticipated during Project operations, as presented in Section 6.8.7.1.2, represent 0.6% of wetland area within the LAA, and thus are evaluated as low. As presented in the CEA results (Section 6.8.7.2), SAR habitat loss is expected to be ≤ 3% within the LAA, for all evaluated species. No unmitigated or uncompensated wetland loss is anticipated as a result of planned restoration and wetland compensation (Appendix H.3). As a result, the overall residual effect of the Project on wetlands is assessed as not significant after mitigation and compensation measures have been implemented and considering the operational time frame of the Project (5 years). Residual effects to wetlands are summarized in Table 6.8-26.

Table 6.8-26: Residual Effects for Wetlands

Project - VC Interactions	Mitigation and Compensation Measures	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction – Beaver Dam Mine Site and Haul Road (clearing and grubbing, direct wetland alteration, and upgrading and new Haul Road construction))	Sediment and erosion control, best management practices, spill preparedness, and engagement in the wetland permitting process.	M VC interaction causes direct loss of 4% of NSE mapped wetlands in the LAA. Direct impact to WSS.	PA Potential adverse effect to wetlands inside the PA	A Seasonal aspects may affect VC	P VC unlikely to recover to baseline conditions	O Effects occur once during the construction phase	IR VC will not recover to baseline conditions	Habitat Loss and Disturbance	Not Significant
Operational – Beaver Dam Mine Site (groundwater interactions, water quality, changes to flow regimes, accidents/malfunctions)	Sediment and erosion control, best management practices, spill preparedness, wetland monitoring and water management.	L VC interaction predicted to result in indirect loss of <1% of NSE mapped wetlands in the LAA	LAA Potential adverse effect to wetlands outside of the PA	A Seasonal aspects may affect VC	LT Effects may extend beyond 5 years	R Effects occur at regular intervals throughout the project	PR Mitigation cannot guarantee a return to baseline conditions	Disturbance	Not Significant
Operational – Haul Road (water quality, changes to flow regimes, accidents/malfunctions)	Sediment and erosion control, best management practices, spill preparedness, and wetland monitoring.	L Small change from baseline conditions	LAA Potential adverse effect to wetlands outside of the PA	A Seasonal aspects may affect VC	LT Effects may extend beyond 5 years	S Effects occur at irregular intervals throughout the Project	R VC will recover to baseline condition	Disturbance	Not Significant
Post Closure – Touquoy Mine Site (potential changes to hydrology in Moose River and associated riparian wetlands)	Sediment and erosion control, best management practices, and spill preparedness, wetland monitoring and water management. Discharge to mimic seasonal flows wherever practicable	N Negligible increase in water quantity, no expected impact to downstream wetlands	LAA VC interaction may extend beyond PA	A Seasonal aspects may affect VC	LT Effects may extend beyond 5 years	R Effects are expected to occur over a regular interval	PR VC will partially recover to baseline conditions	Disturbance	Not Significant
Closure (Active) – Beaver Dam Mine Site (wetland restoration and compensation)	Sediment and erosion control, best management practices, spill preparedness, wetland compensation	L VC interaction restores and compensates lost wetland habitat	PA Potential adverse effect confined to the PA	A Seasonal aspects may affect VC	LT Effects may extend beyond 5 years	O Effects occur once during the reclamation phase	PR Mitigation cannot guarantee a return to baseline conditions	Habitat Reclamation	Not Significant

Notes: See Section 5.11, Table 5.11-1 for definitions of the below characteristics.

Magnitude		Geographic Extent		Timing		Duration		Frequency		Reversibility	
N	Negligible	PA	Project Area	N/A	Not Applicable	ST	Short-Term	O	Once	R	Reversible
L	Low	LAA	Local Assessment Area	A	Applicable	MT	Medium-Term	S	Sporadic	IR	Irreversible
M	Moderate	RAA	Regional Assessment Area			LT	Long-Term	R	Regular	PR	Partially Reversible
H	High					P	Permanent	C	Continuous		

A significant adverse environmental effect for wetlands has not been predicted for the Project for the following reasons, with consideration of the ecological and social context of the LAA surrounding the Project:

- During construction:
  - Direct impacts to wetlands will occur. However, these losses are 4% of the total available wetland habitat within the LAA. The majority of wetlands proposed for alteration are common and relatively isolated systems (swamp habitat). A wetland complex will be completely altered to support development of the open pit (WL56 and 59). These wetlands were anthropogenically created/altered as a result of historic mining activities. The combined magnitude of effects (proposed direct and estimated indirect impacts) results in a moderate magnitude of effect.
  - Impacts are anticipated within four identified or potential WSS (WL14, 17, 59 and 205) to support Project design, which are designated as WSS due to the presence of a sessile SAR (blue felt lichen). Translocation of the blue felt lichen is proposed, where necessary (Appendix P.6). No direct or indirect alteration is proposed within two additional WSS (WL4 and WL29).
  - Within the LAA there is a predicted cumulative loss of wetland habitat for SAR:
    - Mainland moose – 2%
    - Snapping turtle – 2%
    - Rusty blackbird – 3%
    - Olive-sided flycatcher – 2%
- During operations:
  - Limited impact to wetlands is predicted based on control of surface water flows to mimic baseline hydrologic conditions and implementation of sediment and erosion control measures.
- During closure:
  - Limited impact to wetlands is predicted based on control of surface water flows to mimic baseline hydrologic conditions and implementation of sediment and erosion control measures. In addition, there is an opportunity to potentially restore wetland habitat within the PA.
  - Wetland compensation will be completed to off-set Project wetland losses (Appendix H.3), including lost SAR habitat (landbirds and turtles). Off-site restoration opportunities will be prioritized within the tertiary watershed or adjacent watersheds wherever practicable.

6.8.10 Proposed Compliance and Effects Monitoring Program

Wetlands are protected under the provincial *Environment Act* and an approval is required for alteration. Wetland alteration applications will be submitted and permitting will be obtained prior to any construction in a wetland. Wetlands altered by the Project will be compensated at the ratio determined in the Preliminary Wetland Compensation Plan (Appendix H.3) in consultation with NSE. The Proponent will continue to work with NSE to develop the required mitigation measures including wetland compensation to mitigate any loss of habitat based on function and relative value. Assuming that the proposed compensation and mine site reclamation mitigation measures are applied, and that existing site drainage conditions are maintained, the Project is not likely to have significant adverse effects on wetland functional attributes in the area.

Wetland management aims to describe actions taken to verify the predictions of negligible significant adverse effects on wetland functional attributes, quantify wetland response to Project activities and alteration events, examine the effectiveness of mitigation measures taken, and signal a need to implement environmental control measures if monitoring indicates adverse environmental effects are or may be occurring due to activities of the Project. Wetland management is intended to verify that the Project is not likely to have significant adverse effects on wetland functional attributes in the area. The methods for monitoring will be those submitted within the Preliminary Wetland Compensation Plan (Appendix H.3).

Wetland monitoring will be completed to verify the accuracy of the predicted environmental effects and the effectiveness of the mitigation measures outlined in Table 6.8-25. A Preliminary Wetland Compensation Plan has been included in Appendix H.3 and will be refined through the life cycle of the permitting process. The plan commits to monitoring during baseline/pre-construction to establish baseline conditions, and through the operational, closure and post-closure phases (as determined to be required). A Final WLMP will be developed prior to construction in consideration of the on-going Project design, wetland alteration permitting and regulatory consultation. The plan will be refined in order to meet the specific activities and timing of activities within the PA.

A Preliminary Wetland Compensation Plan has been developed in order to satisfy the Nova Scotia Wetland Conservation Policy's (2011) objective of preventing no net loss of wetland habitat and function. This plan includes proposed conservation allowances for fauna SAR, as specified in IR2s CEAA-2-24 and CEAA-2-26. Wetland compensation will be initiated within three years of wetland alteration. Refer to the Preliminary Wetland Compensation Plan (Appendix H.3) for further details.

Implementation of the strategies discussed above will support the mitigation process associated with wetland protection. A wetland awareness program will be implemented to clearly identify boundaries of approved alteration areas and communicate these and all approval requirements to relevant site personnel. The Preliminary Wetland Compensation Plan (Appendix H.3) outlines adaptive management strategies should post construction wetland monitoring and/or ongoing construction monitoring indicate a potential issue above normal variation (i.e., atypical wetland responses to adjacent land activities).

Proposed follow up and monitoring programs have been reviewed with the Mi'kmaq of Nova Scotia during engagement efforts including meetings, sharing of technical documents (Draft EIS, poster boards, Summary of Mi'kmaq Effects and Proposed Mitigation Measures, Plain Language Summary). On-going engagement with the Mi'kmaq will continue through the EA process and associated permitting relating to follow up programs and monitoring.

6.9 Fish and Fish Habitat

6.9.1 Introduction

6.9.1.1 Summary of Fish and Fish Habitat Before Updates

The Beaver Dam Mine (the Project) will operate as a satellite surface mine to the existing and fully permitted Touquoy Gold Mine, located nearby in Moose River Gold Mines, Nova Scotia. The ore that is mined from the Beaver Dam Mine Site will be processed at the existing Touquoy Mine.

Prior to updates, Section 6.9 described the methods and results of baseline characterization as well as predictive studies that were undertaken to support characterization of potential Project effects on the Fish and Fish Habitat Value Components (VCs). Fish are considered an important aquatic resource from an economic, recreational, and cultural perspective within Canada. Fish, and the physical components of their natural environment, are protected under both provincial and federal legislation (Canada Water action 1985a, *Fisheries Act* (1985b), *Fisheries Protect Act* (1997), *Nova Scotia Environment Act* (1995)). Fish and Fish Habitat VCs are linked to other VCs identified for the Project, including surface and ground water quality and quantity, human health, and traditional land use.

The effects assessment for fish and fish habitat described direct impacts to fish in the context of the previous version of the *Fisheries Act* and the serious harm to fish threshold. The subsequent assessment of residual effects incorporated mitigation and monitoring programs for Project effects and, although residual effects were identified, they were characterized as not significant provided that mitigation measures were undertaken.

6.9.1.2 Summary of Updates to Fish and Fish Habitat

The Fish and Fish Habitat Effects Assessment (EA) for the Project has been updated to reflect updates of the Project Description (Section 2) and to address Round 2, Information Requests (IR2) issued by the Impact Assessment Agency of Canada (IAAC, formerly the Canadian Environmental Assessment Agency [CEAA 2019]) and Nova Scotia Environment (NSE 2019). This includes:

- updated description of the existing environment based on ongoing baseline fish and fish habitat surveys,(Appendix J.2, Appendix J.4), as well as surface water monitoring studies (Section 6.7.4 and Appendix G.1);
- identification and evaluation of potential water treatment for the Project, including nitrite removal technologies (included in Appendix P.4 Mine Water Management Plan as Appendix F.2 [Operations Phase Water Treatment Assessment] and Appendix F.3 [Post-closure Phase Water treatment Assessment]);
- update of the Mine Water Management Plan (MWMP) (Appendix P.4);
- a revised significance determination and expanded analysis of direct and indirect effects (Section 6.9.9);
- additional groundwater and surface water modelling was also completed at the Touquoy Mine Site to support the proposed plan for in pit disposal of tailings in the exhausted pit; and
- inclusion of Fish Habitat Offset Plan and Habitat Bank: Preliminary Design (Appendix J.3), to compensate for any losses to fish habitat as a result of the Project.

Standalone responses to IR2s are provided in AMNS (2021). An outline of updates to the Fish and Fish Habitat Environmental Effects Assessment are summarized in Table 6.9-1.

Table 6.9-1: Updated Subsections from the 2019 Revised Environmental Impact Statement – Fish and Fish Habitat

2019 Revised EIS Submission (February 28, 2019)	Updated in 2021	Corresponding 2021 EIS Update Section Number	Reason for Update
-	-	6.9.1 Introduction	• New
6.9.1 Rationale for Valued Component Selection	No	6.9.2 Rationale for Valued Component Selection	• N/A
6.9.2 Baseline Program Methodology	Yes	6.9.3 Baseline Program Methodology	• Addition of 2019 to 2020 field surveys, primarily related to habitat quantification and increased fish collection effort, driven by the modernized *Fisheries Act* and revisions to Project infrastructure (Section 2), and Round 2 IRs. • CEAA-2-19 • CEAA-2-20
6.9.3 Baseline Conditions	Yes	6.9.4 Baseline Results	• Presents results from additional field surveys, added to address PA modification for infrastructure layout • CEAA-2-19 • CEAA-2-20 • NSE 2-123 • NSE 2-121
6.9.4 Consideration of Consultation and Engagement Results	Yes	6.9.5 Consideration Engagement Results	• Additional engagement has occurred since 2019 submission.
6.9.5 Effects Assessment Methodology – **Boundaries**	Yes	6.9.6 Effects Assessment Methodology – **Boundaries**	• Adjusted PA description. • PA modification for infrastructure layout. • LAA was modified due to modified PA and improved interactions analysis.
6.9.5 Effects Assessment Methodology – **Thresholds for Determination of Significance**	Yes	6.9.6 Effects Assessment Methodology – **Thresholds for Determination of Significance**	• Updated significance threshold and magnitude definition. • Reflects the modernized *Fisheries Act* and more detailed effects assessment, particularly related to evaluation of indirect effects to fish and fish habitat. • CEAA-2-02
6.9.6 Project Activities and Fish and Fish Habitat Interactions and Effects	Yes	6.9.7 Project Activities/Interactions with Fish and Fish	• Increased level of detail regarding quantification of direct impact to reflect revised infrastructure layout, and to reflect updates to baseline program and the modernized *Fisheries Act.* • Increased level of detail and analysis related to indirect effects to fish and fish habitat, and quantification of impacts. • Changes to Project timelines. • CEAA-2-07 • CEAA-2-09 • CEAA-2-10 • CEAA-2-12 • CEAA-2-13 • CEAA-2-14 • CEAA-2-16 • CEAA-2-17

Table 6.9-1: Updated Subsections from the 2019 Revised Environmental Impact Statement – Fish and Fish Habitat (continued)

2019 Revised EIS Submission (February 28, 2019)	Updated in 2021	Corresponding 2021 EIS Update Section Number	Reason for Update
			• CEAA-2-18 • CEAA-2-21 • CEAA-2-22 • NSE 2-43 • NSE 2-44 • NSE 2-48
6.9.7 Preferred Alternative Haul Road	Yes	-	• Removed from Project Description.
6.9.8 Mitigation and Monitoring	Yes	6.9.8 Avoidance and Mitigation	• Expanded this section to detail the entire mitigation sequence, of Avoidance, Mitigation and Offsetting. • Addition of a detailed offsetting plan to account for Project-related direct and indirect effects to fish and fish habitat. • CEAA-2-06 • CEAA-2-07 • CEAA-2-08 • CEAA-2-11 • CEAA-2-13 • NSE 2-120 • NSE 2-121
6.9.9 Residual Effects and Significance	Yes	6.9.9 Residual Effects and Significance	• Updated based on field survey results, revisions to Project Description, and revisions to significance threshold and magnitude definition.
6.9.10 Proposed Compliance and Effects Monitoring Program	Yes	6.9.10 Proposed Compliance and Effects Monitoring Program	• Expansion of previous monitoring commitments, and addition of an Preliminary Aquatic Effects Monitoring Plan (to be submitted prior to construction).

Notes: PA = Project Area; LAA = Local Assessment Area; RAA = Regional Assessment Area; - = no update; IR2 = Round 2, Information Requests; CEAA = Canadian Environmental Assessment Agency; EIS = environmental impact statement; N/A = not applicable.

6.9.2 Rationale for Valued Component Selection

Fish and Fish Habitat was selected as a VC for its significance to ecological and socio-economic systems. The Project area encompasses several fish-bearing streams, rivers, and lakes which are protected under provisions of the *Fisheries Act* (1985).

The Fish and Fish Habitat VC could be affected by Project activities during the Construction, Operations, Active Closure, and Post-closure phases. This effects assessment identifies Fish and Fish Habitat as a single VC, whereby changes are, in turn, evaluated using indicators that are relevant, practical, measurable, responsive, accurate and predictable. The assessment of Fish and Fish Habitat as a single VC, rather than assessing individual physical or chemical constituents, was selected through a review of relevant regulations and guidelines, scientific literature, as well as professional experience and judgement.

6.9.3 Baseline Methodology

Baseline characterization studies for the proposed Project have occurred since 2014; the scope of monitoring programs has varied slightly from year to year to reflect updates to the Project Description (Section 2) as well as to respond to IR2 requests issued by IAAC (CEAA 2019) and Nova Scotia Environment (NSE 2019). The characterization studies have continued to be focused in three geographically distinct areas:

1. Beaver Dam Mine Site;

2. The Haul Road; and

3. The existing Touquoy Mine.

A Fish Habitat Assessment Area (FHAA) was developed to evaluate the effects of the Project on fish and fish habitat. The FHAA incorporates the Beaver Dam Mine Site and Haul Road portions of the Project Area (PA), and watercourses downstream from the Beaver Dam Mine Site (i.e., WC23, WC26 and WC27, and incorporating all of Cameron Flowage, downstream along the Killag River to the bridge and Nova Scotia Salmon Association (NSSA) Lime Dosing Station).

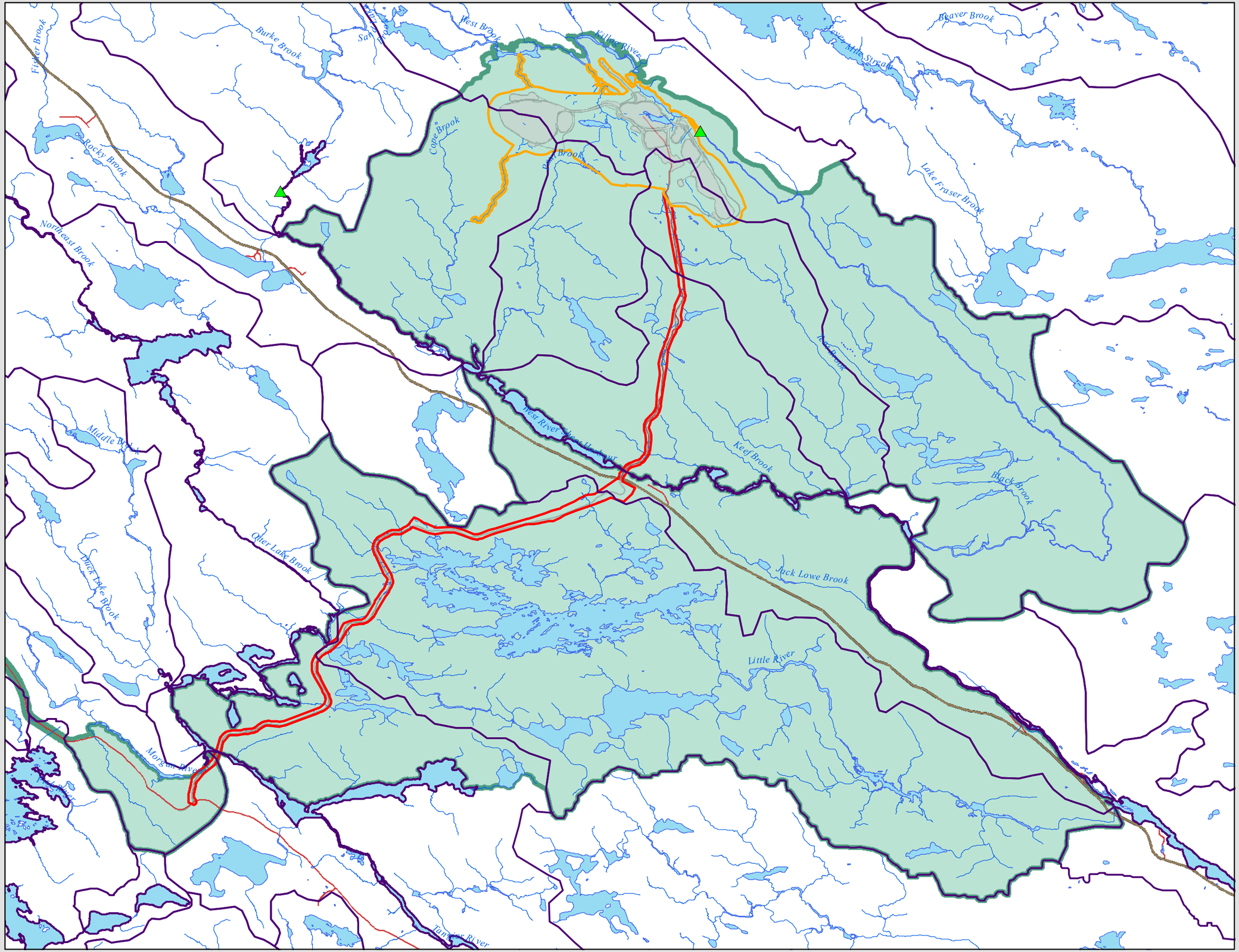
The downstream watercourses were incorporated into the FHAA to assess the maximum extent of effects of the Project from direct and indirect impacts to fish and fish habitat beyond the Beaver Dam Mine Site. The entire FHAA lies within the Local Assessment Area (LAA), which is defined by a selection of tertiary watersheds (Section 6.9.3.3). Additional details regarding the aquatic spatial boundaries (i.e., PA, LAA, and Regional Assessment Area [RAA]) are provided in the Effects Assessment Methodology (Section 6.9.6).

The baseline program methodology is summarized in the subsections below and results of baseline characterization studies are presented in Section 6.9.4. Figures 6.9-2, 6.9-3 and 6.9-4, included in the corresponding baseline methodology subsections below, present and overview of baseline sampling locations within the FHAA, including: fish, benthic macroinvertebrate, culvert condition, daily flow assessment points, and habitat assessment transects.

Detailed maps of individual sampling type and the locations and habitats/stream reaches (i.e., characterization studies) are presented in Appendix J.4.

Complete baseline characterization studies for the proposed Project are provided in the Baseline Fish and Fish Habitat 2019-2020 Technical Report and the Baseline Fish and Fish Habitat 2015-2017 (herein referred to as the 2019-2020 Baseline Report Appendix J.2 and/or the 2015-2017 Baseline Report Appendix H of Appendix J.2, respectively).

The baseline characterization studies and results from the Touquoy Gold Project (i.e., existing Touquoy Mine) used in this effects assessment have been summarized from the Touquoy Gold Project 2007 Focus Report (CRA 2007b) and Environmental Assessment Registration Document (EARD) (CRA 2007a).



Prepared For:

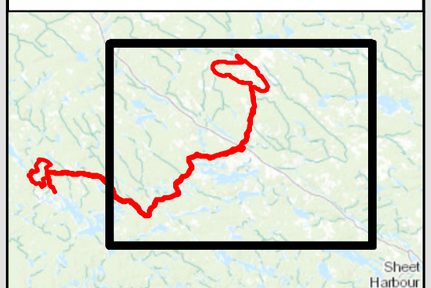
Atlantic Gold

FIGURE 6.9-1

Beaver Dam Mine Project

Fish and Fish Habitat Assessment Areas

- NSSA Lime Doser
- Field Delineated Watercourses within PA
- NSTDB Mapped Watercourses outside PA
- Collector Road
- Local Road
- Planned Mine Infrastructure
- Tertiary Watershed
- Fish Habitat Assessment Area (FHAA)
- Project Area (used for assessment along Haul Road)
- Aquatics Local Assessment Area



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 750 1,500 3,000 m

1:63,800 Scale when printed @ 11" x 17"

Drawn By: LP
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McCallum Environmental Ltd.

Document Name: BD_EIS_Figure6-9-1 Overview

6.9.3.1 Surface Water

Baseline characterization of Surface Water Quantity VC (hydrology) and Surface Water Quality VC conditions at the Project was undertaken to define the existing hydro-climatic regime for the watersheds that could potentially be affected by Project development; baseline methodology for surface water is described in Section 6.7.4 (Surface Water Quantity Baseline) and Section 6.7.5 (Surface Water Quality Baseline). Surface water monitoring (quantity and quality) for the proposed Project has occurred since 2014.

In addition, targeted characterization of surface water conditions at electrofishing locations was completed as follows to support the Fish and Fish Habitat assessment:

- Physicochemical water quality measurements were recorded at each representative section of watercourses and waterbodies selected for electrofishing within the Beaver Dam Mine Site and Haul Road. All water quality measurements were collected using a Horiba multi-probe (W-22XD) or YSI 650 MDS & 600 QS Multi-Probe water quality instrument. Parameters recorded include dissolved oxygen (mg/L), water temperature (°C), pH, and specific water conductivity (µS/cm).
- In 2019 and 2020, in-situ water quality measurements were recorded at all electrofishing and trapping sites prior to each sampling event (Appendix J.2).
- Water quality measurements were recorded for each watercourse reach delineated through detailed habitat assessments. These water quality measurements were collected using a calibrated YSI Multi-Probe water quality instrument or a combination of a Myron Ultrapen Dissolved Oxygen Pen Probe and Hannah Combo pH/Conductivity/TDS Probe at the time of the sampling event/survey.

The Baseline Fish and Fish Habitat 2019-2020 Technical Report (herein referred to as the 2019-2020 Baseline Report (Appendix J.2) presents the survey methods conducted in 2019-2020, supplemental information to 2015-2017 baseline information is described in the Baseline Reports (Appendix H of Appendix J.2).

6.9.3.2 Benthic Macroinvertebrate Sampling

The objective of benthic macroinvertebrate (invertebrate) surveys was to determine abundance and community composition of secondary (benthic invertebrate) producers in the streams, rivers, and wetlands across the FHAA defined for the Project (Figure 6.9-1). Invertebrate sampling was completed using the national standardized CABIN protocol (EC, 2012). Sampling was completed in June 2016 at three locations within the Beaver Dam Mine Site (Figure 6.9-2) and seven locations along the Haul Road (Appendix J.4). Benthic sampling was completed to support fish habitat evaluation as a baseline measurement, as changes in the benthic invertebrate abundance and community structure may indicate perturbations to the natural aquatic environment.

To support baseline characterization, benthic communities in lotic (fast-flowing) and lentic (standing or slow-flowing) environments were sampled. The total number of animals of each type (taxonomic group), as well as total abundance, was determined for each sample collected from the watercourses across the Beaver Dam Mine Site and the Haul Road. These numbers were used to calculate several indices of baseline benthic community health, which can be compared between sites and, with time, at each site. Indices calculated are all commonly used in studies of this kind and include: EPT Ratio (ratio of abundance of mayflies (Ephemeroptera), caddisflies (Trichoptera), and stoneflies (Plecoptera), to total numbers of organisms); Total Abundance (number of animals in the sample and per unit area); and Taxon Richness (number of taxa per sample). Abundance in kicknet samples was expressed on a per sample basis. All organisms present were included in estimates.

Detailed methodology for sample collection and laboratory analyses are provided in Appendix H of the 2019-2020 Baseline Report; (Appendix J.2). Figure 6.9-2 shows benthic macroinvertebrate sample locations.

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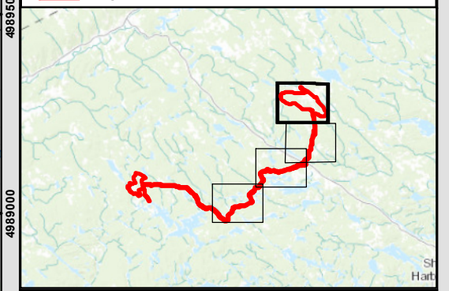
FIGURE 6.9-2A

Beaver Dam Mine Project Electrofishing, Trapping, and Benthic Survey Locations

- Benthic Surveys (2016)
- Trap Locations (2015-2017)
- Trap Locations (2019-2020)
- Negative eDNA Result
- Positive eDNA Result
- Electrofishing Reaches (2015-2017)
- Electrofishing Reaches (2020)
- Field Delineated Watercourses within PA
- NSTDB Mapped Watercourses outside PA
- Local Road
- Dry Weather / Seasonal Road
- Track
- Topo Contours (5 m)
- Open Water
- Field Delineated Wetlands within PA
- Lake
- NSE Mapped Wetlands outside PA
- Proposed Infrastructure
- Project Area



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Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

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Reviewed By: LP

Date: 2021-06-01

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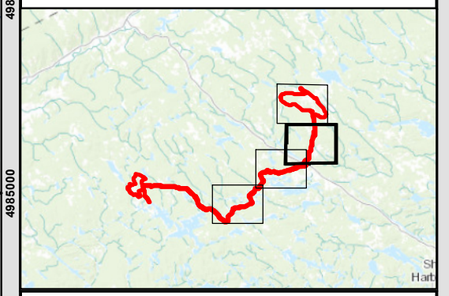
FIGURE 6.9-2B

Beaver Dam Mine Project Electrofishing, Trapping, and Benthic Survey Locations

- Benthic Surveys (2016)
- Trap Locations (2015-2017)
- Electrofishing Reaches (2015-2017)
- Field Delineated Watercourses within PA
- NSTDB Mapped Watercourses outside PA
- Collector Road
- Local Road
- Dry Weather / Seasonal Road
- Diveways (>300 m)
- Track
- Topo Contours (5 m)
- Open Water
- Field Delineated Wetlands within PA
- Lake
- NSE Mapped Wetlands outside PA
- Project Area



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Kent Lake
McGregor Lake
Cope Pond
WC-H
Lawlor Lake
River Lake
Brandon Lake
WC-N
Eagle Nest Basin
Trout Lake

4987500
4987000
4986500
4986000
4985500
4985000
4984500
4984000

520000 520500 521000 521500 522000 522500 523000 523500 524000 524500 525000

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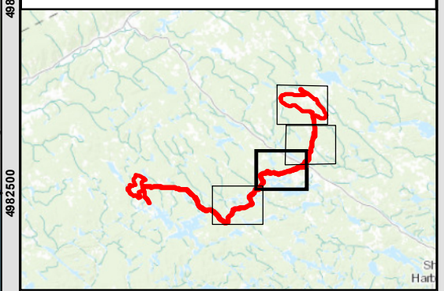
FIGURE 6.9-2C

Beaver Dam Mine Project Electrofishing, Trapping, and Benthic Survey Locations

- Benthic Surveys (2016)
- Trap Locations (2015-2017)
- Electrofishing Reaches (2015-2017)
- Field Delineated Watercourses within PA
- NSTDB Mapped Watercourses outside PA
- Collector Road
- Local Road
- Dry Weather / Seasonal Road
- Diveways (>300 m)
- Track
- Topo Contours (5 m)
- Open Water
- Field Delineated Wetlands within PA
- Lake
- NSE Mapped Wetlands outside PA
- Project Area



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Datum: North American 1983 CSRS
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Document Name: BD_EIS_Figure6-9-XEFishTrapsBenthics

Lower Beaver Lake
River Lake
Middle Beaver Lake
Trout Lake
Upper Beaver Lake
Lake Alma
WC-N
WC-O
WC-V

4985000
4984500
4984000
4983500
4983000
4982500
4982000
4981500

517000 517500 518000 518500 519000 519500 520000 520500 521000 521500 522000

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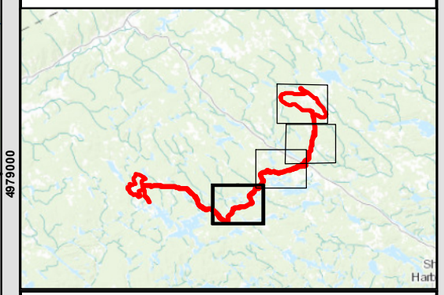
FIGURE 6.9-2D

Beaver Dam Mine Project Electrofishing, Trapping, and Benthic Survey Locations

- Benthic Surveys (2016)
- Electrofishing Reaches (2015-2017)
- Field Delineated Watercourses within PA
- NSTDB Mapped Watercourses outside PA
- Local Road
- Dry Weather / Seasonal Road
- Diveways (>300 m)
- Track
- Topo Contours (5 m)
- Open Water
- Field Delineated Wetlands within PA
- Lake
- NSE Mapped Wetlands outside PA
- Project Area



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 125 250 500 m

1:15,000 Scale when printed @ 11" x 17"

Drawn By: AS Date: 2021-06-01
Reviewed By: LP

Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors,

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Document Name: BD_EIS_Figure6-9-XEFishTrapsBenthics

Big Pond
Sandy Pond
Miller Lake
Mink Lake
Upper Kidney Lake
Rum Lake
Brandy Lake
Johns Pond
Grassy Lake
WC-AA
WC-AH

4981500
4981000
4980500
4980000
4979500
4979000
4978500
4978000

513000 513500 514000 514500 515000 515500 516000 516500 517000 517500

6.9.3.3 Fish Habitat Assessment

Fish habitat assessments were completed in two phases. During initial site assessments completed in 2015-2017 a qualitative evaluation of fish habitat was completed. This included delineation, characterization, and basic descriptions of all aquatic features, including reach-level measurements of fish habitat parameters. The details associated with the qualitative evaluation of fish habitat are provided in Appendix G.4 as well as in the 2015-2017 Baseline Report (Appendix H of the 2019-2020 Baseline Report, Appendix J.2); a summary is presented in this section.

Further to the initial delineation and description of watercourses, and in response to IR2 CEAA-2-19, a more detailed quantitative evaluation of fish habitat was completed in 2019-2020. The methods to describe habitats are outlined in detail in each of these baseline reports and summarized in this section.

Each habitat type has been characterized via surveys using standard methodologies to gather key measurements such as reach length (m), reach wetted and bankfull width (m), reach slope (%), stream substrate composition (% composition), water depths (m), water velocities (m/s), cover (%), and riparian habitat. The data was used to determine the overall habitat area within each reach as well as the habitat suitability based on measured stream substrate, water depths, and water velocities (habitat parameters) for each fish species identified within the Beaver Dam Mine Site (IR2 CEAA-2-06). Fully tabulated fish habitat data is presented in Appendix G of the 2019-2020 Baseline Report (Appendix J.2). Delineated watercourse reaches are presented in Appendix J.4, Figure J.4-2, and representative photos are presented in Appendix C of the 2019-2020 Baseline Report (Appendix J.2).

6.9.3.3.1 Qualitative Evaluation

Watercourses and waterbodies were identified and described across the Beaver Dam Mine Site in Summer 2015, and the Haul Road in Spring 2016. Wetland delineation and evaluation were completed in 2015 (Beaver Dam Mine Site) and 2016 (Haul Road). As a result of the micro-siting of infrastructure, additional supplementary baseline surveys were conducted in July and August 2019, and December 2020 to delineate and characterize additional surface water features within the broader FHAA to support indirect impacts analysis to fish and fish habitat, which incorporated several down-gradient watercourses surrounding the Beaver Dam Mine Site.

The original qualitative descriptions of fish habitat presented in the Revised 2019 EIS (AMNS, 2019) were based on the *Standard Methods Guide for Freshwater Fish and Fish Habitat Surveys in Newfoundland and Labrador: Rivers and Streams* (Sooley et al., 1998), with the descriptions provided for fish of the Salmonidae family, using the Atlantic salmon as the indicator species. Characterization of fish habitat within watercourses, waterbodies and wetlands within the Beaver Dam Mine Site and Haul Road have since been updated to consider all fish species confirmed or potentially present within each aquatic features and support for their various life stages, in consideration of the updated *Fisheries Act* (2019).

6.9.3.3.2 Quantitative Evaluation

Within the Beaver Dam Mine Site component of the FHAA, quantitative evaluations were completed in any watercourse which was expected to be directly or indirectly affected by the Project (CEAA 2-07), following the MEL Standard Operating Procedure (SOP) for detailed fish habitat assessment in streams (Appendix B of 2019-2020 Baseline [Appendix J.2]). This description of habitat by homogeneous section is provided in the baseline results section (Section 6.9.4, Table 6.9-2) and is described in further detail in the 2019-2020 Baseline Report (Appendix J.2).

The methods outlined in the SOP were derived from the following sources:

- The Nova Scotia Fish Habitat Assessment Protocol: A Field Methods Manual for the Assessment of Freshwater Fish Habitat (NSLC, 2018);
- DNR / DFO – New Brunswick Stream Habitat Inventory Datasheets;
- Standard Methods Guide for the Classification and Quantification of Fish Habitat in Rivers of Newfoundland and Labrador for the Determination of Harmful Alteration, Disruption and Destruction of Fish Habitat (DFO, 2012);
- Reconnaissance (1:20,000) Fish and Fish Habitat Inventory (RIC, 2001);
- The US EPA Rapid Bioassessment Protocols For Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates, and Fish (Barbour et al., 1999); and
- The Canadian Aquatic Biomonitoring Network Field Manual, Wadeable Streams (EC, 2012).

In summary, a total of eight watercourses (WC5, WC12, WC13, WC14, WC23, WC25, WC26, and WC27) and three open water features in wetlands (WL56, WL59, and WL61) were described using quantitative evaluation methods. In addition, modified quantitative fish habitat surveys were performed within a 1.7 km stretch of Cameron Flowage/Killag River from December 8 to 16, 2020, the details of which are provided in the baseline results section (Section 6.9.4, Table 6.9-3), and described in further detail in the 2020 Baseline Report (Appendix J.2). Watercourse reaches identified during the quantitative evaluation of fish habitat are summarized in the baseline results section (Section 6.9.4, Table 6.9-2) and identified in Appendix J.4, Figure J.4-2.

To support fish habitat assessments, each surveyed watercourse was delineated into individual reaches defined by discrete homogeneous units (e.g., riffle, run, pool, flat, etc.) as determined in the field in an upstream to downstream direction. Each habitat type contains discrete gradient, substrate types, water depth, and velocity ranges which have been determined using the described biological 'preferences' outlined in Grant and Lee (2004), whenever possible. In smaller, first-order streams, habitat types were often found to be extremely short and variable. For efficiency in the field, when individual habitat types were less than 5 m in overall length, they were be grouped together into one reach containing multiple smaller habitat units. The upstream and downstream ends of each reach were recorded with a handheld GPS device. Fish habitat reaches are presented in Appendix J.4, Figure J.4-2.

For each reach (homogenous section of watercourse), a detailed fish habitat survey was completed which included water quality measurements, designation of substrate and cover types, riparian habitat descriptions, and barrier assessments. Cross-sectional measurements (transects) were established to describe morphological (channel and wetted widths, bank heights) and flow characteristics (velocities and depths) within the reach. Transect measurements were recorded at every 50 m length of reach – for example, if a reach was 150 m in total length, three transects were established within the reach. If multiple habitat types (<5 m in length) were grouped together to form a reach, transects were established within each habitat type represented within the reach. The amount of transects and transect locations were selected and modified as needed in the field based on specific habitat features observed, or limitations related to access, wadeability, and safety concerns.

Percent cover of various substrate types was described within each individual transect using the following parameters:

- Bedrock: Continuous solid rock exposed by the scouring forces of the river/stream;
- Boulder: Rocks ranging from 25 cm to >1 m in diameter;
- Rubble: Rocks ranging from 14 to 25 cm in diameter;
- Cobble: Rocks ranging from 3 to 13 cm in diameter;
- Gravel: Small stones ranging from 2 mm to 3 cm in diameter;

- Sand: Grains ranging from 0.06 to 2 mm in diameter, frequently found along stream margins or between rocks and stones;
- Silt: Very fine sediment particles, usually <0.06 mm in diameter;
- Muck/detritus: Organic material from dead organisms (plant and/or animal); and
- Clay/Mud: fine mineral soil. <0.06 mm in diameter, with the ability to form a ribbon of soil (unlike silt).

For shallow (<2 m) open water features that (i.e., the ponded area of WL59), depth and substrate checks were performed at various locations throughout the feature, and any cover types (vegetation, woody debris, large substrate) were documented and total cover (%) was estimated.

Aquatic features along the Haul Road were not re-evaluated through quantitative fish habitat evaluations as the original, qualitative fish habitat characterizations were considered to provide appropriate fish habitat data for each specific crossing location. Qualitative fish habitat descriptions were completed on short reaches of watercourses typically representing a single homogeneous unit, in a narrow, discrete study area, which directly overlaps the proposed Haul Road and associated impacts from road crossings. Therefore, fish habitat at each Haul Road crossing location is considered a discrete habitat unit based on the short length of each watercourse described, and further detailed quantification was not deemed necessary at this stage.

6.9.3.3.3 Fish Passage Assessment

Throughout baseline watercourse mapping and fish habitat surveys, an assessment of potential fish passage obstacles was completed. When a potential obstacle was encountered, biologists recorded the type of obstacle, height and length of the obstacle, depth of water, along with an estimate of slope where relevant. For subterranean reaches presenting obstacles to fish passage, the contiguity and spatial relationships of discontinuous pools are described, with the intent of understanding a fish's ability to move and/or jump from one step-pool or isolated pool to another.

If a potential barrier is an anthropogenic in nature (i.e., improperly installed culverts), the type of culvert is noted, along with any issues associated with installation that could be remediated to improve passage. Anthropogenic structures such as improperly installed culverts are not typically identified as permanent barriers to fish passage, because through remediation, fish passage can be restored. The temporal nature of an obstacle is noted as well, recognizing that natural and anthropogenic barriers can change with time (i.e., logjams or beaver dams) or remediation (i.e., culvert installation), while others limit passage seasonally (i.e., ephemeral or intermittent streams), and others may be permanent barriers (i.e., some waterfalls). Where an obstacle was identified but the temporal nature of it was uncertain or if it was dependent on flow regime, multiple site assessments and additional fish sampling were conducted to confirm it's passability. Except in extreme circumstances, logjams and beaver dams are not considered barriers to fish passage.

Further to the typical physical characteristics, the ecological context was used to identify evidence of flow and hydrologic connectivity that would provide passage for fish. The NSE Guide to Altering Watercourses (NSE, 2015) is used to support the discussion of whether a regulated watercourse (i.e., defined, natural channel) is present. This guidance includes identifying whether:

- a mineral soil channel is present;
- there is sand, gravel and/or cobbles evident in a continuous pattern over a continuous length with little to no vegetation;
- there is an indication that water has flowed in a path for a length of time and rate sufficient to erode a channel or pathway;
- there are aquatic plants, animals, or fish; or
- there is aquatic vegetation.

Hydrology indicators are used to identify evidence of flow if an initial assessment occurs during a period of low flow. Some examples of hydrology indicators used include water marks on trees, sediment deposits, drift deposits, algal mats, sparsely vegetated concave surface, water-stained leaves, surface soil cracks, drainage patterns, or moss trim lines. Vegetation communities can provide indication of flow (or absence thereof) as well.

Understanding the swimming capabilities of fishes is key to the determination of barriers to fish passage. Swimming capabilities of fishes is dependent upon abiotic factors such as water depth, flow rate, water temperature, height and length of obstacles, and biotic factors such as fish species, length, darting speed, behavioral adaptations, and life history stage. In the assessment of fish passage obstacles, the swimming capabilities of the following species were considered: American eel, Atlantic salmon, brook trout, white sucker, and white and yellow perch. Detailed fish passage assessment methodology and a literature review of the swimming capabilities of each species is presented in the 2019-2020 Baseline Report (Appendix J.2).

6.9.3.4 Fish Collection

6.9.3.4.1 2015 to 2017 Field Collection

Quantitative electrofishing sites were established in areas of confirmed or potential fish habitat within the Beaver Dam Mine Site and Haul Road area with the goal of providing quantitative data on fish populations in selected watercourse reaches. Detailed methods and results for fish surveys completed within the Beaver Dam Mine Site and Haul Road from 2015-2017 are presented in the 2015-2017 Baseline Report (Appendix H of the 2019-2020 Baseline Report; Appendix J.2). The methodology outlined in the Revised 2019 EIS (AMNS 2019) was followed during these surveys. In summary:

- Each watercourse was evaluated for the presence of fish habitat and potential ability to support fish species during initial assessment and identification. Once this was completed, fishing locations and methods were established within reaches of linear watercourses and waterbodies.
- Electrofishing sampling sites (Figure 6.9-2) were established in representative aquatic habitats with high potential to support fish along the Haul Road and within the Beaver Dam Mine Site. The purpose of the electrofishing surveys was to determine fish species presence and abundance within watercourses and associated wetlands within the Beaver Dam Mine Site and Haul Road.
- Electrofishing sites within the Beaver Dam Mine Site employed an “open” site and a single pass - no barrier nets were used to increase the chance of capturing fish migrating into the sampling reach.
- Electrofishing along the Haul Road was performed in select watercourses with the goal of representing each tertiary watershed. Prior to each sampling event, sampling sites located within linear watercourses along the Haul Road were blocked off with barrier nets that were secured to the streambed at either end of the sampling reach. This created a “closed” system from which quantitative population estimates could be calculated. Two passes of electrofishing were performed within each sampling site along the Haul Road.
- Trapping was completed in Cameron Flowage and Crusher Lake in June 2016 to support and supplement electrofishing efforts completed for the Project (Figure 6.9-2).

6.9.3.4.2 2019 to 2020 Field Collection

Detailed methods and results for fish surveys completed within the Beaver Dam Mine Site and Haul Road from 2019 to 2020 are presented in the 2019-2020 Baseline Report (Appendix J.2) and are summarized in this section.

Continued trapping efforts were conducted in September, November, and December 2019 in the western extension of the Beaver Dam Mine Site, specifically those watercourses within the Cope Brook Tertiary Watershed. The overarching goal of this particular

fish collection program was to saturate selected watercourses with a variety of gear types for extended periods of time in order to clearly establish the presence of fish during a range of seasonal flow conditions and ecological periods.

From April through September 2020, a concentrated fishing program was completed within watercourses and waterbodies within and in proximity to the Beaver Dam Mine Site due to proposed impacts to fish and fish habitat within the Local Assessment Area (LAA). This program consisted of the following tasks:

- Continued trapping during high spring flow regimes within the Cope Brook tertiary watershed within selected watercourses identified within and downstream of the proposed Waste Rock Storage Area (WRSA) (Figure 6.9-3); and
- Three rounds of summer fish sampling (electrofishing and trapping) within watercourses and waterbodies predicted to be directly affected, indirectly affected, and unimpacted by Project development.

Three rounds of quantitative and qualitative electrofishing surveys were conducted between June 1 and September 30, 2020 to identify seasonal fish usage throughout the Beaver Dam Mine Site. Sampling reaches of approximately 100 m in length were established within watercourses predicted to be directly impacted, indirectly impacted, and reference sites likely to be unimpacted by Project development (Appendix J.2). Quantitative and qualitative electrofishing reaches and trapping locations are shown on Figure 6.9-2. A complete description of methods for fish surveys conducted during the 2019-2020 field program is presented in the 2019-2020 Baseline Report (Appendix J.2).

6.9.3.5 Environmental DNA

Environmental DNA (eDNA) is a well-established technique which identifies environmental or exogenous DNA molecules from aquatic or semi-aquatic organisms. The premise of eDNA is that all organisms shed genetic material into the environment. Water samples are collected, filtered and analyzed using a qPCR (quantitative polymerase chain reaction) technique to extract eDNA and identify organisms present within the aquatic environment. When genetic material found in the collected water sample matches with a known genetic primer for the target species or taxa, a positive result is provided by the production of fluorescence in the qPCR process. Genetic primers can be species-specific (i.e., based on matching 20 base pairs of a genetic sequence), or generic (i.e., identifying presence of particular taxa such as fish, amphibians, etc., based on a shorter genetic sequence of ten base pairs). One example of a generic test is the eFish primer, developed by the University of Victoria, and used extensively by Bureau Veritas (BV) Laboratory (Bureau Veritas, n.d.).

To support the Project, eDNA analyses was used to identify presence of fish in aquatic habitats underlain by the proposed WRSA using the eFish primer. While this primer has been calibrated primarily using fish species from western Canada, it has been confirmed to detect both American eel and brook trout. Environmental DNA analyses was performed at two sites with confirmed or suspected fish presence, and four sites where fish presence was not expected based on habitat assessments and fish collection completed from September 2019 through July 2020 (refer to Figures 6.9-2 and 6.9-4 for eDNA locations and trapping locations and Figure 6.9-3 for detailed trapping locations specific only to the WRSA). To date, fish collection effort within the WRSA footprint and downstream receiving environment has only resulted in identification of brook trout in WC23 (Sites 5 and 6). Fish collection has not been completed at Site 6; however, habitat assessments and a desktop review have identified contiguous surface flow between Sites 5 and 6, so it is expected that Site 6 is accessible to fish as well. Sample locations 1 through 4 were selected within watercourses WC20 and WC21, and within standing water within their respective wetland habitats. These sites are expected to be inaccessible to fish, based on the presence of the 250 m long subterranean barrier between WC21 and WC23. Sample locations are shown on Figure 6.9-3.

Additional details of eDNA analyses, sample site selection, and results are presented in Appendix J.2.

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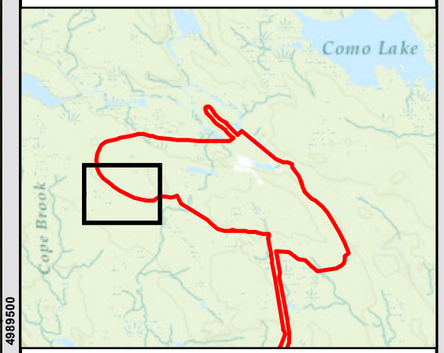
FIGURE 6.9-3

Beaver Dam Mine Project
Wasterock Storage
Intensive Trapping

WL233
WL220
WL222
WL222
WL234
WL235
WL221
WL223
WL227
WL205
WL226
WL236
A
WC21
WC22
WC20
WC24
WC23
B
Upland Forest
1 BKT, 20 May 2020
1 BKT, 20 May 2020
1 BKT, 16 June 2020
1 BKT, 3 July 2020
1 BKT, 21 Nov 2019
1 BKT, 18 May 2020
2 BKT, 6 July 2020
1 BKT, 13 May 2020
1 BKT, 22 April 2020
2 BKT, 18 May 2020
4990000
4989500
519500
520000
520500

- Eel Pot
- Fyke Net
- Minnow Traps
- Culverts
- Field Delineated Watercourses
- Electrofishing Survey
- Field Delineated Wetlands
- Proposed Infrastructure
- NSE Wetlands
- Project Area



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Units: Meter

0 50 100 200 m

1:4,000 Scale when printed @ 11" x 17"

Drawn By: MMD
Reviewed By: LP

Date: 2021-04-14

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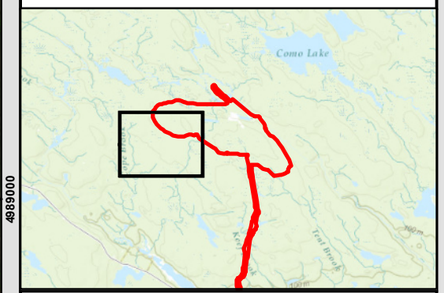
FIGURE 6.9-4

Beaver Dam Mine Project

eDNA Sample Locations and Results

WL220
WL205
WC-21
WC-22
WC-20
WC-24
WC-23
Upland Forest
1
2
3
4
5
6

eDNA results
- Negative
- Positive
- Suspected
- Field Delineated Watercourses
- NSTDB Mapped Watercourses
- Field Delineated Wetlands
- NSE Wetlands
- Proposed Infrastructure
- Project Area



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Datum: North American 1983 CSRS
Units: Meter

0 100 200 400 m

1:8,000 Scale when printed @ 11" x 17"

Drawn By: AS
Reviewed By: LP

Date: 2021-04-14

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6.9.4 Baseline Results

This section presents the most salient results of the baseline characterization studies for the Fish and Fish Habitat VC as well as related VCs, Surface Water Quantity and Surface Water Quality. Detailed results for Fish and Fish Habitat Baseline are presented in Appendix J.2; baseline results for surface water are presented in Section 6.7 (Surface Water Effects Assessment). As described in Section 6.9.3, this section has been updated to include results of the additional surveys required primarily related to habitat quantification and increased fish collection effort, driven by the modernized *Fisheries Act* and revisions to Project infrastructure/ micro-siting of Project infrastructure. Throughout Section 6.9.4, the results of the desktop evaluation for fish species distribution will be presented along with a summary of results from all baseline surveys described in Section 6.9.3.

The potential for each watercourse, waterbody, and wetland to support fish habitat and fish was evaluated throughout the FHAA at the Beaver Dam Mine Site including Cameron Flowage/Killag River, and along the Haul Road, as described in Section 6.9.3. Thirty-five (35) watercourses were identified within the Haul Road (Appendix J.4, Figure J.4-4) and 29 watercourses were identified within the Beaver Dam Mine Site (Appendix J.4, Figure J.4-3). Two waterbodies were identified within the Beaver Dam Mine Site (Crusher Lake and Mud Lake), both of which are confirmed fish frequented. A total of 236 wetlands were also evaluated for fish habitat potential, comprising 117 wetlands within the Beaver Dam Mine Site and 121 wetlands along the Haul Road, with two wetlands (wetlands 64 and 66) located partially within each component.

The underlying subsections present a summary overview of baseline characterization results.

6.9.4.1 Overview

6.9.4.1.1 Hydrological Setting

The Beaver Dam Mine Site lies within the West River Sheet Harbour secondary watershed (1EM-2), which is directly east of the Musquodoboit River Valley system. The watershed occupies an area of roughly 576 square kilometers (km^2). The West River Sheet Harbour watershed (WRSH) discharges to the West River and its tributaries, from north to south. Elevations within the catchment vary from approximately 135 to 165 meters above sea level (masl) in the headwater areas and gradually decrease to sea level at the final outlet located at Sheet Harbour. The headwaters of the drainage basin are located along the topographic divide separating the Musquodoboit River Valley to the northwest. Within the WRSA secondary watershed, the Project intersects eight tertiary watersheds (Killag River, Tent Brook, Paul Brook, Cope Brook, Tent Brook, Keef Brook, Jack Lowe Brook and Little River).

The WRSH watershed is one of 72 watersheds within the Southern Uplands (SU) region. The main river channel, the West River, is approximately 30 km long and has two main tributaries – the Killag and Little Rivers. Fish surveys within the watershed have been ongoing since 1965 and have documented a variety of species present. Of particular research interest has been the presence of Atlantic salmon and provision of salmon habitat within these rivers. According to Ducharme (1972), the Killag River is the most important of the three rivers for Atlantic salmon production due to the presence of excellent spawning grounds. Ducharme (1972) also identified that most of the salmon spawning within the watershed takes place in the Killag River.

The Killag River and Cameron Flowage are the main mapped linear watercourses adjacent to the Beaver Dam Mine Site, and Crusher Lake and Mud Lake are the major mapped lakes. The complex system of streams, lakes, bogs, and wetlands is a direct result of the underlying bedrock geology of greywacke and slate found in the region. The basin ultimately drains to the south via the West River Sheet Harbour, and discharge peaks are likely attenuated to a large extent by the numerous lakes and wetlands through which runoff is routed. Tertiary watersheds for the Project Area (PA) are presented in Section 6.7.4, Figure 6.7-4.

A portion of the Haul Road lies within the Tangier River secondary watershed (1EL-2, including tertiary watersheds associated with Sandy Pond and the Morgan River), and the Touquoy Mine Site exists within the Fish River-Lake Charlotte secondary watershed (1EL-5, including tertiary watersheds associated with Moose River, Square Lake and Scraggy Lake), detailed in Section 6.7.

6.9.4.1.2 Water Quality

Water quality baseline studies have been conducted in the Project area since 2014. Results indicate that overall, the aquatic ecosystem within the Beaver Dam Mine Site and Haul Road is characterized by acidic conditions, with aquatic features within the Cope Brook tertiary watershed exhibiting lower pH levels than aquatic features within the Killag River tertiary watershed. Low pH levels, elevated temperatures, low dissolved oxygen concentrations, and elevated concentrations of some metal parameters may limit fish habitat quality within select systems in the FHAA, particularly within small, sluggish first order streams and shallow open water features that experience with low water depths during the summer months. Additional discussion of water quality results for the FHAA is presented underlying.

The Project is in a highly mineralized region and the geology contributes to naturally acidic pH levels as well as elevated concentrations of many water quality parameters in the area, including iron, arsenic and aluminum (Section 6.7). The occurrence of naturally elevated concentrations in surface waters is commonly observed in regions of planned/proposed mining activities, all over the world (e.g., "Golden Triangle" of northwestern British Columbia, Canada). In such regions, naturally elevated concentrations of certain water quality parameters generally occur where exposure of rock or other geologic materials to oxygen and water results in natural weathering processes, including chemical oxidation and leaching of solid-phase constituents (e.g., metals), which are then transported to surface waters.

Natural acidity and/or exceedances of water quality guidelines in baseline conditions are not a Project effect and, for these parameters, generic water quality guidelines (WQG) such as Canadian Council of Ministers of the Environment Water Quality Guidelines for the Protection of Freshwater Aquatic life (CCME FAL), do not necessarily apply. That is, WQG generally represent generic criteria that are developed by governments or international organizations to identify the concentrations of parameters in the receiving environment that are not expected to cause an adverse effect on various receptors or uses (e.g., aquatic life, wildlife, livestock/agriculture, drinking water. As WQG are intended to apply universally, they do not necessarily account for site-specific factors including the presence/absence of specific species in the receiving environment, or naturally occurring elevated existing water quality due to mineralization of the watershed.

Monitoring results for the Killag River (identified receiving water for the Project) are presented in Section 6.7.5.2, Table 6.7-14; a summary of baseline exceedances for all sampling locations is presented in Section 6.7.5.2, Table 6.7-15. Detailed surface water baseline analytical results and guideline exceedance comparison are presented in Appendix G.1. In general, results indicated that the concentrations of most metals are typically low across the FHAA, often below detectable levels. However, three of the baseline water quality locations (i.e., SW-5, SW-10 and SW14A) located either within, or directly downstream of historic tailings, show metal concentrations exceeding guideline concentrations. During Construction, water impacted by historic activities will be treated as described in Section 6.7.9 and Appendix F.1 (Construction Water Treatment) of Appendix P.4 (Mine Water Management Plan).

The pH of waters in the PA range from circumneutral to acidic; for some monitoring locations proximate to the proposed Beaver Dam Mine Site, pH levels were below acceptable CCME FAL range suitable for fish within freshwater habitat (6.5 to 9.0). In 2016, pH levels in WC4 and Cameron Flowage were recorded within the acceptable CCME FAL range at 6.55 and 6.71, respectively. All watercourses within the Haul Road surveyed in 2016 had recorded pH levels below the range suitable for fish within freshwater habitat. The pH range for aquatic features sampled in 2020 was 4.44 to 7.03, with an average pH of 5.47. Only three sampling sites (Watercourses 13, Cameron Flowage, and WL59) exhibited pH levels within CCME recommended range for freshwater

aquatic life (6.5 to 9.0). Twenty-eight percent (28%) of measurements recorded in-situ during fishing efforts and habitat assessment exhibited pH levels so low (<5.0) as to expect to cause harm to salmonid species. Most of these low pH measurements were recorded in first order streams within the Cope Brook tertiary watershed (WC20, WC21, and WC23). Streams within the Cope Brook tertiary watershed were generally more acidic than those in the Killag River tertiary watershed.

Water temperatures recorded during electrofishing and fish collection in September 2015 and June 2016 ranged from 13.5°C to 23.43˚C. Generally, this range of water temperatures fell within the required ranges for the species expected to inhabit aquatic features within the Beaver Dam Mine Site and Haul Road. Temperatures recorded in WC13 and Wetland 59 in the Beaver Dam Mine Site, and WC-B and WC-AA within the Haul Road were above the optimal range for salmonids (>20°C). The majority of watercourses sampled within the Beaver Dam Mine Site (78%) and Haul Road (71%) had recorded temperatures within the optimal range for cold-water fish species.

In 2020, most watercourses assessed within the Killag River tertiary watershed displayed a general warming trend from early to late summer, with the majority of surveyed watercourses within the Beaver Dam Mine Site measuring at or above 20˚C by the end of August. Of the waterbodies and open water features surveyed in 2020, suitable temperatures for cold-water species were consistently recorded in Crusher Lake. The Mud Lake Outlet (WC27) was also regularly measured as below 20°C, except for one temperature recorded in July. The flooded portion of WL59 ranged above and below 20°C throughout the summer months. WL59 had the highest recorded temperature of all sites at 27°C, and no areas of thermal refuge under 20°C were identified through measurements taken throughout the flooded area during habitat assessments completed on July 21, 2020.

Dissolved oxygen (DO) levels recorded in 2015 across watercourses and waterbodies within the Beaver Dam Mine Site were above the recommended concentrations for both life stages of cold-water biota (>9.5 mg/L). DO levels recorded in the Beaver Dam Mine Site in 2016 (Cameron Flowage and benthic sampling sites) are considered suitable for other life stages of cold-water fishes (>6.5 mg/L). Along the Haul Road, most watercourses had DO levels suitable for other stages of cold-water fishes, with the exception of WC-B (3.9 mg/L) and WC-O (5.3 mg/L). These dissolved oxygen levels are considered limiting to both warm-water and cold-water fish species.

In 2020, ninety-seven percent (97%) of DO levels recorded across aquatic features within the Beaver Dam Mine Site were below the minimum CCME FAL recommended concentration of DO for early life stages of cold-water fishes. Forty-eight percent (48%) of DO levels recorded for watercourses were below levels suitable for any life stage of cold-water fishes, and 44% were below levels suitable for any life stage of cold or warm-water fishes (<5.5 mg/L). Low dissolved oxygen levels were typically associated with small, slow-moving streams and lentic habitats whose riparian habitat is dominated by organic wetlands, including WC20, WC21, WC25, WC26, and WL59. Warmer water temperatures recorded in 2020 is also a likely driver of lower DO levels recorded the Beaver Dam Mine. Most aquatic features within the Beaver Dam Mine Site were at some point measured as having DO concentrations suitable for aquatic life. However, it is likely that DO concentrations within some of these features limit the quality of fish habitat, at least seasonally, and particularly for cold-water species like salmon and trout.

6.9.4.1.3 Benthic Macroinvertebrates

Detailed results including species identifications, summary statistics, and sediment descriptions are provided in Appendix H of the 2019-2020 Baseline Report (Appendix J.2).

Samples were dominated in numbers by Diptera (fly) larvae, principally midges (Chironomidae) at all sites and by juvenile clams (Bivalves), predominantly Sphaeriidae at Watercourse 13. Caddisfly larvae (Trichoptera) occurred frequently at all sites with the exception of one (WC-B.b), and may fly larvae (Ephemeroptera) occurred at twelve of the fourteen sites. Aquatic beetle larvae (Coleoptera), dragonfly/damselfly larvae (Odonata), stonefly larvae (Plecoptera) and dobsonfly/fishfly larvae (Megaloptera)

occurred frequently at most sites. Aquatic Hemiptera (i.e., Gerridae, Corixidae, etc.) also occurred in many of the sites, as well as crustaceans, including the amphipod *Hyalella azteca* (found only at Watercourse 13), and copepods and cladocera (found at a total of eight sites).

Overall abundance and taxon richness within FHAA were low to moderate (110 to 947 individuals/sample and 10 to 31 taxon, respectively). EPT ratios were low at eight of the sites (0.5 to 8.4%), including all watercourses sampled within the Beaver Dam Mine Site, and moderate (16.1 to 50.2%) at the remaining sites (Watercourse N, V, AH, O), all along the Haul Road. The occurrence of EPT groups (Trichoptera, Ephemeroptera and Plecoptera) at most sites suggests that dissolved oxygen and water quality is acceptable, as these groups generally are associated with aquatic habitat having good water quality. However, there are many factors that regulate the distribution and abundance of benthic macroinvertebrates within aquatic environments (as well as biological condition within a waterbody), thus the results of this study only allow for the establishment of baseline conditions that can later be used in a monitoring program to identify potential changes to water quality within these specific environments.

6.9.4.1.4 Atlantic Salmon

The evaluation of expected and potential direct and indirect impacts to fish and fish habitat is being made for all fish species confirmed present within the Beaver Dam Mine Site and Haul Road as required under the *Fisheries Act* (2019). However, a special focus has been paid to Atlantic salmon due to their current population status and the significant habitat restoration efforts undertaken within the WRSH watershed, which is one of the 72 watersheds within the Southern Uplands (SU) Designatable Unit population for Atlantic Salmon.

North American Atlantic salmon breed and spend the early part of their life cycle in freshwater systems throughout Atlantic Canada, eastern Québec, and the northeastern seaboard of the United States. This species requires rivers or streams that are generally clear, cool, and well-oxygenated for reproduction and the first few years of rearing but undertakes lengthy feeding migrations in the North Atlantic Ocean as older juveniles and adults (COSEWIC 2010). The genetic structure and life history traits of Atlantic salmon tend to vary among river populations and this variation among salmon rivers tends to increase with geographic distance. That is, salmon populations are more closely related the nearer their home rivers are located to each other. As a result, DFO manages groups of salmon rivers as metapopulations, called Designatable Units (DUs), based on geography and unique genetic and life history traits (COSEWIC 2010). Based on these features, Atlantic salmon populations are managed under 16 distinct DUs. Among these DUs, COSEWIC has identified five as Endangered (Outer Bay of Fundy, Inner Bay of Fundy, Southern Uplands, Eastern Cape Breton, and Anticosti Island metapopulations). The West River is located within the Southern Uplands DU (Appendix J.3 draft Fish Habitat Offset Plan).

The SU population of Atlantic Salmon has experienced significant reductions over the last few decades, with adult abundance declining from 88 to 99% from observed abundances in the 1980s (DFO, 2013). Salmon assessment activities in the SU region are currently focused on two index populations: the St. Mary's River, and the LaHave River. As of 2019, index populations remain critically low (DFO, 2020). According to DFO (2013), all 22 rivers where juvenile Atlantic salmon were found during 2008/2009 surveys are considered important habitat for SU Atlantic salmon.

Threats to persistence and recovery of SU Atlantic salmon in freshwater environments have been identified by through the Recovery Potential Assessment (DFO, 2013). Threats in freshwater environments that have been recognized with a "high level of overall concern" (DFO, 2013) include: acidification, altered hydrology, invasive fish species, habitat fragmentation due to dams and culverts, and illegal fishing and poaching.

Acidification of freshwater habitats brought about by acidic precipitation is a major, ongoing threat (COSEWIC 2010). Anthropomorphic deposition exacerbates a naturally acidic region where natural sources such as wetlands dominated by

Sphagnum mosses and forests, as well as underlying geology, produce low pH surface waters (NIVA 2001). Even with reduced deposition in recent years, the natural alkalinity is low in the SU region due to natural underlying geology of the system, which results reduced cation-generating capacity, very slow natural neutralization and low natural buffering capacity (DFO 1998; Ritter and Rutherford 2000; MAPS 2013). While sulphate levels have shown significant declines between 1981-1995 (DFO 1997), it did not lead to immediate improvements in river pH due to the low natural buffering capacity (MAPS 2013). Of 60 salmon rivers previously assessed for mean annual pH:

- 14 were identified as extirpated (mean annual river pH less than 4.7);
- 20 were identified as severely impacted (mean annual river pH between 4.7 to 5.0);
- 16 were identified as lightly impacted (mean annual river pH between 5.1 to 5.4); and
- 13 were identified as not impacted (mean annual river pH greater than 5.5) (DFO 1997).

Only rivers with pH greater than 5.4 have non-impacted salmon populations within the SU region of Nova Scotia (NIVA 2001). Mean annual river pH values less than 5.4 are thought to adversely affect salmon spawning success and survival rates (MAPS 2013) and a mean annual river pH less than 5.1 can destabilize salmon productivity (Bowlby et al. 2013).

The Nova Scotia Salmon Association (NSSA) is currently conducting an Acid Mitigation Project in tertiary watersheds that are located within the FHAA for SU Atlantic Salmon populations. In order to offset the acidity of watercourses and improve water quality for Atlantic salmon, the project uses in-stream liming using lime dosing stations installed on the West River Sheet Harbour main branch in 2005 and on the Killag River in 2017, downstream of Cameron Flowage (Appendix J.4, Figure J.4-1). The lime dosing stations are automated systems which contribute specific dosages of powdered limestone directly to the watercourse. Terrestrial/catchment liming via helicopter has ongoing since 2016 with a focus on the headwater riparian areas the Keef Brook (1EM-2G), Paul Brook (1EM-2H) and Tent Brook (1EM-2F) tertiary watersheds (Section 6.7.4, Figure 6.7-4). As a result of the Acid Mitigation Project, treated river pH has increased to 5.5 to 7.5 in the main branch of the WRSH (Halfyard, 2013). The Acid Mitigation Project has also included physical habitat restoration within the West River, fine sediment removal from spawning habitat within the West and Killag Rivers, and terrestrial liming within the catchment area of Keef Brook (NSSA, 2020).

Further details related to Atlantic Salmon in the SU DU and the Acid Mitigation Projects are provided in the Cumulative Effects Assessment (Section 8) (NSE-2-123).

6.9.4.2 Site Specific Study Results

6.9.4.2.1 Fish Habitat: Beaver Dam Mine Site

Fish habitat potential was determined during field identification/delineation through the collection of key fish habitat characteristics of each watercourse and wetland including channel morphology, biophysical descriptions. Quantitative fish habitat assessments revealed suitable habitat for spawning, young of the year, juvenile, and adult life stages for both cold and warm-water species throughout the FHAA. The following subsections provide fish community descriptions by watercourse; detailed fish collection discussion are provided in Appendix J.2 and Section 6.9.4.2.3.

Identified Watercourses and Waterbodies

A summary evaluation of each identified watercourse and open water feature, and the fish species/life stages they support, is provided in Tables 6.9-2 and 6.9-3 and described in further detail in Appendix J.2; watercourses are shown in Appendix J.4, Figure J.4-3.

Within Table 6.9-2, average depth and average velocity are presented as a summary of a minimum of three measured depth and velocity points per transect, as described in the MEL SOP for detailed fish habitat assessments in streams (Appendix B of Appendix J.2). Wherever a range of wetted widths and channel widths are provided, it indicates the range of multiple transects completed within that reach. If, for instance, one reach contained multiple small (<5 m in length) individual units, they were grouped together into one reach, and one transect per habitat type was completed. Complete measurements for each transect within each reach (including each depth and velocity measurement) are provided in Appendix G of the 2019-2020 Baseline Report (Appendix J.2). Qualitative descriptions of each watercourse and waterbody throughout the Beaver Dam Mine Site and Haul Road components of the FHAA are described in Appendix G.4, and fully outlined throughout the 2015-2017 Baseline Report (Appendix J.2).

All waterbodies identified within the Beaver Dam Mine Site (Crusher Lake, Mud Lake) have been confirmed to provide fish habitat. Open water features in wetlands confirmed or presumed to provide fish habitat are described below and displayed on Figure J.4-2 of Appendix J.4. It should be noted that Cameron Flowage while exhibiting both lotic and lentic-like habitat qualities as a contiguous feature with the Killag River, had been considered a waterbody within the context of the Revised 2019 EIS (AMNS 2019), to distinguish it from the more riverine portion of the Killag River. The NSE definition of watercourse includes rivers, lakes, streams, creeks, ponds, etc., so the classification of Cameron Flowage as a waterbody was based on physical parameters, not the regulatory definition. For clarity and consistency with the surface water quality and quantity modelling methods and results, Cameron Flowage is now classified as a watercourse (IR2 NSE-2-121 [AMNS 2021]).

A detailed description of all watercourses that have been evaluated for direct and indirect impacts inside the FHAA is provided in the following sections.

Cameron Flowage – Killag River

Cameron Flowage, located at the northeastern edge of the FHAA, is the primary receiver for most surface water originating from within the Beaver Dam Mine Site prior to it draining offsite through the Killag River to the southeast. No dams or other barriers to fish passage have been observed on Cameron Flowage. The Killag River commences north of Cameron Flowage (Tait Lake) that is located directly northeast of the Beaver Dam Mine Site. The Killag River is one of two major tributaries to the WRSH. The Killag has a rather long and narrow drainage basin, with a main channel length of approximately 27 km. The Killag River system has several associated waterbodies, such as Tait Lake. West Lake, Mud Lake and Crusher Lake are associated with sub-tertiary basins that are tributaries to the Killag River (Section 6.7.4, Figure 6.7-4).

Both Cameron Flowage and the Killag River were selected for focused fishing surveys during the 2019-2020 field program to provide additional baseline data for anticipated future monitoring programs. In December 2020, modified fish habitat surveys were performed within a 1.7 km stretch of this system, from the top of Cameron Flowage (Killag River entrance) to approximately 100 m downstream of the Beaver Dam Road bridge (downstream of the lime doser). Nine cross-sectional measurements (i.e., transects) were taken at representative habitats throughout the system by boat or by wading (Appendix J.4, Figure J.4-2). However, it is important to note that these surveys were performed during high flow with various instances of bankfull flooding; as such, depths and velocities presented below are reflective of high flow conditions.

The Killag River enters Cameron Flowage from the northeast as a series of rapids through a channel width of 10 m. Water depths and velocities measured here at the time of the assessment ranged from 28 to 60 cm, and 0.91 to 1.11 m/s respectively. Substrate was observed to be an even mix of boulder, rubble, and cobble.

As a wide, low velocity flat, habitat within Cameron Flowage is homogenous throughout the first 1 km length. Organic peatlands surround approximately 25% of Cameron Flowage, which is concentrated along its south eastern and northern shorelines. Emergent and floating wetland vegetation is present in the littoral zone adjacent to wetland habitat. Shoreline substrate is comprised of boulders, rubble, and cobble in a muck matrix, which transitions muck-dominance away from the shore. Widths measured along transects ranged from 59.4 to 76.8 m, and maximum water depths and velocities of 3.7 m and 0.16 m/s were recorded. The remaining 200 m length of Cameron Flowage transitions back into a wide, homogenous flat.

A pinch-point (relatively narrow riffle), located approximately 1 km downstream of the inlet of the Killag, separates the two wider flats of Cameron Flowage. Here, the channel confines to a width of 13.7 m, with water depths and velocities at the time of assessment ranging from 38 to 52 cm and 0.61 to 0.80 m/s, respectively. Substrate within the riffle is a boulder, cobble, and rubble mix with traces amounts of muck.

From the outlet of Cameron Flowage to approximately 100 m downstream of the Beaver Dam Road Bridge, the Killag River forms a series of runs, riffles, and slower flats and pools. Channel widths range 7.5 m in confined runs to 14.6 m in wider flats. Water depths and velocities are variable, with depths ranging from 33 cm to just over 1 m in deeper flats and pools, and velocities ranging from slack to 0.45 m/s in faster runs. Immediately downstream of the lime doser, channel width is constricted by constructed banks of riprap. At the time of assessment (December 2020), maximum velocity in this area was measured as 1.2 m/s, and depths ranged from 14 to 71 cm. Boulder, rubble, and cobble-sized rock dominate substrate throughout the surveyed area of the Killag River.

During the 2019-2020 field program, three rounds of trapping efforts (early, mid, and late summer) resulted in the capture of seven species of fish. Species captured included American eel, creek chub, and brook trout, which were not reflected in trap surveys performed during 2015 baseline studies, and banded killifish, golden shiner, white sucker, and yellow perch. Banded killifish made up the vast majority of individuals captured. Within Cameron Flowage, suitable spawning habitat is available for generalist species that show preference for vegetation and soft substrates within lentic environments, including banded killifish, golden shiner, and yellow perch. Spawning habitat for brook trout, white sucker, and creek chub is limited, given the overall lack of clean gravel substrates observed within the along the shoreline. Cameron Flowage also supports both juvenile and adult life stages of American eel with soft substrate and a diversity of cover types.

The Killag River recorded the highest abundance of fish of all sites surveyed during the 2019-2020 field program. The Killag River was also the only site with confirmed presence of Atlantic salmon, with four individual parr captured in July 2020. Additional schools of small (<20 mm) white sucker were also observed during electrofishing surveys but were unable to be captured and are not reflected in population estimates. The Killag River is considered the location of most salmon spawning within the WRSH watershed (Ducharme, 1972), and the most important of the three major rivers (Killag, West, and Little) for overall salmon production. Brook trout, white sucker, and lake chub are also presumed to spawn in this system, which also provides habitat for juvenile and adult American eel.

WC5

WC5 is a permanent watercourse begins as a first order stream draining northward from its headwater wetland source (WL2) towards Crusher Lake. From Crusher Lake, the watercourse continues northward to Mud Lake, collecting flow from smaller mapped watercourses (WC3, WC6, and WC9) along its path.

During the 2019-2020 field program, quantitative electrofishing surveys were conducted within two reaches of WC5 – one south of Crusher Lake and one north of Crusher Lake (Figure 6.9-2). In addition, a detailed fish habitat assessment was conducted along the entirety of the lower reach from the outlet of Crusher Lake to its confluence with Mud Lake (approximately 830 m of linear watercourse). During the detailed habitat assessment, the watercourse was delineated into eight homogenous fish habitat reaches.

Reach 1 begins at the outlet dam of Crusher Lake. This historic, unmaintained dam is owned by the current landowner (Northern Timber) and has been naturalized over time, being infilled by a beaver dam. Reach 1 is a 15 m long high-gradient (20% slope), highly entrenched cascade. Substrate in this area is dominated by boulders, with rubble, cobble, and bedrock present in lesser amounts. Abundant cover is provided by large woody debris and boulder substrate. Channel and wetted widths are 2.0 and 1.2 m, respectively, and average water depth is 11 cm. This reach has been assessed as a permanent barrier to upstream migration for most fish. In addition to the high gradient, there is a 1.3 m vertical drop within the cascade series which ends in a plunge pool with a maximum depth of 20 cm.

After the cascade series, the watercourse transitions into a flatter, 55 m long series of riffle-runs with occasional chutes (Reach 2). Run habitat is the dominant habitat type within this reach. Channel and wetted widths range from 1.7 to 4.0 m and 0.9 to 1.2 m, respectively, and gravel substrates dominate the streambed, which is characterized as a mixture of larger to smaller rocky substrates. A small amount of cover is provided by overhanging vegetation, boulder, and large woody debris. Average water depth within this reach is 7 cm.

Within WL14, the watercourse transitions into a low gradient, low velocity flat connected by short riffle sections for a length of 195 m (Reach 3). Average water depth deepens to 39 cm, and channel and wetted widths range from 1.6 to 2.5 m and 1.3 to 1.7 m, respectively. Deep muck is the dominant substrate type within the flats, rocky substrates dominate the short riffle sections. Moderate cover is provided in various forms (i.e., deep water, overhanging vegetation, undercut banks, boulders, and large woody debris). There are currently two beaver dams located approximately 20 m from the downstream end of the reach which lie approximately 25 m apart.

Reach 4 is characterized as a 66 m long series of beaver dams and debris impoundments (pools) connected by short run sections. Two beaver dams were documented within the reach – one located approximately 35 m from the start of the reach, and another at the end of the reach. Muck substrate dominates the pool sections whereas rocky substrates (bedrock, boulder, and rubble) dominate the short run sections. Channel and wetted widths through the reach are 2.3 m and 1.7 to 1.8 m, respectively, and average water depth is 28 cm. Abundant in-stream woody debris provides the dominant cover types, while boulders, deep pools, and overhanging vegetation provide other forms of cover.

The channel then transitions into a 53 m long riffle-run series, with run as the dominant habitat type. A short debris impoundment (pool habitat) also exists at the downstream extent of the reach. Channel and wetted widths within this section range from 2.1 to 3.2 m and 1.4 to 2.9 m respectively, and average water depth is 0.09. Rubble dominates the substrate present in the riffle-run series, which also contains boulder, cobble, and small amounts of gravel of sand, while muck and rubble co-dominate the substrate within the impoundment pool. Moderate cover is provided by a mix of large woody debris, boulders, undercut banks, and overhanging and emergent vegetation.

From Reach 5, the watercourse de-channelizes through mixed-wood forests, following multiple flow paths for 43 m (Reach 6). Debris jams are present throughout the reach, and boulders dominate the substrate. Within this reach, the average depth of surface water (often occurring between boulders when present) is 24 cm. This reach is thought to pose a navigational challenge to fish species, however, is likely passable and therefore to be conservative, fish passage has been considered based on periodic navigation.

WC5 re-channelizes at Reach 7, which is characterized by a series of a variety of minor habitat types (rapid, run, flat, pool, and cascade). Channel and wetted sections within this reach range from 1.7 to 2.3 m and 0.9 to 2.3 m, respectively, and average water depth is 9 cm. Boulders dominate the substrate, which are intermixed with rubble, cobble, and bedrock. Trace amounts of gravel and muck were also documented. Cover is provided through overhanging vegetation, boulders, and large woody debris.

The final reach (Reach 8) begins as WC5 transitions into low-gradient habitat within WL17. The remaining 340 m of linear watercourse is described as a low velocity flat characterized by deep muck substrate and highly embedded boulders. Channel and wetted widths range from 1.4 to 3.6 m, and average water depth is 48 cm. Overhanging and flooded wetland vegetation, undercut banks, and deeper water provide abundant cover. The reach ends as the watercourse discharges into Mud Lake.

No fish were captured in WC5 south of Crusher Lake during either the 2015 baseline electrofishing surveys or during three rounds of electrofishing conducted during the 2019-2020 field program. North of Crusher Lake, one individual brook trout and three northern redbelly dace were captured during 2015 surveys (Appendix J.2). Over the three electrofishing rounds conducted in Summer 2020, one additional species, lake chub (1 individual) was captured along with brook trout. Population estimates calculated for WC5 peaked in July, with 32 ± 8 individuals. Of all fish survey sites sampled during the 2019-2020 field program, WC5 was the second most productive in terms of brook trout abundance, with 48 individuals captured, accounting for 98% of the total number of fish captured over the three electrofishing surveys (48 of 49 individual fish).

Additional species have been presumed present, specifically within the lowest reach (Reach 8) of WC5, based on direct connectivity, species confirmed, and similar habitat characteristics with Mud Lake. Species that are likely to be present include American eel, banded killifish, brown bullhead, golden shiner, ninespine stickleback, white sucker, and yellow perch.

WC5 provides habitat for a variety of life stages of species confirmed and presumed to be present through the delineated fish habitat reaches. In general, Reaches 1 through 7 are considered to provide a variety of suitable habitats for brook trout, lake chub, northern redbelly dace, and American eel. Of the probable species likely to occur in WC5 due to contiguity with Mud Lake (but not confirmed), American eel was the only species presumed to be present in these reaches (confirmed in Mud Lake) based on their capacity to navigate over and through barriers. Shallow, higher velocity riffle areas dominated by smaller rocky substrate are considered to provide suitable substrate for brook trout and lake chub, while low velocity pools and flats provide suitable spawning areas for northern redbelly dace. Reaches that present a variety of cover types provide suitable habitat for juvenile brook trout and juvenile and adult American eel. Reaches 1 through 7 largely contain multiple, shorter habitat types, and therefore provide a variety of suitable habitats, though the extents of these habitat are naturally small-scale. Reach 6 is considered to provide seasonal passage only. Reach 8 provides suitable habitat for all life stages of banded killifish, brown bullhead, ninespine stickleback, northern redbelly dace, and yellow perch. Suitable habitat was also identified for juvenile and adult American eel, as well as adult life stages of brook trout and white sucker.

WC12

WC12 is a first order stream originating in upland habitat east of WL56. The watercourse disperses through WL56, eventually re-channelizing within the wetland's eastern lobe. The watercourse exits the wetland via culvert under a forestry road and continues east to WL59. It has been described as an ephemeral groundwater seep. Evidence of groundwater seepage into WC12 was suggested by the presence of ferrihydrite; an orange, bacterial slime which often occurs where groundwater reaches the surface. Substrate is dominated by cobble, with lesser amounts or rubble, gravel, and muck. Average channel width is 1 m, and the channel is almost completely shaded by riparian vegetation, mainly in the form of tall shrubs.

No fish surveys were conducted during the 2019-2020 field program. During 2015 baseline surveys, however, three juvenile brook trout were captured in WC12 via electrofishing. It is presumed, therefore, that WC12 may provide suitable juvenile and adult brook trout habitat at some point of the year. Also, Grant and Lee (2004) suggest that groundwater upwelling, as opposed to water velocity, is probably the most critical factor in brook trout spawning site selection. In addition, brook trout have been documented to spawn over silt and detritus providing there is groundwater seepage (Witzel and MacCrimmon, 1983).

Based on the likely presence of groundwater seepage within WC12, the watercourse has been assessed as suitable for brook trout spawning. However, the use of habitat by fish in WC12 is extremely restricted, and is likely only accessible during a small, very wet window of any year.

WC13

WC13 is a second order stream which serves as the outlet channel of WL59. Open water habitat has been created in WL59 through construction of a berm to support historic mining activities in the 1980's. The berm which forms this system has not been maintained, and the culvert and berm are in disrepair. In close proximity to the berm, WC13 (which is the main outlet flowing through the berm/culverts) has been affected by failure of the berm, and fish passage into W5 may be limited for some species. From WL59, the watercourse flows northeast for approximately 280 m through WL61 before emptying into Cameron Flowage. Watercourse WC13 generally contains shallow, higher velocity riffle areas dominated by smaller rocky substrate that are considered to provide suitable substrate for brook trout, creek chub, lake chub, and white sucker based on spawning and rearing habitat preferences of these species (reaches 1, 3 and 5).

Vegetated, low velocity flats and pools also provide suitable spawning habitats for banded killifish, brown bullhead, nine spine stickleback, and northern redbelly dace, and provide rearing habitat for young of the year lake chub (reaches 4 and 5). Suitable juvenile and adult American eel habitat is concentrated in areas of soft substrate and the presence of a variety of cover types (reaches 2, 4 and 5).

WC14

WC14 is an intermittent, first order stream located south of Cameron Flowage, and serves as one of two tributaries to WL59. The watercourse received a detailed fish habitat assessment on July 13, 2020, during which the watercourse was delineated into three homogenous reaches. The upper reach (Reach 1A) is one of two upper branches within the watercourse. It is a 30 m long run, with habitat assumed based on conditions during high flow. At the time of the assessment, the watercourse was mostly dry and only residual, shallow pockets of water remained with an average depth of 9 cm, channel width of 50 cm, and rubble as the dominant substrate, which is intermixed with lesser amounts of muck. Overhanging riparian vegetation (predominantly tree branches) is the major source of cover within the reach.

Reach 1B is the second upper branch within the watercourse and 115 m in length, transitioning between steep, step-pool habitat and areas of no defined channel. Like Reach 1A, this channel was predominantly dry during the assessment, with water restricted to residual, isolated pockets with an average depth of 3 cm, while areas of no defined channel (non-channelized areas of forest drainage) were completely dry. Channelized areas have an average width of 1 m. Large woody debris provides a moderate amount of instream cover, while muck and detritus dominate substrate, with lesser amounts of rubble.

As Reach 1B and 1A converge, the channel becomes contiguous, high-gradient (18% slope), 32 m long series of step-pools. Substrate is dominated by rubble, but also contains boulder, cobble, gravel, and muck. At the time of the assessment, average water depth within residual pools was 3 cm. Average channel width within this reach is 1.3 m.

Electrofishing in WC14 resulted in no fish capture, likely due to dry channel conditions throughout most of the summer. Probable fish presence, based on confirmed species within downstream, fish bearing systems, as well as habitat suitability within the watercourse, include brook trout and American eel.

Suitable, seasonal juvenile and adult brook trout habitat is present throughout the watercourse, provided that fish can access the upstream reaches through the high-gradient of Reach 2 and non-channelized areas of reach 1B. Potential brook trout spawning habitat is restricted to reach 2, which provides a small amount of suitable spawning substrate and probable groundwater seepage. Habitat for adult American eel was documented throughout the watercourse, with more suitable juvenile habitat (deeper muck) provided in reaches 1B and 2. It should be highlighted that these habitat provisions are temporally restricted and are not viable or accessible during periods of low flow.

WC23

Located in the lower western lobe of the PA, WC23 is a first order stream within the Cope Brook tertiary watershed that commences in a boulder field at the southwestern extent of the 250 m expanse of upland forest. This section of upland forest presents a barrier to fish passage which is explained fully in Section 4.1.6 of the 2019-2020 Baseline Report (Appendix J.2). In a letter dated February 23, 2021, ECCC confirmed that watercourses upstream of WC23 (WC 20, 21, 22 and associated wetland habitat) are not considered waters frequented by fish. WC23 forms at the bottom of this upland forest section, and it is considered fish frequented waters, confirmed by fish collection efforts.

Approximately 1 km of the uppermost extent of the watercourse has been surveyed for fish habitat. The surveyed portion of WC23 has been delineated into three homogenous fish habitat reaches and have been described below. After accumulating surface water through the boulder field, WC23 flows southwest, transitioning into a flat characterized by low gradient, low velocity, and muck substrate within a slightly entrenched channel through forested swamp. Boulders comprise approximately 25% of the total substrate. In this reach, channel widths and wetted widths range from 4 to 4.1 m and 2.3 to 3.5 m, respectively. Average water depth throughout this reach is 18 cm, and a moderate amount of cover is present which is largely provided by overhanging trees and a smaller amount of woody debris. In-stream vegetation is scarce. This reach is approximately 150 m in length.

Within the second reach, WC23 remains as a low gradient flat but transitions into a dense alder swamp, with alder shrubs overhanging the entire channel width, and submerged trunks and branches heavily criss-crossing the watercourse channel. Heavy cover is provided by these overhanging and intruding alders, submerged woody debris, and in-stream vegetation. Flow is visibly stagnant, and average water depth is 12 cm. Muck remains the dominant substrate, with lesser amounts of boulder present than in Reach 1. The watercourse flows south for another 150 m, before crossing a forestry road through a corrugated steel culvert.

Reach 3 begins below the culvert. This reach is 754 m in length and is characterized by low gradient flats separated by sections of subterranean flow and a short section of high gradient step-pool habitat. Within the wetted portions of the watercourse, channel

and wetted withs range from 1.1 to 5.3 and 0.9 to 3.0 m, respectively. Substrate is dominated by muck, with lesser amounts of boulder, bedrock, and rubble. Low velocity dominates throughout the reach with the exception of the short step-pool habitat, and average water depth is 20 cm. Cover is mainly provided by overhanging vegetation and large woody debris.

At the time of assessment, there were four documented sections of subterranean flow within the third reach. The lengths of these subterranean areas range from 6 m to approximately 230 m. These areas are characterized by expanses of vegetated boulder fields with no visible surface flow, though unlike the barrier the area lacks soil and flow is mostly audible beneath the boulders, and as such has been defined as a boulder-bed channel. These areas have been assessed as seasonal barriers to fish passage, as water levels are expected to rise between and above the level of the boulders during periods of high flow. Though not complete barriers, it is likely that these subterranean sections restrict passage by acting as navigational obstacles to upstream and downstream migration.

Throughout the extensive electrofishing and trapping efforts performed during the 2019-2020 field program, only seven brook trout were captured in WC23, with a maximum of two individuals caught during any single survey. No suitable spawning or young of the year habitat within WC23 was identified, but all three reaches have been assessed as supporting juvenile and adult brook trout. The low abundance of trout within the watercourse is likely be attributed to a several factors: the absence of suitable trout spawning and young-of-the-year rearing habitat, the presence of multiple seasonal barriers to downstream and upstream migration, and water quality. Although recorded temperatures remained optimal for brook trout throughout the year, pH levels in WC23 demonstrate that on average, the pH is low enough to potentially cause harm to salmonid species (<5.0).

WC25

WC25 exists as the outflow from Wetland WL61. It is a short, first order stream that travels 33 m before emptying into Cameron Flowage. It consists of a short riffle section followed by a low gradient flat. The short riffle exists immediately downstream of the pond where the channel is barely visible, only slightly entrenched from the surrounding wetland habitat. Water depths do not exceed 1 cm and is likely a seasonal barrier to most fish, with the exception of American eel which have been documented to traverse over land in wet, low lying grass habitats (MacGregor et al., 2011). The channel then widens up to 1.0 m and continues as a low gradient, low velocity flat to Cameron Flowage. A relatively small amount of instream cover (10%) is provided by wetland vegetation adjacent to the watercourse. Muck substrate is present throughout the watercourse.

WC25 provides suitable spawning and young-of-the-year habitat to banded killifish, golden shiner, and yellow perch through flooded wetland vegetation and soft substrate in a low velocity stream, though instream vegetation is not abundant. The watercourse may also support juvenile and adult American eel, as well as adult white sucker. Dissolved oxygen levels in WC25 may limit fish production at least seasonally, which was measured in September 2020 as well below the CCME recommended guidelines for any life stage of cold or warm-water fishes (3.6 mg/L).

WC26

WC26 is a first order stream that originates as flow accumulation within WL207, located along the northwestern edge of the PA. The watercourse flows north for approximately 800 m through wetland habitat before discharging into a wide, flat area of the Killag River. The entire watercourse was described through a detailed fish habitat assessment and was delineated into two homogenous reaches.

The uppermost reach (205 m) is described as flat with sections of no defined channel – surface water exists largely as intermittent, isolated pockets of surface water within wetland habitat with an average depth of 34 cm. Substrate is mostly contiguous wetland surface, with some exposed areas of muck in more inundated areas. Abundant cover is present in the form of inundated wetland

vegetation and filamentous algae. During low flow conditions, areas comprising surface water are isolated from each other, impeding fish passage through the reach. It is assumed that during high flow conditions, these inundated areas become hydrologically connected through surface flow. In addition, DO levels recorded throughout the summer within this reach were mostly well below the CCME recommended guidelines for any life stage of cold or warm-water fishes.

The remaining 600 m of habitat is characterized as a permanent, low gradient flat, with channel and wetted widths ranging from 0.7 to 4.7 m, widening as it approaches the Killag River. Abundant cover is available in the forms of overhanging and flooded emergent wetland vegetation, and submergent vegetation within the watercourse channel. Substrate is mostly comprised of muck, with sparse, embedded boulders present at the lower end of the watercourse.

Fishing efforts conducted during the 2019-2020 field program were concentrated within the uppermost reach of the watercourse (Figure 6.9-2). Only one individual ninespine stickleback was captured during the first survey in June, and no other fish were captured during successive surveys, supporting the designation of overall low-quality habitat. However, based on its direct connectivity with the Killag River and habitat characteristics, the lower reach of WC26 has been conservatively presumed to provide habitat for the following species: American eel, banded killifish, brook trout, brown bullhead, golden shiner, white sucker, and yellow perch. The abundant vegetation, low velocity, and soft substrates provide suitable spawning habitat for generalist spawners, including ninespine stickleback, banded killifish, brown bullhead, golden shiner, and yellow perch. No suitable spawning habitat was identified for brook trout or white sucker, but the lower 600 m of the watercourse likely provides refuge and foraging opportunities for adult stages of these species.

WC27 and Mud Lake

Mud Lake and the lacustrine WL17 are located in the northern portion of the Beaver Dam Mine Site. They receive water from WC5, which directs water from Crusher Lake north to WL17 and Mud Lake, flowing into a narrow strip of wetland which separates the eastern and western lobes of the lake. WC27 forms the outlet of Mud Lake, flowing north into the Killag River.

Mud Lake exists as an open waterbody within WL17. The entire shoreline of the lake is composed of this peat wetland, predominantly in the form of a low shrub fen. Adjacent to open water, the wetland consists of low ericaceous shrubs and graminoids. The littoral zone is gently sloped and unshaded by any forest canopy cover, but some shade is provided along the wetland edges by emergent and floating wetland vegetation when water levels are high. Substrate through the lake is composed of deep muck and decaying organic material. Within Mud Lake, the substrate is dominated by mud, with emergent vegetation along the edges when the water level is high. While bathymetry data was not collected for Mud Lake, the depth is not believed to exceed 2 m based on direct observation during wetland and fishing surveys.

The outlet of Mud Lake, WC27, directs water northwest to the Killag River. Like Mud Lake, the riparian area of WC27 is composed of wetland habitat in the form of a low shrub fen. In the spring, the riparian wetland floods which significantly extends the wetted perimeter of the outlet. In the summer, channelized flow narrows into multiple braids which meander through wetland vegetation. The characteristics of WC27 are quite similar to Mud Lake – it is more accurately described as a narrowed extension of the lentic habitat observed in Mud Lake than a true lotic watercourse. Still, a detailed habitat assessment was performed on the outlet via boat based on the methodology described in Section 6.9.3.2.2.

WC27 has been delineated into a single homogeneous reach of a low-gradient flat which extends for 228 m before emptying into the Killag River. The main channel ranges from 3.4 to 9 m wide, velocity is sluggish to visibly stagnant, and the average water depth is 58 cm. Substrate is 100% deep, organic muck - consistent with the substrate in Mud Lake. In-stream cover is abundant, primarily in the form of emergent and submergent vegetation (pickerelweed and various graminoids).

Trapping efforts in Mud Lake and WC27 resulted in the highest species diversity of all lentic sites. The majority of fish captured within this system are considered habitat generalists: golden shiner, banded killifish, white sucker, ninespine stickleback, yellow perch, and brown bullhead. Mud Lake and WC27 support these species' spawning stage by providing abundant in-stream vegetation and soft substrate in a low velocity environment. In addition, the deep muck and vegetation provide usable habitat for juvenile American eel. Although no spawning habitat for lake chub was identified, the system may support young of the year through adult life stages which have been documented over a wider variety of substrates. The system may also provide refuge and feeding opportunities for adult brook trout, but lacks the substrate, flows, and cover diversity to support spawning through juvenile life stages. Water quality within the system is described as generally acidic with areas of low DO but is not considered limiting to overall fish production.

Crusher Lake

The fish and fish habitat characterization of the lake has been updated based on the results of the 2019-2020 field program which included three rounds of trapping within its littoral zone. The lake is located in the central northern zone of the Beaver Dam Mine Site and receives flow from two tributaries. Water exits the lake over a historic, man-made dam which has since been impounded by beavers. Bathymetry data has not been collected for Crusher Lake, but it is estimated that the lake does not exceed 10 m in depth.

Organic peatland surrounds approximately 50% of the lake, which is primarily concentrated along the southern and western shorelines. Floating peatland extends into the waterbody in the eastern and western edges. These lacustrine wetlands support a community of submergent and emergent wetland vegetation (e.g., leatherleaf, Marsh St. John's Wort, and a variety of sedges). In spring, these wetlands flood providing additional seasonal fish habitat. In the summer, mud flats and residual, shallow pools can be observed within these peatlands, but are cut off from the central waterbody. Moderately sloped boulder-lined shores surround the remaining margins of the lake, which is dominated by mature upland forest. Deep, organic muck is the dominant substrate within the lake.

During the 2019-2020 field program, Crusher Lake had the lowest abundance of fish observed of all waterbodies and open water features. A total of five individuals were captured representing three species: brook trout, ninespine stickleback, and golden shiner. Crusher Lake is also known to support banded killifish and brown bullhead, though in low abundance, based on the results of baseline fish collection completed in 2016.

The lentic environment, in-stream vegetation, and soft substrate provide suitable spawning habitat for ninespine stickleback, golden shiner, and brown bullhead. However, no suitable spawning habitat (i.e., gravel shoreline) was identified for brook trout spawning. The lake is unlikely to support any life stage of brook trout other than adults, with provisioning restricted to refuge and foraging opportunities.

Non-Fish Frequented Provincially Regulated Watercourses

Nine additional watercourses within the Beaver Dam Mine Site were identified as provincially regulated, but are not considered fisheries resources. These watercourses are hydrologically isolated, meaning there is no contiguous surface water connecting these watercourses with any upgradient or downgradient fish-bearing systems. Provincially regulated watercourses which have been identified as inaccessible to fish have been described as provincially regulated watercourses, rather than fisheries resources. Fisheries resources and non-fish resource provincially regulated watercourses within the Beaver Dam Mine Site are displayed on Figure J.4-3 of Appendix J.4.

WC10 is a first order stream that forms from pockets of surface water from the western edge of WL27. The channel exists for approximately 75 m then disperses into WL29. No hydrological connection, channelized or otherwise, was observed between the downstream end of WC10 and any downgradient aquatic features (i.e., WC11). High flow evaluations were not completed on WC10 as changes in infrastructure layout resulted in complete avoidance of direct and indirect impacts.

WC15 and WC16 are short channels that form in WL215 and WL207, respectively, located near the northern border of the Beaver Dam Mine Site. These watercourses were originally delineated in 2016, with both observed to go underground at their downstream extents. These watercourses were reassessed during high flow in December 2020 for any signs of hydrological connections to downstream aquatic features. During the high flow assessment, both channels were confirmed to be hydrologically isolated.

WC18 is an ephemeral channel that was originally delineated and characterized in October 2018. The channel was originally observed to turn subterranean, and then disperse into WL217 (softwood swamp). The watercourse was revisited throughout the 2019-2020 field program to confirm connectivity to downstream, fish-bearing resources, characterize fish habitat, and perform fish surveys (trapping, electrofishing). These assessments occurred during both low and high flow regimes in December 2019, May 2020, and again in September 2020. WC18 is rarely channelized – the watercourse is characterized by very diffuse flow that is only identifiable during high flow throughout much of its delineated length. During high flow, the wetted portion of the watercourse is infrequent and extremely shallow. When water is at the surface, depths are not sufficient to put any type of trap or to submerge the anode ring of an electrofisher; as such, no fish sampling was conducted. As it flows northeast towards Cameron Flowage, it completely disperses, preventing any surface connectivity to downstream, fish bearing features.

WC19 is a regulated watercourse located in the southeastern extension of the Beaver Dam Mine Site. The watercourse is intermittently channelized with many subterranean sections. Beginning at the northern extent of WL219, WC10 conducts flow south, eventually completely dispersing into WL66. At the time of the original assessment (July 2019), no channelized or surficial flow was observed through WL66 that would connect WC19 to any downgradient fish-bearing features. This watercourse was reassessed during high flow in December 2020, during which hydrological isolation was confirmed.

WC20, WC21, WC22, and WC24 are located upgradient of a 250 m stretch of upland habitat which prevents fish access into these watercourses. This area was assessed through all flow regimes to identify any indicators of hydrological flow and is consistent across all seasons. This barrier to fish passage is described in detail in the 2019-2020 Baseline Report (Appendix J.2). Supported by extensive fish collection efforts and eDNA results, all wetlands and watercourses upstream of this barrier (WL220, WL205, WC20, WC21, WC22, and WC24) are determined to be not frequented by fish and are not considered fisheries resources. In a letter issued by ECCC on 23 February 2021 (Appendix J.2), it was confirmed that these watercourses and associated wetland habitats are not waters frequented by fish.

Wetlands

To address IR2 CEAA 2-06, fish habitat descriptions for each wetland in in the Beaver Dam Mine Site and Haul Road have been revised, with details presented in Appendix H of the 2019-2020 Baseline Report (Appendix J.2). Wetlands that were assessed as isolated with no surface water connectivity to fish-bearing systems and/or open water features are considered non-fish bearing and do not provide fish habitat. In addition, wetlands with throughflow watercourses are not discussed further if fish habitat was determined to the be confined to the watercourse channel (entrenched), and not provided within the wetland itself.

Fourteen wetlands have been confirmed to provide or potentially provide fish habitat within the Beaver Dam Mine Site and are associated with the following surface water features (Appendix J.4, Figure J.4-3):

- Cameron Flowage: Wetlands 61 and 62;
- Crusher Lake: Wetlands 8 and 10;
- Mud Lake: Wetland 17;
- Watercourse 2: Wetland 4;
- Watercourse 3: Wetlands 4 and 20;
- Watercourse 4: Wetlands 8, 11 and 13;
- Watercourse 5: Wetlands 8, 17 and 44;
- Watercourse 8: Wetland 15;
- Watercourse 10: Wetland 29;
- Watercourse 11: Wetland 29;
- Watercourse 12: Wetlands 56 and 59;
- Watercourse 13: Wetlands 59 and 61;
- Watercourse 14: Wetland 61; and
- Watercourse 25: Wetland 61.

Fish habitat conditions in wetlands is described in Table 3-14 of the 2015-2017 Baseline Report, appended to the 2019-2020 Baseline Report (Appendix J.2). Wetlands with associated fish habitat in shallow open water features anticipated to be directly impacted by Project development within the Beaver Dam Mine Site (Wetlands 56, 59 and 61) were re-evaluated during Summer 2020 through quantitative, detailed habitat assessments and additional fish surveys. The results of these most recent surveys are summarized in Tables 6.9-2 and 6.9-3, and discussed in 2019-2020 Baseline Report (Appendix J.2).

Wetland 56

WL56 is a wetland complex located just west of WL59 within the northern area of the Project Area. The wetland consists of coniferous treed swamp, tall shrub swamp, and low shrub bog habitats, and has been heavily altered through historic mining activities including ditching, road building, and some infilling. Scattered patches of open water exist within this wetland as a result of these historic alterations.

The wetland is described as having a throughflow water regime, receiving drainage from WC12 which commences just 53 m to the west. Water drains into the wetland's western edge, and collects in historic ditching, eventually flooding the central portion of the wetland. This area of open water (approximately 1,274 m^2) is permanently flooded. During wetter times of the year (fall and spring runoff), the wetland passively drains east, which seasonally floods an additional wetland area covering approximately 177 m^2.

This drainage is eventually channelized through a forestry road culvert and disperses into WL59. Fish habitat within the permanently flooded area of WL56 was characterized during the 2019-2020 field program, and a single pass, open site electrofishing survey was completed in September 2020. The maximum depth observed within the flooded area was 0.60 m, with an average depth of 0.47 m. Substrate is largely dominated by organic muck, with lesser amounts of embedded rocky substrate.

The ponded water area is approximately 20% covered with emergent cattails, grasses, and floating algal mats. Ninespine stickleback has been confirmed within WL56; and based on habitat types, it is possible that this habitat supports all life history stages of forage fish such as banded killifish, ninespine stickleback and northern redbelly dace.

Wetland 59

Wetland 59 is a complex consisting of 2.8 ha of treed swamp habitat, completely lacking surface water, and 3.7 ha of open water wetland habitat. Of this 3.7 ha of open water; 3.6 ha is present in one contiguous feature, and three separate small polygons of open water equate to 0.1 ha. These are discontiguous, shallow and often dry during low flow; however, they were included in the fish habitat quantification to be conservatively inclusive. The open water habitat was created by construction of a berm between 1982 and 1992. As a result, what appears to have been a treed swamp at the base of a drumlin, has been flooded to create what is now an open water wetland habitat within a treed swamp wetland complex. The open water habitat is less than 2 m deep and greater than 50% vegetated; as such it is still characterized as wetland habitat. At some point in 2019, a beaver dam was built within this habitat; and it is likely continuing to transition habitat types present within this wetland.

IR2 CEAA-2-07, and follow-up guidance provided by DFO requested clarity in the methods used to calculate impact areas; particularly in habitats underlain by the proposed pit. Within the 2019 EIS, open water habitat accessible to fish was not specifically delineated within the wetland. The 2019 EIS was submitted prior to revisions to the *Fisheries Act*, which now requires more detailed habitat quantification for HADD of fish habitat. Wetland impact areas associated with WL59 presented in the 2019 EIS referred to the entire wetland habitat; rather than fish habitat present within the wetland. WL59 is a disturbed wetland complex, with 2.8 ha which completely lack standing water at all times of the year. To meet the current regulatory requirements, this level of detail has been refined to clearly outline fish habitat within the wetland complex (IR2 CEAA-2-07). A desktop GIS exercise was completed to provide a preliminary delineation of open water within this wetland, which was confirmed by field observations during fish collection and fish habitat assessments. As described above, 2.8 ha of this wetland consists of treed and shrub swamp habitat completely lacking standing water or access to fish at any time of the year.

The permanently flooded area of the wetland comprises approximately 3.6 ha of open water habitat which covers the central, southeastern lobe and a small portion of the northwestern lobe of the wetland. Wetland habitat on the western side of the road was observed to be isolated from the open water portion of WL59 based on assessments conducted in 2015. However, recent (2019) beaver activity has caused the road to flood, creating additional, potential seasonal fish habitat (based on assumed hydrological connectivity during high flow regimes). This potential fish habitat (0.1 ha) completely dries during low flow conditions. The wetland receives input from both WC12 and WC14. WC13 acts as the sole outflow, which drains northeast eventually emptying into Cameron Flowage.

A detailed assessment of fish habitat was completed within the southeastern lobe of WL59 by boat on July 21, 2020. Thirty-three discrete points were established throughout the flooded portion of the wetland where substrate, water depth, and vegetation composition were recorded (Appendix J.4, Figure J.4-1). In-situ water quality measurements were taken at eight randomly selected points out of the 33 discrete points. The flooded portion of WL59 is surrounded by a thin wetland margin along the eastern, northern, and southern shorelines. The northern shoreline is heavily altered and comprises an old access trail and frequent gravel outcrops that extend from the trail south into the wetland. The western wetland lobe is divided by access road which is currently flooded – the wetland habitat west of this road is gently sloped and characterized by abundant broad-leaved cattail. The southern shoreline is characterized by intact, flooded alder swamp, which transitions to moderately sloped mixed-wood forest towards the east. WL59 was likely historically a treed swamp, as evident by abundant standing and fallen woody debris, and landscape position at the base of a drumlin.

The flooded portion of WL59 is approximately 50% vegetated with heavy water lily and bladderwort cover, and less frequent emergent cattail and rushes. Snags and submerged woody debris are abundant throughout. A large beaver dam extends from the southern to northern shorelines approximately 115 m from the western edge. An active beaver lodge is located approximately 110 m west of the eastern shoreline, and an additional beaver dam is located at the outflow dam. The outflow dam, located along the northern eastern shoreline, channelizes water from WL59 into WC13. The dam consists of old concrete barricades which were historically used to flood the wetland. The dam has since eroded away, and old culverts are collapsed, washed out and ineffective. The barricade walls have been infilled by a beaver dam, creating a significant water level drop of approximately 1 m from the south to the north side of the barricade. This beaver dam is considered a seasonal barrier to upstream fish passage from WC13, but likely presents a permanent barrier to fish characterized as weak swimmers.

Substrate throughout the wetland is a thick muck/organic layer. Along the northern shoreline, there is sparse cobble, rubble and gravel sourced from erosion from access trail outcrops. The average water depth within the wetland is 0.75 m, with the maximum water depth recorded of 1.88 m.

Banded killifish, brook trout, brown bullhead, golden shiner and ninespine stickleback have been confirmed within this wetland. It is expected to support all life history stages of banded killifish, brown bullhead, golden shiner and ninespine stickleback, along with juvenile and adult American eel, and adult brook trout.

Wetland 61

In the northwestern lobe of WL61, there is a 173 m^2 headwater pond with water depths up to 1 m. Wetland habitat surrounds approximately 85% of the pond, while moderately sloped mixed-wood upland is present on the southeastern shoreline. Minimal shade is present as a thin band along the shoreline. No submergent or emergent vegetation were documented within the ponded water, nor were any other forms of cover except for water depth near the center of the pond. The visible edges of the pond are gravel dominated, and although not confirmed, substrate towards the center, deeper portion of the pond is assumed to be muck. WC25 exists as the pond's sole outflow – a short, first order stream that travels 33 m before emptying into Cameron Flowage. No fish were confirmed within WL61 or WC25, though it is expected that this habitat supports juvenile and adult American eel, banded killifish, golden shiner, yellow perch and adult white sucker.

Table 6.9-2: Summary of Key Diagnostic Features of Fish Habitat within Watercourses with Potential Direct or Indirect Impact in the Beaver Dam Mine Site Component of the FHAA

Watercourse	Reach	Stream Order	Flow Type[1]	Reach Characteristics										Fish Support[6]					
				Channel Width (m)[2]	Wetted Width (m)[2]	Reach Length (m)	Dominant Habitat Type	Other Habitats Present	Slope (%)[3]	Average Velocity (m/s)	Average Depth (m)	Dominant Substrate	Cover (%)[4]	Confirmed Species (2019-2020)	Probable Species[5]	Spawning	YOY	Juvenile	Adult
WC5	1	2	P	2.0	1.2	15	Cascade	-	20 (F)	0.11	0.11	Boulder	40	BKT, LKC	EEL, BKF, BBH, GSH, 9SP, NRD, WHS, YLP	-	-	BKT	EEL, BKT
	2*	2	P	1.7-4.0	0.9-1.2	55	Run	Riffle, Chute	4 (E)	0.32	0.07	Gravel	10			BKT, LKC	BKT	BKT	EEL, BKT
	3*	2-3	P	1.6-2.5	1.3-1.7	195	Flat	Riffle	<1 – 1 (E)	0.08	0.39	Muck/Detritus	33			BKT, LKC, NRD,	BKT, LKC, NRD	EEL, BKT, LKC, NRD	EEL, BKT, LKC, NRD
	4*	3	P	2.3	1.7-1.8	66	Pool	Run	2 (E)	0.07	0.28	Muck/Detritus	70			NRD	BKT, LKC, NRD	EEL, BKT, LKC, NRD	EEL, BKT, LKC, NRD
	5*	3	P	2.1-3.2	1.4-2.9	53	Run	Riffle, Pool	4 (E)	0.17	0.09	Rubble	17			BKT, LKC, NRD	BKT, LKC, NRD	EEL, BKT, LKC, NRD	EEL, BKT, LKC, NRD
	6	3	P	N/A	N/A	43	No defined channel	-	4 (E)	0.42	0.24	Boulder	32			-	-	-	-
	7*	3	P	1.7-2.3	0.9-2.3	65	Rapid	Run, Flat, Pool, Cascade	6 (F)	0.23	0.09	Boulder	33			-	BKT	EEL, BKT	EEL, BKT
	8	3	P	1.4-3.6	1.4-3.6	340	Flat	-	<1 (E)	0.05	0.48	Muck/Detritus	45			BKF, BBH, 9SP, NRD, YLP	BKF, BBH, 9SP, NRD, YLP	EEL, BKF, BBH, 9SP, NRD, YLP	EEL, BKF, BKT, BBH, GSH, 9SP, NRD, WHS, YLP
WC12	1	1	E	1.0	Dry	50	N/A – dry – likely flat.	-	2 (E)	N/A	Dry	Cobble	61	None	BKT	-	BKT	BKT	BKT
WC13	1*	2	P	3.3-4.8	1.7-3.0	32	Riffle	Flat	1 (F)	0.11	0.07	Gravel	10	EEL, BKF, BKT, CKC, LKC, 9SP, WHS	BBH, NRD	BKT, CKC, LKC, WHS	BKT, LKC, WHS	BKT	BKT, CKC, LKC
	2	2	P	3.1	2.5	8	Pool	-	<1 (E)	0.06	0.10	Muck/Detritus	10			-	BKT, CKC	EEL, BKT, LKC	EEL, BKT, LKC
	3	2	P	1.1	0.8	20	Riffle	-	2 (E)	0.10	0.02	Cobble/Gravel	10			BKT, CKC, LKC, WHS	BKT, WHS	BKT, WHS	BKT, CKC, LKC
	4	2	P	3.0	2.7	35	Flat	-	<1 (E)	0.05	0.46	Muck/Detritus	45			BKF, BBH, 9SP, NRD	BKF, BBH, LKC, 9SP, NRD	EEL, BKF, BBH, LKC, 9SP, NRD\	EEL, BKF, BKT, BBH, LKC, 9SP, NRD, WHS
	5	2	P	0.9	0.6	46	Riffle	Pool	2 (E)	0.04	0.11	Rubble	62			BKF, BKT, BBH, CKC, LKC, 9SP, NRD, WHS	BKF, BKT, BBH, CKC, LKC, 9SP, NRD, WHS	EEL, BKF, BKT, BBH, CKC, LKC, 9SP, NRD, WHS	EEL, BKF, BKT, BBH, CKC, LKC, 9SP, NRD, WHS
WC14	1A	1	I	0.5	0.4	30	Run (high flow only)	-	4 (E)	0.05	0.09	Rubble	80	None	EEL, BKT	-	-	BKT	EEL, BKT
	1B	1	I	1.0	0.6	115	Step-pool (high flow only)	No defined channel	10+ (E)	0.04	0.03	Muck/Detritus	25			-	-	EEL, BKT	EEL, BKT
	2	2	I	1.3	0.8	32	Step-pool	-	18 (F)	0.02	0.04	Rubble	5			BKT	BKT	EEL, BKT	EEL, BKT

Table 6.9-2: Summary of Key Diagnostic Features of Fish Habitat within Watercourses with Potential Direct or Indirect Impact in the Beaver Dam Mine Site Component of the FHAA (continued)

Watercourse	Reach	Stream Order	Flow Type[1]	Reach Characteristics										Fish Support[6]					
				Channel Width (m)[2]	Wetted Width (m)[2]	Reach Length (m)	Dominant Habitat Type	Other Habitats Present	Slope (%)[3]	Average Velocity (m/s)	Average Depth (m)	Dominant Substrate	Cover (%)[4]	Confirmed Species (2019-2020)	Probable Species[5]	Spawning	YOY	Juvenile	Adult
WC23	1*	1	P	4.0-4.1	2.3-3.5	150	Flat	-	1 (E)	0.18	0.10	Muck/Detritus	35	BKT	N/A	-	-	BKT	BKT
	2*	1	P	3.9-5.1	2.6-3.6	150	Flat	-	1 (E)	0.01	0.12	Muck/Detritus	82			-	-	BKT	BKT
	3*	1	P	1.1-5.3	0.9-3.0	754	Flat	Step-pool, Subterranean boulder field	1 (E)	0.07	0.20	Muck/Detritus	44			-	-	BKT	BKT
WC25	1*	1	P	0.6-1.0	0.3-0.6	33	Flat	Riffle	<1 (E)	0.05	0.07	Muck/Detritus	10	None	EEL, BKF, GSH, WHS, YLP	BKF, GSH, YLP	BKF, GSH, YLP	EEL, BKF, GSH, YLP	EEL, BKF, GSH, WHS, YLP
WC26	1*	1	I	0.2-0.6	Dry-0.6	205	Flat	No defined channel	<1 (E)	0.05	0.34	Muck/Detritus	55	9SP	EEL, BKF, BKT, BBH, GSH, WHS, YLP	9SP	9SP	9SP	9SP
	2*	1	P	0.7-4.7	0.7-4.7	600	Flat	-	<1 (E)	0.06	0.26	Muck/Detritus	10			BKF, BBH, GSH, YLP	BKF, BBH, GSH, YLP	EEL, BKF, BBH, GSH, YLP	EEL, BKF, BKT, BBH, GSH, WHS, YLP
WC27	1*	3	P	3.4-9.0	3.4-9.0	228	Flat	-	<1 (E)	0.05	0.58	Muck/Detritus	65	EEL, BKF, BKT, BBH, GSH, LKC, 9SP, WHS, YLP	N/A	BKF, BBH, GSH, 9SP, YLP	BKF, BBH, GSH, LKC, 9SP, YLP	EEL, BKF, BBH, GSH, LKC, 9SP, YLP	EEL, BKF, BKT, BBH, GSH, LKC, 9SP, WHS, YLP
Cameron Flowage/ Killag River[7]	1	4	P	10.0	10.0	196	Rapid	<1	n/a	1.04	0.45	Boulder, Cobble, Rubble	n/a	EEL, BKF, BKT, GSH, WHS, YLP, CRC	BRB, 9SP, LKC	BKF, GSH, YLP	BKF, GSH, YLP, BKT	EEL, WHS, LKC, YLP, BRB, 9SP, BKF, GSH, CRC	EEL, WHS, LKC, YLP, BRB, 9SP, BKF, GSH, CRC
	2	4	P	59.4	59.4	70	Flat		n/a	0.08	1.11	Boulder, Rubble, Muck							
	3	4	P	62	62	330	Flat		n/a	<0.05	2.72	Muck							
	4	4	P	76.8	76.8	440	Flat		n/a	<0.05	1.73	Boulder, Rubble, Muck							
	5	4	P	13.7	13.7	230	Riffle		n/a	0.72	0.44	Boulder, Rubble							
	6	4	P	14.6	14.6	213	Run		n/a	0.35	0.47	Boulder, Rubble, Muck							
	7	4	P	12	12	108	Run	<1	n/a	0.34	0.47	Rubble, Cobble	n/a	BKT, EEL, WHS, ATS[8], LKC, YLP	BRB, 9SP, BKF, GSH, CRC	ATS, BKT, LKC	BKT, ATS, LKC	EEL, WHS, ATS, LKC, YLP, BRB, 9SP, BKF, GSH, CRC	EEL, WHS, ATS, LKC, YLP, BRB, 9SP, BKF, GSH, CRC
	8	4	P	13.6	13.6	144	Flat		n/a	0.05-0.2	0.75	Rubble, Cobble							
	9	4	P	7.3	7.5	n/a	Run		n/a	1.2	0.44	Boulder, rubble							

Note: Habitat assessments also conducted on WC20-22 but excluded from table due to non-fisheries resource designation.

1-Perennial (P) – A stream that flows continuously throughout the year, Intermittent (I) – Streams that go dry during protracted rainless periods when percolation depletes all flow, Ephemeral (E) - A watercourse that flows during snowmelt and rainfall runoff periods only (AT, 2009).

2-Ranges are provided for reaches measured through multiple transects.

3-Whenever possible, slope measurements were taken in-field using a clinometer and meter stick (“F”). If clinometer readings were not possible due to length of reach or visibility obstructions, slopes were estimated based on overall habitat type (“E”,DFO, 2012a).

4-Cover is calculated as a sum of all available cover types present (large woody debris, boulders, undercut banks, deep pools, overhanging vegetation, emergent vegetation, and submergent vegetation).

5-Probable species presence determined for watercourses based on direct aquatic connectivity with another fisheries resource with confirmed species presence and habitat suitability, and/or previous baseline studies as presented in Revised EIS (AMNS 2019) and in Appendix J.2 (2019-2020 Baseline).

6-Species codes: American Eel (EEL), Atlantic Salmon (ATS), Banded Killifish (BKF), Brook Trout (BKT), Brown Bullhead (BBH), Creek Chub (CKC), Golden Shiner (GSH), Lake Chub (LKC), Ninespine Stickleback (9SP), Northern Redbelly Dace (NRD), White Sucker (WHS), Yellow Perch (YLP).

7-Some reach-level measurements within Cameron Flowage – Killag River were not recorded, as this was a modified transect method to account for safety considerations during high seasonal flow in December 2020.

* For reaches highlighted with an asterisk; one reach consists of multiple, small (<5 m in length) individual habitat types. These were combined into a single reach; and a minimum of one transect per habitat type was completed. As such, the measurements provided are a range (widths) or average (depths and velocity) of measurements recorded on each individual transect. Transect level data is provided in the 2019-2020 Baseline Report (Appendix J.2).

Table 6.9-3: Summary of Key Diagnostic Features of Fish Habitat within Open Water Features Proposed for Direct Impact in the Beaver Dam Mine Site Component of the FHAA

Waterbody / Wetland	Area (m^2)	Open Water Characteristics			Fish Support[2]					
		Depth Range (m)	Dominant Substrate	Cover (%)	Species Confirmed (2019-2020)	Probable Species[1]	Spawning	YOY	Juvenile	Adult
WL56	1,274 (permanently flooded) 177 (seasonally flooded)	0.27-0.60	Muck/Detritus	20	9SP	BKF, BKT, NRD	BKF, 9SP, NRD	BKF, 9SP, NRD	BKF, 9SP, NRD	BKF, BKF, 9SP, NRD
WL59	36,106 (permanently flooded) 1,052 (seasonally flooded)	0.19-1.88	Muck/Detritus	50	BKF, BKT, BBH, GSH, 9SP	EEL	BKF, BBH, GSH, 9SP	BKF, BBH, GSH, 9SP	EEL, BKF, BBH, GSH, 9SP	EEL, BKF, BKT, BBH, GSH, 9SP
WL61	173	0.30-1.00	Gravel	0	None	EEL, BKF, GSH, WHS, YLP	-	-	EEL, BKF, GSH, YLP	EEL, BKF, GSH, WHS, YLP

[1]Probable species presence determined for open water features based on direct aquatic connectivity with another fisheries resource with confirmed species presence and habitat suitability, and/or previous baseline studies as presented in Revised EIS (AMNS 2019).

[2]Species codes: American Eel (EEL), Banded Killifish (BKF), Brook Trout (BKT), Brown Bullhead (BBH), Creek Chub (CKC), Golden Shiner (GSH), Lake Chub (LKC), Ninespine Stickleback (9SP), Northern Redbelly Dace (NRD), White Sucker (WHS), Yellow Perch (YLP).

6.9.4.2.2 Fish Habitat: Haul Road

Fish habitat potential was determined at each location during field identification/delineation through the collection of key fish habitat characteristics of each watercourse and wetland including channel morphology and biophysical descriptions. The following subsections provide fish community descriptions by watercourse/wetland with more detailed fish collection discussion provided Appendix J.2 and Section 6.9.4.2.3.

Watercourses

A total of 35 linear watercourses were identified within the Haul Road. A summary of key fish habitat characteristics within each linear watercourse observed along the Haul Road, including current crossing conditions, are presented in Table 6.9-4. Qualitative evaluations of watercourses along the Haul Road were completed on discrete sections of watercourses. As a result, the measurements recorded in 2015-2017 along the Haul Road are appropriate for calculating impact areas for Haul Road upgrades; and more detailed quantitative evaluations of these watercourses was not deemed necessary. All Haul Road watercourses have been confirmed or assumed to be potentially fish bearing. Haul road watercourses and wetlands are shown on Figure J.4-4 of Appendix J.4.

The capacity of each linear watercourse along the Haul Road to support fish species and their life stages (i.e., spawning, young of the year (YOY), juvenile, and adult) has been assessed based on key fish habitat characteristics described through qualitative habitat evaluations and fish species confirmed through electrofishing and trapping surveys in each tertiary watershed intersected by the Haul Road. All species captured within each tertiary watershed along the Haul Road have been considered potentially present within all Haul Road watercourses, to be conservatively inclusive. Atlantic salmon has also been considered for watercourses within the West River Sheet Harbour secondary watershed – Atlantic salmon are considered extirpated from the Morgan River and are therefore not included in the assessment of those watercourses. It is important to note that fish habitat characterization was only performed on short sections of watercourse which overlapped the PA and is not considered representative of the fish habitat along the entire length of each watercourse. Instead, fish habitat characterization is representative of each discrete, homogenous section of watercourse described. In addition, due to the linear nature of the Haul Road Footprint, connectivity to downgradient fish-bearing systems have been assumed for all watercourses in absence of confirmation of barriers to downstream fisheries resources. Descriptions of fish habitat by species and life stage for each linear watercourse with potential impacts due to Haul Road construction are presented in Table 6.9-4.

As noted, the majority of streams delineated along the Haul Road are small, 1st order tributaries located high in their respective watersheds. Many are characterized as low gradient, homogenous streams with low velocity, abundant in-stream vegetation, and soft substrates. These streams may provide suitable spawning, young of year, juvenile and adult life stages of most forage fish/habitat generalists, but lack the habitat provisions necessary to support earlier life stages of white sucker and salmonids. Higher gradient first order streams were observed to contain more complex habitat types (i.e., riffles, runs, pools), moderate velocities, and a variety of rocky substrates with limited fines. These streams likely support various life stages of brook trout, white sucker, and early life stages of lake chub which prefer abundant in-stream cover in the form of rocky substrate, undercut banks and woody debris. Some of these streams were also observed to gravel substrate over shallow riffles and are considered to support brook trout and white sucker spawning.

Higher order streams (2nd to 4th order) commonly contain more complex habitat, including both low velocity habitat types (i.e., flats, pools, glides), and moderate-high velocity types (i.e., runs, riffles, cascades). These streams likely support a more diverse range of species, including habitat generalist and specialists. Two, higher order watercourses are likely to support habitat for Atlantic salmon: the West River Sheet Harbour (WC-N) and Keef Brook (WC-H). The West River Sheet Harbour is considered to provide

suitable habitat for all life stages of salmon, with clean gravel-cobble sized substrate in well aerated areas, to deeper holding pools for adults. Keef Brook is considered to provide suitable habitat for older juveniles, but high velocities, limited water depths, and a lack of gravel substrate limit habitat suitability for spawning, young of year, and adults.

While several waterbodies are identified within close proximity to the proposed Haul Road, the road layout was optimized to avoid impacts to any waterbodies. As a result, detailed descriptions of fish habitat in waterbodies near the Haul Road (i.e., Tent Lake, Kidney Lake, Johns Pond) are not included.

Wetlands

Along the Haul Road, twelve wetlands have been assumed to be fish habitat. Details associated with fish habitat condition in each wetland is provided in Table 3-14 of the 2015-2017 Baseline Report, appended to the 2019-2020 Baseline Report (Appendix J.2). The Haul Road is linear by nature, so a limited evaluation of each watercourse and associated wetland was completed within the confines of the Study Area. Where wetlands provided open water and connectivity to fish bearing watercourses, it was presumed that open water portions of the wetlands were accessible to fish as well, to be conservatively inclusive. Wetlands providing potential fish habitat along the Haul Road are associated with the following surface water features (Appendix J.4, Figure J.4-4):

- Watercourse A: Wetland 64;
- Watercourse B: Wetlands 66 and 68;
- Watercourse C: Wetland 68;
- Watercourse D: Wetland 69;
- Watercourse F: Wetland 74;
- Watercourse G: Wetland 76;
- Watercourse Z: Wetland 146;
- Watercourse AA: Wetlands 159 and 160;
- Cope Pond (outside of PA): Wetland 73;
- Upper Kidney Lake/Big Pond (outside of PA): Wetland 157; and
- Johns Pond (outside of PA): Wetland 168.

Wetland habitat accessible to fish within the Beaver Dam Mine Site and Haul Road may provide suitable habitat for species that prefer slack water, highly vegetated areas and soft, organic substrates for all or some life stages. Wetland habitat is generally considered to provide juvenile rearing, refuge, and food sources for these species.

Table 6.9-4: Summary of Key Diagnostic Features of Fish Habitat within Watercourses along the Haul Road

Watercourse	Tertiary Watershed	Stream Order	Section Length (m)[1]	Watercourse Characteristics												Fish Support[5]				
				Channel Width (m)	Wetted Width (m)	Dominant Habitat Type	Other Habitats Present	Gradient[2]	Velocity[3]	Average Depth (m)	Substrate Composition (%)	In-stream Vegetation (%)	Overhanging Vegetation (%)	Coarse Woody Debris[4]	Current Crossing (condition)	Fish Confirmed	Probable Species			
																	Spawning	YOY	Juvenile	Adult
A	Tent Brook	1	26	0.2-4	0.2-4	Flat	-	L	L	0.10-0.25	Muck (100)	20	65	L	Culvert (buried)		BKF, YLP,	BKF, LKC, YLP,	EEL, BKF, LKC, YLP,	EEL, BKF, BKT, LKC, WHS, YLP
B (Tent Brook)	Tent Brook	2	40	0.2-4	0.2-4	Glide	Riffle, Run	L	L	0.10-0.20	Muck (90), Cobble (10)	10	95	M	Culvert (crushed)		BKF, YLP	BKF, LKC, YLP	EEL, BKF, LKC, YLP	EEL, BKF, BKT, LKC, WHS, YLP
C	Tent Brook	1	50	0.35-0.8	0.35-0.8	Flat	-	L	L	0.05-0.25	Muck (30), Silt (25), Cobble (20), Gravel (15), Rubble (10)	10	50	M	Culvert (functioning)		BKF, YLP	BKF, LKC, YLP	EEL, BKF, LKC, YLP	EEL, BKF, BKT, LKC, WHS, YLP
D	Tent Brook	1	25	0.25-0.8	0.25-0.65	Run	Riffle, Pocket	M	M	0.05-0.20	Cobble (50), Boulder (40), Muck (10)	0	45	L	None		LKC		EEL	EEL
E	Keef Brook	1	75	0.35-1.8	0.25-1.7	Run	Glide, Riffle, Pool	L	M	0.01-0.20	Cobble (80), Boulder (5), Gravel (15)	5	80	H	Culvert (blocked)		BKT, LKC, WHS	BKT, WHS	BKT, LKC, WHS	EEL
F	Keef Brook	2	83	0.7-1.7	0.6-1.5	Run, Pool	-	L	M	0.10-0.30	Muck (75), Gravel (25)	20	70	M	Culvert (crushed)		BKF, YLP	BKF, LKC, YLP	EEL, BKF, LKC, YLP	EEL, BKF, BKT, LKC, WHS, YLP
G	Keef Brook	1	71	0.5-3.5	0.4-3.5	Glide	Run	L	L	0.05-0.30	Muck (50), Gravel (25), Cobble (15)	75	10	M	Culvert (crushed)		BKF, YLP	BKF, LKC, YLP	EEL, BKF, LKC, YLP	EEL, BKF, BKT, LKC, WHS, YLP
H (Keef Brook)	Keef Brook	3	100	1.2-5	1-5	Run	Cascade, Riffle, Pool	M	H	0.02-0.40	Boulder (30), Cobble (40), Rubble (30)	0	60	M	Bridge		LKC		ATS, BKT	BKT
I	Keef Brook	1	64	0.3-1.5	0.3-1.5	Riffle-Run	Pool	L	L	0.05-0.15	Cobble (60), Rubble (20), Boulder (15), Gravel (5)	5	65	L	Culvert (buried)			BKT	EEL, BKT, WHS	EEL
J	Keef Brook	1	80	0.6-2	0.5-2	Run	Pool, Riffle	M	M	0.05-0.23	Muck (40), Cobble (30), Gravel (15)	0	70	M	Culvert (buried)				EEL	EEL, BKT
K	Keef Brook	1	55	0.4	0.3	Riffle	Pool	M	M	0.15	Boulder (40), Sand (40), Gravel (20)	5	100	L	None		BKT, WHS	BKT, WHS	BKT, WHS	
L	Keef Brook	1	47	0.5	0.3	Run	Riffle, Pool	M	L-M	0.10-0.30	Cobble (50), Gravel (50)	0	90	L	Culvert (functioning)		BKT	BKT	BKT	
M	Keef Brook	1	50	0.5-1.1	0.35-1	Run	-	L	L	0.02-0.45	Muck (90), Gravel (10)	5	95	H	Culvert (functioning)				EEL	EEL

Table 6.9-4: Summary of Key Diagnostic Features of Fish Habitat within Watercourses along the Haul Road (continued)

Watercourse	Tertiary Watershed	Stream Order	Section Length (m)[1]	Watercourse Characteristics												Fish Support[5]				
				Channel Width (m)	Wetted Width (m)	Dominant Habitat Type	Other Habitats Present	Gradient[2]	Velocity[3]	Average Depth (m)	Substrate Composition (%)	In-stream Vegetation (%)	Overhanging Vegetation (%)	Coarse Woody Debris[4]	Current Crossing (condition)	Fish Confirmed	Probable Species			
																	Spawning	YOY	Juvenile	Adult
N (West River Sheet Harbour)	Keef Brook / Jack Lowe Brook	4	113	12	12	Run	Cascade, Glide, Riffle	M	H	1.00	Cobble (30), Gravel (30), Rubble (25), Boulder (15)	10	40	L	Bridge	EEL, BKF, BKT, LKC, WHS, YLP	ATS, BKT	ATS, BKT	EEL, ATS, BKT	EEL, ATS, BKT
O	Little River	2	30	0.6-4.3	0.4-4	Glide	Riffle, Pool	L	L	0.15	Muck (65), Rubble (15), Boulder (10), Cobble (10)	7	30	M	None		BKF, WHS	BKF, LKC, WHS	EEL, BKF, LKC, WHS	EEL, BKF, BKT, LKC, WHS
P	Little River	1	30	0.2-1.5	0.2-1.2	Run	Riffle, Pocket	M	M	0.10-0.35	Boulder (40), Cobble (30), Rubble (20), Gravel (10)	0	0	L	None			BKT	BKT	BKT
T	Little River	2	52	1-2.6	1-2.6	Run	Pool, Riffle	L	M	0.01-0.19	Cobble (40), Rubble (20), Muck (20), Gravel (10), Boulder (10)	0	80	M	Culvert (buried)		BKT, LKC, WHS	BKT, WHS	EEL, BKT, WHS	EEL, BKT
U	Little River	1	56	0.5-1	0.5-1	Run	Riffle, Pool	L-M	L-M	0.06-0.40	Muck (50), Gravel (40), Cobble (10)	0	90	L	Culvert (functioning)				EEL	EEL
V	Little River	2	65	1.3-1.5	0.8-1.4	Run	Cascade, Riffle	M	H	0.02-0.17	Boulder (40), Gravel (30), Cobble (30)	5	90	L	Culvert (buried)	EEL, BKT	BKT	BKT	EEL, BKT	EEL, BKT
W	Little River	1	44	0.2-2	0.2-1.5	Run	Pool, Riffle	M	M	0.05-0.22	Muck (90), Rubble (10)	0	90	L	Culvert (hung)				EEL	EEL
X	Little River	1	70	0.3-1	0.25-0.8	Flat	Riffle	M	M	0.05-0.45	Muck (60), Cobble (40)	0	40	M	None				EEL	EEL, BKT
Y	Little River	1	70	0.3-1	0.25-0.8	Flat	Riffle	M	M	0.05-0.45	Muck (60), Cobble (40)	0	40	M	None				EEL	EEL, BKT
AA	Sandy Pond	2	105	0.5-3.5	0.5-3.5	Run	-	L	M	0.20	Cobble (40), Muck (30), Gravel (25), Rubble (5)	10	80	M	Culvert (hung)	BKF, GSH, LKC, WHS	BKF, GSH, LKC	BKF, GSH, LKC, WHS	EEL, BKF, GSH, LKC, WHS	EEL, BKF, BKT, GSH, LKC, WHS
AC	Sandy Pond	1	60	0.5-6	0.5-4	Flat	Riffle, Pool	L	L	0.05-0.20	Boulder (40), Rubble (30), Sand (30)	10	50	L	None		BKF, GSH	BKF, GSH, LKC, WHS	EEL, BKF, GSH, LKC, WHS	EEL, BKF, BKT, GSH, LKC, WHS
AD (Morgan River)	Sandy Pond	4	130	13-17	12-16	Run	-	L	M	1.00+	Too deep to see substrate; Co, Ru, LB, SB	1	10	L	Bridge		BKF, BKT, GSH, LKC WHS	BKF, BKT, GSH, LKC, WHS	EEL, BKF, BKT, GSH, LKC, WHS	EEL, BKF, BKT, GSH, LKC, WHS
AE	Morgan River	1	80	0.5-1.5	0.3-1.2	Run	Riffle, Pool	L	M	0.10	Cobble (55), Gravel (40), Rubble (5)	10	50	L	Culvert (buried)		BKT, LKC. WHS	BKT, LKC, WHS	EEL, BKT, LKC, WHS	EEL, LKC

Table 6.9-4: Summary of Key Diagnostic Features of Fish Habitat within Watercourses along the Haul Road (continued)

Watercourse	Tertiary Watershed	Stream Order	Section Length (m)[1]	Watercourse Characteristics												Fish Support[5]				
				Channel Width (m)	Wetted Width (m)	Dominant Habitat Type	Other Habitats Present	Gradient[2]	Velocity[3]	Average Depth (m)	Substrate Composition (%)	In-stream Vegetation (%)	Overhanging Vegetation (%)	Coarse Woody Debris[4]	Current Crossing (condition)	Fish Confirmed	Probable Species			
																	Spawning	YOY	Juvenile	Adult
AF	Morgan River	1	70	0.5-1.8	0.5-1.8	Flat	Pool, Riffle	L	L	0.20-0.30	Cobble (45), Gravel (30), Rubble (25)	40	70	M	None		BKF, BKT, GSH, LKC WHS	BKF, BKT, GSH, LKC, WHS	EEL, BKF, BKT, GSH, LKC, WHS	EEL, BKF, BKT, GSH, LKC, WHS
AG	Morgan River	1	65	0.4-1.1	0.4-0.9	Run	Riffle, Cascade	L	M	0.20-0.45	Rubble (40), Cobble (30), Boulder (30)	10	55	M	None				EEL, BKT	EEL, BKT
AH	Morgan River	4	100	200-650	200-700	Riffle	Pool	M	L	0.5-0.8	Small Boulder=10 Rubble=30 Cobble=40 Gravel=20	30	30	L	None		BKF, BKT, GSH, LKC WHS	BKF, BKT, GSH, LKC, WHS	EEL, BKF, BKT, GSH, LKC, WHS	EEL, BKF, BKT, GSH, LKC, WHS
AI	Little River	1	70	20	120	Pool	-	L	L	0.1	Mud/clay=90 Rubble-90	0	10	L	None		BKF, WHS	BKF, LKC, WHS	EEL, BKF, LKC, WHS	EEL, BKF, BKT, LKC, WHS

1Linear extent of watercourse described.

2Gradient: H:>5% slope M: 2-5% slope L: <2% slope (estimated only).

3Velocity: H: flows at a speed at which the water is visually rough and irregular, creates eddies, heavier riffles to light rapids (>0.3 m/s) M: flows at a speed which creates smooth to moderate riffles (0.15-0.3 m/s) L: flows so slowly that the water is smooth and fine sediments are not held in suspension (<0.15 m/s).

4Coarse Woody Debris: H:10+ woody debris per 20 m reach, M: 10-5 woody debris per 20 m reach, L: less than 5 woody debris per 20 m section.

5Species codes: American Eel (EEL), Banded Killifish (BKF), Brook Trout (BKT), Brown Bullhead (BBH), Creek Chub (CKC), Golden Shiner (GSH), Lake Chub (LKC), Ninespine Stickleback (9SP), Northern Redbelly Dace (NRD), White Sucker (WHS), Yellow Perch (YLP).

As noted, the majority of streams delineated along the Haul Road are small, 1st order tributaries located high in their respective watersheds. Many are characterized as low gradient, homogenous streams with low velocity, abundant in-stream vegetation, and soft substrates. These streams may provide suitable spawning, young of year, juvenile and adult life stages of most forage fish/habitat generalists, but lack the habitat provisions necessary to support earlier life stages of white sucker and salmonids. Higher gradient first order streams were observed to contain more complex habitat types (i.e., riffles, runs, pools), moderate velocities, and a variety of rocky substrates with limited fines. These streams likely support various life stages of brook trout, white sucker, and early life stages of lake chub which prefer abundant in-stream cover in the form of rocky substrate, undercut banks and woody debris. Some of these streams were also observed to gravel substrate over shallow riffles and are considered to support brook trout and white sucker spawning.

Higher order streams (2nd to 4th order) commonly contain more complex habitat, including both low velocity habitat types (i.e., flats, pools, glides), and moderate-high velocity types (i.e., runs, riffles, cascades), These streams likely support a more diverse range of species, including habitat generalist and specialists. Two, higher order watercourses are likely to support habitat for Atlantic salmon: the West River Sheet Harbour (WC-N) and Keef Brook (WC-H). The West River Sheet Harbour is considered to provide suitable habitat for all life stages of salmon, with clean gravel-cobble sized substrate in well aerated areas, to deeper holding pools for adults. Keef Brook is considered to provide suitable habitat for older juveniles, but high velocities, limited water depths, and a lack of gravel substrate limit habitat suitability for spawning, young of year, and adults.

While several waterbodies are identified within close proximity to the proposed Haul Road, the road layout was optimized to avoid impacts to any waterbodies. As a result, detailed descriptions of fish habitat in waterbodies near the Haul Road (i.e., Tent Lake, Kidney Lake, Johns Pond) are not included.

6.9.4.2.3 Fish Collection

Results of Desktop Study

A desktop evaluation for priority fish species revealed that four priority species have been identified within 5 km of the PA by the ACCDC. These include Atlantic salmon (*Salmo salar*), American eel (*Anguilla rostrata*), alewife *(Alosa pseudoharengus*) and brook trout (S*alvelinus fontinalis*) (ACCDC 2021). Priority fish species identified as having an elevated potential to be located within the PA, based on habitat preferences, and broad geographic range, include American eel, Atlantic salmon, brook trout, brook stickleback (*Culaea inconstans*), and landlocked rainbow smelt *(Osmerus mordax*).

A desktop review was conducted for fish species within major watercourses and waterbodies within the FHAA. The West River Sheet Harbour, contiguous with the Killag River, is known to support Atlantic salmon, brook trout, American eel, brown bullhead, yellow perch, lake chub, creek chub, banded killifish, ninespine stickleback, golden shiner, and white sucker (Halfyard, 2007; NSFA, 2016).

A portion of the Haul Road lies within the Tangier River secondary watershed. Fish species known to occur within this watershed include white sucker, brook trout, white perch, yellow perch, banded killifish, rainbow trout, golden shiner, stickleback sp., alewife, northern redbelly dace, and brown bullhead (Alexander et al. 1986). Nova Scotia Fisheries and Aquaculture (2019) have also recorded common shiner and smallmouth bass in this watershed. Atlantic salmon are considered extirpated from the Tangier River (DFO, 2009).

Atlantic salmon (Nova Scotia Southern Uplands population) are expected to potentially inhabit watercourses within and adjacent to the FHAA (Section 6.9.4.1.4).

2015 to 2017 Collection

As a result of fishing efforts completed in 2015 and 2016 within the Beaver Dam Mine Site and Haul Road, a total 10 species and 145 individual fish were captured across eleven of the eighteen survey locations (16 electrofishing reaches, Cameron Flowage and Crusher Lake), including:

- WC4;
- WC5 (lower – near WC14);
- WC12;
- WC13;
- Wetland 56;
- Cameron Flowage;
- Crusher Lake;
- WC-N;
- WC-V;
- WC-AA; and
- WC-AH.

A summary of fish species identified during electrofishing and trapping surveys throughout fish collection surveys completed in 2015-2017 and 2019-2020 is provided in Table 6.9-5. Further details associated with fish collection methods and results are provided in Appendix J.2.

2019 to 2020 Collection

As a result of fishing efforts completed between September 2019 and September 2020 within the FHAA, a of total eleven species and 1,732 individual fish were captured across ten of the fifteen survey locations, including:

- WC5 (Lower Reach);
- WC13;
- WC23;
- WC26;
- WL56;
- WL59;
- Killag River;
- Cameron Flowage;
- Crusher Lake; and

- Mud Lake/WC27.

A summary of fish species identified during electrofishing and trapping surveys throughout fish collection surveys completed in 2015-2017 and 2019-2020 is provided in Table 6.9-5.

Table 6.9-5: Summary of Fish Species Captured during Electrofishing and Trapping Surveys within the Beaver Dam Mine Site and Haul Road Study Areas

Fish Habitat	2015-2017 Fish Capture Results[(a)]	2019-2020 Fish Capture Results[(a)]
WC-4	9SP	
WC-5	BKT, NRD	BKT, LKC
WC-12	BKT	
WC-13	BKF, BKT, BRB, LKC, NRD	EEL, BKF, BKT, CKC, LKC, 9SP, WHS
WC-23		BKT
WC-26		9SP
WC-27		EEL, BKF, BKT, GSH, LKC, 9SP, WHS, YLP
WL56	BKF	
WL59	NRD	
Cameron Flowage		EEL, BKF, BKT, GSH, WHS, YLP, CKC
Killag River		BKT, EEL, WHS, ATS, LKC, YLP
WC-N	EEL, BKF, BKT, LKC, WHS, YLP	
WC-V	EEL, BKT	
WC-AA	BKF, GSH, LKC, WHS	
WC-AH	EEL, BKT	

Note: [(a)] Species codes: American Eel (EEL), Banded Killifish (BKF), Brook Trout (BKT), Brown Bullhead (BBH), Creek Chub (CKC), Golden Shiner (GSH), Lake Chub (LKC), Ninespine Stickleback (9SP), Northern Redbelly Dace (NRD), White Sucker (WHS), Yellow Perch (YLP).

Fish Species Descriptions

Within the Beaver Dam Mine Site and Haul Road, 12 different species of fish were identified through all electrofishing and trapping surveys. Fish species descriptions for all species captured within the Beaver Dam Mine Site and Haul Road from 2015-2020 are provided in the following sections. Fish presence (confirmed and probable) is provided in Tables 6.9-2, 6.9-3, and 6.9-4 (i.e., Beaver Dam Mine Site, watercourses, open water features, and Haul Road watercourses, respectively), and presented in Appendix J.4, Figure J.4-5. Full details associated with fish abundance and distribution are provided in the 2019-2020 Baseline (Appendix J.2).

Atlantic Salmon

Within the freshwater environment, Atlantic salmon are found in cool, clear, well-oxygenated waters that support a reliable food source of aquatic invertebrates. Gravel and cobble are the preferred substrates for spawning (Bowlby et al., 2013), with redd sites typically located in well aerated areas - a riffle above a pool, or at the tail of pools on the upstream edge of riffles with depths of 10 to 70 cm (Grant and Lee, 2004). Young of year (YOY) will remain near the redd for a few months, after which they disperse downstream, occupying areas of faster velocities as they increase in size (Grant and Lee, 2004). Juveniles can be found occupying a variety of habitats. In summer and fall, they are typically found in moderate velocity runs with clean, rocky substrate free of sand, silt, and detritus (Rimmer et al., 1983). Older parr are usually found in riffles, whereas deeper pools are the preferred habitat during low water levels, high temperatures, and winter freeze (Grant and Lee, 2004).

The SU Population of Atlantic salmon has been assessed as endangered by COSEWIC (2010) and is considered provincially critically imperiled by the ACCDC (S1), but is not currently protected under SARA or NSESA. The SU Population of Atlantic Salmon has experienced significant reductions over the last few decades, with adult abundance declining from 88% to 99% from observed abundances in the 1980s (DFO, 2013). Current adult and juvenile abundance has been assessed as critically low in most rivers, and there is strong evidence for river-specific extirpations – only 54% of rivers in the SU region were found to contain salmon in 2000 (Amiro et al., 2000) and only 38% were found to contain salmon in 2008 (Gibson et al., 2010). The main contributing factors to these declines are considered to be degradation of freshwater habitat, acidification, and poor marine survival (Bowlby et al., 2014). During the 2019-2020 field program, Atlantic salmon parr were captured within the Killag River. No salmon were captured within any other watercourse or waterbody within the Beaver Dam Mine Site or Haul Road.

American Eel

American eel are frequently found in watercourses that offer structural complexity and shade in the form of coarse woody debris, rocks, in-stream vegetation for daytime cover, and an available food source of forage fish, invertebrates, molluscs and vegetation. Migrating elvers are bottom dwellers and spend most of their time burrowed or hidden, including directly into soft bottom sediments (Tomie, 2011). In freshwater, yellow eel continue their migration upstream into rivers, streams, and muddy or silt bottomed lakes (Scott and Crossman, 1998). Like elvers, yellow eel are primarily nocturnal, spending most of the day under cover or buried in soft substrates. These soft substrates are particularly important for overwintering, where the eel hibernate by burying themselves into the bottoms of lakes and rivers (Smith and Saunders, 1995; Scott and Scott, 1998). Trautman (1981) also reported that eel partially or completely bury themselves in mud, sand and gravel during the day, emerging at dusk to begin feeding.

American eel have been assessed as threatened by COSEWIC (2012) and are considered provincially imperiled by the ACCDC (S2). American eel are not currently protected under SARA or NSESA. From 2015-2017, adult American eel were confirmed in watercourses along the Haul Road including WC-N, WC-V, and WC-AH. Juvenile eel were also observed in WC-N and WC-AH. During the 2019-2020 field program, adult American eel were confirmed in Mud Lake/WC27, Cameron Flowage, WC13, and the Killag River. Juvenile eel were also observed in WC13.

Banded Killifish

Banded killifish are freshwater habitat generalists found within the quiet waters of lakes, ponds, and sluggish streams, tolerating a broad temperature, salinity, and DO range (COSEWIC, 2014). Adults tend to school in shallow water characterized by sand, gravel, or muddy substrate, with submerged aquatic plants (Scott and Crossman, 1973). Banded killifish are generally not considered a strong swimmer, and high velocities are thought to limit the species' movement within a watershed (DFO, 2011). Seasonal movement by the species has not been documented, and it is not considered migratory (COSEWIC, 2014).

Banded killifish spawning has been seldom documented; however, it is thought that aquatic vegetation within quiet shallows is a key component in spawning habitat as an attachment point for externally fertilized eggs (Richardson, 1939).

Banded killifish are considered provincially secure by the ACCDC (S5). Banded killifish were captured within both the Beaver Dam Mine and along the Haul Road during the 2015-2017 fish surveys, including WC13, Crusher Lake, the flooded portion of Wetland 56, WC-N, and WC-AA. During the 2019-2020 field program, adult and juvenile banded killifish were confirmed in Mud Lake/WC27, Cameron Flowage, WC13, and the flooded portion of WL59.

Brook Trout

Brook trout are known to inhabit a wide range of cool, freshwater environments, from small headwater streams to large lakes. Water temperature is a critical factor influencing brook trout distribution and production. Though typically not anadromous, brook trout require free passage along streams to move between areas of use, including spawning grounds, overwintering areas, and summer rearing areas.

In Nova Scotia, mature brook trout migrate to spawn in lakes or streams in the fall of the year. Brook trout spawning sites are usually near groundwater upwelling or spring seeps and within a lake or stream with gravel substrate (NSDAF, 2005). Optimal spawning conditions for brook trout include clear substrate 3 to 8 mm in size in shallow water with limited fines (<5%), and velocities of 25 to 75 cm/s (Raleigh, 1982).

Young of the year brook trout require cold water, stable, low velocities and an abundance of in-stream cover. Optimal temperature for juvenile growth is 10 to 16°C, while cover in the form rubble, vegetation, undercut banks, and woody debris should account for a minimum of 15% of total stream area (Raleigh, 1982). In winter, brook trout aggregate in pools beneath silt-free rocky substrate and close to point sources of groundwater discharge (Raleigh, 1982; Cunjak and Power, 1986). Adults use both pools and riffles, with more than 25% in-stream cover being optimal (Raleigh, 1982). Brook trout respond negatively to flashy or hydrologically dynamic systems, and require stable flow for all life stages (Raleigh, 1982).

Brook trout are considered provincially vulnerable by the ACCDC (S3), but have not been assessed by COSEWIC nor are they currently listed under SARA or NSESA. From 2015-2017, juvenile brook trout were captured in WC5 (north of Crusher Lake), WC12, and WC13 within the Beaver Dam Mine Site. Along the Haul Road, juvenile brook trout were confirmed in WC-N and WC-V. One individual adult brook trout was captured in WC-AH. During the 2019-2020 field program, adult brook trout were captured within Crusher Lake, WC5 Reach B, Mud Lake/WC27, Cameron Flowage, WC13, and WC23. Juvenile brook trout (young of the year and parr) were also documented in WC13, WL59, Crusher Lake, WC5, and the Killag River.

Brown Bullhead

Brown bullhead are bottom dwellers that prefer sluggish and warm water in slow-moving streams, ponds, and lakes with abundant aquatic vegetation. The species is resistant to increased levels of pollution and is tolerant of low oxygen concentrations and temperatures up to 31.6°C (Scott and Crossman, 1973).

Brown bullhead spawning occurs in late spring and summer when water temperatures reach 21°C (Scott and Crossman, 1973). Adhesive eggs are deposited into shallow nests that are excavated in mud or sand substrate, covered by at least 15 cm of water (Scott and Crossman, 1973).

Adults can be found in lakes and rivers with a variety of substrates but are typically associated with muddy bottoms. These fish are omnivorous night-feeders and will forage on all types of plant and animal materials that they locate with their barbels.

Brown bullhead are considered provincially secure by the ACCDC (S5). Brown bullhead were confirmed within Crusher Lake and Cameron Flowage, and one juvenile was captured WC-13 during the 2015-2017 fish surveys. No brown bullhead were captured within watercourses along the Haul Road. During the 2019-2020 field program, adult brown bullhead were captured in Mud Lake/WC27 and WL59.

Creek Chub

Creek chub are widely distributed and are considered one of the most common stream minnows in Eastern North America (Scott and Crossman, 1973). Adults prefer small, clear, and cool streams, although the species has been known inhabit the shore waters of small lakes. Optimum habitat is characterized by moderate to high gradients, gravel substrates, and riffle-run and pool habitat with abundant cover (McMahon, 1982).

Spawning occurs in spring in small streams with clean gravel substrate. Males create a pit by swimming vigorously against the stream bottom into which eggs are deposited and then covered with stones (Scott and Crossman, 1973). These pits are most often located just above or below a riffle (McMahon, 1982). Young of the year are often found in shallow areas along the edges of low velocity pools (McMahon, 1982).

Creek chub are considered provincially secure by the ACCDC (S5). During the 2019-2020 field program, 6 individual adult creek chub captured across Cameron Flowage and WC13. No creek chub were identified during the 2015-2017 program.

Golden Shiner

Golden shiner are habitat generalists, primarily found schooling in well vegetated lakes with extensive shallows (Scott and Crossman, 1973). The species can tolerate a wide range of oxygen concentrations and temperatures (Murdy et al., 1997).

Spawning takes place from June to August, when temperatures reach 20°C, during which adhesive eggs are scattered over the substrate, attaching to filamentous algae or other aquatic vegetation (Scott and Crossman, 1973).

Golden shiner are considered provincially apparently secure by the ACCDC (S4). From 2015-2017, adult golden shiner were captured in Crusher Lake and Cameron Flowage, and WC-AA along the Haul Road. During the 2019-2020 field program, adult and juvenile golden shiner were captured in Mud Lake/WC27, Crusher Lake, WL59 and Cameron Flowage.

Lake Chub

Lake chub are a common fish of lakes and rivers, preferring cool, clear water and gravel bottomed streams and lake edges (Page and Burr, 2011). The species is mostly found in shallow water but may move into deeper areas to escape high temperatures (Scott and Crossman, 1973).

When inhabiting lakes and larger rivers, schools of lake chub will undergo spawning migrations to shallow areas of slow tributary streams in the spring, with seasonal movements occasionally being extensive (Scott and Crossman 1973; Stasiak, 2006a). During spawning, non-adhesive eggs are scattered over gravel or rocky substrate (Scott and Crossman, 1973; Stasiak, 2006a). Young of the year and juveniles prefer slow, shallow water. Young of the year are often found in submerged vegetation (Brown et al. 1970), while older juveniles have been found over a variety of substrates (Mecum, 1984).

Lake chub are considered provincially secure by the ACCDC (S5). From 2015-2017, one juvenile lake chub was captured in WC-13 within the Beaver Dam Mine Site. Along the Haul Road, adult lake chub were confirmed present in WC-N and WC-AA. During the 2019-2020 field program, adult lake chub were captured in Mud Lake/WC27, WC5 Reach B, WC13, and the Killag River. Juveniles were also documented in the Killag River, WC5 Reach B and WC13.

Ninespine Stickleback

Ninespine stickleback are found in both brackish waters and the shallow areas of freshwater lakes and ponds. In rivers and streams, the species is generally found in sluggish, cool pools where there is plenty of aquatic vegetation.

Spawning takes place over the summer in fresh water, during which the male constructs a nest off the substrate by binding plant fragments together (Scott and Crossman, 1973). Spawning habitat is primarily characterized by shallow depths, low velocity, dense aquatic vegetation, and mud and silt substrates (McPhail and Lindsey, 1970; Scott and Scott, 1988).

Ninespine stickleback are considered provincially secure by the ACCDC (S5). Ninespine stickleback were only captured in WC-4 during the 2015-2017 fish surveys. During the 2019-2020 field program, stickleback were captured in Mud Lake/WC27, Crusher Lake, WL56, WL59, and WC13, and WC26.

Northern Redbelly Dace

Northern redbelly dace have a strong habitat preference for quiet waters, including beaver ponds, bog ponds, small lakes, and sluggish areas of streams underlain by brown detritus or silt (Scott and Crossman, 1973). Preferred habitats are also characterized by a constant supply of cool groundwater, ensuring sufficient DO levels into the hotter summer months (Stasiak, 2006b).

Characteristics of small streams where this species generally occurs include water supplied by clear, cool springs or seeps, lack of a strong current, cover in the form of undercut banks, heavy vegetation, or brushy debris, and no large piscivorous fish populations (Stasiak, 2006b).

Spawning occurs in the spring to early summer (Scott and Crossman, 1973). Hubbs and Cooper (1936) documented non-adhesive eggs being deposited into dense mats of filamentous algae.

Northern redbelly dace are considered provincially secure by the ACCDC (S5). From 2015-2017, northern redbelly dace were captured in WC5 north of Crusher Lake, WC13, and the flooded portion of WL56. No northern redbelly dace were captured within watercourses along the Haul Road.

White Sucker

White sucker are generalist bottom dwellers found in warm, shallow water areas of lakes and quiet streams. They are most abundant in areas with aquatic vegetation and underwater debris that provide cover.

White sucker are active year-round, spawning in May-June when they migrate into small streams and tributaries with water temperatures of 10 to 18°C (NSSA, 2005). Preferred spawning habitat for white sucker is shallow gravel riffles of moderate water velocity. Lake populations sometimes spawn on gravel shoals where there is wave action (NSSA, 2005). The adults leave the spawning ground after a week or two and return to the river or lake from which they originated (Scott and Crossman, 1973).

Young of the year are typically found over sand and gravel substrates in moderate currents (Twomey et al., 1984). Older juveniles are typically found in shallow backwaters and riffles with moderate water velocities and sand/rubble substrate (Propst, 1982). In-stream cover in the form of rocky substrates, vegetation, and larger woody debris are important for all life stages of white sucker.

White sucker are considered provincially secure by the ACCDC (S5). From 2015-2017, juvenile white sucker were captured in Cameron Flowage, and in two watercourses along the Haul Road (WC-N and WC-AA). From 2019-2020, adult white sucker were

captured within Mud Lake/WC27, Cameron Flowage, WC13, and the Killag River. In addition, juvenile sucker were captured in WC13 and the Killag River. Schools of young of the year white sucker were also observed in the Killag River in 2020, but largely evaded capture via electrofishing.

Yellow Perch

Yellow perch are a schooling, shallow water fish that can adapt to a wide variety of warm or cool habitats. Most yellow perch do not appear to migrate, but some do in patterns which tend to be short and local (Brown et al., 2009). Adults and juveniles are found in large lakes, small ponds, or gentle rivers but are most abundant in clear, highly vegetated lakes (1 to 10 m depth) that have muck, sand, or gravel bottoms (Brown et al., 2009). They prefer summer temperatures of 21 to 24°C.

Spawning occurs in the spring, with adults moving to lake shallows or low velocity areas of rivers with moderate vegetation. Within 1 to 2 months of emergence, young of the year perch move to open water (Krieger, Terrell & Nelson, 1983).

Yellow perch are considered provincially secure by the ACCDC (S5). During the 2015-2017 fish surveys, juvenile and adult yellow perch were captured in Cameron Flowage. Along the Haul Road, a single juvenile yellow perch was captured in WC-N. During the 2019-2020 field program, juvenile and adult yellow perch were captured in Mud Lake/WC27 and Cameron Flowage. A single juvenile was captured in the Killag River during the second round of electrofishing.

Environmental DNA

The results of eDNA samples collected at the Beaver Dam Mine Site are provided in Table 6.9-6. eDNA was completed on the Cope Brook system in order to clearly assess the presence or absence of fish in the WRSA above a natural barrier. The eDNA sampling was completed as an additional methodology to increase confidence in the not fish frequented definition. The laboratory results report is available in Appendix D of the 2019-2020 Baseline Report (Appendix J.2). Sample locations and results are presented in Figure 6.9-4.

Sample results are consistent with expectations based on site knowledge and fish collection efforts to date. eDNA corroborates the capture data and there are no fish above the barrier. Fish presence was not confirmed within Sites 1 to 4, based on biologists' interpretation of results provided in Section 6.9.4.5. This was expected based on all previous fish collection and habitat survey results.

Table 6.9-6: Summary of eDNA Sample Results

Site ID	WC Number	Interpretation
1	Channelized open water within WL220	Negative
2	WC21 – connection between WL220 and WL205	Negative
3	Standing water in WL205	Negative
4	Channelized WC21 within WL205, upstream of subterranean barrier	Negative
5*	WC23, downstream of subterranean barrier	Positive
6*	WC23, downstream of subterranean barrier	Suspected (Field determination: Positive**)

Notes: Positive - presence of DNA of the target taxa in the water. Negative - presence of DNA of target taxa is not confirmed.

*Positive control sites where fish are known to be present.

**Suspected result is interpreted as positive based on confirmed presence of brook trout in contiguous watercourse upstream.

6.9.4.2.4 Touquoy Mine Site

Moose River, which runs along the western extent of the Touquoy Mine Site, was determined to provide habitat for Atlantic salmon and brook trout during surveys conducted in 2005 as part of the Environmental Assessment (CRA, 2007a). Atlantic salmon (juveniles) were observed and suitable rearing and potential spawning habitat is available for the species. It was presumed that the Atlantic salmon observed were landlocked due to their proximity to a known landlocked population within Scraggy Lake. American eel, white sucker, and minnow species were also observed in Moose River. Although not observed, surveys determined that there is good adult and juvenile brook trout feeding habitat, fair rearing habitat, and potential spawning habitat available within Moose River (CRA 2007a).

Fish observed from 2006 electrofishing surveys of Moose River as part of the EARD include; American eel, white sucker, and minnow species (CRA 2007a).

6.9.5 Consideration of Engagement Results

Key issues raised during public and Mi'kmaq of Nova Scotia engagement relating to fish and fish habitat include potential impacts to the Nova Scotia Southern Uplands population of Atlantic salmon; based on proximity of the Project to the Killag River, and Acid Mitigation Projects being completed by the NSSA, and potential indirect effects from wetland alteration or changes to surface water and groundwater quality and quantity on fish and fish habitat.

6.9.6 Effects Assessment Methodology

6.9.6.1 Boundaries

6.9.6.1.1 Spatial Boundaries

Assessment boundaries define the maximum limit within which the effects assessment and supporting studies (e.g., predictive models) are conducted. Boundaries encompass where and when the Project is expected to interact with identified VCs as well as constraints that may be placed on the assessment of those interactions due to political, social, and economic realities (administrative boundaries), and limitations in predicting or measuring changes (technical boundaries). The definition of these assessment boundaries is an integral part of the assessment process and encompasses possible direct, indirect, and induced Project effects, as well as the trends in processes that may be relevant.

The spatial boundaries used for the assessment of Project effects to Fish and Fish habitat are the PA, LAA, and RAA. These are defined below and shown in Section 6.7, Figure 6.7-11:

- The Project Area (PA) consists of the three components: the Beaver Dam Mine Site, the Beaver Dam Haul Road, and the Touquoy Mine Site, extending from Marinette to Moose River Gold Mines, Halifax County, NS (Section 6.7, Figure 6.7-11). The Beaver Dam Mine Site is located at the eastern end of the Beaver Dam Mines Road. The Haul Road spans from the Beaver Dam Mine Site to Moose River Gold Mines, where the Touquoy Mine Site (processing and exhausted pit [to be used to dispose Beaver Dam tailings]) is located. The PA has changed as a result of the expansion of the Beaver Dam Mine Site to accommodate micro-siting of mine infrastructure and ongoing modifications to the Haul Road design, as described in Section 2 (Project Description). These changes have been captured under the existing and additional desktop and field evaluations.
- The Local Assessment Area (LAA) includes the Project Area and further encompasses watersheds that could be potentially directly affected by mine development and operation and comprises tertiary watersheds which intersect each component of

the Project (Section 6.7, Figures 6.7-4 and 6.7-11). The LAA surrounding the Touquoy Mine Site incorporates the Moose River to the west, and only includes the portion of the Square Lake watershed which interacts with the PA. No Project related aquatic effects are expected in the headwater portions of these watersheds. The lakes and watercourses that are included as part of the baseline programs and/or predictions of effects are located within the LAA boundary.

- The Regional Assessment Area (RAA) encompasses the three secondary watersheds that the PA is located within. The RAA is broader than expected Project impacts and considers other project boundaries as per the cumulative effects assessment methodology. Watersheds comprising the RAA are:
    1. West River Sheet Harbour secondary watershed (1EM-2, incorporating the Beaver Dam Mine Site and Haul Road);
    2. Tangier River secondary watershed (1EL-2, incorporating the Haul Road); and
    3. Fish River-Lake Charlotte secondary watershed (1EL-5, which incorporates the Touquoy Mine Site).

As the Project has the potential to cause direct and indirect effects to fish and fish habitat outside of the PA, the LAA is the appropriate boundary for evaluation of this VC.

In addition to the assessment boundaries described above, a Fish Habitat Assessment Area (FHAA) was established to facilitate the field evaluation of watercourses predicted to be indirectly affected by the Project downstream of the PA boundary. This FHAA includes watercourses WC23, WC26, and WC27 to their respective downstream receiving environments (Cope Brook, and the Killag River), Cameron Flowage, and the Killag River downstream to the NSSA Lime Doser. Figure 6.9-1 shows the FHAA in the context of the LAA. In short, the FHAA s a broader spatial area than the Beaver Dam Mine Site that was established to guide field baseline surveys where predicted indirect impacts were identified stemming from the mine infrastructure (Figure 6.9-1).

6.9.6.1.2 Temporal Boundaries

Temporal boundaries reflect those periods during which planned Project activities are reasonably expected to potentially affect a VC. The temporal boundaries used for the assessment of effects to Fish and Fish Habitat are the Construction phase, Operations phase, and Active Closure and Post-closure

To support the effects assessment for the Surface Water VC, and by extension Fish and Fish Habitat, predictive models for were developed for the end of operations model (i.e., max build out) as well as Post-closure. The End-of-mine model (EOM) represents the Project stage with the highest potential for significant effects to the receiving environment and thus the prediction and assessment of potential effects at EOM, and applying to the whole of operations, is a conservative approach. Results of surface water modelling are detailed in the Surface Water Effects Assessment (Section 6.7), and appendices referenced therein.

6.9.6.1.3 Technical Boundaries

The Fish and Fish Habitat effects assessment was developed to incorporate quantitative data from baseline reports as well as predictive surface water modelling including sensitivity analyses; the modelling domains of predictive surface water models represent a technical boundary for the effects assessment; additional discussion in this regard is presented in Section 6.7.7.1

6.9.6.1.4 Administrative Boundaries

Fish and fish habitat were evaluated for the Project within the framework offered by the *Fisheries Act* (2019) and supporting policy statements and documents from DFO, including those referenced herein. DFO interpretation of HADD of fish and fish habitat supports the evaluation of this VC for the purpose of this EIS.

DFO's *Fisheries Act* (RSC, 1985, c.F-14) states:

- Under Section 35(1) that No person shall carry on any work, undertaking or activity that results in harmful alteration, disruption or destruction of fish habitat.
- Also, Section 34.4(1) states No person shall carry on any work, undertaking or activity, other than fishing, that results in the death of fish.
- Under subsection 35(1) a person may carry on such works, undertakings or activities without contravening this prohibition, provided that they are carried on under the authority of one of the exceptions listed in subsection 35(2), and in accordance with the requirements of the appropriate exception. In most cases, this exception would be Ministerial authorizations granted to proponents in accordance with the Authorizations Concerning Fish and Fish Habitat Protection Regulations.

The Policy for Applying Measures to Offset Adverse Effects on Fish and Fish Habitat Under the *Fisheries Act* (DFO 2019) states the following:

> *Works, undertakings or activities resulting in the death of fish or the harmful alteration, disruption or destruction of fish habitat are prohibited under the Fisheries Act unless otherwise authorized. Before approving works, undertakings or activities that will result in the death of fish and/or the harmful alteration, disruption or destruction of fish habitat, Fisheries and Oceans Canada (the Department), must consider if there are alternatives that avoid adverse effects on fish and fish habitat. If the adverse effects on fish and fish habitat are unavoidable, the Department must consider if there are measures to mitigate that would reduce or minimize those adverse effects. Finally, if there are any residual effects, then the Department must consider measures to offset or counterbalance the death of fish and the harmful alteration, disruption or destruction of fish habitat.*

The Department will apply a risk-based approach when evaluating the impacts of works, undertakings or activities on fish habitat. Following from the definition of fish habitat noted above, the Department interprets "harmful alteration, disruption or destruction" as any temporary or permanent change to fish habitat that directly or indirectly impairs the habitat's capacity to support one or more life processes of fish (DFO 2019 [Fish and Fish Habitat Protection Program]).

The Project is currently undergoing federal and provincial environmental assessment under the *Canadian Environmental Assessment Act* 2012 and *Nova Scotia Environment Act,* respectively. Section 6.9.9 describes the residual effects on fish and fish habitat when project mitigations have been considered. As part of the planning and permitting process, this Updated EIS and the draft Fish Habitat Offset Plan will be reviewed by DFO to confirm the likely residual effects of the Project on fish and fish habitat and the need for a Federal Fisheries Authorization. Subsequently, a *Fisheries Act* Application for Authorization including a detailed final offsetting plan will be developed (Appendix J.3 draft Fish Habitat Offset Plan).

6.9.6.2 Thresholds for Determination of Significance

In response to IAAC (CEAA 2019) IR2 CEAA 2-02, the significance determination is revised and is described in Table 6.9-7.

Overall, a significant adverse effect from the Project on fish and fish habitat is defined as an effect that results in an unmitigated or uncompensated net loss of fish habitat as defined under the *Fisheries Act,* and its associated no-net loss policy. Specifically, the residual effects of the Project on Fish and Fish Habitat VC is characterized using standard criteria, including magnitude, geographical extent, duration, frequency, reversibility, and context of the effect (Table 6.9-7). The residual effects assessment concludes with a determination of significance. The screening of project effects, mitigation measures, and the subsequent fish and

fish habitat results are assessed in aggregate to determine whether the residual impacts are "Not Significant" or "Significant" according to the following definitions:

- **Significant Residual Effect:** residual effects have high magnitude, be of potential regional geographic extent and of medium to long term duration, occur at any frequency and only be partially reversible to irreversible.
- **Not Significant Residual Effect:** is defined as negligible to moderate magnitude, are restricted to the PA or near-field receiving environment, are of sporadic or short-term duration, occur at any frequency and are reversible to partially reversible.

Overall, a significant adverse effect from the Project on fish and fish habitat is defined as an effect that results in an unmitigated or uncompensated net loss of fish habitat as defined under the *Fisheries Act,* and its associated no-net loss policy.

Table 6.9-7: Definitions of Characterization Criteria for Residual Effects on Fish and Fish Habitat

Criteria	Description of Ratings
Magnitude	• **Negligible:** no measurable change in fish and fish habitat quantity or quality described as one or more of the following (and/or): o Less than one percent change in surface flow volumes. o No direct loss of fish habitat; and o predicted change of surface water quality indicator is less than 10% of background conditions, (i.e., no measurable change of state of indicator from background conditions). • **Low:** a measurable change in fish habitat area or quality, but within the range of natural variation described as one or more of the following (and/or): o Less than 10% flow reduction and not affecting the ability of documented fish species to use the habitat to carry out one or more life processes; o direct loss of to up to 20 m^2 of fish habitat in any individual fish-bearing wetland or watercourse; and o water quality in the receiving environment is predicted to be greater than guidelines and increase by greater than 10% over baseline levels but remains well within the observed range of natural variation (defined as 25th to 75th percentile baseline water quality). • **Moderate:** a measurable change in fish habitat area or quality, above the range of natural variation, which partially limits the ability of fish to use the habitat to carry out one or more life processes described as one or more of the following (and/or): o Less than 10% flow reduction but greater than a 10% net increase in the duration (number) of days below the 30% MAD (based on daily flows), which partially limits the ability of fish to use the habitat to carry out one or more life processes; o Direct loss of fish habitat, greater than 20 m^2, up to 100 m^2 in any individual fish bearing wetland or watercourse; and o Water quality in the receiving environment is predicted to be greater than guidelines and differ substantially from baseline levels and approaches upper observed limits of natural variation (defined as percentile baseline water quality). • **High:** a measurable change in fish habitat area or quality to an extent which limits the ability of fish to use the habitat to carry out one or more life processes described as one or more of the following (and/or): o Greater than a 10% flow reduction and a greater than 10% increase in number of days below the 30% MAD (based on daily flows), which limits the ability of fish to use the habitat to carry out one or more life processes; o Direct loss of fish habitat greater than 100 m^2 in any individual fish-bearing wetland or watercourse; and o Water quality in the receiving environment is predicted to be greater than guidelines and differ substantially from baseline water quality (outside of 75th to 95th baseline water quality), resulting in a detectable change beyond the range of natural variation.
Geographical Extent	• **Discrete:** effect is limited to receiving environments in the immediate footprint or Project Area (PA). • **Local:** effect is limited to the FFHA/LAA. • **Potential** Regional: effect persists to the Regional Assessment Area.

Table 6.9-7: Definitions of Characterization Criteria for Residual Effects on Fish and Fish Habitat (continued)

Criteria	Description of Ratings
Timing	• Timing represents seasonal occurrence of the effect (e.g., spring vs winter; high flows vs. low flows) and represents effect criteria for designated water users (aquatic resources, human health). The characterization of effect of changes to fish and fish habitat is based on life cycles and is considered in the assessment.
Duration	• **Short term:** effect is restricted to Construction Phase and/or EOM modelling. • **Medium term:** effect occurs in Construction Phase and EOM Phase. • **Long term:** Effect occurs in Construction Phase and EOM Phase and/or persists in PC.
Frequency	• **Sporadic:** VC interaction or effect will occur at irregular intervals throughout any Project Phase. • **Regular:** effect occurs on a regular basis but not continuous basis. • **Continuous:** effect occurs constantly (e.g., every model timestep in a given Project Phase).
Reversibility	• **Reversible:** effect can be reversed. • **Partially reversible:** effect can be partially reversed. • **Irreversible:** effect cannot be reversed, is of permanent duration.

6.9.7 Project Activities/Interactions with Fish and Fish Habitat

6.9.7.1 Overview of Potential Fish and Fish Habitat Interactions

The purpose of this section is to identify how the Fish and Fish Habitat VCs may be affected by interactions with the Project's components and activities and to identify the extent and duration of potential Project-related Harmful Alteration Disruption and Destruction (HADD) of fish habitat, through both direct and indirect pathways of effects.

A direct effect is any Project interaction that results in direct loss or removal (destruction) of fish habitat, through direct imprinting of Project infrastructure on fish habitat, or through complete removal of a stream's entire catchment area or water source. An indirect impact is a Project-related effect which does not result in complete removal of a habitat; however, the quality or suitability of that habitat is altered or disrupted through pathways (a change in groundwater or surface water quality or quantity, for example).

The Project is part of the Moose River Consolidated (MRC) Project, which includes the existing and fully permitted Touquoy Gold Project, located in Moose River Gold Mines, Nova Scotia. The Project will operate as a satellite surface mine to the MRC Project, and crushed ore from the will be transported by truck via the Haul Road to the existing and fully permitted Touquoy Mine. In general, the Project has the potential to effect Fish and Fish Habitat by:

- discharges, including direct discharge to the receiving environment and management of contact water;
- water management activities, including diversions of contact and non-contact water;
- groundwater upwellings and seepage from Project components to receiving environment;
- ML/ARD generated from excavating or exposing material with the potential for ML/ARD, or in runoff from temporary stockpile or road cuts;
- erosion and sedimentation during site clearing, construction, and maintenance activities; and
- dust deposition along the Haul Road Corridor (CEAA 2-37).

Note, during review of Project activities and their expected direct and potential indirect effects to Fish and Fish Habitat, it was understood that authorization under the *Fisheries Act* would be required for Project development due to the presence of fish habitat underlying the proposed pit and due to additional direct and predicted indirect impacts such as flow reductions. Alternatives for all other site infrastructure were considered, focusing specifically on impacts to Fish and Fish Habitat, with the goal of reducing impact to fish and fish habitat. The Fish Habitat Offset Plan is provided in Appendix J.3.

A summary of Project activities and potential interactions with Fish and Fish Habitat by Project Phase is presented in Tables 6.9-8 to 6.9-10. Where Project components/activities are not expected to interact with Fish and Fish Habitat VCs, these components and activities are considered to have no potential effects and are not considered further in the assessment. These include effects to Fish and Fish Habitat as resulting from hazardous waste materials and potential spills well as potential failures of water management structures (e.g., failure settling pond); these are related to occurrences of low likelihood outside of normal operating conditions. These potential effects are addressed in Section 6.18, Accidents and Malfunctions, as well as the draft Spill Contingency Plan (Appendix P.1).

The effects of the Project on Fish and Fish Habitat were determined considering the modelling efforts and effects predictions of the Project on groundwater, surface water and wetlands. This underlying sections are informed by conclusions presented in these other VC sections and should be read in sequence after Sections 6.5 (Geology, Soils and Sediment), 6.6 (Groundwater), and 6.7 (Surface Water).

Table 6.9-8: Potential Project Activities/Interactions with Fish and Fish Habitat at Beaver Dam Mine Site

Project Phase	Duration	Project Interactions
Construction	1 year	• Clearing, grubbing, and grading in preparation of construction • Rock blasting in preparation of construction • Watercourse and wetland alteration in preparation of construction • Mine Site road construction • Surface infrastructure installation and construction • Collection and settling pond construction • Topsoil, till and waste rock transport and storage from site preparation • Surface infrastructure installation and construction • Collection ditch and water management pond construction • Local traffic bypass road construction • Culvert and bridge upgrades and construction • Environmental monitoring • Water collection, treatment and monitoring as required
Operation	5 years	• Rock blasting to access and extract ore • Open pit dewatering, interaction between groundwater drawdown and wetlands • Alteration of surface water hydrology (i.e., ditching of site surface water runoff and surface mine pumped water) and surface water management • Dust and noise management • Emergency Response/Spill Contingency • Explosives management • Environmental monitoring • Water collection, treatment and monitoring as required

Table 6.9-8: Potential Project Activities/Interactions with Fish and Fish Habitat at Beaver Dam Mine Site (continued)

Project Phase	Duration	Project Interactions
Active Closure	2 years	• Site reclamation • Earthworks and replanting • Water collection, treatment, and monitoring • Biophysical monitoring of reclamation landforms • Adaptive Management
Post-closure	10+ years (monitoring, adaptive management)	• Water treatment monitoring and adaptive management, as required

Table 6.9-9: Potential Project Activities/Interactions with Fish and Fish Habitat along the Haul Road

Project Phase	Duration	Project Interactions
Construction	1 year	• Clearing, grubbing, and grading in preparation of construction • Rock blasting in preparation of construction • Watercourse and wetland alteration in preparation of construction • Haul Road construction and upgrades • Local traffic bypass road construction • Culvert and bridge upgrades and construction • Sediment and Erosion Control Management • Environmental Monitoring • General waste management
Operation	5 years	• Haul Road maintenance and repairs • Dust and noise management • Emergency Response/Spill Contingency • Sediment and Erosion Control Management • Environmental monitoring • General waste management
Active Closure	2 years	• N/A[(a)]
Post-closure	10+ years (monitoring, adaptive management)	• N/A

Note: [(a)] Decommissioning and Reclamation of the Haul Road is not expected. The Haul Road will be returned to owner for forestry industry.

N/A = not applicable.

Table 6.9-10: Potential Project Activities/Interactions with Fish and Fish Habitat at the Touquoy Mine Site

Project Phase	Duration	Project Interactions
Construction	1 year	• N/A
Operation	5 years	• Tailings and Water Management • General waste management • Environmental monitoring
Active Closure	2 years	• Site reclamation • Earthworks and replanting • Water collection, treatment and monitoring • Biophysical monitoring of reclamation landforms • Adaptive Management
Post-closure	10+ years (monitoring, adaptive management)	• Post closure interaction with discharge from Touquoy Mine Site pit to Moose River

N/A = not applicable.

6.9.7.2 Beaver Dam Mine Site, Fish and Fish Habitat Effects

In this section-describes potential Project effects to Fish and Fish Habitat VCs identified above by Project phase (Tables 6.9-8 to 6.9-10) are further categorized as either:

1. Direct Effects: is any Project interaction that results in direct loss or removal (destruction) of fish habitat, through direct imprinting of Project infrastructure on fish habitat, or through complete removal of a stream's entire catchment area or water source

2. Indirect Effects: a Project-related effect which does not result in complete removal of a habitat; however, the quality or suitability of that habitat is altered or disrupted through pathways (a change in groundwater or surface water quality or quantity, for example).

Table 6.9-11 identifies direct and indirect effects of all fish-bearing aquatic habitats potentially impacted by Project development at the for the Project, including the Beaver Dam Mine Site. These aquatic habitats/fisheries resources are shown on Figure J.4-3 of Appendix J.4.

Further, a summary of all fish-bearing aquatic habitats identified within the Beaver Dam Mine Site is provided in Table 6.9-12 to clearly show which habitats have potential direct or indirect impacts associated with the Project. Fisheries resources that are carried through the effects assessment have been determined to have a potential interaction with the Project and are presented in Table 6.9-13. Within Table 6.9-13, the commencement of potential effects to fish habitat is provided, along with the temporal duration of impacts. For some interactions, the effect commences during operation, but may not be fully realized through operations, such as indirect effects from flow reduction. The residual effects characterization with a focus on magnitude and significance of each direct and indirect interaction are described in Section 6.9.8.

Table 6.9-11: Potential Direct and Indirect Impacts to Fish and Fish Habitat within the Project Area

Impact Type	Direct Impact	Project Phase	Indirect Impact	Project Phase
Destruction of fish habitat	Removal of watercourse, and open water features within the Beaver Dam Mine Site and Haul Road to support mine development including the pit resulting in direct loss of fish habitat.	C	N/A	N/A
Fish mortality	Loss of habitat within the Beaver Dam Mine Site and Haul Road (removal of, watercourse, open water) to support mine development could result in incidental mortality to fish for various species and life stages.	C	N/A	N/A
Changes in composition and characteristics of fish populations	N/A	N/A	Loss of watercourse and/or open water habitat or indirect operational impacts within the mine footprint may result in fish population changes including composition and characteristics of various fish species	C
			Potential for change in fish populations due to changes in water quality or quantity, including effects associated with groundwater to surface water interactions	O, CL
Vibrations from Blasting	Vibrations and pressure from blasting activities within the Beaver Dam Mine Site could result in mortality or affect fish behaviour, spawning and migration	C, O	Blasting adjacent to open water and watercourses has the potential for vibrations/pressure wave and fly rock which could affect fish.	C, O
Mine Activities			Mining activities adjacent to wetlands and watercourses has the potential to alter surface and/or subsurface water flows/hydraulic conductivity which could affect fish behaviour, spawning and migration.	C, O

Table 6.9-11: Potential Direct and Indirect Impacts to Fish and Fish Habitat within the Project Area (continued)

Impact Type	Direct Impact	Project Phase	Indirect Impact	Project Phase
Alteration of fish habitat (hydrology): If the hydrological regime of a wetland, watercourse, or open water feature is altered, fish habitat can be negatively affected	Complete dewatering, infilling or flooding of a wetland, watercourse, or open water feature to facilitate Project development resulting in direct loss of fish habitat.	C, O	Wetlands, watercourses, open water features, and associated fish habitat are also at risk of indirect impacts as a result of management and collection of mine contact water, drainage basin hydrologic adjustments, land elevation changes, blasting etc. causing dewatering. Inadvertent damming of up-gradient wetlands, watercourses, and open water features from construction related infrastructure (i.e., roads with lack of flow through infrastructure) can also affect downstream fish habitat. Changes in surface hydrology can impact downstream water quantity which can affect fish habitat.	C, O, CL
	Alteration of hydrological inputs and outputs into partially altered wetlands, watercourses, or open water has the potential to alter remaining (undeveloped) associated fish habitat.	C, O, CL	Removal of on-site watercourses or outflow and throughflow wetland habitat has the potential to alter the localized hydrology in down-gradient surface water systems and associated fish habitat.	C, O, CL
			Hydrological changes can impact the use of a wetland, watercourse, or open water feature by fish and other aquatic organisms as a habitat resource.	C, O, CL
			Surface water ditching can reduce inputs into wetlands, watercourses, and open water features, reducing water levels, collecting mine contact water, and potentially affecting fish and fish habitat.	C, O, CL
Alteration of fish habitat (water quality): If water quality within upland riparian habitat, riparian wetlands, watercourses, or open water features is altered, the capacity for habitat to support fish can be negatively affected.	Removal (alteration) of riparian wetlands, upland riparian zones, and watercourses from the landscape leading to a change in water quality in down-gradient aquatic receivers (i.e., streams, additional wetlands and lakes) resulting in an adverse change to fish or fish habitat.	C, O, CL	Alteration of riparian habitat (upland and wetland), watercourses, or open water features increases the risk of down grade sedimentation which could affect fish and fish habitat.	C, O, CL
			The effect of increased sedimentation as a result of up-gradient activities (i.e., earth moving, removal of vegetation, soil stockpiling) has the capacity to suffocate existing plant life and increase nutrient levels in downgrade surface water systems. Dust created as a result of construction activities can have a similar impact.	C, O, CL
			Runoff from acid producing rock exposed during construction activities has the potential for negatively altering water quality within down-gradient fish habitat through closure (NSE-2-44).	CL
			Operational discharge of water has potential to negatively affect water quality.	O, CL

Note: C = Construction Phase; O = Operation Phase; CL = Active Closure Phase.

Table 6.9-12: Summary of Fish Resources Evaluated in the Effects Assessment: Beaver Dam Mine Site

Tertiary Watershed	Fish Habitat[1]	Predicted Interactions with Fish and Fish Habitat[2]	Description of Interaction	Carried Forward through Effects Assessment
Cope Brook (1EM-2-J)	WC-23	Indirect	Flow reduction from contact water collection	Yes
	Cope Brook	No direct impact. Indirect impacts evaluated below.	This system is carried through the effects assessment as a downstream receiving environment to upstream impacts	Yes
Killag River (1EM-2-D)	WC-2	No impact	No Impact	No
	WC-3	No impact	No impact	No
	WC-4	No impact	No impact	No
	WC-5	Direct and Indirect	Internal Haul Road, and potential flow reduction from contact water collection	Yes
	WC-6	No impact	No impact	No
	WC-7	No impact	No impact	No
	WC-8	No impact	No impact	No
	WC-9	No impact	No impact	No
	WC-12	Direct	Direct impact to support pit development	Yes
	WC-13	Direct	Pit perimeter berm and loss of catchment area	Yes
	WC-14	Direct	Internal haul road and loss of catchment area	Yes
	WC-17	No impact	No impact	No
	WC-25	Direct	Pit perimeter berm	Yes
	WC-26	Indirect	Flow reduction from contact water collection	Yes
	WC-27	Indirect	Flow reduction from contact water collection	Yes
	Killag River/ Cameron Flowage	No direct impact. Indirect impacts evaluated below.	This system is carried through the effects assessment as a downstream receiving environment to upstream impacts	Yes
	Crusher Lake	Indirect	Crusher Lake is being evaluated for potential effects related to flow reduction	Yes
	Mud Lake/ WL17	Indirect	Mud Lake & WL17 are being evaluated for potential effects related to flow reduction	Yes
	WL-4	No impact	No impact	No
	WL-8	No impact	No impact	No
	WL-10	No impact	No impact	No
	WL-11	No impact	No impact	No
	WL-13	No impact	No impact	No

Table 6.9-12: Summary of Fish Resources Evaluated in the Effects Assessment: Beaver Dam Mine Site (continued)

Tertiary Watershed	Fish Habitat[1]	Predicted Interactions with Fish and Fish Habitat[2]	Description of Interaction	Carried Forward through Effects Assessment
	WL-15	No impact	No impact	No
	WL-20	No impact	No impact	No
	WL-29	No impact	No impact	No
	WL-44	No impact	No impact	No
	WL-56	Direct	Direct impact to support development of open pit	Yes
	WL-59	Direct	Direct impact to support development of open pit	Yes
	WL-61	Direct	Direct impact to support development of open pit	Yes
	WL-62	No impact	No impact	No
Killag River/ Paul Brook (1EM-2-D/ 1EM-2-H)	WC-11	No impact	No impact	No
Tent Brook (1EM-2-F)	WC-28	No impact	No impact	No
	Tent Brook	No direct impacts. Indirect impacts evaluated below.	This system is carried through the effects assessment as a downstream receiving environment	Yes

Notes: 1 Includes fisheries resources only. Non-fish bearing, provincially regulated watercourses (identified in Section 6.9.4.2) and wetlands identified as inaccessible to fish (described in Section 6.9.4.2) have been excluded from this table.

2 Includes impacts to fish habitat only. In wetlands, where impacts may be proposed in portions of the wetland which have been determined to be inaccessible to fish, the response in this table will be 'No impacts'; however, impacts to the wetland habitat itself will be described in detail in Section 6.8.

Table 6.9-13: Commencement of Effects to Fish Habitat by Construction Phase, and Duration of Effect

Tertiary Watershed	Fish Habitat[1]	Predicted Interactions with Fish and Fish Habitat[2]	Phase When Effects Will Commence	Duration of Potential Impact to Fish and Fish Habitat[2]
Cope Brook (1EM-2-J)	WC-23	Indirect	Construction*	Permanent
	Cope Brook	No direct impact. Indirect impacts evaluated below.	Construction*	Permanent
Killag River (1EM-2-D)	WC-5	Direct	Construction	Permanent
	WC-5	Indirect	Construction*	Permanent
	WC-12	Direct	Construction	Permanent
	WC-13	Direct	Construction	Permanent
	WC-14	Direct	Construction	Permanent
	WC-25	Direct	Construction	Permanent
	WC-26	Indirect	Construction*	Permanent
	WC-27	Indirect	Construction*	Permanent
	Killag River/ Cameron Flowage	No direct impact. Indirect impacts evaluated below.	Construction*	Permanent
	Crusher Lake	Indirect	Construction*	Permanent
	Mud Lake/ WL17	Indirect	Construction*	Permanent
	WL-56	Direct	Construction	Permanent
	WL-59	Direct	Construction	Permanent
	WL-61	Direct	Construction	Permanent
Tent Brook (1EM-2-F)	Tent Brook	No direct impact. Indirect impacts evaluated below.	Construction*	Permanent

Notes: Impacts are expected to commence during construction as water collection facilities are constructed. The effect may not be fully realized until operation.

[1]Non-fish bearing, provincially regulated watercourses (identified in Section 6.9.4.2), and wetlands identified as being inaccessible to fish (described in Section 6.9.4.2) have been excluded from this table.

[2] All potential Beaver Dam Mine Site impacts are described here. The evaluation of magnitude or significance of effects is not quantified or described in this table.

6.9.7.2.1 Direct Effects

The Project will result in direct effects to fish habitat; Table 6.9-14 presents potential direct fish habitat impacts within the Beaver Dam Mine Site. Direct impacts to fish and fish habitat will occur during the construction phase of the Project through activities such as mine site infrastructure and road construction and will be permanent.

Direct impacts include fish inhabited waters which will either be directly imprinted by Project infrastructure or are expected to experience complete loss of flow due to complete loss of catchment from infrastructure placement. Watercourses determined to be inaccessible to, and uninhabited by, fish are not included in direct impacts to fish and fish habitat. Details associated with reach-level measurements, including justification for any determination of 'inaccessible to fish' are provided in the 2019-2020 Baseline Report (Appendix J.2), and Section 6.9.4.

Table 6.9-14 shows the estimated surface area (m^2) and habitat units (HU; 100 m^2) of the expected total direct impact to fish in response to IR2 CEAA 2-06 and CEAA 2-07. A list of species known or expected to be present within each system is provided; as this information is used to select appropriate species for Habitat Suitability Indexing (HSI) within the draft Fish Habitat Offset Plan (Appendix J.3). Methods used to measure impact areas are summarized in Section 6.9.3.3.2 and described in further detail (including raw data from each individual transect measurement) in the 2019-2020 Baseline Report (Appendix J.2).

As outlined in Table 6.9-14, five watercourses and three wetlands within the Beaver Dam Mine Site comprising fish habitat will be directly impacted by the mine development and have either confirmed fish habitat, fish presence, or are accessible to fish. While WC1 is located within the Beaver Dam Mine Site, the Project interaction with that watercourse is the construction of the Haul Road, (i.e., where the Haul Road component of the PA meets the Beaver Dam Mine Site component of the PA). Since the impact is related to Haul Road construction, this impact is presented within the Haul Road evaluation of Project interactions. The total quantity of fish habitat directly lost by the Beaver Dam Mine Site is 39,443.44 m^2 (394.43 habitat units) which will require a *Fisheries Act* authorization and therefore will be included in the draft Fish Habitat Offset Plan (Appendix J.3). All direct impacts to fish and fish habitat within the Beaver Dam Mine Site are shown on Figure J.4-6 of Appendix J.4.

Impacts related to the development of the open pit, pit perimeter berm and internal haul roads are expected to be permanent. This includes impacts to Wetlands WL56, WL59, and WL61 and Watercourses WC5, WC12, WC13, WC14 and WC25. As part of the open pit development, the fish access between Wetlands 56/59 and Cameron Flowage via Watercourse WC13 will be removed. A road around the open pit will impact the open water fish habitat within Wetland WL61 and Watercourse WC25. The internal haul road will also impact Watercourse WC14 (CEAA 2-07).

Based on the results of fishing surveys and fish habitat assessments, no Atlantic salmon have been confirmed or are anticipated to reside in any of the fish-bearing aquatic features anticipated to be directly impacted by Project development. No direct impacts to Atlantic salmon will result from the Project.

Full descriptions of fish habitats proposed for direct impact are outlined in 2019-2020 Baseline Report (Appendix J.2). A summary of fish habitat of systems proposed for direct impact (Table 6.9-14) is provided in Section 6.9.4.3.1.1 and shown on Figure J.4-6 of Appendix J.4.

Table 6.9-14: Direct Fish Habitat Impacts within the Beaver Dam Mine Site

Fish Habitat	Fish Species known or Expected (for HSI)[a]	Infrastructure	Length (m)	Average Width (m)	Area (m^2)	Habitat Units	Fish Rescue Release Point
WC5	BKT, LKC, EEL, BKF, BBH, GSH, 9SP, NRD, WHS, YLP	Internal Haul Road (culvert installation)	70	2.2	154.0	1.54	WC5
WC12	BKT	Pit	40	1.0	93.00	0.93	WC5 or Killag
WC13	EEL, BKF, BKT, CKC, LKC, 9SP, WHS, BBH, NRD	Complete loss of catchment area	151	1.9	279.45	2.79	Cameron Flowage
WC14	EEL, BKT	Internal haul road, and complete loss of catchment area	196	0.6	108.80	1.09	Cameron Flowage
WC25	EEL, BKF, GSH, WHS, YLP	Complete loss of catchment area	39	0.45	17.55	0.18	Cameron Flowage
WL56	9SP, BKF, BKT, NRD	Open pit	n/a	n/a	1,454.27	14.54	Cameron Flowage, plus Crusher and or Mud Lakes based on abundance
WL59	EEL, BKF, BBH, GSH, 9SP	Open pit	n/a	n/a	37,162.70	371.62	
WL61	EEL, BKF, GSH, WHS, YLP	Pit Perimeter Road	n/a	n/a	173.67	1.74	
Total					**39,443.44**	**394.43**	

Notes: [a] HSI: Habitat Suitability Index.

[b] Species codes: American Eel (EEL), Atlantic Salmon (ATS), Banded Killifish (BKF), Brook Trout (BKT), Brown Bullhead (BBH), Creek Chub (CKC), Golden Shiner (GSH), Lake Chub (LKC), Ninespine Stickleback (9SP), Northern Redbelly Dace (NRD), White Sucker (WHS), Yellow Perch (YLP).

6.9.7.2.2 Indirect Effects

Potential indirect effects on Fish and Fish Habitat are summarized in Table 6.9-11. To support a response to IR2 CEAA 2-06 and CEAA 2-07, a thorough evaluation of indirect effects to the Fish and Fish Habitat VCs as been completed.

A series of detailed studies have been completed to support this evaluation of changes to the Surface Water VC and associated indirect effects on Fish and Fish Habitat VC and HADD. Surface Water predictions for the Project were produced through the development of deterministic water balance modelling for both the Beaver Dam Mine Site and the existing Touquoy Mine. Summaries of model approaches, assumptions, and sensitivity analyses as they relate to surface water predictive efforts are provided in Section 6.7.7.3. Full details and results of surface water studies conducted to support the environmental assessment are appended here as:

- Appendix D (Predictive Water Quality Assessment) of Appendix P.4 Mine Water Management Plan;
- Appendix A (Water Balance Analyses) of Appendix P.4 Mine Water Management Plan;
- Appendix F.8 Beaver Dam Gold Project Assimilative Capacity Study of Moose River – Touquoy Pit Discharge; and
- Appendix G.3 Additional Water Quality Modelling to Support the Mine Site Water Management Plan.

The results of the above studies, including results of the residual effects assessment for Surface Water VCs, are summarized in the underlying sections to support the assessment to Fish and Fish Habitat VC. Fulsome discussion of the effects assessment to Surface Water VCs is provided in Section 6.7.

Surface Water Quantity

Proposed Project activities that will affect the Surface Water Quantity VC include construction of water management and water diversion features, dewatering activities, and management of contact water (including discharges of treated effluent to the Killag River).

Surface runoff from mine features will be directed to settling ponds for treatment prior to being released into the Killag River and Tent Brook systems. The north settling pond will receive and treat runoff from the waste rock, low-grade ore and topsoil stockpiles, the crusher pad, administrative building area and site roads. Surface water and groundwater collected in the pit sump will also be dewatered to the north settling pond. The east settling pond will receive runoff from the till stockpiles, part of the organic stockpile and site roads. The north and east settling ponds discharge to the Killag River. The south settling pond will receive runoff from another other part of the organic stockpile and a topsoil stockpile. The south settling pond discharges to WC19 of the Tent Brook system.

The Water Balance model indicates that mine site development will increase the Killag River catchment area, and decrease the Mud Lake, Tent Brook and Cope Brook catchments due to the placement of mine features in their baseline drainage areas. A summary of catchment areas at EOM, including the change relative to baseline, are presented in Section 6.7.8.2, Table 6.7-24. Section 6.7.8.2, Table 6.7-25 through Table 6.7-29 present the monthly and annual metrics for identified assessment points in the receiving environment relative to baseline conditions. The key observations are:

- The development of the Beaver Dam Mine Site results in small increases in streamflow volume at the Killag River assessment point defined in the water balance analysis (Appendix A [Water Balance Analysis] of Appendix P.4 Mine Water Management Plan). The predicted increase in annual streamflow is 2.2% in EOM conditions and 1.1% in PC conditions. The small increases are a result of the change in land cover and the diversion away from the adjacent watersheds to the Killag River.

- There will be a 4.4% decrease in annual discharge from Crusher Lake due to the proposed water extraction to meet the domestic water demand. The proposed development results in a <1% increase in Crusher Lake discharge in PC conditions, and 18.3% and 13.7% decreases in Mud Lake discharge in EOM and PC conditions, respectively. The hydrologic impacts to Mud Lake are due to the placement stockpiles and influence of the open pit on groundwater flow patterns in the catchment.
- The proposed development results in a 1.1 to 1.2% and 5.7% reduction in annual streamflow volume at the Tent Brook and Cope Brook assessment points, respectively, in both EOM and PC conditions. The impacts to the Tent Brook system are considered to be low. The impacts to the Cope Brook system are due to the placement of the waste rock stockpile in its baseline catchment.
- Addition discussion of Project effects on MAD flows, as well as additional assessment of potential base flow reduction of the Cameron Flowage and Killag River, is presented in the underlying sections.

Project Effects on Mean Annual Discharge Flows

An evaluation of the potential Project effects on mean annual discharge (MAD) flows was completed by GHD. The methods and results of this evaluation are provided in the Water Balance Analysis (Appendix A of Appendix P.4 [Mine Water Management Plan]) and summarized in Section 6.7.7.3.1. The objectives of the Water Balance Analysis are to assess the impacts of the mine on drainage patterns in surrounding watercourses, and also to provide inputs to the predictive water quality analysis to determine the type and level of treatment required at the proposed Site discharge locations. Monthly and annual streamflow volumes were compared between three mine development stages at sixteen assessment points where the Site will discharge or impact flows in the natural environment. In addition, a water balance analysis of the open pit mine was performed to determine the time required for the pit to fill with water and form a lake as part of the proposed Project draft Reclamation and Closure Plan (Appendix P.2).

Under EOM conditions, open pit inputs include pit wall runoff generated by precipitation falling directly on the pit and groundwater inflows. Outputs include evaporation and dewatering to the north settling pond. The pumping rate to the north settling pond is set equal to the difference between the inputs and evaporation from the pit, based on the assumption that the pit will be kept dry during operations (Appendix A [Water Balance Analysis] of Appendix P.4 [Mine Water Management Plan]).

Post-closure, the open pit inputs include direct precipitation, Site runoff, and groundwater inflows. Output includes evaporation. Open pit water balance calculations were performed under two PC scenarios: (1) following formation of the pit lake, and (2) while the pit is being filled with water. Under PC Scenario 1, pit lake discharge occurs when the balance between the inputs, outputs and stored water exceeds the permanent pool storage volume of the lake, which is approximately 16,000,000 m^3 at a containing elevation of 127 metres above sea level (masl). The permanent pool storage volume of the pit lake was assumed to be full at the beginning of the simulation (Appendix A [Water Balance Analysis] of Appendix P.4 [Mine Water Management Plan]).

A simulation for PC Scenario 2 was performed to estimate the pit filling time. Depth-varying groundwater inflow rates were obtained from the groundwater model (Appendix A [Water Balance Analysis] of Appendix P.4 [Mine Water Management Plan]). Precipitation and evaporation volumes were calculated by multiplying the difference between precipitation and evaporation by the surface area of the water in the pit. The surface area of the water in the pit varies based on the stage of the water. Surface areas are provided at 10 m increments. Pit wall runoff was calculated as the product of precipitation, surface area of the pit above the water surface, and the runoff coefficient of the pit wall. A runoff coefficient of 0.85 was used based on studies completed at the Touquoy Mine Site (Stantec pers. comm., 2018). The time to fill the pit was calculated as the sum of the volume of water in the pit divided by the total inflow rate to the pit at each stage. Based on these calculations the predicted pit filling time is approximately 13 years. The Water Balance Analysis provides detailed results of all monthly flow modelling methods and results. Domestic withdrawal of water

from Crusher Lake during operations is incorporated into this analysis, along with all groundwater baseflow interactions (Appendix A [Water Balance Analysis] of Appendix P.4 [Mine Water Management Plan]).

The Projects' impacts to lake water levels in Mud Lake and Crusher Lake were assessed by converting instantaneous (average daily) flow rates of the historical record to flow depths at the WC5 and WC27 upstream assessment points using the Manning's equation. The change in flow depths at the lake outlet assessment points were then used to estimate the change in lake water levels. Flow depths were computed for various flow statistics and compared between the mine development stages.

Daily Flows

Watercourses within and adjacent to the Beaver Dam Mine Site that may be indirectly affected by flow reduction have been identified and have been assessed as to whether predicted indirect habitat losses would be considered alterations to fish habitat, as described in Section 6.9.7.2. The evaluation of monthly average discharge is an important exercise, however when an evaluation is based on averages, the full range of the impact can be overlooked. As such, the Project team completed an additional evaluation of the Project's potential indirect effects on surface water quantity by further refining the GHD model as described in in Appendix P.4 to a daily time step. The Project team used the results of the preliminary Water Balance Analysis to identify additional surface water flow assessment points, to inform revisions to the Water Balance Analysis . The majority of the assessment points (fifteen of sixteen) presented in the Water Balance Analysis have been selected to identify both the magnitude and spatial extent of flow reduction effects, using the daily flows rather than monthly averages. The daily flow evaluation assessment points are provided in Figure 6.9-5. The additional surface water assessment points were selected on main receiving environments (i.e., Cope Brook, Tent Brook and the Killag River), to confirm whether flow reductions on smaller tributaries were substantial enough to affect flows in the downstream receiving environments. Wherever possible, daily flows in downstream receiving environments were compared with upstream reference points. As the Project is located at the top of the Tent Brook watershed, no upstream reference point was available. The assessment points used to analyze flow reductions and potential impacts to fish are shown in Figure 6.9-5.

The assessment quantified the change in habitat availability and related it to existing habitat within the affected streams. This was accomplished using two approaches; comparison of reduced flows to DFO guidelines on cumulative alterations and comparison of reduced flows to habitat point-of-inflection based on wetted perimeter method (DFO, 2013).

Hydrologic methods included a review of the instantaneous (daily) flows within each watercourse against the DFO framework related to ecological flow requirements (DFO 2013). That is, the review of instantaneous (daily) flow data to determine if:

- Cumulative flow alterations >10% in amplitude of the instantaneous flow in the river relative to a "natural flow regime" are predicted (a cumulative flow alteration of <10% is considered to have a low probability of detectable impacts to ecosystems); and/or
- Cumulative flow alterations that result in instantaneous flows <30% of the MAD are predicted (these may have a heightened risk of impacts).

If either condition is identified, a more rigorous level of assessment is recommended to evaluate potential impacts on ecosystem functions which support fisheries. Streams that did not exceed these criteria were not included in further hydraulic analysis.

A comparison between existing and predicted flow alterations relative to an increase beyond 10% MAD is straight forward. Because estimated flow reductions are based on relatively permanent changes to watercourse conditions caused by changes in water balance, any watercourse that naturally contains a period of time with flows <30% MAD will continue to have instantaneous flows <30% MAD (by definition). The potential cumulative decrease in flow beyond 30% MAD, however, needs to be considered in terms of the relative change in duration (frequency) that may occur below 30% MAD.

Prepared For:

Atlantic Gold

FIGURE 6.9-5

Beaver Dam Mine Project

Potential Direct and Indirect Fish and Fish Habitat Impacts

- Indirect Impact to Flow
- No Significant Impact to Flow
- Upstream Reference
- NSSA Lime Dosing Station
- Direct Impact: Watercourses
- Indirect Impact: Flow Reduction
- Fisheries Resources
- Provincially Regulated Watercourses
- Beaver Lake I.R.
- Project Area

Note: Arrows show flow direction



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 0.25 0.5 1 kilometer

1:25,000 Scale when printed @ 11" x 17"

Drawn By: LP
Reviewed By: MMD

Date: 2021-06-01

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

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An increase in the duration of instantaneous flow that is <30% MAD may be important in habitat reaches or regions where water temperatures, or some other water quality parameter, could reach sub-lethal or lethal limits for a portion of the year. Simultaneous monitoring of such habitat parameters (e.g., thermal) and flow monitoring/modelling for small streams to correlate thermal limits and decreased flows would be challenging and may not identify the habitat limiting factor. A reasonable assumption is that moderate increases in the number of days where flows are reduced to <30% might affect fish populations and habitat productivity/sustainability due to cumulative reductions in water and/or habitat quality.

A review of the instantaneous flow data indicates that additional days with flows <30% MAD occur either directly before or after a day, or series of days, already containing flows <30% MAD, that is they extend an existing period of lower flows. For example, Figure 19 in the draft Fish Habitat Offset Plan (Appendix J.3) shows the MAD as well as the predicted flow reductions in WC27. While all extensions are at most two days, this could cumulatively affect fish within the affected habitat and it is recognized that this can result in a habitat alteration. Similar to the DFO framework approach where a cumulative flow alteration <10% would have a low probability of detectable impacts to ecosystems, a <10% increase in the frequency of instantaneous flow days occurring below 30% MAD for an average flow year (or <5% for a dry year) will likely have a low probability of detectable impacts to ecosystems. However, increases above this would have greater potential to indirectly impair the habitat's capacity to support one or more life processes.

It is noted that the uncertainty regarding criteria set at 10% increase in the number of days where flows occur at <30% has not yet been fully validated by extensive literature review or manipulations. However, a relative increase of 10% in the number of days below what is a relatively high flow threshold (flows below 30% MAD are regularly encountered within natural streams) is conservative and can therefore be considered reasonable. It may also require a rigorous monitoring program associated with a Fisheries Act authorization within habitats considered indirectly affected to provide greater certainty going forward. Consideration might also be given to stream reductions that occur only during the life of the mine (up to EOM) but are then restored upon PC; these might require less offsetting or increased monitoring to determine if offset is required.

Hydraulic analysis was completed on all watercourses that exceeded either the 10% MAD flow reduction or a 10% increase in number of days where flows were <30% MAD (or both). Transects within each watercourse as well as stream measurements were used to generate stream cross section models. The existing habitat (wetted perimeter) on each transect was determined at the MAD as well as 30% MAD. The discharge at 30% MAD represented the flow where cumulative reductions may have a heightened risk of greater potential to indirectly impair the habitat's capacity to support one or more life processes and therefore HADD that would require offsetting measures to avoid significant negative effects on fish and fish habitat. The potential habitat alteration as a result of flow reductions were therefore calculated in metres squared for each watercourse based on the predicted wetted perimeter at 30% MAD as a conservative quantity of indirect impact. That actual amount of the altered habitat that is considered harmful will be determined by DFO during the fisheries Authorization application process.

The Wetted Perimeter Method (WPM) equation validations and supporting information is provided in Appendix A of the draft Fish Offset Plan. Field data collection on WPM transects (including raw data) is provided in the 2019-2020 Baseline Report (Appendix J.2) and summarized in Section 6.9.4.2.2.

Daily Flow Modelling Approach

Detailed, long-term, direct flow data from the PA is not available given the small size of the watercourses. Therefore, streamflow conditions for each affected watercourse were modelled. Streamflow within a watercourse is equal to surface runoff plus baseflow. Surface runoff and baseflow were generated using a conceptual hydrologic model in GoldSim which runs on a daily time step. Rainfall and snowmelt were added to a soil storage element as inputs, and evapotranspiration was subtracted from the soil storage

element as an output on dry days. A "surplus" from the soil storage element was generated after the soil's available water capacity had been exceeded. The "surplus" was partitioned into surface runoff and baseflow recharge into a groundwater aquifer according to a baseflow index (BFI). The BFI was determined from the groundwater model results. Baseflow discharges from the groundwater aquifer at a rate based on the baseflow recession constant, also determined from the groundwater model.

Lakes were also modelled as storage elements in GoldSim, which were assumed to be full in initial conditions. Inputs to the lake include surface runoff, baseflow, and precipitation falling directly on the lake. Output is lake evaporation. Lake discharge is calculated as the overflow from the lake storage element.

The hydrologic model was used to model streamflow and lake discharge from non-site features in EOM/PC conditions. EOM and PC were used as these represent "worse-case" scenarios in terms of effect on streamflow. End-of-Mine would be at a time when mine pits and waste rock would be at a maximum and therefore having maximum influence on baseflow as well as surface flow conditions. Post-closure conditions represent a time period after full mine pit flooding and no remaining active water management/pumping and/or discharges. Variations in baseflow due to the influence of mine development on groundwater flow patterns were determined in the groundwater model. These impacts were incorporated in the GoldSim model as percent changes from baseline conditions.

Daily Flow Data Screening Results

Estimates of daily flows for an average flow year were determined based on the median annual precipitation within the dataset (2003). The estimate for a dry flow year were based on lowest annual precipitation within the dataset (1992).

Table 6.9-15 outlines the results of flow alterations at both End of Mine and Post Closure scenarios. The results indicate that three watercourses, WC 23, 26 and 27, exceed the 10% change in MAD flow. These habitats are therefore selected for further evaluation of indirect impacts to fish habitat. A fourth watercourse, WC5, does not exceed the 10% flow reduction, however, this system has a greater than 10% increase in the number of days at which the flow drops below 30% MAD. As a result, WC5 is screened into the evaluation of indirect impacts to fish habitat. Further details regarding impacts to fish habitat within WC5, 23, 26, and 27 are presented in Section 6.9.7.1.7

As shown, watercourses WC-5, WC-23, WC-26, and WC-27 all have exceedances of at least one criterion and were carried forward to be assessed and quantified. While the predicted reductions within WC-26 and WC-27 were predicted to be moderate, the change in flows within the Killag River immediately downstream of each confluence is predicted to be relatively low at less than 3.5% showing the overall low contribution of each tributary to the Killag River.

The total number of days when the flow within the Killag River just downstream of each confluence was also reviewed under baseline (non-project) and EOM/PC conditions. The Killag River would incur one additional day below the 30% MAD at the confluence of WC-26 (during dry flow conditions) and only three or four additional days a year below the confluence of WC-27 (average and dry years, respectively). Additionally, at the upriver end of Cameron Flowage, approximately 2.0 km downriver from the confluence of WC-27, there is only one additional day below 30% MAD (in both average and dry years). The Killag River had a predicted increase in flow and decrease in number of days <30% MAD within and downstream of Cameron Flowage likely because baseflow losses to the nearby pit will be augmented by the collection, treatment, and release of all pit water back to the Killag River which would include flows from around the full mine pit from other watercourses. Therefore, flow reductions within the northern portion of the Killag River as a result of flow reductions in WC-26 and WC-27 is considered low magnitude, negligible and not a harmful alteration of habitat.

While the Killag River is not screened into the indirect effects assessment based on flow reduction; the following section will outline any broader potential indirect effects associated with the Project on this system; as it is the nearest, most substantial receiving environment, and it is of vital importance to Atlantic salmon.

Table 6.9-15: Summary of Flow Reduction in Downstream Receiving Aquatic Habitats for Screening Purposes

Watercourse	Modelled DFO Criteria			Modelled % Flow Alteration (%MAD)[1]	>10% Flow Alteration Criteria Exceeded?	Increase Days <30% (%)
	100% MAD (m^3/s)	90% MAD (m^3/s)	30% MAD (m^3/s)			
Average Flow Year						
WC-5	0.025	0.022	0.007	-4.7	No	**+12.2**
WC-23	0.054	0.049	0.016	**-17.4**	Yes	**+14.8**
WC-26	0.023	0.021	0.007	**-25.0**	Yes	**+25.2**
WC-27	0.070	0.063	0.021	**-18.5**	Yes	**+21.4**
Tent Brook	0.091	0.082	0.027	-2.9	No	+0.0
Killag River						
Killag River Upstream of Project	0.412	0.371	0.124	0.0	No	+0.0
Killag River Downstream of WC-26 confluence	0.460	0.414	0.138	-1.2	No	+0.0
Killag River Downstream of WC-27 confluence	0.554	0.499	0.166	-3.2	No	+2.6
Killag River at Cameron Flowage	1.064	0.958	0.319	-1.7	No	+0.9
Killag River at NSSA Lime Dosing Station	1.118	1.001	0.335	+1.0	No	-7.0
Killag River Downstream of Project	1.169	1.052	0.351	+1.0	No	-9.6
Cope Brook						
Cope Brook Upstream of WC-23	0.075	0.068	0.335	0.0	No	0.0
Cope Brook Downstream of WC-23 confluence	0.143	0.129	0.351	-6.7	No	+5.2
Dry Flow Year						
WC-5	0.016	0.015	0.005	-6.1	No	**+11.6**
WC-23	0.037	0.033	0.011	**-18.9**	Yes	**+10.5**
WC-26	0.016	0.014	0.005	**-25.0**	Yes	**+14.7**
WC-27	0.047	0.042	0.014	**-17.0**	Yes	**+15.3**
Tent Brook	0.062	0.055	0.016	-3.2	No	+0.7
Killag River						
Killag River Upstream of Project	0.279	0.251	0.084	0.0	No	+0.0
Killag River Downstream of WC-26 confluence	0.311	0.280	0.093	-1.3	No	+0.7
Killag River Downstream of WC-27 confluence	0.374	0.337	0.112	-3.2	No	+2.8
Killag River at Cameron Flowage	0.720	0.648	0.216	-1.8	No	+0.7
Killag River at NSSA Lime Dosing Station	0.756	0.680	0.227	+1.6	No	-6.3
Killag River Downstream of Project	0.802	0.722	0.241	+1.4	No	-6.3
Cope Brook						
Cope Brook Upstream of WC-23	0.051	0.046	0.015	0.0	No	+0.0
Cope Brook Downstream of WC-23 confluence	0.097	0.087	0.029	-7.2	No	+2.8

[1] Flow alteration noted is the largest reduction between End-of-Mine and Post-closure. All flows based on instantaneous (daily) flows

DFO = Fisheries and Oceans Canada; m3/s = cubic meters per second; MAD = mean annual discharge; > = greater than; < = less than; % = percent; WC = watercourse.

Cameron Flowage – Killag River, Additional Assessment

Methods and results of predictive water balance and water quality modelling is summarized above in Section 6.9.7.2.2 (Indirect Effects, Beaver Dam Mine Site) and detailed in Surface Water Effects Assessment (Section 6.7) and references presented therein. The most salient points specific to the Cameron Flowage and surface water quantity is presented in this section; surface water quality is disused in Section 6.9.7.2.2.2.

The simulated change in baseflow throughout the Cameron Flowage watershed is presented in Table 7.4 of Appendix F.5 (Hydrogeologic Modelling Report). The simulated baseflow reduction ranges from 677 to 754 m^3/d at EOM and from 446 to 620 m^3/d at PC. The range in baseflow reduction represents 2 to 3% of total baseflow in the Cameron Flowage watershed and is under 1% of the total average annual flow in Cameron Flowage. Approximately 50 to 60% of the total baseflow reduction is simulated to occur within the Beaver Dam Mine Site Property Boundary, and the remaining 40 to 50% of total baseflow reduction is simulated to occur between the Property Boundary and the LAA, indicating that Beaver Dam Mine Site operations will not impact the baseflow contribution to Cameron Flowage beyond the LAA.

The range in simulated baseflow reduction to the Cameron Flowage watershed is from 2 to 3% of average annual baseflow and is under 1% of total average annual flow. Potential effects of this baseflow reduction to Cameron Flowage are discussed in further detail in the draft Fish Offset Plan (Appendix J.3).

AMNS commits to maintaining compliance with all applicable water quality guidelines at the site discharge points, and within the receiving aquatic environment (Cameron Flowage/Killag River), given the proposed contact water collection and treatment plan. Provided treatment and mitigation measures outline throughout the EIS and associated management plans are followed, no indirect impacts to fish and fish habitat are predicted based on effluent discharge from the Project. Furthermore, there are no predicted impacts to the NSSA Acid Mitigation Project (NSSA AMP) (IR2 NSE 2-43) as a result of predicted water quality from the Project within Cameron Flowage/Killag River. Finally, Project effluent will be released within a pH range of 6.0 to 9.5, as per MDMER requirements, which is neutral compared with the naturally acidic background levels found within the Killag River. As a result, addition of treated effluent is not expected to exacerbate the current acidity of the Killag River. Given that water treatment will occur prior to release and considering all of the associated contingencies for water management outlined in the MWMP, adverse impacts (harmful alteration) on fish and fish habitat are not expected in Cameron Flowage/Killag River due to predicted changes in water quality. These conclusions will be confirmed by an Aquatic Effects Monitoring Program (AEMP) which includes the EEM specific to MDMER, and any necessary refinements to geochemical source terms, and groundwater and surface water predictive modelling throughout the life of the mine. Adaptive management measures will be provided within the final AEMP during permitting should monitoring determine that actual effluent quality does not match with predictions provided within this EIS.

In addition to possible reductions in flow within Killag River due to reduced flows within watercourse tributaries and baseflow (groundwater) changes due to pit influences, several other possible interactions between the Beaver Dam Mine Site and the Killag River were assessed including the location of the North Pond discharge into Cameron Flowage, possible habitat dewatering and habitat accessibility due to water release delays, thermal effects of reduced groundwater inflow, and possible water quality alterations. These additional assessments are provided in the Fish Offset Plan (Appendix J.3) and include consideration of:

- Augmentation at the North Pond Discharge Location: flow augmentation will mitigate any flow impacts that a reduction in baseflow would have on the total flow in Cameron Flowage and further downriver within the Killag River.
- Sensitivity Analysis – Effect from a Cessation of Discharge to Cameron Flowage/Killag River; and
- Sensitivity Analysis - Habitat Accessibility Due to Water Release Delays.

Surface Water Quality

The Surface Water Quality VC and identified indicators were either assessed quantitatively by predictive water modelling (total and dissolved metals, anions, and nutrients; mg/L) or qualitatively based on geochemical characterization studies and professional judgement and experience (e.g., pH, TSS). For surface water quality, predictive modelling was performed on a monthly basis for the average year climatic conditions. Performing the water quality assessment on a monthly basis allows for the prediction of the seasonality characteristics of water quality in the Killag River. This allows for the assessment of the wet and dry months to determine the month with the highest effect on the water quality in the Killag River and will assist with the design of water quality treatment options at the Project Site. The only discharge points with potential for discharge of impacted mine effluent into the Killag River system are the north settling pond (EOM) and the pit (PC). There are three discharge points proposed during EOM conditions and PC conditions (Figure 6.7-13 and 6.7-14). Thus, in the model, receiving water quality predictions were generated for:

1. EOM: near-field mixing zone (100 m downstream of each discharge point with the potential for constituent transport);
2. PC: near-field mixing Zone on Killag River for the Pit; and
3. EOM and PC: far-field mixing zone (approximately 1 km downstream of Near Field - Pit - PC discharge point in the Killag River).

Surface Water Quality predictions are presented in Section 6.7.8.2.3, Tables 6.7-30 through 6.7-38. The key observations are:

- For the Killag River under the EOM scenarios, water quality predictions for near-field mixing zone and far-field mixing in the base case are consistently below selected water quality benchmarks. The initial analysis assumed no treatment of mine contact water in the north settling pond and only analyzed the results from a mass balance (dilution) calculation at the extent of the predicted mixing zone. The results indicated that, while concentrations for some parameters are anticipated to increase above baseline levels, at the near-field mixing zone there are no exceedances of either CCME, NSE Tier 1 criteria. As water quality criteria are defined by national and international entities as protective of the receiving environment and all water users, there are no anticipated effects to surface waters are a result of discharges from the Project to the Killag River.
- In the EOM upper case scenario, nitrite is predicted to exceed CCME FAL guidelines in three months of the year. In response to IR2 CEAA-2-35, potential nitrite removal technologies have been identified and evaluated for the Project (Appendix F.2 [Water Treatment Assessment Operation] of Appendix P.4 [Mine Water Management Plan]). Further note that a treatment system will be designed to ensure that all site effluent water meets MDMER and will reflect assimilation capacity of the receiving environment, such that any potential effects from nitrite to Fish and Fish Habitat, will be fully mitigated (Section 6.7.9).
- Treatment will occur, as required, prior to discharge into the receiving environment to ensure discharge meets MDMER regulations and will reflect assimilation capacity of the receiving environment, such that concentrations in the Killag River do not exceed exceedances of either CCME, NSE Tier 1 criteria. or site-specific guidelines, as applicable.
- It is unlikely ARD onset will occur during the operations phase (5 years). An engineered cover will be placed immediately following operations during active closure.

Total Suspended Sediments (TSS)

The potential effects on surface water quality, and by extension Fish and Fish Habitat, from increased erosion and sedimentation are qualitatively assessed in this section. Erosion and sedimentation effects on surface water quality can be indicated primarily by changes in turbidity and total suspended solids (TSS) in surface waterbodies. However, for the Project there is generally minimal risk of effects from erosion and sedimentation on surface water quality due to the limited extent of planned surface disturbances and the proposed use of pre-existing infrastructure such as roads, camp, and the processing facility.

Mitigation and management strategies for erosion and sediment control will follow best management practices (BMPs). General strategies for erosion prevention are described in Section 6.7.9; specific details of mitigation and management strategies for the minimization of erosion and control of sediment, including specific BMPs to be applied during Project Construction, Operations, and Closure, are discussed primarily in the draft Erosion and Sediment Control Plan (Appendix C of the Mine Water Management Plan [Appendix P.4]). Where soil erosion may still occur despite preventative measures, sediment control strategies may be implemented to capture sediments before they are released to the receiving environment. The success of erosion management and sediment control measures would be monitored by regular inspection and maintenance of all water management and sediment control structures, which will include prompt attention to potential erosion sites, ditch or culvert failure and blockage, or outside seepage. Accumulated sediment would also be routinely removed from ditches and retention structures.

Potential effects from sedimentation and erosion are most likely to occur during the Construction and Active Closure phases, when surface materials will likely be disturbed during construction or reclamation activities. As TSS loads are generally low in Project area streams, any additional sediment loading has the potential to increase TSS and turbidity in the receiving environment. Potential effects due to sedimentation and erosion have the greatest potential to occur during periods of significant overland flow, such as freshet and rainfall events. However, planned disturbances in the Project Area are limited, and implementation of BMPs and mitigation measures as summarized in Section 6.7.9 and detailed in the draft Erosion and Sediment Control Plan (Appendix C of the Mine Water Management Plan [Appendix P.4]) and will prevent substantial change of surface water quality near the proposed access corridor and other planned site upgrades. Further, water quality responses to run-off include increased concentrations of TSS but tend to be temporary and localized (Forman 1998).

Habitat Quality/Suitability – Thermal

Cold-water fish, including salmonids, require that surface water temperatures remain within a certain range for maximal suitability and survival. Under low-flow conditions during summer months, groundwater discharge (baseflow) to Cameron Flowage may sustain a significant portion of the total flow within Cameron Flowage; therefore, the potential reduction in baseflow as a result of the Beaver Dam Mine Site development may impact the average temperature within Cameron Flowage. While all water pumped from the proposed open pit will be rerouted via surface water ditches to maintain the same total flow within Cameron Flowage relative to baseline conditions, water entering Cameron Flowage via the surface water ditches may be at a higher temperature than if that water reached Cameron Flowage through subsurface baseflow. Therefore, measured groundwater and surface water temperatures were evaluated relative to the predicted reduction in baseflow to predict the potential average temperature change in Cameron Flowage under low-flow conditions that could result from development of the Beaver Dam Mine Site (Appendix P.4).

The potential temperature change in Cameron Flowage as a result of the development of the Beaver Dam Mine Site based on the measured flow rates and temperatures in Cameron Flowage, the measured groundwater temperatures and the predicted baseflow reduction at EOM and PC as presented in Appendix H (Baseflow Mitigation Assessment) in Appendix P.4 (Mine Water Management Plan). Cameron Flowage will likely be most sensitive to potential reductions in baseflow during low-flow conditions in summer months when baseflow makes up the largest proportion of total stream flow and surface water temperatures within

Cameron Flowages are near their maximum. Therefore, GHD selected the two-week period with the lowest average flow rate recorded at surface water monitoring stations (SW-1A and SW-2A), corresponding to August 16 through August 29, 2019, as being representative of low-flow conditions in Cameron Flowage. By applying heat and mass balance modelling, the predicted temperature increase during the identified low-flow conditions is 0.5°C under EOM conditions relative to baseline, and 0.26°C under PC conditions relative to baseline. These predicted increases correspond to an increase from mean baseline water temperature 20.21 to 20.71°C and 20.47°C for EOM and PC, respectively.

Monitoring will be completed to demonstrate that temperature changes within Cameron Flowage are within the predicted range. These monitoring commitments will be confirmed in the Preliminary Aquatic Effects Monitoring Program (AEMP), which is included in Appendix P.5.

The resolution of baseflow modeling within Cameron Flowage cannot determine if existing groundwater inflows to Cameron Flowage are diffuse or provide concentrated "upwelling" area(s). Field surveys to confirm the absence (or presence) of groundwater upwelling area(s) along the west shore of Cameron Flowage have been partially completed; however, icing conditions just prior to surveys limited the ability of the thermal drone to detect possible groundwater upwelling sites. Therefore, additional surveys are scheduled during the 2021 open water season and the uncertainty around existing groundwater seepages can be addressed prior to final offset design.

The thermal regime of a river or reach is tied to its landscape geomorphology, geology, and vegetation (O'Sullivan et al. 2019); however, studies on the spatial distribution of thermal refuges have found greater occurrences of them to be significantly associated with areas of higher channel curvature, close proximity of incoming tributaries, and channel confinement (ratio of valley width to channel width) (Dugdale et al. 2015; Larken and Sharp 1992; van Balen et al. 2008; Winter et al. 1998). While the Cameron Flowage can be described as a semi-confined river channel section, given the general topography (i.e., low river valley relief, lack of river channel curvature, and limited inflow tributaries near the Open Pit area) concentrated groundwater upwelling locations are not likely. While the overall change in water temperature is not predicted to increase more than 0.5°C, over baseline, if groundwater upwelling(s) are confirmed, a portion of the west shoreline would be altered and therefore a portion of the estimated total area may be included in the fish habitat affected (Appendix J.3).

Effects of Blasting on Fish

Indirect impacts to fish and fish behavior, spawning grounds and migration patterns are possible from blasting activities associated with mine development. The detonation of explosives near watercourses within the Project Area can produce post-detonation shock waves which involves a rise to a high peak pressure and then a subsequent fall to below ambient hydrostatic pressure. This pressure deficit can cause impacts in fish (Wright and Hopky, 1998). An overpressure in excess of 100 kPa can result in effects in fish including damage to the swim bladder in finfish, and potential rupture and hemorrhage to the kidney, liver, spleen and sinus venous. It is also possible that fish eggs and larvae can be damaged (Wright and Hopky, 1998). The degree of damage is related to the type of explosive, size and pattern of the charges and the distance to the watercourse, depth of water within the watercourse, and species, size and life stage of the fish.

Wright and Hopky (1998) provide guidelines on methods and practices for blasting which are "intended to prevent or avoid the destruction of fish, or any potentially harmful effects to fish habitat that could result from the use of explosives". Included in these guidelines are recommended setback distances from the land-water interface to ensure explosive charges do not result in an instantaneous pressure change greater than 100 kPa, the pressure at which damage to fish is likely to occur (Wright, 1982). Wright and Hopky (1998) provide additional blasting setback recommendations to avoid impacts to spawning beds (peak particle velocities >13 mm/s) during periods of egg incubation.

An Explosives Management Plan will be developed to ensure adherence to all applicable setbacks outlined within Wright and Hopky (1998). At the Beaver Dam Mine Project, the following Explosive Management Best Management Practices are considered to minimize potential impacts to waters frequented by fish including the Cameron Flowage/Killag River:

- Determine final power factor based on 50 kPa as per guidelines.
- Excavate 1 to 2 m trench below the blast area and internal to the open pit to create an air void to attenuate/direct vibration and pressure away from Cameron Flowage/Killag River. Once the void is created, blasts will be oriented perpendicular to the river to further mitigate vibration and pressure wave propagation away from Cameron Flowage/Killag River.
- Use of line drilling will be considered;
- Use of electronic detonators for more accurate detonator timing to reduce the potential for fragmentation and minimize vibrations.
- Blast parameters such as hole size, drilling pattern, use of decked loads will be evaluated on a regular bases.
- Monitoring program will include a combination of seismograph with geophones microphones, and hydrophones will be implemented and blasting practices will be adaptively managed based on outcomes.
- Use of blast mats should be considered to limit any flyrock being thrown into the river.
- A detailed explosive management plan will be developed as part of the permitting process.

6.9.7.3 Haul Road, Fish and Fish Habitat Effects

In this section-potential Project effects to Fish and Fish Habitat VCs identified above by Project phase (Table 6.9-9) are further categorized as either as direct or indirect, for the Haul Road area.

Table 6.9-11 identifies direct and indirect effects of all fish-bearing aquatic habitats potentially impacted by Project development at the for the Project, including along the Haul Road.

A summary of potential direct and indirect effects carried forward for the effects assessment for the Haul Road is provided in Table 6.9-16 and Table 6.9-17. Construction of the Haul Road has the potential to directly affect fish habitat through upgrading the existing road, and through installation of watercourse crossings. These impacts will occur during the construction phase and are permanent. As a result, the commencement of effects and temporal extent of impacts are not repeated in Table 6.9-13. Predicted impacts to fish habitat includes all direct impact (i.e., loss of habitat to support mine infrastructure and haul road crossings), and all potential indirect impacts.

Table 6.9-16: Summary of Fish Resources Evaluated in the Effects Assessment: Haul Road

Tertiary Watershed	Fish Habitat[1]	Predicted Interactions with Fish and Fish Habitat[2]	Description of Interaction	Carried Forward through Effects Assessment
Keef Brook (1EM-2-G)	WC-E	Direct	Replace culvert and improve fish passage	Yes
	WC-F	Direct	Replace culvert and improve fish passage	Yes
	WC-G	Direct	Replace culvert and improve fish passage	Yes
	WC-H (Keef Brook)	Direct	Replace existing bridge	Yes
	WC-I	Direct	Replace culvert	Yes
	WC-J	Direct	Replace culvert and improve fish passage	Yes
	WC-K	Direct	Replace culvert and improve fish passage	Yes
	WC-L	Direct	Realignment and culvert	Yes
	WC-M	Direct	Realignment and culvert	Yes
	WL-73	Direct	Direct impact to support Haul Road upgrade	Yes
	WL-74	No impact	No impact	No
	WL-76	Direct	Direct impact to support Haul Road upgrade	Yes
Keef Brook / Jack Lowe Brook (1EM-2-G/ 1EM-2-N)	WC-N (West River Sheet Harbour)	Direct	Replace existing bridge	Yes
Little River (1EM-2-P)	WC-O	Direct	New culvert	Yes
	WC-P	Direct	New culvert	Yes
	WC-Q	No Impact	No crossing necessary	No
	WC-R	No Impact	No crossing necessary	No
	WC-S	No Impact	No crossing necessary	No
	WC-T	Direct	Replace culvert and improve fish passage	Yes
	WC-U	Direct	Replace culvert	Yes
	WC-V	Direct	Replace culvert and improve fish passage	Yes
	WC-W	Direct	Replace culvert and improve fish passage	Yes
	WC-X	Direct	Replace culvert and improve fish passage	Yes
	WC-Y	Direct	Replace culvert and improve fish passage	Yes
	WC-Z	No Impact	No crossing necessary	No
	WC-AI	No Impact	No crossing necessary	No

Table 6.9-16: Summary of Fish Resources Evaluated in the Effects Assessment: Haul Road (continued)

Tertiary Watershed	Fish Habitat[1]	Predicted Interactions with Fish and Fish Habitat[2]	Description of Interaction	Carried Forward through Effects Assessment
	WL-146	Direct	Direct impact to support Haul Road upgrade	Yes
	WL-154	Direct	Direct impact to support Haul Road upgrade	Yes
Little River/ Sandy Pond (1EM-2-P/ 1EL-2-C)	WL-157	No impact	No impact	No
Morgan River (1EL-2-H)	WC-AE	Direct	Replace culvert and improve fish passage	Yes
	WC-AF	Direct	Realignment, replace culvert and improve fish passage	Yes
	WC-AG	Direct	Realignment, replace culvert and improve fish passage	Yes
	WC-AH	No Impact	No crossing necessary	No
Sandy Pond (1EL-2-C)	WC-AA	Direct	Replace culvert and improve fish passage	Yes
	WC-AB	No Impact	No crossing necessary	No
	WC-AC	Direct	Realignment and culvert	Yes
	WC-AD (Morgan River)	Direct	Replace existing bridge	Yes
	WL159	Direct	Direct impact to support Haul Road upgrade	Yes
	WL160	Direct	Direct impact to support Haul Road upgrade	Yes
	WL168	No impact	No impact	No
Tent Brook (1EM-2-F)	WC-1	Direct	Replace existing culvert	Yes
	WC-A	Direct	Culvert to improve fish passage	Yes
	WC-B (Tent Brook)	Direct	Culvert to improve fish passage	Yes
	WC-C	Direct	Realignment and culvert	Yes
	WC-D	Direct	Realignment and culvert	Yes
	WL64	Direct	Direct impact to support Haul Road upgrade	Yes
	WL66	Direct	Direct impact to support Haul Road upgrade	Yes
	WL68	No impact	No impact	No
	WL69	No impact	No impact	No

1Non-fish bearing, provincially regulated watercourses (identified in Section 6.9.3.3.1.1.2), and wetlands identified as being inaccessible to fish (described in Section 6.9.4.3.2.2) have been excluded from this table.

2 Includes impacts to fish habitat only. In wetlands, where impacts may be proposed in portions of the wetland which have been determined to be inaccessible to fish, the response in this table will be 'No impacts'; however impacts to the wetland habitat itself will be described in detail in Section 6.8.

6.9.7.3.1 Direct Effects

The Project is expected to result in direct impacts to fish and fish habitat through construction of the Haul Road and associated watercourse crossings (Table 6.9-16). A preliminary road design has been completed, with cut and fill lines, alignment and construction materials identified. The Haul Road will be two lanes, with single lane bridges, following the existing forestry road to the greatest extent possible. Corrugated steel pipe culverts are not the preferred option for watercourse crossings in Nova Scotia due to corrosion issues; so concrete culverts will be used in fish habitats, wherever bridges are not practicable. Corrugated steel pipe culverts may be used for general cross drainage outside of fish habitat. The conceptual Haul Road design is described in the Project Description (Section 2).

To address IR2 CEAA 2-06, all watercourses and wetlands along the Haul Road identified as potential fish habitat are considered fish habitat for the purposes of the direct impact estimates (wetlands with contiguous and/or open water areas). The methods used to describe watercourses and fish habitat along the Haul Road are provided in the 2015-2017 Baseline Report, which is appended to the 2019-2020 Baseline Report (Appendix J.2).

A total of 36 watercourses located at or near crossings and/or road expansion of the Haul Road. Three watercourse crossings are expected to impact wetland habitat accessible to fish as well (WCA and WL64, WCB and WL66, and WCAA which is associated with WL159 and WL160).

- Of the 29 watercourse crossings required, 22 have existing crossings. Seven will require new culvert installations (no impacts to fish passage expected).
- Of the 22 existing crossings, three bridges are present and will be replaced, with no impact to fish habitat and no improvement to fish passage.
- Of the 19 culvert crossings, five culverts are properly installed, and currently allow fish passage. Culvert replacements will continue to allow fish passage, with no improvement to fish passage.
- Of the remaining 14 culverts are all currently limiting fish passage, due to improper installation and/or maintenance (hung, crushed, blocked or buried). By upgrading culvert crossings at each of these locations, fish passage to upstream systems is expected to improve.

In addition to watercourse crossings, impacts to wetlands accessible to fish are proposed in three wetlands (aside from those associated with watercourse crossings listed above). These are wetlands WL73, WL149 and WL159. Fish habitat is present on both sides of the proposed Haul Road in WL73 and WL147, so installation of culverts is expected to provide fish passage where it is currently lacking. Fish habitat is only present on one side to he proposed Haul Road at WL154, so installation of a new culvert here is not expected to improve fish passage (as no fish resource exists on the upstream side of the Haul Road).

A summary of habitat suitability by species and life history stage for watercourses along the Haul Road is provided in Table 6.9-4. None of the proposed direct effects to fish habitat along the haul road are expected to occur in suitable habitat for Atlantic salmon.

As outlined in Table 6.9-17, eight wetlands that are expected or confirmed to support fish habitat will be partially altered within the Haul Road to support road upgrades, widening and re-alignment as required. Two wetlands are known to support fish (Wetland 159 and 160) based on direct connectivity with Watercourse WC-AA. The six remaining wetlands have been identified as potential fish habitat and have been conservatively included in the total direct impact to fish habitat and associated Offset Plan.

Additional wetlands that are expected to provide fish habitat that overlap with the proposed Haul Road re-alignment include Wetlands WL68, WL74, and WL157. However, potential fish habitat (contiguous surface water or open water features) within these wetlands are not located within the proposed Haul Road footprint and thus are not included in Table 6.9-16:

- **WL68:** Potential fish habitat restricted to an area adjacent to NSTDB mapped watercourse, located approximately 60 m east of road. Proposed Haul Road re-alignment overlaps approximately 2 m^2 of wetland edge habitat only, inaccessible to fish.
- **WL74:** Fish habitat potential in open water marsh habitat located east of exiting forestry road only – no overlap with proposed Haul Road re-alignment. The Haul Road footprint does overlap wetland lobe on western side of road, but fish habitat is confined to the throughflow, entrenched watercourse (WC-F) only. Direct impacts to fish habitat from the Haul Road are therefore only calculated for WC-F.
- **WL157:** Two lobes of wetland (north and south) separated by existing forestry road, both riparian to NSTDB mapped waterbodies. Fish habitat within wetland is confined to areas immediately adjacent to waterbodies – no fish habitat (contiguous surface water/open water features) associated with these wetlands is currently overlapped by the Haul Road footprint. Wetland habitat immediately adjacent to the existing forestry road is dry. No culvert/bridge currently exists between these two lobes. Proponent will consider installation of a culvert to re-establish natural wetland hydrology which may provide upstream/downstream fish access into NSTDB waterbodies.

Direct impacts to Wetlands WL68, WL74, and WL157 are discussed in Section 6.8. Impacts to wetlands which do not provide fish habitat (i.e., isolated wetlands, wetlands lacking surface water) are fully evaluated in Section 6.8. Fish habitat within wetlands was described in a conservatively inclusive manner. Since the Haul Road Study Area was relatively narrow and linear in nature; watercourses were not typically assessed beyond the PA to confirm connectivity; as a result, where open water or watercourses were observed, they were presumed to be accessible to fish.

All areas of wetland with confirmed or expected fish habitat (contiguous surface water and/or open water areas) overlapped by the Haul Road re-alignment cut and fill extent (maximum direct impact area of Haul Road) have been calculated using average width and length measurements recorded during qualitative habitat evaluation (i.e., width of watercourse x length of impacted watercourse = area of directly impacted waterbody). Haul Road impacts are provided in m^2, as requested in IR2 CEAA 2-20, and they include new culvert installations, and replacement of existing culverts to accommodate widening of the road. Impact areas were assessed on a case-by-case basis, considering the context of whether a crossing was new or existing, and considering the condition of existing culverts. In instances where a culvert was present but deemed based on condition to be impassable to fish, the upgraded culvert proposed was determined to be a net benefit to fish and fish habitat; these are identified in Table 6.9-16 below as improvements to fish passage, with no direct impact to fish habitat. While the improvement of fish passage is acknowledged; the benefits to fish related to access to new habitats have not been quantified or considered in the Fish Habitat Offset Plan (Appendix J.3). This impact area also includes an allowance for a multi-use bypass road, which has been added to the Project Description. All expected direct impacts to fish and fish habitat from the Haul Road and bypass road are shown on Figure J.4-6 (Appendix J.4).

Some wetlands that are expected to provide fish habitat have been excluded from direct impact calculations based on the Haul Road re-alignment where the road will not impact portions of wetlands accessible to fish. For example, WL169 is contiguous with John's Pond; but proposed impacts to this wetland are in a portion of the wetland inaccessible to fish; meaning that portion of the wetland lacks standing water at any time of the year (in this example, the impact is proposed on the south side of the existing forestry road with no hydrologic connectivity between that portion of the wetland and John's Pond. A similar situation would involve impacts to a portion of a wetland complex which lacks standing water at all times of the year, such as a treed swamp component of a wetland complex). In other examples, the presence of the existing forestry road has resulted in a backup of water on one side of the road. In these situations (i.e., Wetlands WL64 and WL66), the wetland boundaries and flooded waters accessible to fish are

different sizes on each side of the existing road, based on installation of inadequate drainage structures at the time of road construction. In these situations, wetland impacts, and impacts to fish habitat in those wetlands, will not be consistent on each side of the road. Wetlands that were assessed as isolated with no surface water connectivity to fish-bearing systems and/or open water features are considered non-fish bearing and do not provide fish habitat (i.e., WL89). In addition, wetlands with throughflow watercourses are not discussed further if fish habitat was determined to the be confined to the watercourse channel (entrenched), and not provided within the wetland itself (i.e., WL74 is contiguous with WCF, which is highly entrenched. Impact to fish habitat here is described in relation to WCF, not WL74) (IR2 CEAA 2-20).

The proposed cut and fill line for the upgraded haul road and a multi-use bypass road was used to calculate impact areas to fish habitat. Inconsistencies in direct impact areas on each side of the Haul Road, as displayed on Figure J.4-6 of Appendix J.4, should be expected. Wetlands/fish habitat areas (m^2) that overlap the Haul Road re-alignment are based on wetland habitat on either side of the road, with any irregular buffering of impact occurring based on cut and fill extents and local topographic relief (IR2 CEAA-2-20).

Expected direct impacts to fish and fish habitat that may result in a habitat alteration from the Haul Road and bypass road are presented in Table 6.9-17. The Preferred Alternative Haul Road has been removed from the Project Description (IR2s CEAA 2-21, CEAA-2-22, NSE-2-48).

Table 6.9-17: Potential Direct Fish Habitat Impacts within the Haul Road

Watercourse Location	Current Crossing (Condition)	Plan for Upgraded Haul Road*	Direct Footprint Impact (m^2)	Impact to Fish Passage
WC-1	Culvert (functioning)	Proposed upgraded road alignment perpendicular to WC. Extend existing culvert, following standard mitigation measures.	0	None
WC-A	Culvert (buried)	Proposed upgraded road alignment perpendicular to WC. Replace buried culvert. Standard mitigation will apply to limit impact to fish habitat and overall improve fish habitat through removal of buried culvert.	0	Improvement
WC-B	Culvert (crushed)	Proposed upgraded road alignment perpendicular to WC. Replace crushed culvert. Standard mitigation will apply to limit impact to fish habitat and overall improve fish habitat through removal of crushed culvert.	0	Improvement
WC-C	Culvert (functioning)	Proposed upgraded road alignment perpendicular to WC on eastern side of road. Replace functioning culvert. On western side of road, alignment expected to have direct impact on WC through ditching. Standard mitigation will apply to limit impact to fish habitat.	7.4	None
WC-D	None	Proposed upgraded road alignment perpendicular to WC. Install new culvert at crossing location. Standard mitigation will apply to limit impact to fish habitat.	10.5	None – no mapped aquatic feature upstream of road

Table 6.9-17: Potential Direct Fish Habitat Impacts within the Haul Road (continued)

Watercourse Location	Current Crossing (Condition)	Plan for Upgraded Haul Road*	Direct Footprint Impact (m^2)	Impact to Fish Passage
WC-E	Culvert (blocked)	Proposed upgraded road alignment perpendicular to WC, east of existing road. Remove blocked culvert on existing road and install new culvert downstream at new crossing location. Standard mitigation will apply to limit impact to fish habitat and overall improve fish habitat through removal of blocked culvert.	0	Removal of old buried culvert: Improvement New culvert: None
WC-F	Culvert (crushed)	Proposed upgraded road alignment perpendicular to WC, west of existing road. Remove blocked culvert on existing road and install new culvert downstream at new crossing location. Standard mitigation will apply to limit impact to fish habitat and overall improve fish habitat through removal of crushed culvert.	0	Removal of old crushed culvert: Improvement New culvert: None
WC-G	Culvert (crushed)	Proposed upgraded road alignment perpendicular to WC. Replace crushed culvert. Standard mitigation will apply to limit impact to fish habitat and overall improve fish habitat through replacement of crushed culvert.	0	Improvement
WC-H	Bridge (functioning)	Proposed upgraded road alignment perpendicular to WC. Existing bridge to be expanded to facilitate multi-use bypass road, and parallel new bridge for Haul Road. Standard mitigation will apply to limit impact to fish habitat.	0	None
WC-I	Culvert (buried)	Proposed upgraded road alignment perpendicular to WC. Replace buried culvert. Standard mitigation will apply to limit impact to fish habitat.	0	None – no mapped aquatic feature upstream of road
WC-J	Culvert (buried)	Proposed upgraded road alignment perpendicular to WC on eastern side of road. Replace buried culvert. On western side of existing road, alignment overlaps approximately 19 m of parallel stream that flows into western ditch. Proposed road upgrade will funnel the WC directly across the road to the eastern side and away from the ditch network associated with the road. Standard mitigation will apply to limit impact to fish habitat.	21.6	Improvement
WC-K	Culvert (buried)	Proposed upgraded road alignment perpendicular to WC. Install new culvert. Replace buried culvert. Standard mitigation will apply to limit impact to fish habitat and overall improve fish habitat through installation of culvert.	0	Improvement

Table 6.9-17: Potential Direct Fish Habitat Impacts within the Haul Road (continued)

Watercourse Location	Current Crossing (Condition)	Plan for Upgraded Haul Road*	Direct Footprint Impact (m^2)	Impact to Fish Passage
WC-L	Culvert (functioning)	WC runs parallel to current road in western roadside ditch. Proposed road upgrade will require the functioning culvert to be replaced to funnel the WC directly across the road to the eastern side and away from ditch network associated with the road. Proposed road alignment overlaps approximately 53 m of parallel ditched stream. Standard mitigation will apply to limit impact to fish habitat.	15.9	None
WC-M	Culvert (functioning, North), None (South)	Proposed upgraded road alignment is perpendicular to WC at two locations (north and south). Northern crossing will require an extension to existing culvert which is functioning. Southern crossing will require installation of a new culvert. Standard mitigation will apply to limit impact to fish habitat.	10.9	None – no aquatic features mapped upstream of southern crossing
WC-N- West River	Bridge (functioning)	Proposed upgraded road alignment perpendicular to WC. Existing bridge to be expanded to facilitate multi-use bypass road, and parallel new bridge for Haul Road. Standard mitigation will apply to limit impact to fish habitat.	0	None
WC-O	None	Proposed new road designed perpendicular to WC. Requires culvert installation. Standard mitigation will apply to limit impact to fish habitat.	29.3	None
WC-P	None	Proposed new road designed perpendicular to WC. Requires culvert installation. Standard mitigation will apply to limit impact to fish habitat.	10.2	None
WC-T	Culvert (buried)	Proposed upgraded road alignment perpendicular to WC. Replace buried culvert. Standard mitigation will apply to limit impact to fish habitat and overall improve fish habitat through removal of buried culvert.	0	Improvement
WC-U	Culvert (functioning)	Proposed upgraded road alignment perpendicular to WC. Replace functioning culvert. Standard mitigation will apply to limit impact to fish habitat.	0	None
WC-V	Culvert (buried)	Proposed upgraded road alignment perpendicular to WC. Replace buried culvert. Standard mitigation will apply to limit impact to fish habitat and overall improve fish habitat through removal of buried culvert.	0	Improvement
WC-W	Culvert (hung)	Proposed upgraded road alignment perpendicular to WC. Replace hung culvert. Standard mitigation will apply to limit impact to fish habitat and overall improve fish habitat through replacement of hung culvert.	0	Improvement

Table 6.9-17: Potential Direct Fish Habitat Impacts within the Haul Road (continued)

Watercourse Location	Current Crossing (Condition)	Plan for Upgraded Haul Road*	Direct Footprint Impact (m^2)	Impact to Fish Passage
WC-X	None	Proposed upgraded road alignment is perpendicular to WC and will require a new culvert installation. Standard mitigation will apply to limit impact to fish habitat and overall improve fish habitat through providing fish access to upstream aquatic resources.	12.1	Improvement
WC-Y	Culvert (buried)	Proposed upgraded road alignment is perpendicular to WC. Replace buried culvert. Standard mitigation will apply to limit impact to fish habitat and overall improve fish habitat through replacement of buried culvert.	0	Improvement
WC-AA	Culvert (hung)	Proposed upgraded road alignment perpendicular to WC. Replace hung culvert. Standard mitigation will apply to limit impact to fish habitat and overall improve fish habitat through removal of hung culvert.	0	Improvement
WC-AC	None	Proposed upgraded road alignment overlaps with the top end of this watercourse (3.7 m). This area may be altered to support road upgrades. Standard mitigation will apply to limit impact to fish habitat.	8.3	None
WC-AD-Morgan River	Bridge (functioning)	Proposed upgraded road alignment perpendicular to WC. Existing bridge to be expanded to facilitate multi-use bypass road, and parallel new bridge for Haul Road. Standard mitigation will apply to limit impact to fish habitat.	0	None
WC-AE	Culvert (buried)	Proposed upgraded road alignment perpendicular to WC. Replace buried culvert. Standard mitigation will apply to limit impact to fish habitat and overall improve fish habitat through replacement of buried culvert.	0	Improvement
WC-AF	None	Proposed upgraded road alignment overlaps with the bottom end of this watercourse (40.2 m), at which point the watercourse currently empties into the southern ditch along the existing road. Current ditch drains east towards culvert at WC-AE. Proponent will consider installation of a culvert to funnel the watercourse directly across the road north towards WC-AH, away from the ditch network associated with the road. Standard mitigation will apply to limit impact to fish habitat.	46.3	Improvement
WC-AG	None	Proposed upgraded road alignment overlaps with the bottom end of this watercourse (18.4 m), at which point the watercourse currently empties into the southern ditch along the existing road. Current ditch drains east towards culvert at WC-AE. Proponent will consider installation of a culvert to funnel the watercourse directly across the road north towards WC-AH, away from the ditch network associated with the road. Standard mitigation will apply to limit impact to fish habitat.	12.0	Improvement

Table 6.9-17: Potential Direct Fish Habitat Impacts within the Haul Road (continued)

Watercourse Location	Current Crossing (Condition)	Plan for Upgraded Haul Road*	Direct Footprint Impact (m^2)	Impact to Fish Passage
WL64	Culvert (buried) – see WC-A	Buried culvert associated with WC-A located at wetland crossing. Proposed upgraded road alignment overlaps surface water features (presumed fish habitat) both sides of road. Replacement of buried culvert likely to improve fish access into wetland.	48.7	Improvement
WL66	Culvert (crushed) at northern crossing – see WC-B, None at southern crossing	Proposed upgraded road alignment overlaps wetland complex at two locations – a northern crossing (associated with WC-B) and a southern crossing. At northern crossing, proposed upgraded road alignment overlaps surface water features (presumed fish habitat) on both sides of road. Replacement of crushed culvert on WC-B likely to improve fish access into wetland. No culvert/bridge currently exists at southern crossing. Proposed upgraded road alignment overlaps surface water features (presumed fish habitat) on west side of road. Proponent will consider installation of a culvert to re-establish natural wetland hydrology which may provide fish access into previously inaccessible fish habitat.	487.0	Improvement
WL73	None	No culvert is present at current wetland crossing. Proposed upgraded road alignment overlaps surface water features (presumed fish habitat) currently exist on both sides of road, likely caused by road impoundment. Proponent will consider installation of a culvert to re-establish natural wetland hydrology which may provide fish access into previously inaccessible fish habitat.	185.2	Improvement
WL76	Culvert (crushed) – see WC-G	Crushed culvert associated with WC-G located at wetland crossing. Proposed upgraded road alignment overlaps surface water features (presumed fish habitat) both sides of road. Replacement of crushed culvert likely to improve fish access into wetland.	398.6	Improvement
WL146	None	No culvert is present at wetland crossing. Proposed upgraded road alignment overlaps surface water feature (presumed fish habitat) on both sides of road – extensive flooding on west side likely caused by road impoundment. Proponent will consider installation of a culvert to re-establish natural wetland hydrology which may provide fish access into previously inaccessible fish habitat from WC-Z.	106.4	Improvement

Table 6.9-17: Potential Direct Fish Habitat Impacts within the Haul Road (continued)

Watercourse Location	Current Crossing (Condition)	Plan for Upgraded Haul Road*	Direct Footprint Impact (m^2)	Impact to Fish Passage
WL154	None	Headwater wetland confined to west side of road. Proposed upgraded road alignment overlaps surface water feature (presumed fish habitat). No culvert proposed.	176.9	None
WL159	Culvert (hung) – see WC-AA	Hung culvert associated with WC-AA located at wetland crossing. Proposed upgraded road alignment overlaps surface water feature (confirmed fish habitat). Replacement of hung culvert likely to improve fish access upstream to WL160.	6.5	Improvement
WL160	Culvert (hung) – see WC-AA	Hung culvert associated with WC-AA located at wetland crossing. Proposed upgraded road alignment overlaps surface water feature (confirmed fish habitat). Flooding observed in wetland likely caused by improper culvert sizing. Replacement of crushed culvert likely to improve fish access and re-establish natural wetland hydrology.	836.5	Improvement
Total			**2,430.3**	

* For all reaches requiring fish rescue prior to culvert installation, fish will be released within the same watercourse or waterbody, typically in an area downstream of the proposed impact unless site conditions necessitate otherwise.

6.9.7.3.2 Indirect Effects

Sedimentation/Erosion as well as mortality from blasting represent the primary pathways of potential indirect effects to Fish and Fish Habitat VC along the Haul Road. These are discussed in the following sections.

Total Suspended Solids (TSS)

Surface disturbance during Project activities has the potential to increase sedimentation and erosion of soils and overburden materials. As described above for the Beaver Dam Mine Site, potential effects on surface water quality from increased erosion and sedimentation are qualitatively assessed; erosion and sedimentation effects on surface water quality can be indicated primarily by changes in turbidity and total suspended solids (TSS) in surface waterbodies. However, for the Project there is generally minimal risk of effects from erosion and sedimentation on surface water quality due to the limited extent of planned surface disturbances and the proposed use of pre-existing infrastructure such as roads, camp, and the processing facility.

To avoid indirect effects to fish habitat due to construction of the Haul Road, the sub-base will be constructed with 600 mm thick Type 2 (sub-50 mm crushed material), rather than fill available from on-site construction. This sub-base will likely need to be imported from a commercial quarry to meet the specification and drainage requirements, and to minimize potential for sedimentation by purchasing washed stone. The road base will be constructed from a wearing course, quantified as a 200 mm thick Type 11 (sub-25 mm crushed stone). Similar to the sub-base, this will be sourced from a commercial quarry to ensure the rock is clean, and the potential for sedimentation is reduced.

All culverts will be installed in accordance with NSE and DFO regulations and approvals. Careful selection of construction material, and strict adherence to the Erosion and Sediment Control Plan and approval conditions will minimise the potential for indirect impacts to watercourses through construction and operation of the Haul Road.

At the Haul Road, potential effects from sedimentation and erosion are most likely to occur during the Construction and (active) Closure phases, when surface materials will likely be disturbed during construction or reclamation activities. As TSS loads are generally low in Project area streams, any additional sediment loading has the potential to increase TSS and turbidity in the receiving environment. Potential effects due to sedimentation and erosion have the greatest potential to occur during periods of significant overland flow, such as freshet and rainfall events. However, planned disturbances in the Project Area are limited, and implementation of BMPs and mitigation measures as summarized in Section 6.7.9 and detailed in Environmental Management and Monitoring Plans will prevent substantial change of surface water quality near the proposed access corridor and other planned site upgrades. Further, water quality responses to run-off include increased concentrations of TSS but tend to be temporary and localized (Forman 1998). As such, all potential indirect effects to fish habitat through construction of the Haul Road are expected to be negligible, as AMNS commits to adhering to the site-specific draft Erosion and Sediment Control Plan (Appendix C of Appendix P.4 Mine Water Management Plan). The clear, porous sub-grade identified above will support natural cross-drainage, supplemented by drainage culverts and watercourse culverts wherever necessary. Where required, fish rescues will be completed in advance of culvert installation to reduce the likelihood of death of fish by means other than fishing. As such, no residual indirect effects are expected following mitigation of impacts along the Haul Road.

The likelihood of indirect hydrological alteration to fish habitat along the Haul Road is low and these potential impacts have not been included in quantitative evaluation of impacts from the Project. With appropriate mitigation measures in place, the Project will not indirectly affect fish and fish habitat along the Haul Road

6.9.7.4 Indirect Effects to Adjacent Streams

As described in Section 6.9.7.3.2, development of the Project may result in indirect effects to downstream receiving environments. Project infrastructure has been designed to minimize direct impacts to fish to the greatest extent practicable, and revisions to mine water management has allowed AMNS to update the Water Balance Analysis across the site and reduce impacts to key fisheries resources including the system from Crusher Lake to Mud Lake, compared with that presented in the 2019 EIS. The Water Balance Analysis is provided in Appendix A of Appendix P.4 (Mine Water Management Plan) and the Project effects for the monthly flows are described in Section 6.7.8. To fully evaluate the effect to fish and fish habitat, surface runoff and baseflow were generated using a conceptual hydrologic model in GoldSim which runs on a daily time step. The effect of the Project on daily instantaneous flows is further evaluated here for WC5, 23, 26, and 27 based on the results of screening (Section 6.9.7.2.2.1). These systems were selected for further evaluation because the surface water modelling results indicated that either the monthly average flows are predicted to change by more than 10%, and/or there is a predicted >10% increase in the number of days where flow drops below the 30% MAD.

This analysis of these four systems includes effects assessment relating to the predicted flow reductions and any associated changes in quality of the fish habitat because of the predicted changes within the stream systems (WC5, WC23, WC26, WC27) and the associated waterbodies (Crusher Lake and Mud Lake). This section also describes any indirect impacts to fish and fish habitat along the Haul Road from the construction of the road and associated watercourse crossings. Finally, this section provides analysis of groundwater seepage predictions which may affect fish and fish habitat outside of Cameron Flowage/Killag River, which has already been addressed through the predictive surface water modelling and associated evaluated of fish and fish habitat in Cameron Flowage/Killag River in Section 6.9.7.2.2.

A total of 15 transects were completed using the WPM to model estimates of flow at each habitat transect to quantify potential habitat alterations due to flow reductions. Appendix J.4, Figure J.4-2 provides the location of each transect within the Project area that were selected during 2019-2020 Baseline surveys. Each transect represents a portion of its respective watercourse near the transect survey location. The potential habitat alterations within watercourses determined to have flow reductions with a moderate

probability of detectable impacts has been quantified as the area below the 30% MAD and is approximately 7,728.88 m^2 . The entire habitat area below 30% MAD was identified to account for the uncertainty associated with the complex interactions between stream low flow, depth and physicochemical parameters such as temperature and dissolved oxygen. Although the entire area below 30% MAD has been quantified as potentially altered, the final determination of how much area is deemed as harmfully altered will need to be determined by DFO during the fisheries authorization process. As shown by the limited aerial reduction in habitat within each watercourse, the habitat's capacity to support one or more life processes is not likely to be significantly impacted, The flow reductions represent a partial and mostly reversible alteration and not a loss to the entire stream habitat.

6.9.7.4.1 WC5

Estimates of daily flows within WC5 are predicted to decrease by 4.7% of MAD flow. This flow reduction is of moderate magnitude; however, a more detailed evaluation of daily flows indicates that this represents a 12.2% increase in the number of days where flow remains below the 30% MAD. The Project is anticipated to exacerbate the natural low flow period by extending it from 113 days per year below 30% MAD at baseline to 129 days below 30% MAD at EOM (Tables 6.9-18 and 6.9-19). During PC, the predicted number of low flow days decreases to 115, which is only a 1.8% increase in number of days below 30% mad (representing a low magnitude of change). Using the WPM to calculate loss of habitat due to flow reduction, WC5 is predicted to have aerial reduction of 17.40 m^2 during EOM, and only 4.26 m^2 at PC; however, as discussed above the total potentially altered habitat was quantified as the entire 30% MAD wetted width or 1,700.19 m^2. Based on the limited magnitude, duration and spatial extent of flow reduction, it is expected that the remaining habitat within WC5 will maintain capacity to support life history phases of fish (e.g., remaining habitat quantity, temperature regime).

Crusher Lake is part of the Mud Lake catchment; and WC5 is the main inlet and outlet to Crusher Lake. Impacts to Crusher Lake have been modelled with consideration of changes in baseflow, and changes in daily and monthly flows. During operations, water will be extracted from Crusher lake at a rate of 3 m^3/hr to support domestic and truck wash water demands. The mine impacts to lake water levels were assessed by converting instantaneous (average daily) flow rates to the historical record to flow depths within WC5 upstream assessment point using Manning's equation (Table 6.9-20). The change in flow depths at the lake outlet assessment points were then used to estimate the change in water levels. Flow depths were computed for various flow statistics and compared between the mine development stages. These results show that the water levels within Crusher Lake are not anticipated to change as a result of the Project. Details of this analysis are presented in the Water Balance Analysis (Appendix A of Appendix P.4 Mine Water Management Plan).

Table 6.9-18: Summary of End-of-Mine (EOM) Wetted Perimeter Analysis using Modelled Daily Flows

Stream ID	Represented Habitat Length (m)	MAD			30% MAD		Modelled Flow Alteration at EOM				
		m^3/s	Existing Habitat Area (m^2)	Days <30% MAD	m^3/s	Existing Habitat Area (m^2)	(% MAD)	(m^3/s)	Habitat Area Change at 30% MAD (m^2)	Days <30% MAD	Increase Days <30% (%)
WC-23	1053	0.054	4487.64	115	0.016	3541.36	-17.4	0.045	161.53	132	+14.8
WC-26	805	0.023	1927.05	115	0.007	1554.50	-25.0	0.018	105.94	144	+25.2
WC-5	832	0.025	2075.04	113	0.007	1700.19	-4.7	0.023	17.40	129	+12.2
WC-27	228	0.070	1146.74	112	0.021	932.83	-18.5	0.058	37.54	136	+21.4
Total Habitat Alteration (m^2)			**9636.47**			**7,728.88**			**322.41**[1]		

Notes: EOM represents habitat change over moderate duration (until End of Mine), average flow year.

Positive flow alteration in Cameron Flowage therefore habitat losses not applicable

Through discussion with DFO the entire area below 30% MAD is considered potentially altered due to uncertainty associated with extreme low flow and physicochemical habitat parameters. The amount of this habitat considered harmfully altered with be determined with DFO during the fisheries authorization process.

1 EOM has greater habitat loss than PC scenario. Values represent aerial reduction in 30% MAD area due to flow reductions.

Table 6.9-19: Summary of Post-Closure (PC) Wetted Perimeter Analysis using Modelled Daily Flows

Stream ID	Represented Habitat Length (m)	MAD			30% MAD		Modelled Flow Alteration at PC				
		m^3/s	Existing Habitat Area (m^2)	Days <30% MAD	m^3/s	Existing Habitat Area (m^2)	(% MAD)	(m^3/s)	Habitat Area Change at 30% MAD (m^2)	Days <30% MAD	Increase Days <30% (%)
WC-23	1053	0.054	4487.64	115	0.016	3541.36	-17.4	0.045	161.53	132	+14.8
WC-26	805	0.023	1927.05	115	0.007	1554.50	-19.6	0.019	48.54	133	+15.7
WC-5	832	0.016	2075.04	113	0.005	1700.19	-1.2	0.024	4.26	115	+1.8
WC-27	228	0.070	1146.74	112	0.021	932.83	-13.7	0.061	27.39	128	+14.3

Notes: PC represents habitat change over long duration (after all influence of mine operations and closure), average flow year.

Positive flow alteration in Cameron Flowage therefore habitat losses not applicable

1 EOM has greater habitat loss than PC scenario

Table 6.9-20: Flow Depth Comparison at the WC-5 Assessment Point (Crusher Lake)

Flow Depth Statistic	Flow Depth (m)		
	Baseline Conditions	EOM Conditions	PC Conditions
Minimum	0.00	0.00	0.00
10th Percentile	0.04	0.00	0.04
25th Percentile	0.04	0.00	0.04
50th Percentile	0.06	0.06	0.06
75th Percentile	0.10	0.09	0.10
90th Percentile	0.14	0.14	0.14
Maximum	0.43	0.43	0.43
Mean	0.11	0.11	0.11

6.9.7.4.2 WC23

Estimates of daily flows within WC23 were determined to decrease by 17.4% of MAD flow during EOM and PC scenarios, and a 14.8% increase in number of days where daily flow drops below the 30% MAD (Tables 6.9-18 and 6.9-19). This translates to an increase in number of days below 30% MAD flow from 115 days per year at baseline conditions, to 132 days per year at EOM and PC phases. This change in flow is expected to extend the duration of the low flow period by a total of 17 days. As a result of predicted monthly and daily flow reductions, the magnitude of this effect is determined to be high. This effect limits the ability of the habitat to sustain one or more life processes, and as a result, the habitat loss is quantified and included in the draft Fish Habitat Offset Plan (Appendix J.3).

Using the WPM to calculate loss of habitat due to flow reduction, this results in an aerial reduction below 30% MAD of 161.53 m^2 but a potential habitat alteration to the entire 30% MAD area of 3,541.36 m^2. As shown in Tables 6.9-18 and 6.9-19, the flow reduction in WC23 results in a low magnitude of effect to Cope Brook, considering both monthly and daily flows (i.e., change is below the detection limit of 10%). Based on the limited magnitude and spatial extent of flow reduction, it is expected that the remaining habitat within WC23 will maintain life history phases of fish.

6.9.7.4.3 WC26

Estimates of daily flows within WC26 were determined to decrease by 25% of MAD flow during EOM, and 19.6% at PC, representing a high magnitude of change in flow. The daily flow alteration assessment indicates that this would result in a chance from 115 days below the 30% MAD flow in baseline to 144 days and 144 days below MAD flow in EOM and PC, respectively, representing a 25.2% and 15.7% increase in the number of days below 30% MAD flow

Using the WPM to calculate loss of habitat due to flow reduction, WC26 is predicted to have an aerial reduction below 30% MAD of 105.4 m^2 during EOM and decreases during PC to 48.54 m^2. However as discussed above, a larger area associated with the entire 30% MAD has been identified as potentially altered, and is quantified as 1,554.50 m^2. Based on the limited magnitude and spatial extent of flow reduction, it is expected that the remaining habitat within WC26 will maintain capacity to support life history phases of fish.

6.9.7.4.4 WC27

Estimates of daily flows within WC27 were determined to decrease by 18.5% of the MAD at EOM, and 13.7% at PC. The predicted number of days which experience a decrease below 30% MAD is expected to increase from 115 at baseline to 132 days at EOM, and 128 days at PC. This represents a 21.4% increase in the number of low flow days at EOM, and a 14.3% increase in the number of low flow days at PC (Tables 6.9-18 and 6.9-19). The downstream effects to the Killag River are expected to be low in magnitude, with <10% change in MAD flow and a less than 10% increase in the number of days below 30% MAD. Using the WPM to calculate of the aerial extent of habitat change due to flow reduction, WC27 is predicted to have a 30% MAD area reduction of 37.54 m^2 during EOM, and only 4.26 m^2 at PC. However, again recognizing that an uncertainty remains in the low flow habitat conditions during extreme low flow, we have quantified the entire area below 30% MAD (932.83 m^2) as potentially altered. Based on the limited magnitude, duration and spatial extent of flow reduction, it is expected that the remaining habitat within WC5 will maintain capacity to support life history phases of fish.

In both development stages, the percent change in total inflow is less than the percent changes in surface runoff and baseflow, because the Crusher Lake discharge is included in the total inflow volume, and the Crusher Lake discharge is less impacted by Site development.

Although the results show there is a reduction in total inflow, and correspondingly, lake discharge under EOM and PC conditions, the lake water levels are not anticipated to drop below the invert of the outlet channel during EOM and PC conditions on a monthly basis (i.e., the outlet channel should never run dry). This is because the monthly lake inputs, including direct precipitation, Crusher Lake discharge through WC5, surface runoff, and baseflow exceed the monthly losses by evaporation. As a result, the lake will continue to discharge to WC27. However, water levels in the outlet channel, and therefore the lake, are anticipated to drop marginally compared to baseline conditions as described in Table 6.9-21.

Table 6.9-21: Flow Depth Comparison at the WC27 Upstream Assessment Point (Mud Lake)

Flow Depth Statistic	Flow Depth (m)		
	Baseline Conditions	EOM Conditions	PC Conditions
Minimum	0.00	0.00	0.00
10th Percentile	0.07	0.05	0.06
25th Percentile	0.10	0.09	0.09
50th Percentile	0.16	0.15	0.15
75th Percentile	0.24	0.22	0.22
90th Percentile	0.32	0.28	0.29
Maximum	0.59	0.54	0.55
Mean	0.20	0.18	0.19

The Mine impacts to lake water levels were assessed by converting instantaneous (average daily) flow rates to the historical record to flow depths within WC27 upstream assessment point using Manning's equation (Table 6.9-21). The change in flow depths at the lake outlet assessment points were then used to estimate the change in water levels. Flow depths were computed for various flow statistics and compared between the mine development stages. These results show that the water levels within Mud Lake are predicted to change by a maximum of 0.05 m as a result of the Project. This represents a maximum potential water level change

of less than 10% of the natural baseline modeled range. Details of this analysis are presented in the Water Balance Analysis (Appendix A of Appendix P.4 Mine Water Management Plan).

6.9.7.5 Summary of Direct Effects to Fish and Fish Habitat

The Fish and Fish Habitat Protection Policy (DFO 2019) outlines the prohibitions under the *Fisheries Act* related to the death of fish by means other than fishing, and to the harmful alteration, disruption and destruction of fish habitat. Through various Project revisions, AMNS has been able to reduce the direct loss of fish habitat to the extent practicable. The measures taken to avoid impacts to fish habitat are outlined in greater detail in Section 6.9.8.

Death of fish is expected to be low, once mitigation measures are implemented, including development and implementation of a fish rescue plan prior to commencement of construction activities in confirmed fish habitat. Mortalities are not expected, except through incidental mortalities associated with fish rescue activities. Details associated with the fish rescue approach are provided in Section 6.9.8.2.2. Recent and past experience suggests that mortality of fish during fish rescues is typically in the range of 1 to 3%. Furthermore, AMNS commits to adhering to approved timing windows for construction to minimize impact to eggs, larvae, and juvenile fish, wherever practicable.

Direct alteration within the Beaver Dam Mine Site is restricted to small first and second order streams and open water wetlands, which lack suitable habitat for Atlantic salmon. Road crossings to be constructed along the Haul Road will follow all avoidance, minimization and standard mitigations to reduce direct impacts to fish and fish habitat and limited direct impact. There is no expectation of change to the composition of populations of fish from direct loss and alteration of fish habitat. Furthermore, the larger waterbodies present within the Beaver Dam Mine Site (Mud Lake, Crusher Lake) will be avoided during Project development, limiting impact to fish populations present in these relatively larger systems.

Road crossings to be constructed along the Haul Road will follow all avoidance, minimization and standard mitigations to reduce direct impacts to fish and fish habitat and limited direct impact. There is no expectation of change to the composition of populations of fish from direct loss and alteration of fish habitat. Furthermore, the larger waterbodies present within the Beaver Dam Mine Site (Mud Lake, Crusher Lake) will be avoided during Project development, limiting impact to fish populations present in these relatively larger systems.

6.9.7.6 Summary of Indirect Effects to Fish and Fish Habitat

The assessment of Surface Water Quality results indicated that, while concentrations for some parameters are anticipated to increase above baseline levels, at the near-field mixing zone there are no exceedances of either CCME, NSE Tier 1 criteria. As water quality criteria are defined by national and international entities as protective of the receiving environment and all water users, there are no anticipated effects to surface waters are a result of discharges from the Project. Further note that a treatment system will be designed to ensure that all site effluent water meets MDMER and will reflect assimilation capacity of the receiving environment, such that any potential effects from nitrite to Fish and Fish Habitat, will be fully mitigated (Section 6.7.8).

Based on reduced flow comparisons to DFO framework for ecological flow, it was determined that reductions in four watercourses would have a moderate probability of detectable impacts to ecosystems that support fisheries. Flow reduction is anticipated due to drainage area and/or baseflow reductions in Crusher Lake Outflow (WC5), South Tributary (WC23), West Tributary (WC26), and Mud Lake Outflow (WC27). Although the actual area of reduced wetted channel due to the flow reductions is quantified at 322.41 m^2 we have quantified a much larger area as potentially altered. Through discussion with DFO the entire area below 30% MAD (approximately 7,728.88 m^2) is considered potentially altered due to uncertainty associated with extreme low flow and physicochemical habitat parameters. The amount of this habitat considered harmfully altered with be determined with DFO during

the fisheries authorization process and is expected to be reduced or require less offsetting given that the habitats are expected to maintain the ability to support the existing fish communities.

These areas of flow reduction will be included in the site monitoring plans (AEMP) to verify the predictions and confirm that the systems continue to support the existing fish populations. Water quality predictions, and associated ecotoxicity evaluation, during both operations and closure phases conclude low ecological risk (including fish) in the receiving environment (Cameron Flowage). Figure 6.9-5 and Table 6.9-22 shows a summary of fish habitat impacts by type (direct and indirect).

Table 6.9-22: Summary of Potential Habitat Alterations and Mitigations for Beaver Dam Project

Habitat Measure	Project Area	Habitat Type	Habitat Units (m^2)	Habitat / Condition Description
Habitat that may be Altered, Disrupted or Destructed	Infrastructure Footprint Direct Habitat Descruction	Mine Site Streams	652.80	Riffle, pool, rapid, and run habitats dominated by intermittent reaches, heavy vegetation, and high summer water temperatures and low dissolved oxygen levels.
		Mine Site Open Water	38,790.64	Waterbodies dominated by muck/detritus substrates, most formerly disturbed by historic mining activities.
		Haul Road Stream	184.50	Small streams
		Haul Road Open Water	2,245.80	Small open water within wetlands
	Indirect Downstream Potential Alteration	Mine Site Streams	7,728.88	Pool and run habitat with varying substrates and cover. Water quality ranging from low to suitable. Some high water in summer and low pH but overall better condition than those in direct footprint.
		Open Water	-	n/a
Total			**49,602.62**	
Mitigation	Regained Habitat Connectivity	Stream	-	17 locations along haul road have unpassable culverts. Replacment will mitigate habitat fragmentation but has not been quantified.
	Groundwater Upwelling Station	Stream	3,300.00	If groundwater upwelling location idenfied in Cameron Flowage, groundwater pump or modification to the North Pond outflow will be installed. **Note:** This is not considered offseting.
Total			**3,300.00**	

6.9.7.7 Fish and Fish Habitat Effects: Touquoy Mine Site

The Touquoy Mine Site is currently operational. The use of the Touquoy Mine Site for the processing of Beaver Dam Mine ore and tailings management (exhausted pit) will not involve modification to the current footprint or further impacts to fish and fish habitat. The exhausted pit has the capacity to store all mine tailings until scheduled release post-closure. Moving the existing tailings pipeline from the permitted Tailings Management Facility (TMF) to direct water to the exhausted pit will occur within the disturbed footprint of the permitted Touquoy Project and will not result in additional impacts to fish and fish habitat.

Potential impacts to surface water quality and quantity as a result of the storage of Beaver Dam tailings in the exhausted Touquoy open pit mine were examined. The Touquoy Mine Site open pit will naturally fill which will result in water covering the tailings surface. Pit water will be treated via the existing Touquoy effluent treatment plant and downstream treatment discharge facilities

and once the water meets MDMER discharge criteria it will be naturally released via a spillway into Moose River (Appendix F.8 Project Assimilative Capacity Study of Moose River – Touquoy Pit Discharge).

The use of the exhausted Touquoy pit for tailings storages will result in the accelerated filling of the pit from that of the Touquoy reclamation plan.

- Tailings will be deposited in the open pit for approximately 41 months. The spillway and conveyance channel are designed to accommodate the inflow design flood in accordance with the Canadian Dam Association (CDA) guidelines. The spillway invert is set at elevation 108 m relative to the Canadian Geodetic Vertical Datum of 2013 (CGVD2013), approximately 2 m below the lowest Touquoy pit elevation to prevent overtopping. The final water cover over the deposited tailings will limit oxygen availability, reduce metal leaching conditions and further improved water quality. A spillway at the top of the open pit will be constructed to divert water a closure (Appendix F.8 Project Assimilative Capacity Study of Moose River – Touquoy Pit Discharge).
- No water will be discharged from the exhausted Touquoy open pit until the pit reaches the final spillway elevation, which is estimated to be in Year 13.
- Water withdrawal from Scraggy Lake may be required for processing Beaver Dam Mine ore at start-up however the intent is to use recycle water from the pit and the site for processing.

The use of the exhausted Touquoy pit for tailings storage of Beaver Dam tailings may affect the receiving environment of Moose River through seepage and effluent discharge. Water within the pit lake will not be discharged until it meets the WQOs (CCME 2003 and NSEQS 2010) and MDMER (Schedule 4) limits, the magnitude of the effect is expected to be low to negligible on Moose River quality and downstream tributaries.

- The predicted receiving environment concentration of arsenic of 0.021 mg/L; risks to aquatic life associated with predicted arsenic concentrations are anticipated to be low.
- The aluminum concentration of 0.183 mg/L for aluminum is well with the natural variation of existing conditions of the Moose River (i.e., predicted below the 75th percentile receiver quality in Moose River).
- Concentrations of key parameters of interest (arsenic, cobalt, copper and nitrite) in groundwater were predicted in the model to meet CCME FAL/NSE EQS after mixing with Moose River 100 m downstream of the discharge point (Section 6.6.7.3 and Appendix F.8).

There are no further effects to fish and fish habitat anticipated to be caused by the processing of ore and the management of tailings (exhausted pit) from the Beaver Dam Mine. Surface water quality and quantity will continue to be monitored over the life of the Touquoy facility as part of existing approval for the Touquoy mine life and the revised approval for the proposed extended life of the Touquoy site associated with processing of Beaver Dam ore. Therefore, with the exception of the above and continued potential for accidents and malfunctions and environmental monitoring, there are no direct or indirect effects to fish and fish habitat anticipated from the Project at the Touquoy Mine Site during the construction and operations phases. For further information regarding Touquoy Mine Site and fish and fish habitat interactions, refer to the EARD (CRA 2007b) and Focus Report (CRA 2007a). Fish mitigations and monitoring are presented in Sections 6.9.8 and 6.9.10 and will be further addressed as part of the permitting process.

6.9.8 Avoidance and Mitigation

6.9.8.1 Avoidance

Measures to Avoid for the conservation and protection of fish habitat is the first and most important step in the hierarchy of measures and therefore have been the major focus of this Project to date. There have been a number of measures put in place to avoid and minimize the effects on fish and fish habitat.

Through the iterative process of Project design, a revised site layout has been assessed and implemented through changes to the Project Description (Section 2). Although components such as the open pit are fixed due to the location of the resource, other Project infrastructure such as stockpiles and road networks have some flexibility in their location and have been optimized in the site layout. Prior to adjusting the site infrastructure layout following issuance of the Round 1, Information Requests (CEAA 2017), a review of environmental constraints was completed, incorporating all biophysical and regulatory findings identified during baseline surveys to date; primarily driven by avoidance of fish habitats and regulated setbacks on lichen Species at Risk. The most prominent revision to the Revised 2019 EIS (AMNS, 2019) infrastructure layout is that the waste rock storage area (WRSA) has been moved to the west of Crusher Lake to avoid impact to aquatic habitats contiguous with Crusher Lake (WC2-5), and the associated indirect impacts from flow reduction (Appendix A [Water Balance Analysis] of Appendix P.4 [Mine Water Management Plan]). This has resulted in new predicted indirect impacts to fish habitat in WC23, WC26, and WC27; however, these effects have been fully assessed and incorporated into the draft Fish Habitat Offset Plan (Appendix J.3).

In the Revised 2019 EIS (AMNS 2019), indirect impacts to fish habitat were predicted through flow reduction to Crusher Lake and Mud Lake, and through increases in flow to the Tent Lake watershed. Through the revised infrastructure layout and associated revision to the Water Balance Analysis (Appendix A of Appendix P.4 Mine Water Management Plan), these changes in flow have been moderated, and currently no significant change in flow are predicted in Crusher Lake or Tent Lake (IR2 NSE-2-122) (or associated watercourses), and the flow reduction in the Mud Lake outlet is predicted to be moderate in magnitude. This avoidance of impacts to the Crusher Lake and Mud Lake systems has resulted in new indirect impacts to Watercourses WC5, WC23, WC26 and WC27; these effects have been fully assessed, quantified as part of the overall impact assessment, and included in the draft Fish Habitat Offset Plan (Appendix J.3).

An additional revision to the Project infrastructure is the segregation of NAG and PAG waste rock stockpiles, and relocation of the PAG stockpile directly south of the pit. Placement of the PAG stockpile south of the pit allows for predicted groundwater seepage to drain into the pit, where water is managed and treated as needed, prior to discharge. In addition, a Metal Leaching and Acid Rock Drainage Management Plan (Appendix E.5) is being developed to monitor acid rock drainage during the life of mine. AMNS will adaptively manage the placement and long-term reclamation of acid rock drainage on-site.

The predicted changes in inflow, discharge and water level at Mud Lake are incorporated in the revised Water Balance Analysis document (Appendix A of Appendix P.4 Mine Water Management Plan) to support the response to IR2 NSE-2-120. Mud Lake water levels are controlled by the elevation of the outlet, and are not anticipated to drop below the existing invert of the outlet channel during EOM and PC conditions. A summary of predicted changes to Mud Lake is provided in Section 6.9.7.4.4, and provided in detail in the final Water Balance Analysis (Appendix A of Appendix P.4).

Crusher Lake is part of the Mud Lake catchment; however, its catchment area remains unchanged from baseline conditions. As such, there is no predicted changes in runoff volumes to Crusher lake from baseline conditions. There will be minor impacts to total inflow to Crusher Lake, attributed to small changes in baseflow contributions due to the influence of the mine pit development on groundwater flow patterns in the area. There is no predicted change in water level within Crusher lake, and the depth of Mud Lake is predicted to decrease by a maximum of 0.05 m.

Through the revisions to Project infrastructure, efforts were made to improve the water balance results, to moderate surface water flows through the Beaver Dam Mine Site and reduce indirect impact to downstream receiving environments. Table 6.9-23 provides the updated water balance results which demonstrate minimization of indirect impacts through reconfiguration of the infrastructure layout and associated mine water management facilities. Detailed monthly predictions and modelling methods are provided in the Water Balance Analysis (Appendix A of Appendix P.4 Mine Water Management Plan).

Table 6.9-23: Summary of Water Balance Analysis Changes from 2019 to 2021

Catchment Area	2019 EIS Predictions: Change in Annual Runoff from Baseline Conditions		Current Predictions: Change in Annual Runoff from Baseline Conditions	
	EOM	PC	EOM	PC
Killag	0.91%	0.03%	2.2%	(-2.2%)*, 1.1%
Mud Lake – WC27	-43.0%	-35.5%	-18.3%	-13.7%
WC27	-	-	-17.3%	-13.0%
Crusher Lake	-52.1%	-52.1%	-4.7%	-1.2%
Tent Lake	53.1%	53.1%	-1.1%	-1.2%
West Tributary – WC26	No impact	No impact	-22.2%	-17.5%
South Tributary – WC23	No impact	No impact	-15.2%	-15.2%

Notes: EIS = environmental impact statement; EOM = end-of-mine; PC = post-closure; WC = watercourse; % = percent. * Represents prediction during pit filling.

As shown in Table 6.9-23, through revisions to infrastructure layout, AMNS has been able to achieve substantial improvements in the water balance analysis in Mud Lake/WC27, Crusher lake and Tent Lake. The adjusted placement of the WRSA has resulted in new indirect impacts to flow in the WC26 (west) and WC23 (south) tributaries; however, this adjustment was a net benefit to fish and fish habitat through avoidance of direct impacts to tributaries to Crusher Lake and Mud Lake. Moderate levels of flow reduction are anticipated in the Mud Lake-WC27 catchment area, West Tributary-WC26 and South Tributary-WC23. These impacts have been quantified and accounted for in the draft Fish Habitat Offset Plan (Appendix J.3).

Given the sensitivity of Atlantic salmon in the Killag River, AMNS briefly considered alternative effluent release locations. The entire Mine Site component of the PA is located within the West River Sheet Harbour, with the majority lying within the Killag River tertiary watershed. Cameron Flowage/Killag River was identified as an effluent release location because of proximity to the proposed pit and water collection ponds, that minimal disturbance would be required to allow water to flow in this direction. Predictive water quality assessments indicated that all predicted exceedances in constituents of concern could be effectively treated to meet compliance with MDMER guidelines at the discharge point, and federal and provincial regulatory guidelines which are protective of aquatic health at the 100 m mixing zone, given the assimilative capacity of Cameron Flowage/Killag River.

Alternative discharge locations such as Cope Brook and Paul Brook would result in release of effluent upstream of the Beaver Lake IR 17 and both of these watersheds have lower assimilative capacities. The Project is located at the top of the Tent Brook watershed, which flows into the West River Sheet Harbour downstream of the Beaver Lake IR 17; however, it is anticipated that this system has lower assimilative capacity. Furthermore, all three of these locations would still ultimately flow into the West River Sheet Harbour; regardless, so the key objective at this time is to manage water quality within site, prior to release.

Another potential alternative would involve pumping effluent into the East River Sheet Harbour watershed, into a habitat such as Como Lake, only 2 km northeast of the pit. This was not strongly considered, as AMNS is capable of meeting compliance at the release point. Releasing effluent into another secondary watershed, or even into any of the alternative tertiary watershed would introduce another suite of indirect effects related to increased flow at the release point and potentially morphological adaptations

depending on the resilience of the receiving environment, along with exacerbating potential for flow reduction in the Killag River, by cutting off the circular flow path used as a mitigative measure for predicted baseflow reductions in Cameron Flowage. For these reasons, AMNS has determined that effluent release within Cameron Flowage is the most technically defensible option, and water treatment will ensure compliance within the mixing zone.

The Preferred Alternative Haul Road has been removed from the Project Description (Section 2) to minimize potential impacts. The movement of ore will be transported between the Beaver Dam Mine Site and the Touquoy Mine Site for processing using an existing road network. A portion of the network requires upgrading and some re-alignment to allow safe movement of large ore-carrying vehicles. Additionally, an ATV bypass road will be constructed parallel to the haul road to allow for safe non-mine, recreational vehicle use. As a result, direct HADD can be minimized and existing impacts due to damaged, non-functioning crossings can be mitigated.

6.9.8.2 Mitigation

Measures to mitigate any adverse effects on fish and fish habitat include both standard best practices that are implemented through all phases of the Project (e.g., construction, operation, decommissioning) and site-specific mitigation designs. Measures to Mitigate and minimize losses or reduced productivity of fish habitat have been established at several locations within the Project. Site-specific mitigation designs include a potential groundwater pump at Cameron Flowage, a groundwater interceptor trench (if required based on water quality) west of the PAG Stockpile, and fish relocation activities.

To avoid or mitigate additional loss of waters frequented by fish or harm to fish habitat during Project construction, operations and closure phases, a combination of site-specific mitigation measures as defined through permitting, approvals and environmental assessment commitments and best management practices will be used. Measures and standards will include, but are not limited to, construction water management; erosion and sedimentation controls; and adherence to timing windows to protect sensitive life cycle periods.

6.9.8.2.1 Surface Water Quantity and Quality Mitigation

Design and operation of surface water management infrastructure represents a key aspect of planned mitigation and management activities; surface water management infrastructure at the existing Touquoy Mine and the proposed Beaver Dam Mine Project have been developed to attain the following performance objectives:

1. minimize the amount of precipitation and runoff that comes into contact with potential contaminant sources during mine operations through surface water diversions;

2. avoid effects to surface water and downstream water users by collecting and capturing all potentially contaminated water for mine reuse (reclaim water) or directing to water treatment prior to offsite discharge; and

3. manage and control other non-contaminated surface water on the Project site.

This description mitigation measures is detailed in the Mine Water Management Plan (MWMP) plan provided in Appendix P.4. In summary, the objective of the MWMP is to support and guide mine water management through the construction, operation, active closure, and post-closure phases of the Project. The primary objectives of water management at the Beaver Dam Mine Site are to reduce operational risks and environmental impacts of mining. The following strategies are planned to achieve the primary objectives:

- Mitigate water quality and quantity impacts on receiving waters.
- Reduce the water inventory at the Beaver Dam Mine Site through off-site drainage of non-mine contact water.
- Incorporate system flexibility to manage water under variable climatic conditions.
- Reduce water quality monitoring requirements through the establishment of minimal effluent discharge points.
- Provide an effective adaptive monitoring program to manage mine water quantity and quality, throughout various stages of Beaver Dam Mine Site development and maintain the mine in compliance with regulatory requirements and approval conditions.
- Water treatment will be designed to ensure that concentrations of surface water within Cameron Flowage/Killag River meet regulatory requirements during operations and post-closure phases of the Project (Appendix P.4 Mine Water Management Plan).

The updated Predictive Water Quality model results from adjusted nitrate, nitrite and ammonia source terms demonstrate a decrease in constituents of concern concentrations under EOM conditions as compared to the 2019 EIS submission. Treatment will be required at the North Settling Pond to ensure compliance with Nitrite levels at the discharge point in July, August and September. Nitrate and ammonia continued to have no predicted exceedances (Appendix D Predictive Water Quality Assessment in Appendix P.4). It has been determined that an aeration lagoon and polishing pond associated with the North Settling Pond will allow AMNS to meet CCME objectives for water quality (Appendix D Predictive Water Quality Assessment in Appendix P.4).

The Water Balance Analysis indicated that the Killag River is expected to see a 2.2% and 1.1% increase in annual runoff volume under EOM and PC conditions (Appendix A Water Balance Analysis in Appendix P.4). However, this assessment does not account for the potential impact to baseflow within the Killag River due to drawdown from the open pit and the potential impacts to Cameron Flowage during the approximately 13 years it will take for the open pit to fill with water, when there is no direct discharge from the site planned.

The predicted reduction in baseflow under operating conditions is mitigated by flow path of the groundwater that discharges to proposed site infrastructure (i.e., the open pit). Groundwater will flow into the open pit where it will be pumped to the North Pond before it is discharged back into Cameron Flowage. The impact that the baseflow reduction during operation conditions will have on the total flow in the Killag River is expected to be mitigated by this circular flow path in which all groundwater that discharges to Site infrastructure is collected, treated, as necessary, and then discharged back into Cameron Flowage. During pit filling, surface flows are predicted to decrease by 2.2%.

During the closure phase, water from the North Settling Pond will be discharged into the pit to expedite pit filling. During times of low flow in Cameron Flowage while the pit is filling, treated water from the North Settling Pond will be diverted to the northern end of Cameron Flowage as necessary, to supplement flow. The baseflow reduction under pit filling conditions is to be mitigated by continuing operation of the North Pond while the pit is being filled with water. All site surface water will be directed first towards the North Pond with an overflow leading to the Pit. This overflow discharge has been designed to direct surface water discharge at the northern end of Cameron Flowage. AMNS has located the discharge location upstream of the open pit and north of the topsoil pile in order to minimize impact on baseflow reduction in Cameron Flowage/Killag River. Ninety-nine percent of the predicted baseflow

reduction will occur downstream of the discharge location. The North Pond will be maintained at full capacity with the purpose of providing surface water discharge to Cameron Flowage during the months of July, August and September, as required. This flow augmentation will mitigate the impacts that a reduction in baseflow would have on the total flow in Cameron Flowage, as these are the months in which baseflow dominates the total flow volume.

Once the pit has been filled, Cameron Flowage is still anticipated to see a decrease in baseflow due to a reduction in hydraulic gradient between the proposed footprint of the open pit and Cameron Flowage. The reduced baseflow in Cameron Flowage will be mitigated by the discharge point of the pit lake. While the discharge point of the pit lake occurs near the downstream end of Cameron Flowage, the overall runoff to the Killag River is expected to increase by 1.1% (Appendix H Baseflow Mitigation Assessment in Appendix P.4), resulting in an increase in total flow in the Killag River, despite the reduction in baseflow. As described in Section 6.9.7.2.2.1, baseflow reduction, and changes in surface flow (monthly and daily flows) are anticipated to result in a low magnitude of effect to Cameron Flowage and the Killag River.

Project scheduling will provide time to confirm existing groundwater predictions within the Cameron Flowage near the Open Pit area. Therefore, the uncertainty around losses of existing groundwater seepages will be addressed prior to any potential Open Pit operations. Should groundwater upwelling locations be identified during ongoing monitoring and used within Cameron Flowage, further mitigation and adaptive management will be considered including the design and installation of groundwater pump(s) during Project Operations. Details on possible locations would require additional site-specific details such as groundwater depth, temperature, access, groundwater recharge rate, power requirements, and geology, would be required prior to final determination as a feasible mitigation option during Project operations.

The following mitigation may be implemented to reduce the risk of contaminant transport to fish and fish habitat:

- Implementation of an interceptor trench to achieve hydraulic containment of potential COC migration west from the PAG waste rock stockpile in the event that groundwater quality monitoring indicates COC concentrations are approaching the Tier 2 PSS in this area.

6.9.8.2.2 Fish Rescue

Wherever avoidance of direct impacts is not practicable, a fish rescue will be completed to avoid death of fish. Prior to completion of in-stream work related to the Project, fish rescue and relocation will be required in habitats proposed for direct alteration, as outlined in Table 6.9-14 and Table 6.9-16 (Mine Site and Haul Road, respectively). The fish rescue approach is provided herein, with the goal of outlining the framework of fish rescue activities.

The primary goal of fish rescue work is to capture and relocate as many fish as is reasonably practicable, considering habitat area and complexity, access, and safety considerations as the key constraints. As the extent of those constraints is somewhat unknown, a quantitative estimate of fish mortality is not provided herein. Fish rescue work will not occur without permission granted under the *Fisheries Act* (2019) for a HADD, and death of fish by means other than fishing. As such, it is expected that a small proportion of fish present may not be successfully rescued; however, it is the goal of a fish rescue operation to minimize the death of all fish in habitat to be lost. This is completed by following the framework outlined herein, which describes a series of approaches to be used in an adaptive management capacity based on the constraints present. It is our professional opinion, based on experience with EISs and EAs throughout Canada, that a specific depletion target or mortality estimate is not typically required, or accurate, at the EIS stage. AMNS commits to a reasonable level of effort to rescue as many fish as practicable, and that the details surrounding reasonable depletion efforts is completed at the permitting phase in consultation with DFO.

Guidance for the approach to a fish rescue was obtained from Fisheries and Oceans Canada (2015); Appendix F, Fish Rescue Guidelines. A fish rescue plan will be provided to DFO for approval at the permitting phase of the Project and prior to any fish rescue activities. While the specific capture methods will be finalized during permitting, the general approach will involve a combination of passive trapping, seine netting, dip netting, and electrofishing in habitats where each is effective. Timing of fish rescue activities will be closely coordinated with habitat dewatering or other water diversion/infilling activities during construction. While eggs, larvae and small young-of-year life stages of fish are very difficult to successfully locate, collect, and relocate, habitat construction activities will be planned to avoid periods of egg incubation whenever possible; however, it is known that many fish rescue programs cannot successfully guarantee the loss of these small life stages.

The fish rescue will be completed by a team of aquatic ecologists, experienced in the collection, handling and transfer of fish. The team will obtain a scientific research license which allows for collection of fish, including collection for fish rescue purposes. A fish transfer license will only be required if fish are to be transferred from one watershed to another, which is not being considered. Release locations within the same watercourse, or those watercourses where natural connectivity exists will be used. The team will adhere to all specific terms and conditions of the Scientific Licence.

For linear and open water features which are safely wadeable and easily isolated, the following approach to fish rescue will be taken. The license holder will identify the area to be isolated and barrier nets (or similar) will be installed on the upstream and downstream ends of the habitat. The specific fish rescue methodology will vary based on factors such as depth, substrate, wadeability, water temperature and turbidity of the water. The following techniques will be used either alone or in combination, until an appropriate depletion target is reached. The effectiveness of this approach is expected to be high, with little to no mortalities expected. Recent and past experience suggests that mortality of fish that have been captured and handled during relocation activities is typically in the range of 1 to3%. Standard Operating Procedures (SOP) for each method as well as an overall plan that will describe methods of holding, transporting, and monitoring fish during rescue will be provided as part of the permitting process. Contingencies for reducing fish stress from high water temperatures and/or low dissolved oxygen will also be provided. Included in typical capture programs are:

- Passive trapping (minnow traps, eel pots, fyke nets);
- Seining;
- Electrofishing; and
- Dip-netting.

All fish collection methods were selected based on inherent low mortality (i.e., gill nets and other lethal fish collection methods will not be used). The rescue will be completed to minimize handling and stress to fish, particularly if completed during warmer months. Measures such as oxygen supplementation and water cooling will be used as needed. A sub-sample of individuals per species will be sampled (physical measurements recorded), with the remaining to be identified and enumerated only. To reduce handling and stress to fishes, measurements of length, weight and age class, will not be recorded, unless requested by DFO (in consideration of Atlantic salmon, if caught). Fish will be released into the natural environment as soon as possible, and the rescue team will closely monitor fish for signs of stress.

For fish rescue work to support road crossings and culvert installations along the Haul Road, fish will be released on the downstream side of each crossing. Within the Beaver Dam Mine Site, fish rescue work to support road crossings will follow the same methodology, with the release point downstream of the impact area (e.g., watercourses 1 and 5). Fish captured in smaller watercourses which are tributaries to Cameron Flowage (WC12, 13, 14, 25, and WL61) will be released within Cameron Flowage, as close as possible to the rescue reach. While fish abundance is anticipated to be low in WL56, its proximity to Cameron Flowage

will also mean that these fish will also be targeted for release there. The rescue team of fisheries biologists will be supported by 'porters' as necessary, to facilitate quick transport and releases of fish back into the natural environment.

For open water features where safe wading is not possible due to water depth and soft substrate, AMNS will consider the use of a barge or boat-based electrofisher or rely on passive trapping. Within the open water portion of WL59, abundant standing dead trees and snags present challenges for both access, safety, and fishing efforts, particularly electrofishing. In this habitat, the fish rescue will likely occur through successive isolation of sections where possible, using repeated days of extensive trapping efforts and seine netting. This work will be conducted immediately prior to, and during dewatering efforts, to facilitate isolation of fish in smaller, shallower portions, where fishing efforts can be concentrated.

Fish captured in WL59 will be released primarily into Cameron Flowage, as it is the nearest contiguous watercourse. Based on the catch results, the team will consider releasing some fish into Crusher Lake and/or Mud Lake, to reduce competition for resources in a single release location. Due to the physical parameters of this habitat, a moderate to high level of effectiveness is predicted for fish rescue efforts, and some mortalities may be inevitable. Trapping efforts to date have identified (in decreasing abundance) Banded Killifish, Golden Shiner, Brown Bullhead, Brook Trout and Ninespine Stickleback. Water temperature is believed to be a limiting factor for coldwater species within this habitat, and suitable habitat for Atlantic salmon was not observed within this wetland.

AMNS commits to implementing all practicable methods and a reasonable level of effort to rescue all fish from habitat that will be dewatered, diverted, and/or infilled. During the completion of each rescue reach, personnel will remain on site during all de-watering to dip-net any fish remaining in the reach, wherever safely practicable. This will allow an estimate of mortalities to be provided to DFO in a summary report outlining results of the fish rescue. Fish release locations for each individual fish habitat within the Mine Site are identified in Table 6.9-14. Along the Haul Road, wherever fish rescues are required, the release point will be within the same watercourse, typically downstream of the rescue reach.

6.9.8.2.3 Mitigation Measures Summary

To mitigate and reduce overall loss of function of fish and fish habitat, the actions provided in Table 6.9-24 will be implemented by AMNS within wetlands and watercourses where direct impacts and potential indirect impacts to fish and fish habitat are expected. Mitigation measures will be confirmed and adaptively managed through ongoing monitoring requirements, as described at the permitting stage. Considering the extensive planning, the ongoing engagement with the Mi'kmaq of Nova Scotia and stakeholders, and the use of proven mitigation measures/best management practices, AMNS is confident that the Project can be constructed, operated, rehabilitated, and closed, in an environmentally responsible and safe manner that minimizes and mitigates impacts to fish habitat.

Where possible the offset and compensation measures will be constructed in advance of major Project impacts. This approach will allow for the initial development and stabilization of the works to be achieved, and significant colonization of the new replacement habitats by adjacent fish communities while fisheries impacts occur. Any changes to the approximate time periods specified in the final plan would require notification and approval by DFO in advance of a revised schedule.

Table 6.9-24: Proposed Mitigation Measures for Fish and Fish Habitat

Project Phase	Mitigation Measure
C, O, CL	Complete site meetings with relevant staff/contractors to educate and confirm policies related to working around fish bearing surface water systems including schedule of construction activities to minimize unauthorized disturbance and limit vegetation clearing
C	Provide signage on fish habitat streams

Table 6.9-24: Proposed Mitigation Measures for Fish and Fish Habitat (continued)

Project Phase	Mitigation Measure
C	Complete micro siting of mine infrastructure to avoid or minimize fish habitat impact as necessary
C	Complete fish rescue within all fish bearing streams to be impacted by the Project, prior to commencement of mine development, with DFO approval if required
C	Implement construction methods that reduce potential interaction with fish habitat and limit vegetation clearing around watercourses
C	Complete culvert installations and upgrades in accordance with the NSE Watercourse Standard (2015) or as updated at time of construction. Limit vegetation clearing
C, O	Maintain 30 m riparian wetland and watercourse buffers, where practicable.
C, O	Use vegetated buffers and aquatic vegetation wherever practicable to provide shade to on-site ponds.
C, O	Install groundwater pumps to supplement baseflow in Cameron Flowage, if necessary
C, O, CL	Implement a groundwater interceptor trench on the west side of the PAG stockpile, if necessary
C	Minimize the removal of vegetation upgradient of watercourses and stabilize shorelines or banks disturbed by any activity associated with Project activities
C	Minimize the temporal extent of in-stream works as much as practicable
C, O	Follow DFO-advised *Measures to avoid causing harm to fish and fish habitat* pertaining to blasting (DFO 2019)
C, O	A detailed explosive management plan will be developed as part of the permitting process.
C, O	Use an emulsion-type explosive that will minimize nitrogen release to surface water and groundwater
C, O	Use clean, non-ore-bearing, non-watercourse derived and non-toxic materials for erosion control methods
C, O	Incorporate drainage structures, where necessary, to dissipate hydraulic energy and maintain flow velocities sufficiently low to prevent erosion of native soil material
C, O	Limit clearing within confirmed fish habitat outside of approved alteration areas to within approved areas.
C, O	Acquire and follow watercourse alteration permits
C, O	Adhere to applicable timing windows, as directed by DFO, for construction where infilling has been approved in wetlands and watercourses where fish habitat is present
C, O	Ensure fueling areas are a minimum of 30 m from waterbodies
C, O	Use and maintain properly sized screens on any water intakes or outlet pipes to prevent entrainment or impingement of fish (DFO, 2020)
C, O	Ensure that machinery arrives on site in a clean condition and is maintained and free of fluid leaks
C, O	Develop and implement Mine Water Management Plan
C, O, CL	Collect and treat all contact water, as required
C, O, CL	Implement Erosion and Sediment Management Plan
C, O, CL	Maintain pre-construction hydrological flows into and out of down-stream surface water habitats, to the extent practicable, to limit indirect impacts to fish habitat
C, O, CL	Complete offsetting for HADD including for permanent loss of fish habitat through fish habitat restoration activities, subject to DFO approval, as required under the *Fisheries Act*
C, O, CL	Develop and implement the Aquatic Effects Monitoring Program to identify and further mitigate any additional adverse impacts to fish and fish habitat

Notes: C = Construction; O = Operations; CL = Active Closure; DFO = Fisheries and Oceans Canada; HADD = Harmful Alteration, Disruption or Destruction; NSE = Nova Scotia Environment.

Monitoring of standard mitigations described above will be supported by the MWMP (Appendix P.4) and AEMP (Appendix P.5), both of which will be in place prior to construction activities to minimize possible disturbances of fish and fish habitat. To ensure that the measures and standards described are implemented as proposed, AMNS onsite monitors (or designates) will monitor

construction and implementation of this plan. Monitoring will clearly be defined in the final Offset Plan, and DFO Authorizations, and be reported to DFO in an "as constructed" report provided following the works being completed. The "as constructed" monitoring report will document the construction of the offset and works as per the approved plans, and a summary of the mitigation measures and any contingency measures implemented to prevent further impacts to fish habitat. A detailed photographic record will be taken during implementation of the plan using consistent vantage points prior to, during and post construction.

6.9.8.3 Offsetting

A summary of the potential impacts quantification is provided above (CEAA 2-07). Standard mitigations as well as project-specific avoidances and redesigns have minimized the impacts to only those habitats where avoidance and further mitigation is not possible. It is understood that the final HADD determination will be determined by DFO; however, this preliminary quantification is provided to show that the offset concepts described herein can be designed to meet anticipated HADD quantity expectations, including any offset ratios. It should be noted that most of the impacted lacustrine habitat is degraded due to past disturbances by others and contains substandard water quality for fish (e.g., DO, temperature, substances).

6.9.8.3.1 Conceptual Habitat Offsets

The Project as proposed would result in the permanent impact to fish habitat and its associated productive capacity, through a portion of waterbodies and watercourses within the Project Mine site as well as along the Haul Road. It also would result in indirect alterations to habitat downstream of the Project infrastructure footprint due to partial flow reductions. Proven techniques in similar geographic settings for similar fish species provide the greatest likelihood of offsetting lost productive capacity for the long term, are least likely to fail structurally, and require the least amount of maintenance. Low-risk options that are biologically relevant were prioritized during the development of offsetting concepts. In addition to offsetting using proven methods, a focus on habitat improvements and rehabilitation around Atlantic Salmon, a fish species of local and provincial importance, was also incorporated wherever possible in each offset option.

Several concepts have been identified for preliminary assessment and are presented in the draft Fish Habitat Offset Plan, (Appendix J.3). Each measure was assessed using a ranked scale across numerous categories that describe various aspects of option feasibility. Potential options were evaluated by consideration of multiple criteria including:

- Adherence to DFO's principles and policy for offsetting;
- Location within the Beaver Dam watersheds (e.g., Killag River) and close to the Beaver Dam Mine Site;
- Self-sustaining;
- Technically feasible and economically viable; and
- Provide similar "in-kind", or higher quality, habitat as an offset.

The identified potential offsetting concepts identified in the draft Fish Habitat Offset Plan, (Appendix J.3) were developed without detailed engagement with the Mi'kmaq of Nova Scotia, agencies, or public groups and are therefore considered preliminary; however, the options identified conform to the criteria and provide offset habitat located within the same ecological unit / watershed and provide habitat types and suitabilities similar to, or greater than, the habitat being lost.

Some of the key offset measure considered and proposed include:

- offsite and onsite habitat rehabilitation and enhancement;
- offsite and onsite habitat development (pools / ponds);

- Musquodoboit River channel enhancements; and
- complementary measures (research orientated).

6.9.9 Significance of Residual Effects

This effects assessment was developed to be consistent with Fish and Fish Habitat Protection Policy (DFO, 2019), which states "*the Department interprets "harmful alteration, disruption or destruction" as any temporary or permanent change to fish habitat that directly or indirectly impairs the habitat's capacity to support one or more life processes of fish*." However, it is recognized that the total impacts determined within this assessment will be further reviewed and determination of the amount of HADD will be made by DFO during the authorization application process.

This effects assessment includes:

- impact assessment criteria, Section 6.9.5.2, developed in consideration of the policy and relevant scientific literature (DFO, 2013b; DFO, 2019; DFO, 2005; Newbury and Gaboury, 1993; Fosse, Brown, Scruton and Beersing, 2001, for example).
- Site specific mitigation measures to avoid and/or minimize the duration or extent of indirect effects to fish and fish habitat are provided in Section 6.9.8.
- Direct and indirect impacts to fish and fish habitat have been quantified through detailed habitat evaluations, and hydrologic and hydraulic analyses. A conservative approach for quantifying indirect impacts due to flow reductions has been taken to identify potential alteration of the wetted areas below the 30% MAD, recognizing that the channels are expected to maintain existing fish communities. Furthermore, all areas with proposed direct and indirect impact have been accounted for in the Offsetting Plan, to meet the no-net-loss policy under the *Fisheries Act*. Work associated with fish and fish habitat will be completed in accordance with DFO and NSE regulatory approvals.
- Potential impact quantification and offsets have been provided within the Offset Plan (Appendix J.3) and will require confirmation of the HADD determinations by DFO.
- The assessment carefully considered potential impacts to the Atlantic salmon population and their habitat throughout both direct and indirect interactions resulting from the Project.
- An aquatic effects monitoring program (AEMP) is being developed to validate impact predictions as well as to identify adaptive management measures that may be required during construction, operations, and closure.

A significant adverse environmental effect for fish and fish habitat has not been predicted for the Project for the following reasons, with consideration of the ecological and social context of the LAA surrounding the Project:

- During construction:
  - Direct impacts to fish and fish habitat will occur. However, the current Project infrastructure layout has allowed AMNS to achieve complete avoidance of first order tributaries to Crusher Lake and Mud Lake, and a more equalized site-wide water balance which reduces indirect impacts to downgradient fish habitat.
  - Direct loss of habitat within the Beaver Dam Mine Site will be required to allow for development of the Pit and pit perimeter berm primarily, with small direct impacts related to internal haul roads and loss of upstream flow (i.e., WC5, WC13, WC14). The majority of direct habitat loss within the Beaver Dam Mine Site is within WL59, which is an open water wetland constructed to support historic mine activities.

  - Direct impacts to fish habitat along the Haul Road are minimal in scale, and required to allow for upgrades to the existing forestry road. This involves installation of 29 watercourse crossings; 12 of which are expected to improve fish passage through upgrading culverts which are currently either crushed, buried, blocked or hung.
  - The water collection and treatment system will be constructed, and collection of contact water will commence near the end of the construction phase of the project.
  - Strict adherence to the Erosion and Sediment Control plan will limit the potential indirect effects to fish and fish habitat commencing in the construction phase, and continuing throughout the operational life of the Project.
  - The death of fish by means other than fishing will be limited by the completion of fish rescue wherever direct impact is required.
- During operations:
  - All direct impacts to fish habitat will have been completed, and no new direct impacts are expected.
  - Water collection, treatment and effluent release will occur, resulting in indirect effects to four watercourses through reduction of both daily and monthly average flows. Mud Lake is also predicted to experience a small reduction in water level (maximum 5 cm). Where flow reduction is of a magnitude that it is predicted to result in alteration of fish habitat; the impact area has been incorporated into the offset plan.
  - With appropriate treatment of effluent discharge, the magnitude of the residual effect to the Killag River at the Beaver Dam Mine Site is considered negligible (within established criteria or background concentrations at the 100 m compliance point).
  - Effluent is predicted to be of neutral pH, limiting potential impact to Killag River.
  - Changes in flow to the Killag River and resultant changes to fish habitat quality from pit operations and dewatering have been predicted to be low.
- During closure:
  - With appropriate treatment of effluent discharge, the magnitude of the residual effect to the Killag River at the Beaver Dam Mine Site is considered negligible (within established criteria or background concentrations at the 100 m compliance point).
  - Effluent is predicted to be of neutral pH, limiting potential impact to Killag River, a low pH river with current efforts to increase pH to support salmon restoration.
  - During pit filling, flows in the Killag River are expected to decrease by 2.2% MAD flows; however, the duration of low flow period based on daily flows is expected to decrease (fewer low-flow days compared to baseline). Following pit filling, the Killag River is expected to observe a surplus in surface water on the order of 2.2%. These interactions are low in magnitude and not expected to result in any harmful alteration of fish habitat within the Killag River.

Table 6.9-25: Residual Effects for Fish and Fish Habitat

Project VC Interactions	Parameter	Mitigation and Compensation Measures	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction – Beaver Dam Mine Site & Haul Road Direct watercourse and wetland alteration	Direct	Sediment and erosion control, best management practices, spill preparedness, and completion of watercourse and fish habitat alteration permitting. Offset Plan. Fish Rescue	H VC interaction causes direct loss of fish habitat.	PA Potential adverse effect to fish habitat is limited to the PA	A Watercourse alteration will occur outside of sensitive periods for fish; however, other interactions may seasonally affect VC	P Effect is expected to be permanent	O Effects occur once during the construction phase	IR VC will not recover to baseline conditions	Habitat Alteration Disruption or Destruction	Not significant
Construction – Beaver Dam Mine Site Altered hydrology and altered surface water quality. Removal of historical tailings	Indirect	Sediment and erosion control, best management practices, spill preparedness, and completion of watercourse and fish habitat alteration permitting. Offset Plan.	M (WC5) H (WC23, WC26, WC27)L moderate to high changes to baseline conditions on downstream habitats	LAA Potential adverse effect to fish habitat outside of the PA	A Seasonal habitat provisions may affect VC	P Effect is expected to be permanent	R Effects occur at regular intervals as construction progresses	IR VC will not recover to baseline conditions	Habitat Alteration	Not significant
Construction – Haul Road Watercourse crossings	Direct	Sediment and erosion control, best management practices, spill preparedness, and completion of watercourse and fish habitat alteration permitting. Offset Plan.	L to H VC interaction causes direct loss of fish habitat. L < 20 m^2, M 20 m^2 - 100 m^2, H > 100 m^2 per crossing	PA Potential adverse effect to fish habitat is limited to the PA	A Seasonal habitat provisions may affect the VC	P Effect is expected to be permanent	O Effects occur once during the construction phase	IR VC will not return to baseline conditions	Habitat Alteration Disruption or Destruction	Not significant
Construction – Haul Road Watercourse crossings – improve fish passage	Direct	N/A	N/A	LAA Potential adverse effect to fish habitat outside of the PA	A Seasonal habitat provisions may affect the VC	P Increased habitat connectivity is permanent	O Effects occur once during the construction phase	IR VC will not return to baseline conditions	Increased habitat connectivity	Not significant
Operations –Beaver Dam Mine Site Indirect impacts including groundwater drawdown, groundwater seepage, altered surface water quality Cameron Flowage/Killag River Tent Lake Cope Brook	Indirect	Interceptor trench west of PAG stockpile Water treatment (as required) Discharge point location at northern end of Cameron Flowage Surface water from pit dewatering activities will be designed to discharge back into Cameron Flowage/Killag River at rates to mimic seasonal flows, where practical Vegetative buffers to provide shade to on-site ponds Install groundwater pumps to supplement baseflow in Cameron Flowage	L Interaction likely to cause indirect impacts to fish habitat	LAA Potential adverse effect to fish habitat outside of the PA	A Seasonal habitat provisions may affect VC	P Effect is expected to be permanent	R Effects occur at regular intervals throughout the Project	PR Groundwater drawdown effects will cease once the pit lake has filled. Surface water interactions are partially reversible	Habitat alteration	Not significant

Table 6.9-25: Residual Effects for Fish and Fish Habitat (continued)

Project VC Interactions	Parameter	Mitigation and Compensation Measures	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
		Explosives Management Best Management Practices								
Operations – Haul Road Indirect impacts to surface water quality	Indirect	Sediment and erosion control, best management practices, and spill preparedness.	N Negligible change to fish and fish habitat	LAA Potential adverse effect to fish habitat outside of the PA	A Seasonal habitat provisions may affect VC	P Effect is expected to be permanent	R Effects occur at regular intervals throughout the Project	PR VC will partially return to baseline conditions (reduction in traffic once haul trucks cease)	Habitat alteration	Not significant
Post Closure – Beaver Dam Mine Site and Touquoy Mine site Surface water quality Cameron Flowage/Killag River Moose River	Indirect	Water treatment (as required)	N VC interaction will remain below appropriate guidelines	LAA VC interaction will extend beyond PA	A Seasonal aspects will affect VC	P Effect is expected to be permanent	R Effects are expected to occur over a regular interval	PR VC will partially recover to baseline conditions	Change in water quality	Not significant

Notes: See Table 6.9-7 for definitions of the below characteristics.

See Section 5, Table 5.11-1 for Nature of Effect definitions

Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility
N Negligible	PA Project Area	N/A Not Applicable	ST Short-Term	O Once	R Reversible
L Low	LAA Local Assessment Area	A Applicable	MT Medium-Term	I Intermittent	IR Irreversible
M Moderate	RAARegional Assessment Area		LT Long-Term	R Regular	PR Partially Reversible
H High			P Permanent	C Continuous	

6.9.10 Proposed Compliance and Effects Monitoring Program Update

An Environmental Effects Monitoring Plan (EEM) has been initiated and will be fully implemented to support compliance with the monitoring requirements in MDMER. This will form one component of the broader Aquatic Effects Monitoring Program (AEMP), which will monitor all aquatic ecosystems where Project effects are predicted to validate impact predictions as well as to identify adaptive management measures that may be required during construction, operations, and closure. A conceptual AEMP is provided in Appendix P.5. Baseline data to support the EEM and AEMP has, and continues to be, collected to support ongoing effects assessment over the life of mine.

The purpose of the AEMP is to identify potential changes the Project may have on the surrounding aquatic environment. This includes the following specific objectives:

- to determine any short- and long-term aquatic effects of the Project on downstream aquatic receptors;
- to evaluate the accuracy of impact predictions made in the EIS;
- to assess the efficacy of impact mitigation measures;
- to provide the data necessary to report on state of the environment on an annual basis, and to inform adaptive management approaches to reduce or eliminate Project-related effects; and
- to recommend any necessary and appropriate changes to future versions of the AEMP.

Proposed study areas include watercourses and waterbodies adjacent to planned infrastructure within the Beaver Dam Mine Site including WC5/Crusher Lake, WC23, WC26, WC27/Mud Lake, and Cameron Flowage/Killag River. Study areas also incorporate those selected for Environmental Effects Monitoring (EEM) downgradient of proposed effluent discharge locations as required under the MDMER (Cameron Flowage/Killag River).

In accordance with the federal *Fisheries Act,* mines in Canada regulated under the MDMER are required to conduct periodic EEM studies as part of their authority to deposit effluent. The objective of EEM under MDMER is to evaluate the effects of metal and diamond mining effluents on fish, fish habitat, and the use of fisheries resources. EEM programs consists of two general components, namely biological monitoring studies (fish population study, fish tissue study, and benthic invertebrate community survey) and effluent and water quality monitoring studies (effluent characterization, water quality monitoring, and sublethal toxicity testing). The components of EEM monitoring have been brought forward into the Conceptual AEMP Design Plan.

The scope of the AEMP involves monitoring of water quality, water quantity, sediment quality, periphyton, benthic invertebrates, fish habitat and community, and fish health and fish tissue. The AEMP describes the proposed sampling frequency, schedule and intensity, as well as identified significance thresholds, action levels and suggested responses should significant thresholds be exceeded. The AEMP also provides a proposed reporting schedule to federal and provincial regulators. The Conceptual AEMP can be found in Appendix P.5.

6.10 Habitat and Flora

6.10.1 Introduction

6.10.1.1 Summary of Habitat and Flora Before the Update

The Project is located in the Eastern Ecoregion of the Acadian Ecozone and lays within the Eastern Interior Ecodistrict (previously subdivided into the Eastern Interior and Eastern Drumlins Ecodistricts). Habitat surveys confirmed 10 different ecosites (AC1, 2, 4, 5, 7, 8, 10, 11, 13) within the Beaver Dam Mine Site (n=6) and Haul Road (n=9). Dominant ecosites identified within the Beaver Dam Mine Site generally support vegetation types from the spruce-pine and spruce-hemlock forest groups, with some associated with a natural disturbance regime. Ecosites identified within the Haul Road generally support a broader variety of vegetation types from the spruce-pine, intolerant and tolerant hardwood, mixed wood, open woodland, spruce-hemlock and intolerant hardwood forest groups. Habitat within the Project Area (PA) is largely disturbed as a result of timber harvesting, historic mining and/or road and trail networks. An interior forest analyse was conducted to quality Project impacts through habitat fragmentation.

A total of 294 vascular plant species were identified, five of which were considered priority species: lesser rattlesnake plantain (*Goodyera repens*, S3), southern twayblade (*Neottia bifolia*, syn. *Listera australis*, S3) appalachian polypody (*Polypodium appalachianum*, S3), and highbush blueberry (*Vaccinium corymbosum*, S3S4). No Species at Risk (SAR) vascular plants were observed. Eleven priority lichen species were observed, three of which were SAR: boreal felt lichen (*Erioderma pedicellatum*), blue felt lichen (*Pectania plumbea)*, frosted glass whisker lichen (*Sclerophora peronella*).

The Project was assessed to impact 45 hectares (ha) of interior forest within the Beaver Dam Mine Site and 116 ha of interior forest within Old Forest Unit 582 along the Haul Road. Project development will directly impact vascular and non-vascular flora, predominantly during the construction phase. Indirect effects to vascular and non-vascular flora could include altered hydrology, dust deposition, sedimentation and erosion, accidents and malfunctions, and the introduction of invasive species. As a result of mitigations and detailed design planning, the predicted residual environmental effects of Project development and production on habitat and flora are assessed to be adverse, but not significant. Project effects to priority species are discussed in Section 6.13.

6.10.1.2 Summary of Updates to Habitat and Flora

As a result of PA modifications and continued infrastructure micro-siting since the 2019 Environmental Impact Statement (EIS) submission, additional habitat surveys observed an additional two ecosites (AC3 and AC9) within the Beaver Dam Mine Site, totalling 12 ecosites within the Beaver Dam Mine Site (n=10) and Haul Road (n=9). General habitat trends and dominance did not change since the 2019 EIS. A habitat desktop analysis was conducted to quality the habitat types and disturbed areas presented within the Beaver Dam Mine Site, Haul Road and Local Assessment Area (LAA). The interior forest analyse was updated in the Updated 2021 EIS (AMNS 2021) and further assessment of Old Forest Unit 582 and potential Old Growth was conducted. One additional vascular plant species, Nova Scotia Agalinis (*Agalinis neoscotica*, S3S4), was observed during supplementary field surveys for the Updated 2021 EIS (AMNS, 2021). A total of 295 species of vascular plants species were observed, including six priority species. No additional priority lichen were observed.

Impacts to habitat and flora were reassessed based on changes to the PA and Project infrastructure. The desktop habitat analysis shows that the Project related habitat impacts in relation to the LAA are low to moderate and the Project predominantly impacts previously disturbed areas. As a result of infrastructure changes, the Project is will affect a total of 237 ha of interior forest habitat, which accounts for 9% of predicted interior forest in the LAA and 0.3% within the Regional Assessment Area (RAA). Further assessment of Old Forest Unit 582 found that the proposed Haul Road alignment may impact 0.22 ha Potential Old Growth, which

was delineated during a preliminary survey. A potential alternative Haul Road route option is presented to avoid the Potential Old Growth.

No new direct or indirect impacts to flora are expected. Project effects to habitat and flora remain adverse, but not significant.

Table 6.10-1: Updated Subsections from the 2019 Revised Environmental Impact Statement –Habitat and Flora

2019 Revised EIS Submission (February 28, 2019)	Updated in 2021	Corresponding 2021 EIS Update Section Number	Reason for Update
-	-	6.10.1 Introduction	• New
6.10.1 Rationale for Valued Component Selection	No	6.10.2 Rationale for Valued Component Selection	-
6.10.2 Baseline Program Methodology	Yes	6.10.3 Baseline Program Methodology	• Addition of 2019 field surveys: • Additional survey areas as a result of PA modification for infrastructure micro-sitting. • Review and update priority species (IR NSE 2-184) • Habitat Desktop Analysis • Potential Old Growth Forest survey
6.10.3 Baseline Conditions	Yes	6.10.4 Baseline Conditions	• Present results from 2019 field surveys: • Additional survey areas as a result of PA modification for infrastructure micro-sitting. • Review and update priority species (IR NSE 2-184) • Results of Potential Old Growth Forest survey
6.10.4 Consideration of Consultation and Engagement Results	No	6.10.5 Consideration of Engagement Results	-
6.10.5 Effects Assessment Methodology – **Boundaries**	Yes	6.10.6 Effects Assessment Methodology – **Boundaries**	• PA modification for infrastructure micro-sitting: • Adjusted PA description. • LAA was enlarged due to the modified PA. • RAA was enlarged where necessary due to the modified PA.
6.10.5 Effects Assessment Methodology – **Thresholds for Determination of Significance**	Yes	6.10.6 Effects Assessment Methodology – **Thresholds for Determination of Significance**	• Updated significance threshold and magnitude assessment • Reflect changes in VC baseline conditions, the Habitat Desktop Analysis and improved significance assessment criteria • Response to IR CEAA 2-02.
6.10.6 Project Activities and Habitat and Flora Interactions and Effects	Yes	6.10.7 Project Activities/Interactions with Habitat and Flora	• Updated based on field survey results and changes to baseline conditions. Changes to project timelines. • Reflect changes in VC baseline conditions and updates to project infrastructure and operations. • Quantify direct impact by habitat type, including Old Forest and Potential Old Growth
6.10.7 Preferred Alternative Haul Road	Yes	Section removed	• The Preferred Alternative Haul Road is no longer being considered and has been removed from the Project Description and EIS

Table 6.10-1: Updated Subsections from the 2019 Revised EIS Habitat and Flora (continued)

2019 Revised EIS Submission (February 28, 2019)	Updated in 2021	Corresponding 2021 EIS Update Section Number	Reason for Update
6.10.8 Mitigation	No	6.10.8 Mitigation	• Updated based on field survey results and changes to effects assessment • Proposed mitigations for Potential Old Growth Project interactions
6.10.9 Residual Effects and Significance	Yes	6.10.9 Residual Effects and Significance	• Updated based on field survey results and changes to significance threshold determination. • Change to magnitude determination • Reflect changes to significance threshold and magnitude assessment.
6.10.10 Proposed Compliance and Effects Monitoring Program	No	6.10.10 Proposed Compliance and Effects Monitoring Program	• Updated monitoring program -

PA = Project Area; LAA = Local Assessment Area; RAA = Regional Assessment Area; - = no update; IR2 = Round 2, Information Requests; CEAA = Canadian Environmental Assessment Agency; EIS = environmental impact statement; N/A = Not Applicable.

6.10.2 Rationale for Valued Component Selection

Flora species and ecosystem habitats, and the fauna species which rely upon these communities, may be altered, either directly or indirectly, by proposed Project activities. Field programs were developed to identify priority species, in particular SAR, which are protected under federal and provincial SAR legislation.

6.10.3 Baseline Program Methodology

Methodology of habitat and flora surveys within the Beaver Dam Mine Site and Haul Road (excluding the existing Mooseland Road portion) are discussed below. Information pertaining to Touquoy Mine Site has been brought forward from the EARD and Focus Report (CRA 2007a,b). Methods and results are summarized in subheadings within the applicable sections and are carried forward into the effects assessment as appropriate.

In 2019, the PA was modified to allow for the micro-siting of infrastructure within the Beaver Dam Mine Site, as described in Section 6.8. As a result, targeted habitat and flora surveys were conducted within the modified PA (Section 5.5, Figure 5.5-1) in July and August 2019 to identify and record additional flora species and ecosystem habitats.

6.10.3.1 Priority List Methodology and Desktop Evaluation

A detailed desktop study to examine potential for presence of and effects on SAR within the vicinity of the Beaver Dam Mine Site and Haul Road was completed. This desktop evaluation for SOCI and SAR was completed in advance of field programs to advise the detailed methodologies outlined in Section 6.13 SOCI and SAR are collectively referred to as priority species.

As outlined in the EA guidance documented cited above, the compilation of a priority species list is habitat driven, rather than observation driven (based on information provided in reports from Atlantic Canada Conservation Data Centre (ACCDC) or the Maritime Breeding Brid Atlas (MBBA), for example). This is based on the recognition that observation-based datasets are not comprehensive lists of species identified in any given area. As such, the information provided observation driven sources are supplementary to the priority species list, rather than forming the basis of the priority species list.

Sightings of priority species recorded within 5 kilometres (km) and 100 km by ACCDC were reviewed (reports included in Appendix I.1 and I.2). Original reports were prepared for the Beaver Dam Mine Site on September 8, 2014, for the Haul Road on June 3, 2016, and an additional report was prepared for the Touquoy Mine Site on September 10, 2015. An updated ACCDC report was attained and reviewed for the Beaver Dam Mine Site and Haul Road on January 4, 2021 in order to consider new species occurrences and potential impacts (IR2 NSE 2-184).

When the ACCDC prepares a rare species report, they provide the user with georeferenced shapefile points of rare species records within 5 km of the center of the study area. However, NSL&F has classified several species as 'location sensitive', meaning that ACCDC is not permitted to provide specific location data for these species in their reports. Concern about exploitation of location-sensitive species precludes inclusion of coordinates in the rare species reports. Location sensitive species in Nova Scotia include black ash (*Fraxinus nigra*), Blandings turtle (*Emydoidea blandingii*), wood turtle (*Glyptemys insculpta*), peregrine falcon anatum/tundrius populations (*Falco peregrinus*, pop.1), and any bat hibernaculum. If any of these species are present within 5 km of the center of the study area, the ACCDC report will simply identify that they are present, but will not provide specific location data. No location sensitive species were documented within 5 km of the Beaver Dam Mine Site and Haul Road in any of the ACCDC reports. The NSL&F Significant Species and Habitats Database was reviewed as well.

The Nova Scotia Department of Communities, Culture and Heritage provided an Environmental Screening Report including a list of flora and fauna SAR and SOCI documented by their staff within the vicinity of the Beaver Dam Mine Site and Haul Road. The Nova Scotia Special Places Environmental Screening report is provided in Appendix I.4. Additional priority lichen data were received from the Mersey Tobeatic Research Institute in 2019, and incorporated in the desktop evaluation. This data was used to advise field methodology and targeted lichen surveys for additional field programs completed, as well as inform Project impact assessments and mitigation approaches.

The compilation of the priority species list and the review of all other available desktop resources for priority species observations is done primarily to advise field methodology, and they inform field staff to the species they are likely to encounter during field surveys. The desktop review for priority species provided the study team with information that directly guided the methods and the timing of all field programs. All field staff reviewed the desktop evaluation for priority species prior to commencing field work. This allowed field staff to review field identification guides and ensured that they were familiar with priority species identification and their status ranks.

6.10.3.2 Habitat Survey

Habitat assessments were completed in October 2014, May 2015 and July/August 2019 within the Beaver Dam Mine Site, and in May 2016 within the Haul Road. Using available forestry and wetland databases, habitat survey routes were created with the goal of assessing all of the major habitat types and landscape features throughout the Beaver Dam Mine Site and Haul Road. During the 2019 field evaluations, 14 additional habitat survey points (HSP) were established within the Beaver Dam Mine Site, totaling 51 HSPs in the Beaver Dam Mine Site and Haul Road (Figures 6.10-1A to 6.10-1D).

The habitat survey methods and results are presented with the acknowledgment of three biases built into the survey methods.

- One bias is towards upland habitat. This bias was purposefully built into the survey methods with the understanding that all wetlands within the Beaver Dam Mine Site and Haul Road will be delineated and described in detail and their function as habitats within the landscape of the Beaver Dam Mine Site and Haul Road would be captured in the wetland program (Section 6.8).
- The second bias is towards forested landscape as opposed to non-forested landscapes. In this context, clear cut lands, or those which have experienced timber harvesting of any sort, are still considered forested because the removal of timber is only a temporary disturbance. Non-forested portions of the landscape, such as roads or extensive gravel areas, often associated with historic mine workings, were not assessed during the habitat survey simply because they lack forest cover to be described and their capability for supporting forest cover in the foreseeable future is low based on the level of disturbance.
- The third bias in this survey is that habitat surveys were completed at discrete points and no effort was made to delineate the extent of that habitat type around those points. As such, the ability to extrapolate habitat survey results across the entire PA is limited. These HSPs are meant to describe habitat in 'snapshots' of specific locations. The results of the habitat survey are meant to describe the diversity of habitat types present throughout the Beaver Dam Mine Site and Haul Road and the relative abundance thereof, rather than absolute percent cover of each habitat type throughout the Beaver Dam Mine Site and Haul Road.

Two surveyors walked the habitat survey routes. HSPs were established along the survey route based on anticipated and observed habitat types. The distance between HSPs was dependent upon the complexity of major habitat types across the landscape, approximately 250 metres (m) for the Beaver Dam Mine Site and approximately 1 km along the Haul Road.

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FIGURE 6.10-1A

Beaver Dam Mine Project

Habitat Survey Locations

HP048 (AC6)
HP049 (AC5)
HP047 (AC6)
HP043 (AC6)
HP046 (AC5)
HP045 (AC10)
Mud Lake
HP002 (AC7)
Cameron Flowage
HP001 (AC10)
HP003 (AC6)
HP006 (AC8)
HP004 (AC11)
HP005 (AC11)
HP007 (AC10)
Crusher Lake
HP008 (AC10)
HP012 (AC10)
HP011 (AC10)
HP010 (AC11)
HP009 (AC10)
HP015 (AC10)
HP013 (AC10)
HP014 (AC10)
HP039 (AC9)
HP016 (AC4)
HP017 (AC6)
HP050 (AC5)
HP051 (AC10)
HP041 (AC4)
HP018 (AC6)
HP040 (AC13)
HP038 (AC3)
HP019 (AC1)

519500 520000 520500 521000 521500 522000 522500 523000 523500 524000

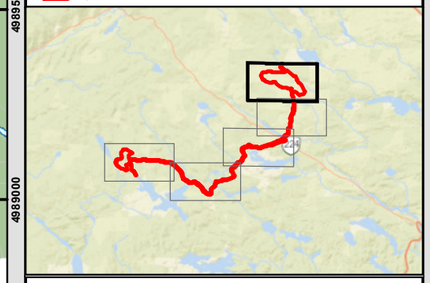
4991500 4991000 4990500 4990000 4989500 4989000 4988500 4988000

Habitat Survey Points (Ecosite)
- AC9
- AC8
- AC7
- AC6
- AC5
- AC4
- AC3
- AC13
- AC11
- AC10
- AC1

Field Delineated Watercourses
NSTDB Mapped Watercourses

Forest/Non-Forest Grouping
- Brush
- Clear Cut
- Inland water
- Rock Barren
- Miscellaneous (eg Mines, Mills etc)

Forest Cover Type
- Softwood >75%
- Mixed Forest 25 -75%
- Hardwood >75%
- Field Delineated Wetlands
- Project Area



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Drawn By: AS
Reviewed By: XX

Date: 2021-02-26

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

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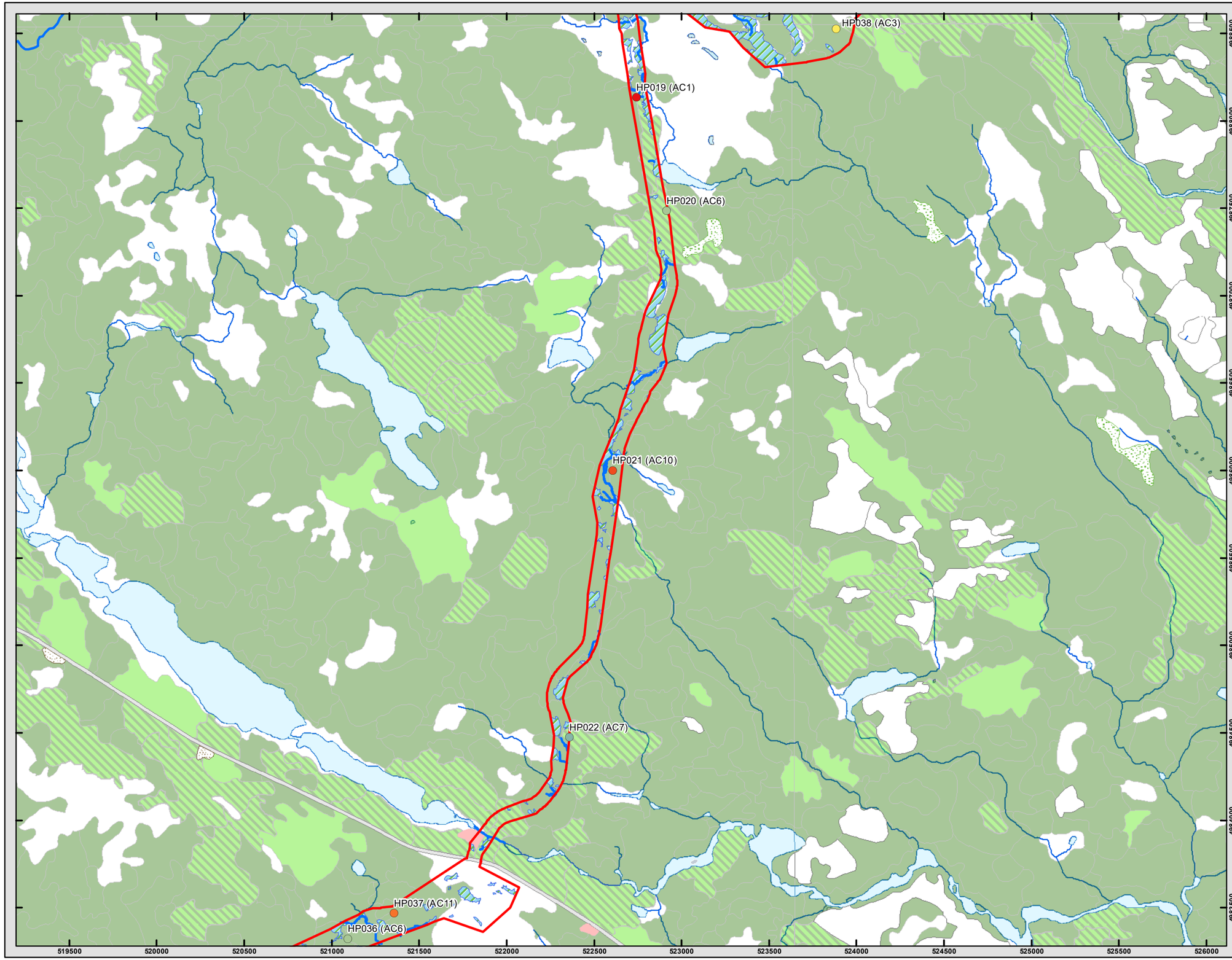

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FIGURE 6.10-1B

Beaver Dam Mine Project

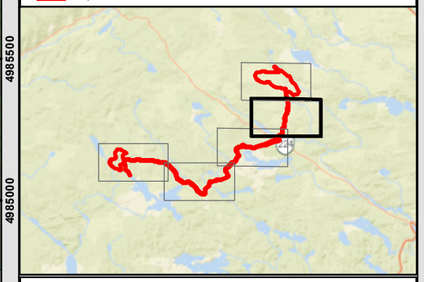
Habitat Survey Locations

Habitat Survey Points (Ecosite)
- AC7
- AC6
- AC3
- AC11
- AC10
- AC1

Field Delineated Watercourses
NSTDB Mapped Watercourses

Forest/Non-Forest Grouping
- Brush
- Clear Cut
- Inland water
- Urban (developed)
- Miscellaneous (eg Mines, Mills etc)
- Gravel Pit
- Power, Road or Rail Corridors

Forest Cover Type
- Softwood >75%
- Mixed Forest 25 -75%
- Hardwood >75%
- Field Delineated Wetlands
- Project Area



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Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 250 500 1,000 m

1:20,000 Scale when printed @ 11" x 17"

Drawn By: AS
Reviewed By: XX

Date: 2021-02-26

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

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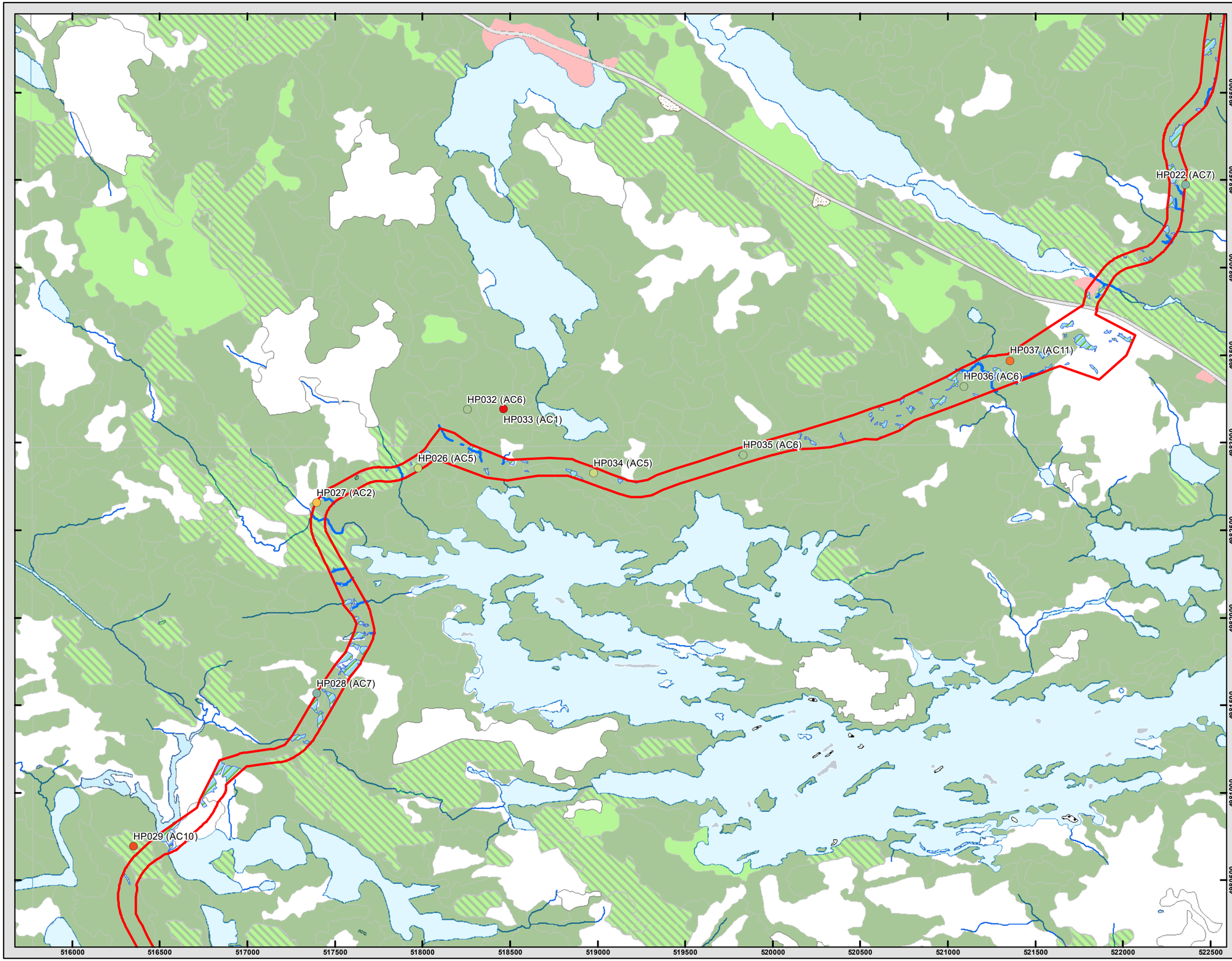

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FIGURE 6.10-1C

Beaver Dam Mine Project

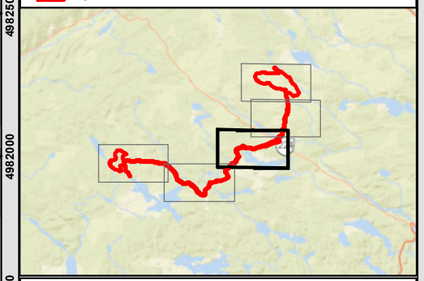
Habitat Survey Locations

Habitat Survey Points (Ecosite)
- AC7
- AC6
- AC5
- AC2
- AC11
- AC10
- AC1

Field Delineated Watercourses
NSTDB Mapped Watercourses

Forest/Non-Forest Grouping
- Clear Cut
- Inland water
- Rock Barren
- Urban (developed)
- Miscellaneous (eg Mines, Mills etc)
- Gravel Pit
- Power, Road or Rail Corridors

Forest Cover Type
- Softwood >75%
- Mixed Forest 25 -75%
- Hardwood >75%
- Field Delineated Wetlands
- Project Area



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Units: Meter

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1:20,000 Scale when printed @ 11" x 17"

Drawn By: AS
Reviewed By: XX

Date: 2021-02-26

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

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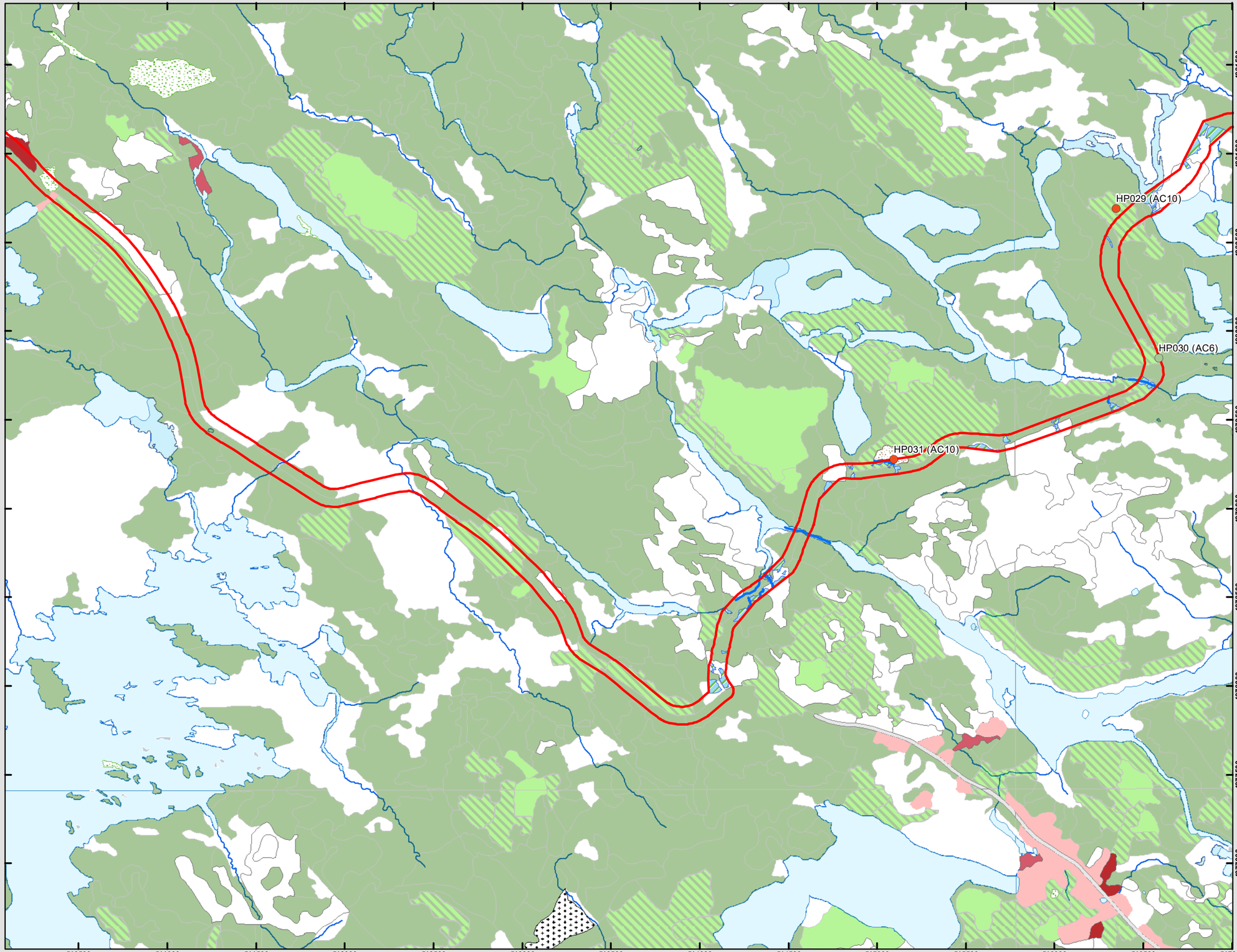


Prepared For:

Atlantic Gold

FIGURE 6.10-1D

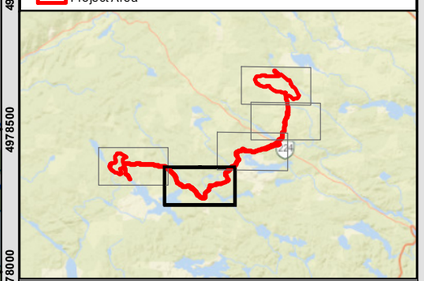
Beaver Dam Mine Project

Habitat Survey Locations

Habitat Survey Points (Ecosite)
- AC6
- AC10
- Field Delineated Watercourses
- NSTDB Mapped Watercourses

Forest/Non-Forest Grouping
- Brush
- Alders <75%
- Alders >75%
- Clear Cut
- Inland water
- Rock Barren
- Urban (developed)
- Miscellaneous (eg Mines, Mills etc)
- Gravel Pit
- Power, Road or Rail Corridors

Forest Cover Type
- Softwood >75%
- Mixed Forest 25 -75%
- Hardwood >75%
- Field Delineated Wetlands
- Project Area



Coordinate System: NAD 1983 CSRS UTM Zone 20N
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Document Name: BD_EIS_Figure6-10-XHSP

The Forest Ecosystem Classification (FEC) for Nova Scotia guide book was used to describe habitat characteristics within the HSPs. The following information was collected at each HSP:

- Vegetation type was determined using Part 1 of the FEC guide (Neily et al. 2011). Each stand was classified by overall forest group code and vegetation type using the keys provided in the guide book. Forest groups are general groupings of vegetation types. Within each forest group (open woodland or tolerant hardwood, for example), there are several specific vegetation types. Vegetation types are recurring and identifiable plant communities which reflect differences in site conditions, natural disturbance regimes, and successional stage. For example, TH4 is a tolerant hardwood forest group dominated by sugar maple and white ash vegetation type, while TH6 is a tolerant hardwood forest group dominated by red oak and yellow birch vegetation type.
- Ecosite was determined using Part 3 of the FEC guide (Keys et al. 2011). This guide provides keys to identify ecosites using an edatopic grid, which is a two-dimensional diagram used to plot ecosystems and ecosites based on their relative moisture and nutrient regimes. Ecosites are units which represent ecosystems that have developed under a particular nutrient and moisture regime. A finite range of vegetation types will naturally grow in any given ecosite.
- An approximation of forest stand age was determined using broad classifications for stand age (regenerating, immature, mature, over mature). This approximation is based on a combination of factors, such as total basal area, level of canopy coverage, senescence of older trees and presence of cavity trees, and species composition of the canopy, shrub and understory vegetation.
- Natural or anthropogenic disturbance is recorded in each site. The level and type of disturbance is identified and the timing of the disturbance is noted as well if it is apparent. Examples of natural disturbances include timber harvesting or road development. Natural disturbance regimes include fire, pests, wind throw, and natural senescence.
- Representative photos were taken of each site.

Habitat survey results were purposefully biased towards upland habitats, based on the fact that the wetland program would collect detailed information about each individual wetland within the Beaver Dam Mine Site and Haul Road. The habitat surveys were completed early in the field evaluation, prior to other survey efforts (i.e., October 2014, May 2015). These surveys provide valuable insight into the overall habitat composition of the Beaver Dam Mine Site and Haul Road, while helping to inform methodologies of other field programs.

6.10.3.2.1 Touquoy Mine Site

Habitat surveys were completed at the Touquoy Mine Site from 2004 to 2006 as part of the EARD process (CRA 2007a).

6.10.3.3 Vascular Plant Survey

As described in the Guide to Addressing Wildlife Species and Habitat in an EA Registration Document (NSE, 2009b) and the Beaver Dam Mine Project EIS Guidelines (CEAA, 2015), a complete vascular plant inventory is not typically required for an environmental assessment. In accordance with the documents referenced above, the vegetation survey focused on the identification of vegetative communities, with particular attention to identifying priority species. Priority species methodologies, including desktop review, are described in detail in Section 6.13.3.

Habitat types were identified on a broad scale within the Beaver Dam Mine Site and Haul Road and then meander transects through each habitat type were conducted to ensure that a variety of habitat types were surveyed for vegetation. Vascular plant assessments occurred early and late in the growing season to capture plant species with different phenology. Spring surveys to

capture spring ephemerals and early developers were completed on June 22 to 23, 2015 at the Beaver Dam Mine Site and on June 22 to 23 2016 along the Haul Road. Late season surveys to capture late developing species were completed on September 8, 12, and October 9, 2014 at the Beaver Dam Mine Site and on September 11 to 12, 2016 along the Haul Road. An additional vascular plant survey was conducted within the 2018 western expansion to the Beaver Dam Mine Site on September 18, 2018. Further vascular plant surveys were conducted in August 22 and 30, 2019 as a result of the continued PA modification, within the western and southeastern expansions of the Beaver Dam Mine Site.

For these surveys, a list of all priority species records found within 100 km of the Beaver Dam Mine Site and Haul Road was assembled prior to the survey being undertaken (from ACCDC and Environmental Screening results) to provide additional information and support the priority species list regarding the potential presence of priority species within the PA. The specific timing of field surveys was determined based on the identification of priority species that were documented within 20 km of the Beaver Dam Mine Site and Haul Road by the ACCDC.

6.10.3.3.1 Touquoy Mine Site

Vascular plant surveys were conducted in August 2004, May and June 2005, and September 2006 as part of the EARD process.

6.10.3.4 Lichen Survey

Specific methods for lichen surveys were determined based on identification of SOCI and SAR lichens through the desktop review (e.g., ACCDC reports). The Project Team did not complete a comprehensive list of all lichen species within the Beaver Dam Mine Site and Haul Road. The survey area included the Haul Road and was extended beyond the PA in the vicinity of the Beaver Dam Mine Site, defined as the lichen study area (LSA), so the Project Team could understand the distribution of rare lichens in a broader context. The lichenologist did record several opportunistic observations of common lichen species during the focused surveys for priority lichen species at the Beaver Dam Mine Site, surrounding LSA, and Haul Road. As a result of PA modifications, in 2019, additional lichen surveys, focused on SOCI and SAR, were conducted within the western and southeastern expansions of the Beaver Dam Mine Site. The LSA has been expanded to incorporate these new areas (Section 6.13, Figure 6.13-2A).

Detailed methods for lichen SOCI and SAR field surveys and desktop evaluation are presented in Section 6.13.3 and lichen results are described in Sections 6.10.4.4 and 6.13.4.3, respectively.

6.10.3.4.1 Touquoy Mine Site

Lichen surveys were conducted at the Touquoy Mine Site in 2004 and 2005 as part of the EARD process (refer to CRA 2007 for further methodological details). An additional survey, at the request of NSLF, was conducted in February 2007 at the Touquoy Mine Site in areas where blue felt lichen (*Degelia plumbea*) was previously observed.

6.10.3.5 Habitat Desktop Analysis

The Forest Inventory database (NSL&F, 2016) was reviewed within the LAA (see Section 6.10.6.1 for definition) and overlayed with the Haul Road (excluding Mooseland Road) and Beaver Dam Mine Site. Since the Touquoy Mine Site is an existing mine site, and the existing Mooseland Road portion of the Haul Road will not result in changes to habitat and flora, they were excluded from this analysis. The purpose of this analysis was to determine the percent cover of each habitat type within the LAA and compare to the predicted disturbance (direct habitat loss) to each habitat type from Project infrastructure. The predicted disturbance by habitat type from the Haul Road and Beaver Dam Mine Site was calculated as a percentage of that habitat type available within the LAA to determine the magnitude of direct impacts to habitat (Section 6.10.7.1).

The Forest Inventory database is a snapshot of Nova Scotia's forested and non-forested communities including anthropogenic disturbances. This database reflects aerial interpretation of photographs from 1992 – 2016 which includes data on wetlands, forested uplands, managed forests (e.g., cutblocks, selective cuts, plantations etc.), urban development and open waterbodies. During this analysis, data retrieved from this database was then grouped into four main categories which are: upland natural forests, wetlands and waterbodies, non-forested upland communities and disturbed. The four main habitat categories and provides descriptions is summarized in Table 6.10-2.

Table 6.10-2: Habitat Type Categories and Descriptions

Habitat Type Category	Habitat Type Sub-category	Description
Upland Forests	Natural Forests Stand	Natural forest stands are any forested stand which have no history of silviculture practices (e.g., clear cut, plantations, old field etc.). Within this sub-category, these stands are broken down further into hardwood and softwood dominant stands.
	Managed Forests	Managed forest is a catch-all term for forested landscapes which have history of silviculture practices, which include: • Cut-blocks • Old fields • Treated silviculture activity • Partial cuts/selective cuts
	Other	This sub-category includes forested stands which either have no data on species composition or are classified as brush (unmerchantable timber which is often regenerative forests)
Wetlands and Waterbodies	Lakes, Ponds and Beaver flowage	In land lake features and beaver flowages are included in this category.
	Wetlands	This sub-category includes all wetland classes identified within the database. The wetland types classified in the Forestry Inventory Database includes: • Open bogs • Treed bogs • Lake wetlands (lacustrine wetlands) • Wetlands (all wetland classes which are not defined above)
Non-forested Upland Communities	Barrens	This subcategory includes barrens and rock barrens which are defined below: • Barrens – any area with less than 25% of live tree cover containing ericaceous vegetation with less than 50% rock out crops • Rock barren – any area covered by at least 50% exposed rock outcrop and/or boulders with less than 25% live tree cover
Disturbed	Anthropogenic Disturbance	Includes gravel pits, old quarries, rail road corridors, urban development and road corridors.

6.10.3.6 Old Forest and Interior Forest Desktop Analysis

A desktop mapping exercise was conducted to identify mature forest and interior forest habitat in relation to Project infrastructure. The NSDNR Old Forest Policy 2012 definition of old forest and interior forest were used to determine these habitat types.

Interior forest is defined as area within a forest sheltered from edge effects. The Old Forest Policy uses an edge effect distance of 200 m from disturbance. Any patch that is suitably outside of this edge effect but is under 15 ha is considered as incapable of supporting interior forest. In reality, interior forest is dependent on the condition being measured and the nature of the edge interface (NSDNR, 2012). For this review, patches of interior forest were identified by buffering the NSL&F road and rail layer by 200 m to

represent existing disturbance and associated edge effect. Any patch outside this buffer, greater than 15 ha, and within the LAA was considered potential interior forest habitat.

Old Forest is defined as a stand or collection of stands containing Old Growth and/or mature climax conditions (NSDNR, 2012). Mature climax is a forest stand of trees aged 80 to 125 years old and Old Growth forest is a stand with trees 125 years or older. Old Forest was used as a representation of mature forest for this review. Stands of Old Forest were identified using the Nova Scotia Old Forest Layer. This dataset identifies crown land forest stands that meet the Old Forest criteria under the Old Forest Policy. (NSFA 2016).

To determine potential Project impact on interior forest and Old Forest, Project infrastructure and the Haul Road centerline were buffered by 200 m to represent the extent of edge effect influence from disturbance. This area was referred to as the Project Influence Zone.

6.10.3.6.1 Potential Old Growth Field Survey

Field surveys were conducted within Old Forest Unit 582 which interacts with the Project, as determined by Section 6.10.3.6, to assess for potential Old Growth. The survey, and resulting analysis, was conducted by a Registered Professional Forester. Individual forest stands or polygons with common characteristics, within Old Forest Unit 582, were identified and characterized using photo interpretation of recent (2017) aerial imagery. Representative stands which contained any significant characteristics of Old Forest were then field assessed. Structural characteristics assessed to quantify Old Forest include, detailed aging, disturbance, diameter distribution, canopy layers and patches, snags and fallen woody debris. Forest stands were assigned a class using the general criteria in the NSLF Old Forest Policy: Class 1 – Old Growth, Class 2 – Mature Climax, Class 3 – Immature Climax and Class 4 – Non-Climax.

6.10.4 Baseline Conditions

Updates to habitat and flora (total number, location, etc.) reflected within this section are as a result of additional surveys required by changes to the Beaver Dam Mine Site and Haul Road in order to incorporate the micro-siting of Project infrastructure.

6.10.4.1 Desktop Evaluation

Three priority vascular plants have been observed within 5 km of the Beaver Dam Mine Site and Haul Road according to the ACCDC report (Appendix I.1 and I.2); southern twayblade (*Neottia bifolia*, syn. *Listera australis*), flat-stemmed pondweed (*Potamogeton zosteriformis*) and Nova Scotia agalinis (*Aglinis neoscotica*). No priority vascular plants have been observed within 5 km of the Touquoy Mine Site according to the ACCDC report (Appendix I.3). In regard to lichens, boreal felt lichen (*Erioderma pedicellatum*) was cited within 5 km of the PA in all ACCDC reports. Additional priority lichen species observed within the ACCDC reports within 5 km of the PA are listed in the Table 6.10-3.

The priority lichen dataset received from the Mersey Tobeatic Research Institute (MTRI) identified four priority species within the PA and surrounding LAA, inclusive of the dedicated LSA: boreal felt lichen, blue felt lichen, blistered jellyskin lichen (Leptogium corticola) and salted shell lichen (Coccocariai palmicola) (Table 6.10-3).

The Nova Scotia Department of Communities, Culture and Heritage provided a list of flora and fauna SAR and SOCI documented by their staff within the vicinity of the PA. The priority flora species are as follows; Michaux's dwarf birch (*Betula michauxii*), showy lady's slipper (*Cypripedium reginae*), flat-stemmed pondweed (*Potamogeton zosteriformis*), alder-leaved buckthorn (*Rhamnus alnifolia*), northern bog violet (*Viola nephrophylla*), and golden alexanders (*Zizia aurea*) (Table 6.10-3).

Table 6.10-3: Desktop Identified Priority Vascular Plants and Lichens

Common name	Scientific name	COSEWIC	SARA	NSESA	S-Rank	Source
Priority Lichen Species						
Boreal felt lichen - Atlantic pop.	*Erioderma pedicellatum (Atlantic pop.)*	Endangered	Endangered	Endangered	S1	ACCDC/MTRI
Graceful felt lichen (Vole ears lichen)	*Erioderma mollissimum*	Endangered	Endangered	Endangered	S1S2	ACCDC
Blue felt lichen	*Pectania plumbea*	Special Concern	Special Concern	Vulnerable	S3	ACCDC/MTRI
Black-foam lichen	*Anzia colpodes*	Threatened	Threatened	Threatened	S3	ACCDC
Frosted glass-whiskers	*Sclerophora peronella*	Special Concern	Special Concern		S1?	ACCDC
White-rimmed shingles lichen	*Fuscopannaria leucosticte*	-	Threatened	-	S2S3	ACCDC
Ghost Antler lichen	*Pseudevernia cladonia*	-	-	-	S2S3	ACCDC
Tooth-leaved nitrogen lichen	*Tetraplodon angustatus*	-	-	-	S2?	ACCDC
Eastern candlewax lichen	*Ahtiana aurescens*	-	-	-	S2S3	ACCDC
Blistered tarpaper lichen	*Collema furfuraceum*	-	-	-	S3	ACCDC
Peppered moon lichen	*Sticta fuliginosa*	-	-	-	S3	ACCDC
Corrugated shingles lichen	*Fuscopannaria ahlneri*	-	-	-	S3	ACCDC
Powdered Fringe lichen	*Heterodermia speciosa*	-	-	-	S3	ACCDC
Blistered jellyskin lichen	*Leptogium corticola*	-	-	-	S3	ACCDC/MTRI
Blue-gray moss shingle lichen	*Moelleropsis nebulosa*	-	-	-	S3	ACCDC
Bottlebrush frost lichen	*Physconia detersa*	-	-	-	S3S4	ACCDC
Salted shell lichen	*Coccocariai palmicola*	-	-	-	S3	ACCDC/MTRI
Shaggy fringed lichen	*Anaptychia palmulata*	-	-	-	S3S4	ACCDC
Priority Vascular Plant Species						
Michaux's dwarf birch	*Betula michauxii*	-	-	-	S2S3	CCH
Showy lady's slipper	*Cypripedium reginae*	-	-	-	S2	CCH
Flat-stemmed pondweed	*Potamogeton zosteriformis*	-	-	-	S3	ACCDC/CCH
Alder-leaved buckthorn	*Rhamnus alnifolia*	-	-	-	S3	CCH
Northern bog violet	*Viola nephrophylla*	-	-	-	S2	CCH
Golden alexanders	*Zizia aurea*	-	-	-	S1	CCH
Southern twayblade	*Neottia bifolia*	-	-	-	S3	ACCDC
Nova Scotia agalinis	*Agalinis neoscotica*	-	-	-	S3S4	ACCDC

6.10.4.2 Habitat Survey Results

The PA is located in the Eastern Ecoregion of the Acadian Ecozone. Ecoregions are subdivisions of the larger ecozones and express macroclimate as a distinctive ecological response to climate through soils and vegetation (Neily et al., 2005).

Ecoregions are further subdivided into ecodistricts, which reflect macroelements of the physical and biological attributes of ecosystems which will ultimately influence biodiversity. The PA lays within the Eastern Interior Ecodistrict (previously subdivided into the Eastern Interior and Eastern Drumlins Ecodistricts). The Eastern Interior Ecodistrict is generally characterized by highly visibly bedrock where glacial till is very thin, exposing the ridge topography. Where till is thicker, ridged topography is masked and thick softwood forests occur. There are a few drumlins and hills scattered throughout the ecodistrict and fine textured soils are derived from slates (NSLF 2017).

Ecosites are units which represent ecosystems that have developed under a variety of conditions and influences, but which have similar moisture and nutrient regimes. An ecosite is associated with a finite range of soil and site conditions and a finite range of vegetation types that grow naturally under those conditions. Ecosites represent general productivity units and provide an ecological setting through which vegetation and soil types can be grouped and compared. In this application, the value in ecosite classification lies in wildlife habitat analysis and biodiversity considerations. For example, ecosite classification can be used to help determine the likelihood of finding particular rare plants that prefer specific moisture or nutrient regimes.

Within the PA, there are confirmed 12 ecosites, of which 10 were observed in the Beaver Dam Mine Site (six ecosites previous to additional 2019 surveys) and nine within the Haul Road. No additional HSPs were completed within the Haul Road in 2019. Eighteen vegetation types (VT) were observed during habitat surveys. Collectively, and as a result of the dominance of nutrient poor acidic soils, predominant VTs comprised of conifer species as the dominant canopy layer, often with sparse, low diversity herbaceous layers. The single most dominant VT is SH5 which is dominated by red spruce – balsam fir and Schriber's moss. The HSPs within the Beaver Dam Mine Site and Haul Road is shown in Table 6.10-4. The following sections describe the ecosites identified throughout the Beaver Dam Mine Site and Haul Road, grouped by predominant nutrient regime.

The 10 ecosites identified within the Beaver Dam Mine Site are within the dry to fresh moisture regimes, with very poor to rich nutrient regimes. The spruce-hemlock (AC10) and spruce-pine (AC3, AC6, AC7) forest groups dominate the Beaver Dam Mine Site. Spruce-hemlock forest groups are characterized by red spruce (*Picea rubens*), white pine (*Pinus strobus*), and eastern hemlock (*Tsuga canadensis*). These species have high shade tolerance and are long lived species, which can support old growth conditions. Spruce-hemlock forest groups generally do not support many species of rare plants but provide good quality habitat for a diversity of mammals and birds. Generally, spruce-pine forest groups are associated with a natural disturbance regime of fire, which leads to stands dominated by spruce, pine, and understorey vegetation tolerant of acidic, nutrient poor conditions.

Within the Beaver Dam Mine Site, less abundant ecosites include spruce-tamarack (AC4), pine-oak (AC5), spruce-fir-maple (AC8), maple-spruce (AC9), spruce-birch (AC11) and maple-beech (AC13). Spruce-tamarack and spruce-fir-maple forest groups are typically associated with poorly drained soils of coniferous and mixedwood treed swamps. While pine-oak and maple-spruce forest groups support similar species assemblages, the greater nutrient availability of the maple-spruce group creates more fertile and diverse understory conditions. The spruce-birch and maple-beech forest groups commonly support climax forests with limited natural stand disturbance and resultant uneven-aged forests. Climax softwood and mixedwood forests area typical of the spruce-birch forest group, whereas the maple-beech group supports climax hardwood forests.

Of the 31 established HSPs within the Beaver Dam Mine Site, the most abundant ecosite was AC10, accounting for 36% of all survey points (Figure 6.10-2). The next most abundant ecosite within the Beaver Dam Mine Site is AC6 (19%), followed by AC5 and AC11 (each 10%).

Table 6.10-4: Habitat Survey Results within the Beaver Dam Mine Site and Haul Road

Habitat Survey Point	PA Component	Ecosite	VT[a]	Stand Age	Level and Type of Disturbance	Comments
HP001	Beaver Dam Mine Site	AC10	SH4	Regenerating	Moderate -harvested	Overstory dominated by red spruce and balsam fir with white pine, yellow birch, and red maple. Understory dominated by sapling red spruce and balsam fir with velvet-leaved blueberry, bracken fern, bunchberry, and goldthread groundcover.
HP002	Beaver Dam Mine Site	AC7	SP6	Immature	Low	Overstory dominated by balsam fir and black spruce with tamarack, red maple, and white birch. Understory dominated by regenerating balsam fir and black spruce with raisin, bracken fern, sheep laurel, goldthread, and creeping snowberry.
HP003	Beaver Dam Mine Site	AC6	SP4	Regenerating	Moderate - harvested	Some remnant mature white pine in overstory with black spruce, tamarack, black spruce, balsam fir, and red maple. Understory dominated by regenerating balsam fir and bracken fern with black spruce, red maple, wild raisin, mountain holly, sheep laurel, bunchberry, and velvet-leaved blueberry.
HP004	Beaver Dam Mine Site	AC11	SH3	Immature	Low	Softwood stand. Overstory dominated by red spruce and balsam fir with red maple, yellow birch, and white pine. Understory dominated by regenerating balsam fir and hay-scented fern with red spruce, bunchberry, evergreen wood fern, and lady fern.
HP005	Beaver Dam Mine Site	AC11	SH5	Regenerating	Harvested	Disturbed stand. Overstory dominated by red spruce and red maple with yellow birch and white birch. Understory dominated regenerating balsam fir with red maple and wild raisin.
HP006	Beaver Dam Mine Site	AC8	WC7	Immature	Low	Treed coniferous swamp. Overstory dominated by tamarack with red maple, balsam fir, black spruce, and white birch. Understory dominated by spinulose wood fern, balsam fir, speckled alder, bunchberry, and creeping snowberry.
HP007	Beaver Dam Mine Site	AC10	MW1	Regenerating	Harvested	Disturbed stand. Overstory dominated by red spruce with yellow birch, red maple, and white birch. Understory dominated by regenerating balsam fir and strawberry with red spruce, red maple, yellow birch, sheep laurel, Labrador tea, creeping snowberry, and white meadowsweet.

Table 6.10-4: Habitat Survey Results within the Beaver Dam Mine Site and Haul Road (continued)

Habitat Survey Point	PA Component	Ecosite	VT[a]	Stand Age	Level and Type of Disturbance	Comments
HP008	Beaver Dam Mine Site	AC10	TH7	Regenerating	Harvested	Disturbed stand. Overstory dominated by yellow birch with balsam fir and white birch. Understory dominated by regenerating yellow birch and balsam fir. Mature trees are entirely absent, as is herb layer due to leaf litter/canopy cover.
HP009	Beaver Dam Mine Site	AC10	SH8	Immature	Low	Softwood stand. Overstory dominated by balsam fir with red maple and yellow birch. Understory dominated by balsam fir, red maple, and bunchberry.
HP010	Beaver Dam Mine Site	AC11	SH4	Immature	Low	Softwood stand. Overstory dominated by white pine with red spruce, balsam fir, and red maple. Understory dominated by bunchberry with sheep laurel and balsam fir.
HP011	Beaver Dam Mine Site	AC10	MW2	Regenerating	Harvested	Disturbed stand. Overstory dominated by red spruce with white pine, balsam fir, red maple, and white birch. Understory dominated by red spruce saplings and sheep laurel with red maple saplings, wild raisin, bunchberry, mayflower, and bracken fern.
HP012	Beaver Dam Mine Site	AC10	MW2	Regenerating	Harvested	Disturbed stand. Overstory dominated by red spruce with red maple, balsam fir, white birch, white pine, and yellow birch. Understory dominated by regenerating balsam fir and bunchberry with pin cherry, tamarack, sheep laurel, bracken fern, mayflower, and velvet-leaved blueberry.
HP013	Beaver Dam Mine Site	AC10	MW2	Regenerating	Harvested	Disturbed stand. Overstory dominated by red maple with white birch, red spruce, and yellow birch. Understory dominated by regenerating balsam fir with twinflower, bunchberry, low-bush blueberry, red raspberry, and New York fern.
HP014	Beaver Dam Mine Site	AC10	MW2	Regenerating	Harvested	Disturbed stand. Overstory dominated by balsam fir with red spruce, red maple, yellow birch, and white birch. Understory dominated by regenerating balsam fir, red maple, and bunchberry with red spruce, yellow birch, bracken fern, and twinflower.
HP015	Beaver Dam Mine Site	AC10	SH5	Mature	Low	Balsam fir and black spruce. Very little understory vegetation.

Table 6.10-4: Habitat Survey Results within the Beaver Dam Mine Site and Haul Road (continued)

Habitat Survey Point	PA Component	Ecosite	VT[a]	Stand Age	Level and Type of Disturbance	Comments
HP016	Beaver Dam Mine Site	AC4	WC2	Immature	Low	Treed coniferous swamp. Overstory dominated by black spruce with tamarack, red maple, and balsam fir. Understory dominated by wild raisin and Labrador tea with red maple, black spruce, tamarack, sheep laurel, bunchberry, twinflower, cinnamon fern, and steeplebush.
HP017	Beaver Dam Mine Site	AC6	SP4a	Regenerating	Harvested	Disturbed stand with remnant mature white pine in overstory. Overstory dominated by black spruce, balsam fir, white pine, and red maple. Understory dominated by regenerating balsam fir and sheep laurel with wild raisin, bunchberry, bracken fern, velvet- leaved blueberry, mountain holly, and teaberry.
HP018	Haul Road	AC6	SP4a	Regenerating	Harvested	Disturbed- cut. Overstory dominated by balsam fir, black spruce, red maple, white pine. Understory dominated by sheep laurel, wild raisin, bracken fern, and teaberry.
HP019	Haul Road	AC1	SP3a	Immature	Low	Overstory dominated white birch and balsam fir, red and black spruce, white pine. Understory dominated mayflower, bracken fern, and sheep laurel.
HP020	Haul Road	AC6	IH6	Regenerating	Harvested	Disturbed. Overstory dominated by red maple and white birch.
HP021	Haul Road	AC10	MW4	Immature to mature	Low	Overstory dominated white birch, yellow birch.
HP022	Haul Road	AC7	SH5	Immature to mature	Harvested	Disturbed. Overstory dominated by red spruce.
HP026	Haul Road	AC5	SP4	Mature	Low	Overstory dominated by white pine and red spruce. Understory dominated by red maple and balsam fir, occasionally.
HP027	Haul Road	AC2	OW2	Mature	Low	Overstory has abundant cover of red spruce. Shrub layer dominated by white birch. Understory dominated by sheep laurel, teaberry, and bracken fern.
HP028	Haul Road	AC7	SP4	Mature	Low	Overstory dominated by white pine.
HP029	Haul Road	AC10	TH7	Mature	Low	Overstory dominated by yellow birch. Understory dominated by evergreen wood fern.
HP030	Haul Road	AC6	SH5	Mature	Low	Overstory dominated by balsam fir.
HP031	Haul Road	AC10	MW1	Immature to mature	Low	Overstory has abundant cover of balsam fir, white birch, and yellow birch.

Table 6.10-4: Habitat Survey Results within the Beaver Dam Mine Site and Haul Road (continued)

Habitat Survey Point	PA Component	Ecosite	VT[a]	Stand Age	Level and Type of Disturbance	Comments
HP032	Haul Road	AC6	SH5	Immature to mature	Low	Overstory has abundant red spruce. Understory dominated by cinnamon fern.
HP033	Haul Road	AC1	OW2	Mature	Low	Overstory dominated by black spruce. Understory dominated by teaberry and bracken fern.
HP034	Haul Road	AC5	SH5	Mature to over mature	Low	Overstory dominated by black spruce. Understory dominated by sheep laurel and bracken fern.
HP035	Haul Road	AC6	SH5	Mature to over mature	Low	Overstory dominated by red spruce and red maple. Understory dominated by sheep laurel.
HP036	Haul Road	AC6	SP5	Mature	Low	Overstory dominated by black spruce. Understory dominated by bracken fern.
HP037	Haul Road	AC11	SH4	Mature	Low	Overstory dominated by red spruce and black spruce. Understory dominated by sheep laurel.
HP038	Beaver Dam Mine Site	AC3	OW2	Mature	Low	Softwood stand. Overstory dominated by black spruce with balsam fir and northern wild raisin. Understory dominated by rhodora, Schrebers moss and sphagnum.
HP039	Beaver Dam Mine Site	AC9	IH6	Immature	Low	Mature hardwood stand. Overstory dominated by red maple with white birch.
HP040	Beaver Dam Mine Site	AC13	MW2	Mature	Low	Mixed wood stand. Overstory dominated by balsam fir with red maple, red spruce, and white birch. Understory is sparse but dominated by bunchberry and twinflower.
HP041	Beaver Dam Mine Site	AC4	MW4	Immature	Low	Mixed wood stand. Overstory dominated by balsam fir with yellow birch and red maple. Understory dominated by regenerating balsam fir.
HP042	Beaver Dam Mine Site	AC13	MW2	Immature	Harvested	Mixed wood stand. Overstory dominated by red maple with white pine and balsam fir. Understory dominated by bunchberry and black huckleberry.
HP043	Beaver Dam Mine Site	AC6	SP6	Mature	Low	Mixed wood stand. Overstory dominated by red spruce with balsam fir and white birch. Sparse herbaceous layer with Schreber's moss

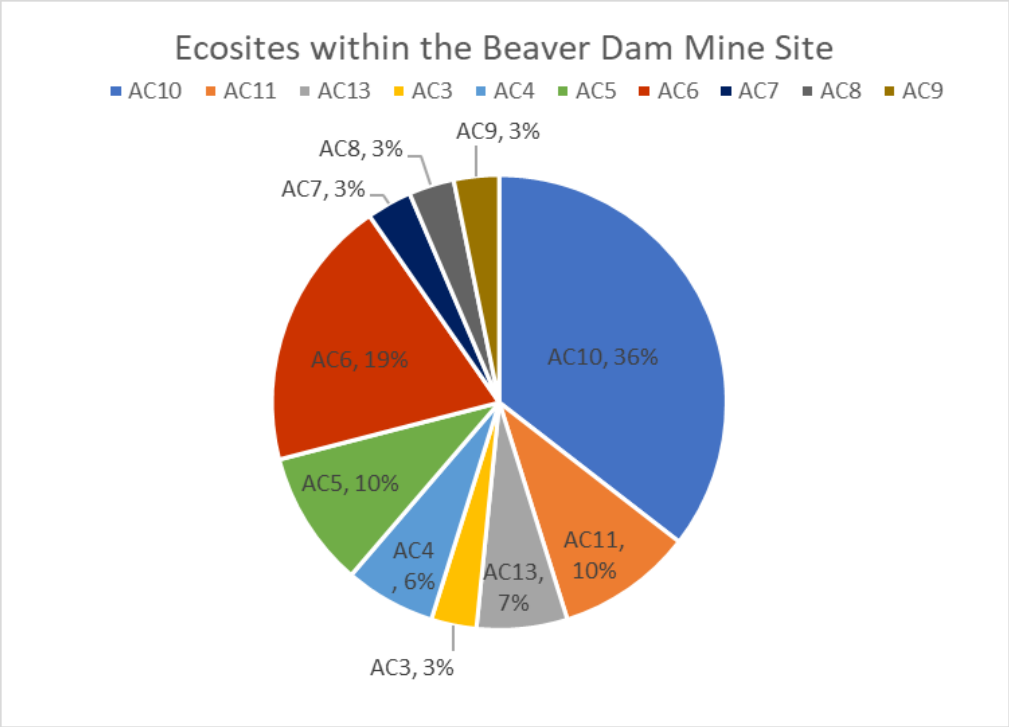
Table 6.10-4: Habitat Survey Results within the Beaver Dam Mine Site and Haul Road (continued)

Habitat Survey Point	PA Component	Ecosite	VT[a]	Stand Age	Level and Type of Disturbance	Comments
HP044	Beaver Dam Mine Site	AC6	SP6	Mature	Low	Mixed wood stand. Overstory dominated by red spruce with white birch. Sparse herbaceous layer dominated by creeping snowberry.
HP045	Beaver Dam Mine Site	AC10	IH7	Mature	Low	Mixed wood stand. Overstory dominated by red maple with scattered balsam fir. Understory dominated by hay scented fern and bunchberry.
HP046	Beaver Dam Mine Site	AC5	SH8	Mature	Low	Softwood stand. Dominated by balsam fir with a closed canopy. Sparse herbaceous layer dominated by bryophytes including stair step moss and Schreber's moss.
HP047	Beaver Dam Mine Site	AC6	SP6	Regenerating	Harvested	Disturbed. Scattered regenerating red spruce, mountain holly, bracken fern, and black huckleberry.
HP048	Beaver Dam Mine Site	AC6	SH4	Mature	Low	Softwood stand. Overstory dominated by red spruce with small amounts of white pine. Understory dominated by mountain holly, bracken fern, and sheep laurel.
HP049	Beaver Dam Mine Site	AC5	SH8	Mature	Low	Softwood stand. Overstory dominated by a closed canopy of balsam fir. Sparse herbaceous layer with scattered starflower.
HP050	Beaver Dam Mine Site	AC5	SH8	Mature	Moderate	Softwood stand. Overstory dominated by balsam fir with scattered red spruce. Sparse herbaceous layer dominated by Schreber's moss.
HP051	Beaver Dam Mine Site	AC10	IH7	Mature	Moderate-Harvested	Mixed wood stand. Overstory dominated by red maple. Understory dominated by dwarf red raspberry and giant goldenrod.

[a] VT: Vegetation Type

Note: HP01-HP17 and HP38-HP51 are within the Beaver Dam Mine Site Mine. HP18-37 (excluding HP23-HP25) are within the Haul Road. HP23-HP25 were along an alternate Haul Road design, which is no longer being consider. These HPs have been removed from this assessment.

Figure 6.10-2: Relative Abundance of Ecosites within the Beaver Dam Mine Site



Within the Haul Road, HSPs fell within nine different ecosites. Ecosites identified within the Haul Road were within the very dry to wet moisture regime, with very poor to rich nutrient regimes. These ecosites generally support a broader variety of vegetation types from the spruce-pine, intolerant and tolerant hardwood, mixed wood, open woodland, spruce-hemlock and intolerant hardwood forest groups.

Similar to the Beaver Dam Mine Site, the spruce-hemlock (AC10) and spruce-pine (AC2, AC6, AC7) forest groups also dominate the Haul Road. Most Haul Road forest groups were observed within the Beaver Dam Mine Site and are described previously. The pine-spruce (AC1) group was only observed within the Haul Road and is associated with upland areas with near-surface bedrock and nutrient poor, coarse textured soils.

Of the 17 established HSPs within the Haul Road, the most abundant ecosite was AC6, accounting for 35%. The next most abundant ecosite within the Haul Road is AC10 at 17%, followed by AC1, AC5, AC7, and AC11 at 12% each (Figure 6.10-3).

A summary of ecosite abundance across the PA is presented in Figure 6.10-4. Of the 48 established HSPs within the Beaver Dam Mine Site and Haul Road. AC10 and AC6 make up 54% of the ecosites observed within the PA and account for 29% and 25%, respectively.

Figure 6.10-3: Relative Abundance of Ecosites within the Haul Road

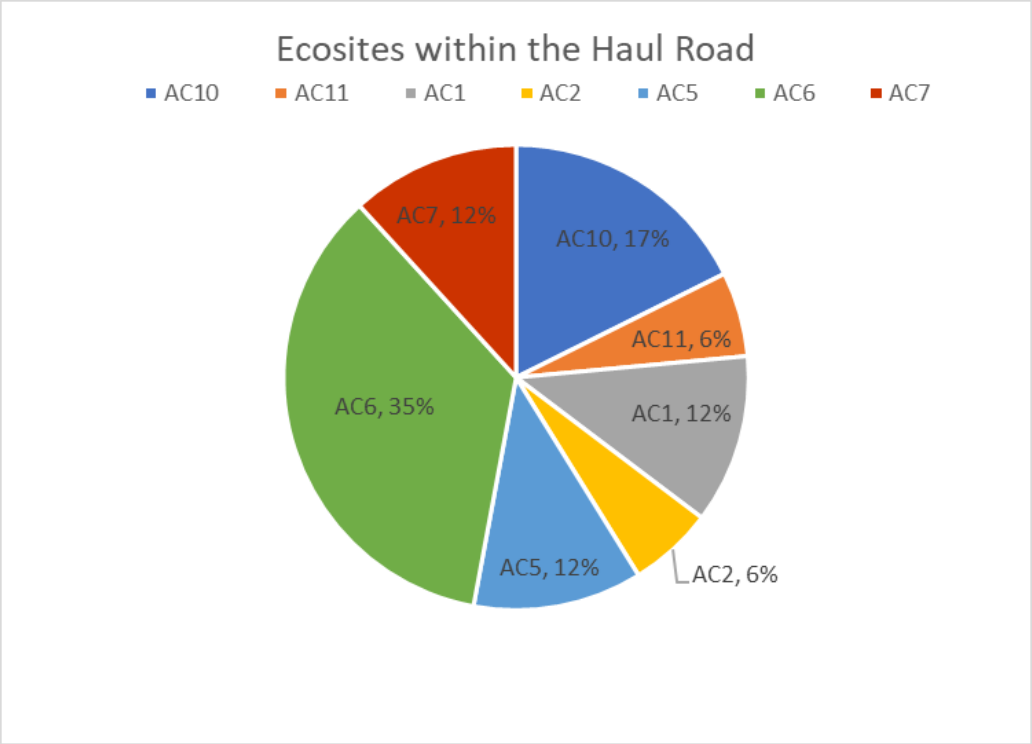
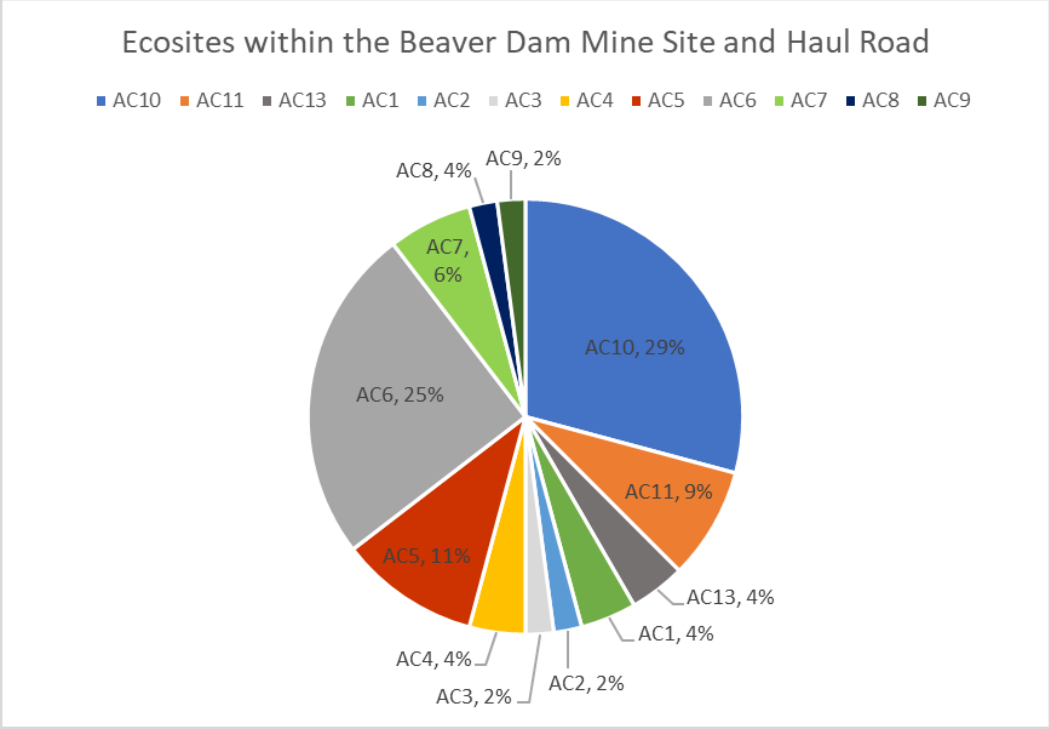


Figure 6.10-4: Ecosites within the Beaver Dam Mine Site and Haul Road



6.10.4.2.1 Very Poor Nutrient Regime

Ecosites with very poor nutrient regimes encountered within the Beaver Dam Mine Site and Haul Road include AC1, AC2, AC3 and AC4. These ecosites represent very dry, fresh, moist and wet moisture regimes, respectively. Ecosite AC1 was observed twice within the Haul Road. At the survey points, the Beaver Dam Mine Site and Haul Road supported open woodland and spruce-pine vegetation types, typical of dry moisture regimes within the very poor nutrient regime. This ecosite occurs mainly on upper slopes or crests of exposed bedrock. Ecosite AC2, also observed within the Haul Road, supported an open woodland forest type as well. Ecosite AC3 was observed once within the Beaver Dam Mine Site and supported an open woodland is supported, typical of a poor nutrient regime. This ecosite mainly occurs on level, upper or middle slopes where there is moderate exposure to weather conditions. One of the HSPs assessed was classified as ecosite AC4, which occurs mainly on poorly to very poorly drained level areas and depressions with coarse textured glacial till and/or organic deposits. This ecosite has wet, very nutrient poor to very poor soils, which generally support poorly stocked stands of black spruce with tamarack (sometimes stunted).

6.10.4.2.2 Poor Nutrient Regime

Forty percent of HSPs were classified under a poor nutrient regime. Ecosites AC5, AC6, AC7, and AC8 represent dry, fresh, moist, and wet moisture regimes, respectively.

Ecosite AC5 occurs on well- to rapidly-drained sites and generally supports a canopy of white pine, red spruce, black spruce, or red maple. This ecosite mainly occurs on higher or level topographies. Within the Beaver Dam Mine Site and Haul Road, this ecosite supported spruce-pine and spruce-hemlock vegetation types. Ecosites AC6 and AC7 occur primarily on well drained to imperfectly-drained slopes with coarse textured glacial till deposits and fresh to moist, nutrient poor soils. These conditions generally support closed canopy stands of white pine and black spruce. When balsam fir is present, it is generally intermediate in the canopy and of low vigor. Early successional stands are dominated by large-toothed aspen (*Populus grandidentata*), red oak (Quercus rubra), and red maple. Within the Beaver Dam Mine Site and Haul Road, HSPs within these ecosites were identified to be within the spruce-pine, intolerant hardwood, and spruce-hemlock forest groups.

Ecosite 8 typically occurs in depressions or areas with poorly or very poorly drained soils, generally supporting wetland habitat. Typical canopy coverage within this ecosites can range from spruce, balsam fir, and larch, and occasionally red maple and white ash. Within the Beaver Dam Mine Site and Haul Road, this ecosite supported a wet coniferous forest group.

6.10.4.2.3 Medium Nutrient Regime

Within the Beaver Dam Mine Site and Haul Road specifically, and within Nova Scotia more generally, the majority of Acadian climax softwood and mixed wood forests are found on sites with medium nutrient regimes, which include AC9, AC10 and AC11. AC9 occurs on dry, well drained steep slopes with shallow glacial till and generally supports an early successional forest. Within the Beaver Dam Mne Site, this ecosite supported hardwood stands dominated by red maple with white birch. Occurring mainly on well-drained slopes with medium textured glacial till deposits, AC10 has fresh, nutrient-medium soils which generally support late successional forests dominated by red spruce, eastern hemlock, and yellow birch. Earlier successional forests contain balsam fir, white birch, red maple, and trembling aspen (*Populus tremuloides*). Within the Beaver Dam Mine Site and Haul Road, a variety of vegetation types and forest groups were found within AC10 ecosites, including mixed wood, spruce-hemlock, and tolerant hardwood forest groups.

Occurring mainly on imperfectly drained lower slopes and level areas with medium textured glacial till deposits, AC11 ecosites have moist, nutrient-medium soils which generally support mixed wood climax communities dominated by red spruce, hemlock and yellow birch. Earlier successional forests are similar in nature to those found in AC10. Within the Beaver Dam Mine Site and Haul Road, four of the HSPs within ecosite AC11 were identified within the spruce-hemlock forest group, while a single site was identified within the spruce-pine forest group.

6.10.4.2.4 Rich Nutrient Regime

Ecosite AC13 was observed in two locations within the Haul Road. This ecosite occurs on well drained slopes with a fresh to moist water regime. This ecosite typically supports late successional forests dominated by sugar maple, American beech, yellow birch, white ash, and red maple. Early successional stands may be dominated by aspen or white birch. In each location observed within the Haul Road, this ecosite supported an intolerant hardwood vegetation type, dominated by mature red maple and yellow birch.

6.10.4.2.5 Habitat Survey Conclusions

The current condition of the Beaver Dam Mine Site is disturbed and fragmented habitat based on timber harvesting and historic mining activity. The level of disturbance within the Beaver Dam Mine Site disproportionately affects uplands over wetlands. Large, natural, undisturbed wetland habitats do exist within the Beaver Dam Mine Site (particularly Wetlands 2 and 29). A network of roads and trails is present throughout the site, with parts of the Beaver Dam Mine Site characterized by un-vegetated gravel and crushed stone, and a large fabricated settling pond used during mining activities (wetland 59) exists in the Beaver Dam Mine Site.

Upland forests in the Beaver Dam Mine Site have experienced relatively high levels of disturbance from timber harvesting. Of the 31 HSPs in the Beaver Dam Mine site, 42% (n=13) have experienced some level of disturbance, typically timber harvesting, within the recent past. While mature, undisturbed habitats are present in the Beaver Dam Mine Site, particularly in large wetland complexes, generally, the Beaver Dam Mine Site has experienced significant levels of disturbance. As mentioned in the methodology section, portions of the Beaver Dam Mine Site have experienced significant levels of disturbance from historic mining practices as well.

The level of disturbance identified within the Haul Road is significantly lower, with only 15% of HSPs having experienced timber harvesting. However, 80% of the survey was completed within approximately 50 m of an existing road. This means that many natural forest stands are present, but the overall landscape is still somewhat disturbed, based on habitat fragmentation by the presence of an existing road. The effect of habitat fragmentation and disturbance to terrestrial fauna is described in further detail in Section 6.10.7.

In areas affected by natural or anthropogenic disturbance (e.g., wind throw or tree harvesting, respectively), early successional stands were determined to be in the mixed wood forest group. The dominant disturbance regime in the PA is timber harvesting, which is present in patches throughout upland forests. Generally speaking, uplands within the PA contain immature or unevenly aged coniferous stands or mixed wood stands. Several pockets of mature coniferous forests are scattered throughout the PA, but over-mature stands were generally uncommon. Pure deciduous stands (including both tolerant and intolerant hardwood forests) are infrequent within the Beaver Dam Mine Site, though they do occur occasionally within the Haul Road.

The ecosites and vegetation types observed are representative of the Eastern Ecoregion of the Acadian Ecozone as described in Section 6.10.3.2. The habitat survey results indicate a greater diversity of ecosites and vegetation types within the Haul Road compared with the Beaver Dam Mine Site. This is to be expected given the broader geographic extent of the Haul Road and the relatively disturbed nature of the Beaver Dam Mine Site. None of the ecosites or vegetation types across the Beaver Dam Mine Site and Haul Road are unique or rare in the local or regional context. Furthermore, none of the ecosites observed are known to

have an elevated potential to support rare vegetation species (for instance, ecosites AC14, AC16 and AC17 are all documented as having higher potential to support rare and at risk vegetation species).

Overall, current and historic land use throughout the PA has resulted in a patchwork of mature, immature, regenerating, and disturbed stands. The PA contains a diversity of habitat types and landscape features, but has experienced a considerable amount of disturbance and habitat fragmentation as a result of historic mine operations and current and historic timber harvesting practices.

6.10.4.2.6 Touquoy Mine Site

Habitat present within the Touquoy Mine Site include coniferous forest, deciduous forest, mixed forest, cutover forest, wetlands, rural residential areas, and areas to be cleared (CRA 2007a).

6.10.4.3 Vascular Plants

A total of 295 species of vascular plants were identified within the Beaver Dam Mine Site and the Haul Road (Appendix K.1). One additional vascular plant species, Nova Scotia Agalinis (*Agalinis neoscotica*, S3S4), was observed during additional field surveys in 2019. The diversity of species is moderate to high, especially considering the low fertility of soils within the PA; however, this is attributed to the range of habitat types encountered, from natural aquatic systems, a variety of wetland types, and both intact and disturbed upland habitats. The vegetation species observed are largely native species, with relatively low diversity and abundance of roadside exotic or invasive species. The species and communities of vascular plants encountered were typical given the eco-regional context, nutrient regimes, moisture regimes, and disturbance regimes. Invasive species were documented whenever observed.

Of the 295 species identified, six are considered priority species; lesser rattlesnake plantain (*Goodyera repens*, S3), southern twayblade (*Neottia bifolia*, syn. Listera australis, S3) appalachian polypody (*Polypodium appalachianum*, S3), highbush blueberry (*Vaccinium corymbosum*, S3S4) and Nova Scotia agalinis (*Agalinis neoscotica*, S3S4; Section 6.13, Figure 6.13-2A). These will be discussed further in Section 6.13.

Upland habitat throughout the PA is characterized by exposed granite boulders and coarse-textured, well-drained soil. The soil shows evidence of an impoverished condition, with low nutrient levels. This is evident in the forest groups and vegetation types that are found, as outlined in Section 6.10.4.2 (habitat survey results). Ericaceous shrub species such as sheep laurel (Kalmia angustifolia) and black huckleberry (*Gaylussacia baccata*) are frequent, along with other species which thrive in impoverished soil, such as mountain holly (*Nemopanthus mucronatus*), wild raisin (Viburnum nudum), and black spruce (*Picea mariana*). Where somewhat richer, finer soil till deposits are present, mixed wood to tolerant hardwood forests occur and include dominant species such as yellow birch (Betula alleghaniensis), red maple (Acer rubrum) and occasionally large-toothed aspen (*Populus grandidentata*).

Overall, understory vegetation layers are characteristic of low to medium soil fertility forest ecosystems described in Nova Scotia's Forest Ecosystem Classification system. Indicator species occurring in medium fertility sites include northern long beech fern (*Phegopteris connectilis*) and Christmas fern (*Polystichum arctostichoides*), while species occurring in poorer conditions include trailing arbutus (Epigaea repens), bracken fern (Pteridium aquilinum), and pink lady's-slippers (*Cypripedium acaule*). Large portions of the PA, particularly within the Beaver Dam Mine Site, have undergone large-scale anthropogenic disturbance in the form of clearcutting, which has resulted in a much younger forest landscape with less valued, more shade-intolerant and opportunistic tree species. Much of the diversity of vascular plants is attributed to wetland habitat. Wetlands have been described in detail in Section 6.8. The wetlands encountered generally supported vascular plant communities typical of nutrient poor peatlands and treed swamps, such as leatherleaf (*Chamaedaphne calyculata*), Atlantic sedge (*Carex atlantica*) and tussock sedge (*Carex stricta*)

dominated low shrub bogs, and black spruce (*Picea mariana*), mountain holly (*Nemopanthus mucronatus*), and cinnamon fern (*Osmunda cinnamomea*) swamps. Open wetlands are primarily dominated by sphagnum moss with scattered and dwarfed black spruce, red maple (Acer rubrum), and speckled alder (*Alnus incana*). Several common species of Atlantic coastal plain flora were observed within wetlands throughout the Beaver Dam Mine Site and the Haul Road. These include species such as branched bartonia (*Bartonia paniculata*), Atlantic sedge, dwarf huckleberry (*Gaylussacia bigeloviana*), bog fern (*Thelypteris simulata*), and purple bladderwort (Utricularia purpurea). Vegetation communities identified throughout the Beaver Dam Mine Site and Haul Road generally exhibit low fertility and low potential for rare species. Priority species will be discussed in detail in Section 6.13. A complete list of all vascular plants identified within the Beaver Dam Mine Site and the Haul Road is included in Appendix K.1.

6.10.4.3.1 Touquoy Mine Site

Coniferous forest is the most common forest habitat type within the Touquoy Mine Site. These forests are dominated by red spruce, balsam fir, bunchberry (*Cornus canadensis*) and goldthread (*Coptis trifolia*). No SOCI plants were observed during vascular plant surveys conducted in August 2004, May and June 2005, and September 2006 as part of the EARD process (CRA 2007a). One black ash (*Fraxinus nigra*) was discovered within the Touquoy Mine Site incidentally during wetland surveys in September 2015. It is discussed in further detail within Section 6.13.

6.10.4.4 Lichens

The LSA shown on Figure 6.13-2A was established based on increased potential for rare lichens in the general vicinity of the Beaver Dam Mine Site and the level of proposed ground disturbance within the Beaver Dam Mine Site. Both the Beaver Dam Mine Site and the LSA are located within the LAA. The goal of the expanded study area for lichens around the Beaver Dam Mine Site was to determine, if rare lichens were identified within the Beaver Dam Mine Site, whether these species were unique to that specific location or whether they were present within the broader geographical context.

A comprehensive list of lichen species was not completed, as the primary focus was in identifying SOCI and SAR lichen. However, common lichen species observed opportunistically during priority lichen surveys were recorded and are presented in the table below. Twenty-three species were recorded within the LSA (Beaver Dam Mine Site, surrounding area, and Haul Road [Figure 6.13-2A]) and during the targeted 2019 surveys in the expanded LSA (western and southeastern expansions of the Beaver dam Mine Site). Of these species, 11 are listed as SAR or SOCI. More details on priority species results, including location details and habitat associations, are presented in Section 6.13. A list of species observed within the LSA and Haul Road are provided in Table 6.10-5, priority species are bolded.

While the specific habitat requirements of each of priority lichen species varies slightly, they all require mature to over-mature forests. Stand age is one of the greatest determinants of lichen diversity (McMullin, Duinker, Cameron, Richardson, & Brodo, 2008). Within the Beaver Dam Mine Site and broader LSA, small to moderate scale disturbance is abundant in the form of timber harvesting, particularly to the north and east of the PA; however, where mature, intact natural stands within the Beaver Dam Mine Site support several rare species of lichen. According to lichen specialist, Chris Pepper, the habitat along the Haul Road generally lacked over-mature red maple and balsam fir required to support rare lichen species. This habitat is present within and surrounding the Beaver Dam Mine Site, where forest stands supported a diversity of cyanolichen species. According to Mr. Pepper, the diversity and abundance of lichen species observed within the entire Beaver Dam Mine Site and Haul Road, including priority species is typical of similar habitats

Table 6.10-5: Lichen Species Observed within the Lichen Study Area

Common Name	Scientific Name	COSEWIC	SARA	NSESA	SRank**	BDMS/HR or LSA*
Boreal felt lichen* **	***Erioderma pedicellatum***	Endangered	Endangered	Endangered	S1	LSA
Blue felt lichen	***Pectenia plumbea***	Special Concern	Special Concern	Vulnerable	S3	Both
Frosted glass-whiskers lichen	***Sclerophora peronella***	Special Concern	Special Concern	-	S1?	Both
Blistered tarpaper lichen	*Collema nigrescens*	-	-	-	S3	BDMS/HR
Blistered jellyskin lichen	*Leptogium corticola*	-	-	-	S3	BDMS/HR
Eastern candlewax lichen	*Ahtiana aurescens*	-	-	-	S2S3	BDMS/HR
Peppered moon lichen	*Sticta fuliginosa*	-	-	-	S3	BDMS/HR
Powdered fringe lichen	*Heterodermia speciosa*	-	-	-	S3	BDMS/HR
Salted shell lichen	*Coccocarpia palmicola*	-	-	-	S3S4	Both
Slender monk's hook lichen	*Hypogymnia vittata*	-	-	-	S3S4	BDMS/HR
Fringe lichen	*Heterodermia neglecta*	-	-	-	S3S4	BDMS/HR
Jelly lichen	*Collema subflaccidum*	-	-	-	S5	Both
Blue jellyskin lichen	*Leptogium cyanescens*	-	-	-	S5	Both
Pink-earth lichen	*Diabaeis baemoyces*	-	-	-	S5	BDMS/HR
Star-tipped reindeer lichen	*Cladonia stellaris*	-	-	-	S5	BDMS/HR
Gray reindeer lichen	*Cladonia rangiferina*	-	-	-	S5	BDMS/HR
British soldiers	*Cladonia cristatella*	-	-	-	S5	Both
Beard lichen	*Usnea sp.*	-	-	-		Both
Yellow specklebelly	*Pseudocyphellaria perpetua*	-	-	-	S5	Both
Lungwort lichen	*Lobaria pulmonaria*	-	-	-	S5	Both
Textrured lungwort	*Lobaria scobiculata*	-	-	-	S5	Both
Smooth lungwort	*Lobaria quercizans*	-	-	-	S5	Both
Crumpled rag lichen	*Platismatia tuckermanii*	-	-	-	S5	BDMS/HR

Notes: * BDMS/HR: observed within the Beaver Dam Mine Site or Haul Road. LSA: Identified within the broader lichen study area only.

**S-Ranks have been updated to reflect changes in rankings since original submission

***A follow up survey conducted in the fall of 2016 determined that all three BFL thalli were no longer present. Their absence was reconfirmed on December 4, 2017.

6.10.4.4.1 Touquoy Mine Site

Lichen surveys conducted in the Touquoy Mine Site in 2004 and 2005 as part of the EARD process found the presence of blue felt lichen (*Degelia plumbea*). An additional lichen survey in 2007 found 20 additional species (CRA 2007a). Eight of the 21 species identified in 2007 are priority species, further detail within Section 6.13.

6.10.4.5 Habitat Desktop Analysis

Within the LAA, the Upland Forest category was the dominant habitat type and accounted for 74% of the total habitat type cover. A breakdown of the percent cover of each habitat type within LAA and impact area is presented in Table 6.10-6 and Figures 6.10-5A to 6.10-5E. Furthermore, the percent of habitat expected to be directly impacted by the Beaver Dam Mine Site and Haul Road compared to the LAA is presented below. The expected impact (percent habitat cover proposed to be directly impacted by the Beaver Dam Mine Site and Haul Road) was then used to calculate the magnitude of impacts to each habitat type, as described in Section 6.10.7.

Table 6.10-6: Habitat Cover Type within the Beaver Dam Mine Site, Haul Road and the Local Assessment Area

Habitat Cover	Area within the LAA (Ha)	% Area within the LAA	Area within Project Area (BD Mine Site and HR) (Ha)	% within the Project Area (BD Mine Site and HR)
Upland Forest				
Hardwood Dominant Stands	637.3	10.7	42.2	17.3
Softwood Dominant Stands	3,081.3	51.8	92.1	37.8
Other[a]	470.4	7.9	73.8	30.3
Managed Forests[b]	668.6	11.2	9.6	4.0
Wetlands and Waterbodies				
Lakes, Ponds, Beaver flowage	227.5	3.8	4.6	1.9
Wetlands (includes all wetland classes)	825.4	13.9	8.2	3.4
Non-forested Upland Communities				
Barrens (includes rock barrens)	16.3	0.3	0	0
Disturbed				
Anthropogenic Disturbances[c]	20.3	0.3	13.4	5.5
TOTAL	**5,947.1**	**-**	**244**	**-**

[a] Includes unmerchantable timber, often which is regenerative stands and stands which were not categorized as hardwood or softwood stands.

[b] Managed forests include plantations, cutblocks, selective cuts etc.

[c] Includes roads, railways, urban development, quarries, gravel pits, mining activity etc.

This desktop analysis is limited by the accuracy of the Nova Scotia Forestry Inventory and mapped wetlands layers, but provides a coarse scale representation of the habitat types and forest condition within the LAA, the Beaver Dam Mine Site, and Haul Road. It is acknowledged that certain habitats which are presented in the database may be over or under-represented compared to the current ground conditions.

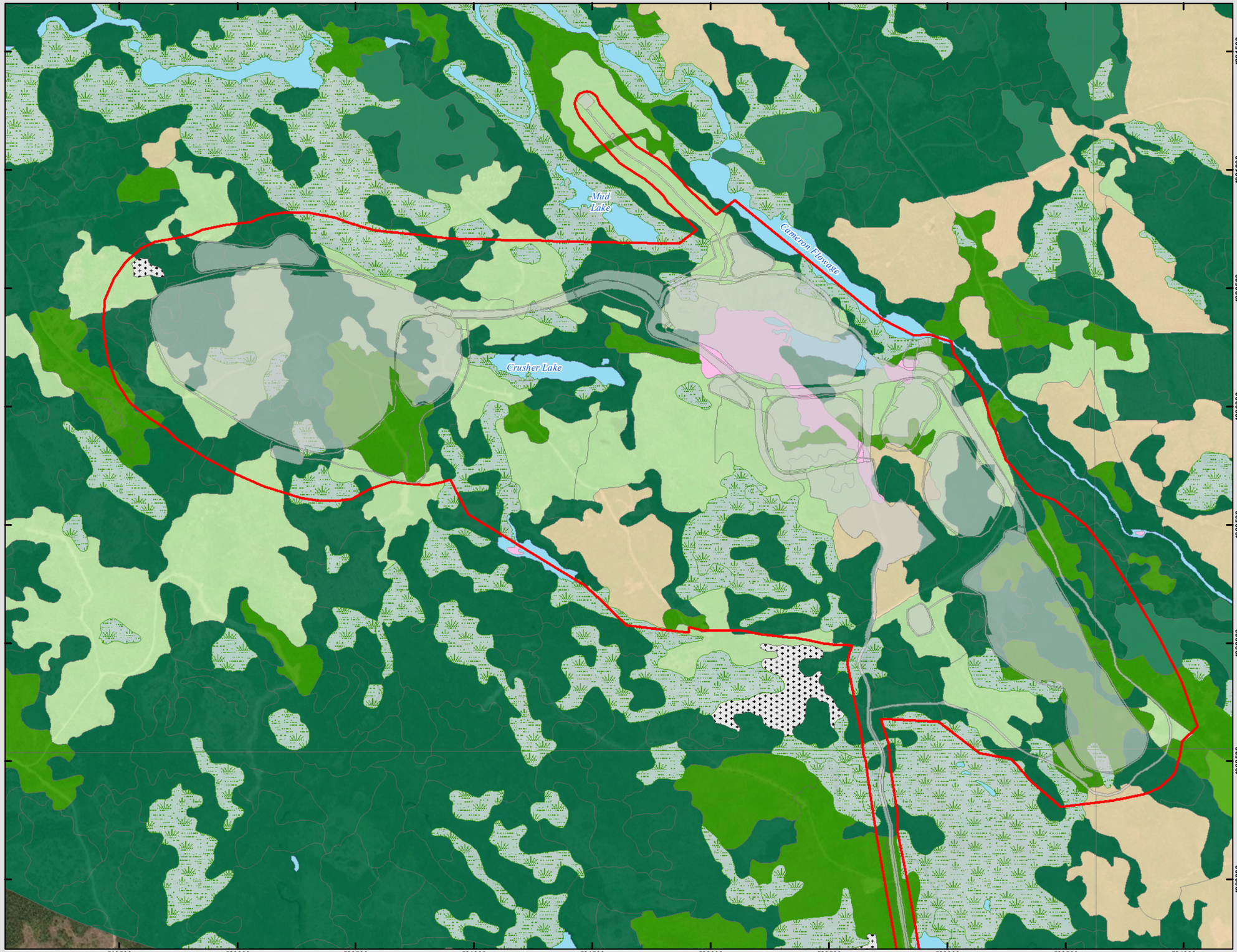
Prepared For:

Atlantic Gold

FIGURE 6.10-5A

Beaver Dam Mine Project

Habitat Cover Types

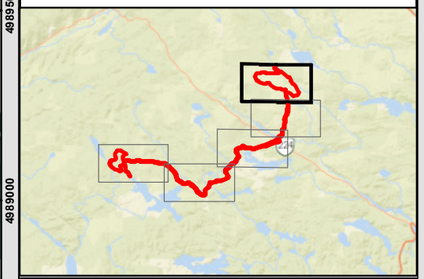


Upland Natural Forests
- Hardwood Dominant Stands
- Softwood Dominant Stands
- Other
- Managed Forests
- Wetlands

Wetlands and Waterbodies
- Lakes, Ponds, Beaver flowage

Non-forested Upland Communities
- Barrens

Disturbed
- Anthropogenic Developments
- Planned Infrastructure
- Project Area



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Projection: Transverse Mercator
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Drawn By: AS
Reviewed By: XX

Date: 2021-05-11

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri

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Document Name: BD_EIS_Figure6-10-XCover

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FIGURE 6.10-5B

Beaver Dam Mine Project

Habitat Cover Types

Upland Natural Forests
- Hardwood Dominant Stands
- Softwood Dominant Stands
- Other
- Managed Forests
- Wetlands

Wetlands and Waterbodies
- Lakes, Ponds, Beaver flowage

Non-forested Upland Communities
- Barrens

Disturbed
- Anthropogenic Developments
- Planned Infrastructure
- Project Area

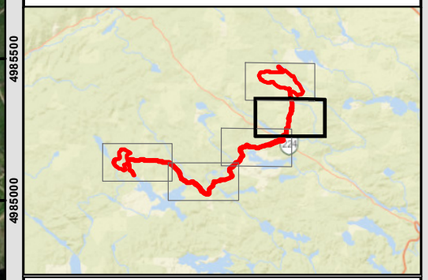

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FIGURE 6.10-5C

Beaver Dam Mine Project

Habitat Cover Types

Upland Natural Forests
- Hardwood Dominant Stands
- Softwood Dominant Stands
- Other
- Managed Forests
- Wetlands

Wetlands and Waterbodies
- Lakes, Ponds, Beaver flowage

Non-forested Upland Communities
- Barrens

Disturbed
- Anthropogenic Developments
- Planned Infrastructure
- Project Area

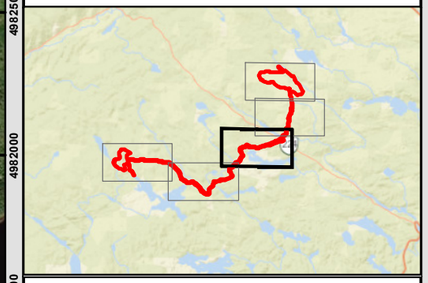

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FIGURE 6.10-5D

Beaver Dam Mine Project

Habitat Cover Types

Upland Natural Forests
- Hardwood Dominant Stands
- Softwood Dominant Stands
- Other
- Managed Forests
- Wetlands

Wetlands and Waterbodies
- Lakes, Ponds, Beaver flowage

Disturbed
- Anthropogenic Developments
- Planned Infrastructure
- Project Area

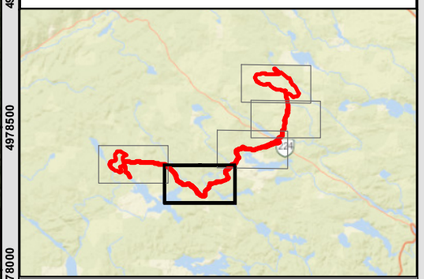

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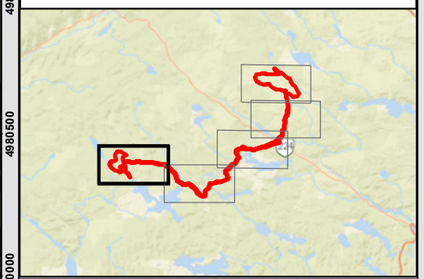
FIGURE 6.10-5E

Beaver Dam Mine Project

Habitat Cover Types

Planned Infrastructure

Project Area



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6.10.4.6 Old Forest and Interior Forest

The Old Forest stands in close proximity to the LAA as shown in Figure 6.10-6. The Haul Road bisects one Old Forest stand (Unit 582) indicated in the Old Forest layer. Old Forest Unit 582 is 437.4 ha but it should be noted that this area is an estimate based on the Old Forest layer and the stand boundaries were not field delineated. Old Forest Unit 582 is made of three forest elements: Red and Black Spruce Hummocks, Spruce Pine Hummocks and Tolerant Mixedwood Hills. This stand also provides interior forest habitat.

The LAA is covered with a network of roads and forestry trails creating a largely disturbed forest landscape. The extent of the existing edge effect largely covering the majority of the LAA, including most of the Haul Road, is shown in Figure 6.10-6. Five potential interior forest patches fall within the Project Influence Zone, as defined in Section 6.10.3.6, one along the Haul Road within Old Forest Unit 582, and four within the Beaver Dam Mine Site, along the northern edge of the PA (patch 1); to the south of the western waste rock stockpile (patch 2); east of the crusher pad (patch 3); and west of the organic material stockpile (patch 4). Impacts to other areas of interior forest along the Haul Road will be limited to patches less than 1 ha, as the rest of the alignment follows existing roads. There were no other impacted patches within the Beaver Dam Mine Site that were large enough (more than 15 ha) to support interior forest conditions.

6.10.4.6.1 Potential Old Growth Field Survey

The following forest stand classes were observed and delineated during the Old Forest Unit 582 survey:

- Class 1 – Potential Old Growth: 7 ha (2%);
- Class 2 – Mature Climax: 76 ha (17%);
- Class 3 – Immature Climax: 320 ha (73%); and
- Class 4 – Non-Climax: 33 ha (8%).

The structure of the forest within the Class 1 and Class 2 stands varies considerably. The main stand component is typically a mixture of immature red spruce and mature balsam fir, 13 to 15 m in height, 40 to 80 years old and a crown closure of 40 to 60%. Scattered throughout the majority of these stands, in singles, patches and irregular groups, are larger red spruce and white pine, aged from 80 to 125 years and older. Where the density of these older trees is sufficient (at least 30% of the stand basal area), the patch or stand can be classified as Potential Old Growth (Class 1) or Mature Climax (Class 2), depending on the detailed age. The location of Potential Old Growth, based on preliminary field surveys, in relation to the Haul Road is shown in Figures 6.10-6.

The Old Forest Unit 582 field survey and Class assignments reflect preliminary findings. AMNS will work with NSLF to confirm the classification of Old Forest Unit 582 and the locations of Old Growth through the Integrated Resources Management Process.

6.10.5 Consideration of Engagement Results

Key issues raised during public and Mi'kmaq engagement relating to habitat and flora include potential effect on biodiversity and permanent loss of habitat associated within the Beaver Dam Mine Site and Haul Road. Potential effects on traditional uses of land and resources by the Mi'kmaq were noted, including medicinal food and plants.

The results of the public and Mi'kmaq engagement have been considered in the environmental effects assessment, including AMNS's commitments on mitigation and monitoring measures and proposed compliance and effects monitoring programs, as well as AMNS's broader commitment to ongoing public and Mi'kmaq engagement. Specific to evaluating the effect on habitat and flora, these are found within the following environmental effects assessment.

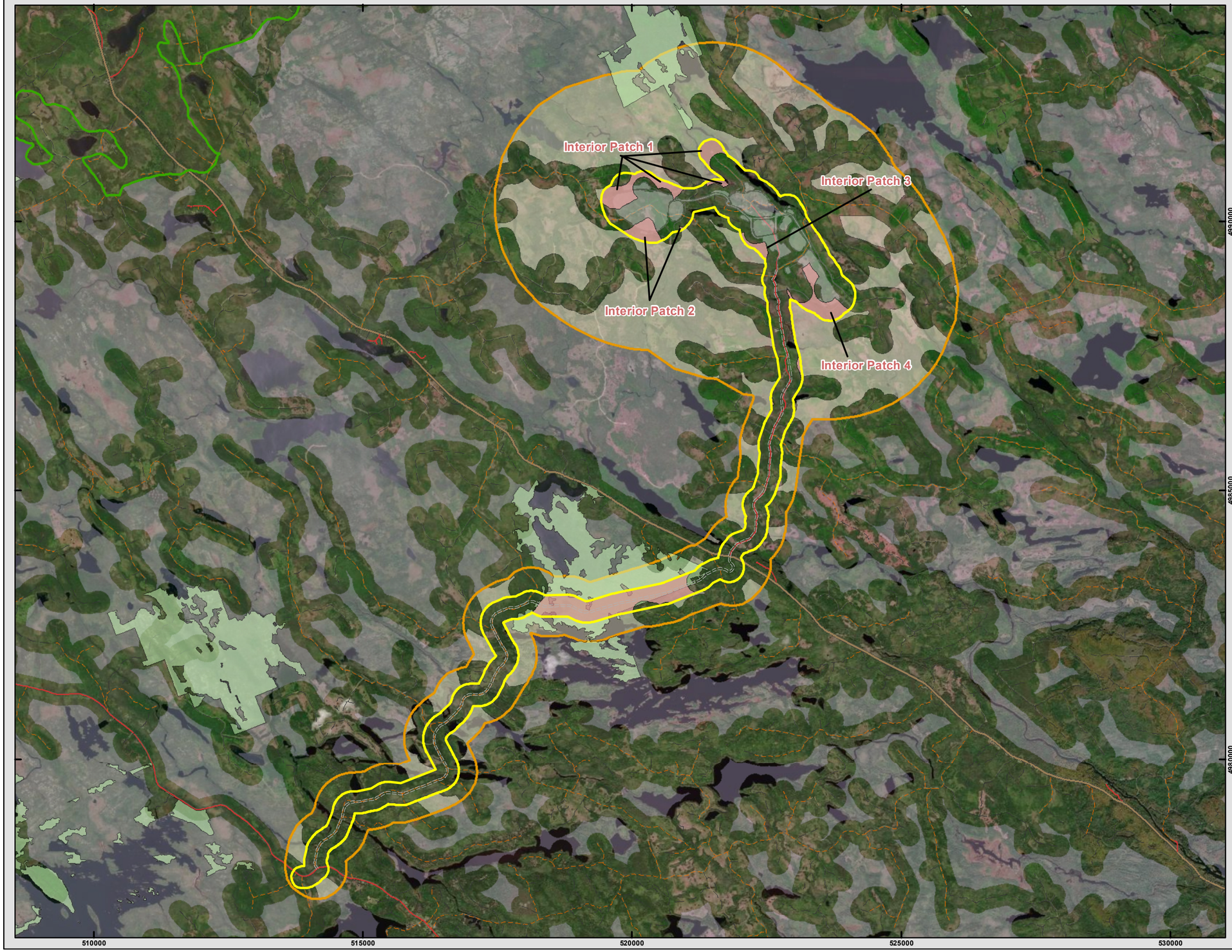

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FIGURE 6.10-6

Beaver Dam Mine Project

Interior and Mature Forest Habitat

- Haul Road Centreline
- BD Mine Site and HR 200 m Influence Zone
- Predicted Interior Forest Affected by Project
- Old Forest Stands
- Predicted Interior Forest in Local Assessment Area
- Predicted Interior Forest Patches in Regional Assessment Area
- Proposed Infrastructure
- Habitat and Flora Local Assessment Area
- Habitat and Flora Regional Assessment Area



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6.10.6 Effects Assessment Methodology

6.10.6.1 Boundaries

6.10.6.1.1 Spatial Boundaries

The spatial boundaries used for the assessment of Project effects to habitat and flora is described below.

The PA (Section 5.5, Figure 5.5-1) consists of the three project components; Beaver Dam Mine Site, Touquoy Mine Site, and the Haul Road and extends from Marinette to Moose River Gold Mines, Halifax County, NS. The Beaver Dam Mine Site is located at the eastern end of the Beaver Dam Mines Road. The Haul Road spans from the Beaver Dam Mine Site to Moose River Gold Mines, where the Touquoy Mine Site [processing and exhausted pit (to be used to dispose Beaver Dam tailings)] is located. The PA has changed as a result of the expansion of the Beaver Dam Mine Site to accommodate micro-sitting of mine infrastructure and ongoing modifications to the Haul Road design, as described in Section 2. These changes have been captured under the existing and additional desktop and field evaluations.

The LAA (Figure 6.10-7) consists of a 2 km buffer surrounding the Beaver Dam Mine Site and a 500 m buffer surrounding the Haul Road (excluding Mooseland Road). The LAA includes the focused LSA surrounding the Beaver Dam Mine Site. This area encompasses the maximum expected extent of Project direct and indirect impacts to habitat and flora. The LAA has been modified to reflect the changes in the PA. The Touquoy Mine Site and the Mooseland Road portion of the Haul Road were not included in the LAA because there is not expected to be a change to habitat and flora from current conditions.

The RAA (Figure 6.10-7) encompasses NSL&F's Ecological Land Classification Ecodistrict 440 (Eastern Interior) within Halifax Regional Municipality (HRM), east and north of Lake Charlotte. Where the Ecodistrict boundary approached the northern extent of the Beaver Dam Mine Site, the RAA was enlarged to include a 5 km buffer around the PA. This Ecodistrict spans an area broader than the expected Project impacts and considers other project boundaries as per cumulative effects methodology. These spatial boundaries will help to identify the direct or indirect impacts to flora species and critical habitats, and the effects of the Project on distribution and abundance of these species.

Assessment of habitat and flora will be completed in consideration of the LAA as the primary spatial boundary. All spatial boundaries will help to identify the direct or indirect impacts to flora and habitat and the effects of the Project on distribution and abundance of these species.

6.10.6.1.2 Temporal Boundaries

The temporal boundaries used for the assessment of effects to habitat and flora are the construction, operational, active closure and post-closure phases.

6.10.6.1.3 Technical Boundaries

No technical boundaries were identified for the effects assessment of habitat and flora.

6.10.6.1.4 Administrative Boundaries

There are no administration boundaries (specific legislation) that guided the evaluation of flora and habitat for this EIS.

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FIGURE 6.10-7

Beaver Dam Mine Project

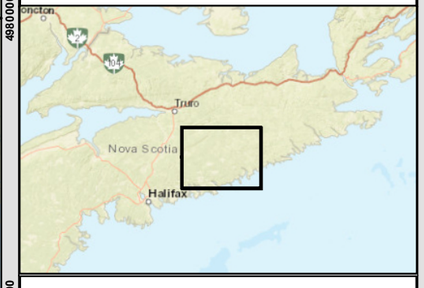
Spatial Boundaries: Habitat and Flora

Beaver Dam Mine Site

Touquoy Mine Site

Haul Road

- Project Area
- Habitat and Flora Local Assessment Area
- Habitat and Flora Regional Assessment Area



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6.10.6.2 Thresholds for Determination of Significance

A significant adverse effect from the Project on habitat is defined as an effect that is likely to cause a permanent, unmitigated, alteration to habitat that supports flora species distribution. An adverse effect that does not cause a permanent alteration of habitat is considered to be not significant. Significance criteria related to impacts to flora SOCI and SAR are presented in Section 6.13. A detailed analysis and definition of significance criteria for wetland habitat are presented in Section 6.8.

For the purposed of this analysis, habitat is defined as:

- A natural environment composed of both living organisms (biotic) and non-living components (abiotic) which function together as an ecological unit and includes managed forests (e.g., treated stands, cutblocks, plantations). Urban and industrial developments (e.g., roads, houses, quarries etc.) are excluded from this definition.

The magnitude of a predicted direct change in habitat is determined by the habitat analysis results described in Section 6.10.3.5.

- **Negligible** – the Project is predicted to result in less than one percent direct loss of habitat types within the LAA.
- **Low** – the Project is predicted to result in 1-5% direct loss of a habitat type within the LAA, and the loss of habitat is mitigated in the long term through reclamation planning and other mitigation measures as determined to be necessary based on flora species and communities present.
- **Moderate** – the Project is predicted to result in 5 to 25% direct loss of a habitat type within the LAA and the loss of habitat is mitigated in the long term through reclamation planning and other mitigation measures as determined to be necessary based on flora species and communities present.
- **High** – the Project is predicted to result in greater than 25% direct loss of a habitat type within the LAA and the loss of habitat is not mitigated in the long term through reclamation planning and other mitigation measures as determined to be necessary based on flora species and communities present.

The timing of residual effects for habitat considers when the residual environmental effect is expected to occur, considering seasonal aspects. The duration of residual effects considers the time frame over which the effects are likely to last, ranging from short-term to permanent. For the purpose of the effects' assessment related to habitat, long term reflects the commencement of reclamation activities. The frequency of residual effects considers the rate of recurrence of the effects, ranging from once to continuous. The reversibility of residual effects considers the time required for habitat to recover to naturalized conditions, or whether the changes to habitat, if identified, are permanent.

6.10.7 Project Activities/Interactions with Habitat and Flora

Potential interactions between Project activities and physical and cultural heritage resources within the Beaver Dam Mine Site and Haul Road are outlined in Tables 6.10-7 and 6.10-8.

Development of the Beaver Dam Mine Site and the Haul Road will cause direct impacts to habitat and flora, including upland forested habitat and wetlands. This will occur within the construction phase of the Project. Habitat within the PA and surrounding landscape currently exhibits fragmented conditions based on historic mine operations, existing road and trail networks, and current and historic forestry activity. Project activities are likely to result in increased habitat fragmentation and a decrease in habitat quality. A portion of this disturbance is expected to impact interior forest and Old Forest.

Table 6.10-7: Potential Project Activities/Interactions with Flora at Beaver Dam Mine Site

Project Phase	Duration	Project Interactions
Construction	1 year	• Clearing, grubbing, and grading in preparation of construction • Till and waste rock from site preparation transport and storage • Watercourse and wetland alteration in preparation of construction • Mine Site road construction • Surface infrastructure installation and construction • Collection and settling pond construction • Sedimentation and erosion from construction activities • Generation of dust from construction activities • Invasive species introduction or spread
Operations and Maintenance	5 years	• Sedimentation and erosion from mining activities • Generation of dust from mining activities • Invasive species introduction or spread
Active Closure	2 years	• Site reclamation activities • Sedimentation and erosion from reclamation activities • Generation of dust from mining activities
Post-closure	+10 years (monitoring)	• N/A

Table 6.10-8: Potential Project Activities/Interactions with Flora along Haul Road

Project Phase	Duration	Project Interactions
Construction	1 year	• Clearing, grubbing, and grading in preparation of construction • Watercourse and wetland alteration in preparation of construction • Haul Road construction and upgrades • Sediment and erosion from Haul Road activity • Dust from Haul Road activity • Invasive species introduction or spread
Operations and Maintenance	5 years	• Haul Road maintenance and repairs including sanding for traction control and snow removal • Sediment and erosion from Haul Road activity • Dust from Haul Road activity • Invasive species introduction or spread
Closure	2 years	• Generation of dust
Post-closure	+10 years (monitoring)	• N/A[(a)]

[(a)] Decommissioning and Reclamation of the Haul Road is not expected. The Haul Road will be returned to owner for forestry industry.

6.10.7.1 Direct and Indirect Impacts of the Project on Habitat and Flora

6.10.7.1.1 Direct Impacts

Direct impacts of the Project on habitat were determined by the desktop analysis described in Section 6.10.4.5. Based on the definitions of magnitude of impact, it is anticipated that all impacts to the habitat types identified in the desktop analysis have an expected negligeable to moderate impact magnitude with the exception to anthropogenic disturbances (Table 6.10-9).

Development of the Beaver Dam Mine Site and upgrading and construction of new sections of the Haul Road (Section 2, Figure 2.3-3) will result in direct impacts to vascular and non-vascular individuals and to flora communities at the full or partial forest stand level. The effects of the Project on flora encompass vascular and non-vascular flora in aquatic, wetland, and upland habitats. As such, many of the effects described in Section 6.8 specific to wetland habitat will directly relate to effects on flora. The majority of direct mortality to flora will occur during site preparation and construction. Impacts to flora SOCI and SAR are presented in Section 6.13.

The high percent (66%) impact to anthropogenic disturbances shows that the Project utilizes the existing disturbed areas within the LAA. Since this category is already disturbed and provides limited natural habitat for species, the high percent does not equal a determination of high magnitude of impact to habitat. Anthropogenic impact has only been included in Table 6.10-9 for comparison purposes - only natural habitat types have been carried forward for the habitat effects assessment.

Table 6.10-9: Habitat Type within the Project Area, Local Assessment Area and Magnitude of Impacts

Habitat Type	Area within the LAA (Ha)	Area within Project Area (BD Mine Site and HR) (Ha)	% of habitat type within the LAA directly impacted by the Project	Magnitude of Impacts to Habitat within LAA
Upland Forest				
Hardwood Dominant Stands	637.3	42.2	6.6	Moderate
Softwood Dominant Stands	3,081.3	92.1	3.0	Low
Other[a]	470.4	73.8	15.7	Moderate
Managed Forests[b]	668.6	9.6	1.4	Low
Wetlands and Waterbodies				
Lakes, Ponds, Beaver flowage	227.5	4.6	2.0	Low
Wetlands (includes all wetland classes)	825.4	8.2	1.0	Low
Non-forested Upland Communities				
Barrens (includes rock barrens)	16.3	0	0.0	Negligible
Disturbed				
Anthropogenic Disturbances[c]	20.3	13.4	66.0	N/A
TOTAL	**5,947.1**	**244**	**4.1**	**Low**

[a] Includes unmerchantable timber, often which is regenerative stands and stands which were not categorized as hardwood or softwood stands.

[b] Managed forests include plantations, cutblocks, selective cuts etc.

[c] Includes roads, railways, urban development, quarries, gravel pits, mining activity etc.

6.10.7.1.2 Direct Impacts of the Project on Old Forest and Interior Forest

Direct impacts to Old Forest Unit 582 will occur where the new section of the Haul Road (Section 2, Figure 2.3-3) is to be constructed. This area is unavoidable as the Haul Road was re-routed through this area to avoid impacts to the Beaver Lake IR and has been placed to avoid the waterbodies in the area. The Haul Road will be designed along the southern side of this stand, keeping the core area of this stand intact. This stand also has interior forest properties. One hundred and ten hectares of interior forest would be directly impacted, or face edge effects, from this new section of Haul Road.

As mentioned above, the landscape in this region is a patchwork mosaic of different levels of disturbance dominated by varying successional ages of regrowth from forestry activities. A large network of trails and roads have resulted from this forestry and other anthropogenic activity throughout this region. The LAA has largely been affected from these disturbances, as well as historical mining activities, which has reduced the amount of interior forest present within the LAA.

The Project Influence Zone, as defined in Section 6.10.3.6, interacts predominantly with five potential interior forest patches within the LAA. One is 112 ha along the Haul Road, which include 102 ha of the Old Forest Unit 582 polygon, as discussed above and in Section 6.10.3.5. This section of Old Forest Unit 582 is entirely located within the Tolerant Mixedwood element and primarily impacts Class 3 Immature Climax forest (more than 60%). The western portion of the Old Forest Unit 582 Influence Zone is composed of Class 1 Potential Old Growth (4%) and Class 2 Mature Climax (31%) stands. Impacts to Potential Old Growth are described in Section 6.10.7.1.1.2 below. The other four patches are within the Beaver Dam Mine Site, where the infrastructure will directly impact or create edge effects within 55 ha of interior forest along the northern edge of the PA (patch 1); 20 ha to the south of the western waste rock stockpile (patch 2); 8 ha east of the crusher pad (patch 3); and 38 ha west and south of the organic material stockpile (patch 4). There are a few patches each under 1 ha along the Haul Road. Of the 2,660 ha of predicted interior forest that has been identified within the LAA, the Project is will affect a total of 237 ha of interior forest habitat, which accounts for 9% of predicted interior forest in the LAA and 0.3% within the RAA.

While the baseline quantity of interior forest unaffected by edge effects from roads and other anthropogenic disturbance within the PA may be limited, there is still documented Old Forest available within the region, especially to the north and southwest of the PA. Overall, the increase in physical fragmentation is expected to be low, based on the current high level of disturbed habitat as discussed.

6.10.7.1.3 Direct Impacts of the Project on Potential Old Growth

Preliminary field surveys documented two patches of Potential Old Growth with the Old Forest Unit 582. The southernmost portion interacts with the proposed alignment of the new construction section of Haul Road (Figure 6.10-8 and Section 2, Figure 2.3-3). Based on preliminary surveys, a total of 2.40 ha of Potential Old Growth is located within the PA. The current proposed Haul Road design is expected to impact 0.22 ha of this Potential Old Growth area.

The Project will work to avoid and/or mitigate impacts to defined Old Growth wherever practicable. A potential alternative Haul Road route option is presented to avoid the Potential Old Growth, and will be considered depending on NSLF consultation and assessment of preliminary survey results, engineering constraints and road design considerations.

Middle Beaver Lake

Upper Beaver Lake

Lake Alma

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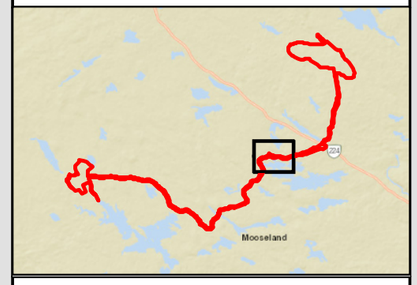
FIGURE 6.10-8

Beaver Dam Mine Project

Potential Old Growth Haul Road Re-alignment

- Potential Old Growth Impact Area (2,185m2)
- Haul Road
- Potential Old Growth Forest
- Potential Alternative Haul Road Alignment
- Old Forest Unit 582
- Project



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6.10.7.1.4 Indirect Impacts

Project activities have the ability to indirectly affect flora in the construction, operational, and decommissioning phases of the Project. The vast majority of Project interactions with flora will occur during construction, specifically during clearing, grubbing, and grading. Indirect impacts could include altered hydrology as a result of activity (including dewatering) in close proximity to wetland habitat; increased edge effects through habitat fragmentation; erosion and sedimentation from Project activities; emissions and dust accumulation; accidental spills involving deposition of a deleterious substance, including fuel oil, lubricants, or engine oil, and impoundment of up-gradient wetlands if inadvertent dams are built as part of the mine development (roads can act as dams if not constructed properly to allow water flow through them).

Movement of equipment during site preparation, operation, and maintenance can result in deposition of dust on vegetation within close proximity of roads when conditions are dry. This affects flora through the deposition of dust on leaves, which temporarily reduces evapotranspiration, photosynthesis and can bioaccumulate within tissue, particularly for non-vascular flora such as lichen (Degtjarenko, 2016; Naeth and Wilkinson 2008; Farmer, 1993). Over time this may reduce overall growth rates and alter vegetation communities. Similarly, winter maintenance of the Haul Road and site roads can affect plant growth adjacent to roads by placement of sand or stockpiling of snow. Further discussion on indirect impacts to flora SOCI and SAR is presented in Section 6.13.

Additional indirect impacts to native plant communities include the potential for introduction of invasive species. Seeds and roots of invasive species can be transferred from construction equipment, transportation vehicles, or workers (footwear and clothing) into adjacent habitat during construction and operational activities. Introduction of invasive species can occur when equipment or people enter vascular plant communities, or indirectly via runoff or dust from the roads. Invasive species, such as purple loosestrife (*Lythrum salicaria*), can severely degrade habitat quality and outcompete many native species, particularly along roadsides. Construction of the Project within the Beaver Dam Mine Site, upgrades to the Haul Road, and operations/trucking along the Haul Road will result in increased traffic levels. As a result, the likelihood of introduction of invasive species is elevated within the Beaver Dam Mine Site and along the entire length of the Haul Road, including the section of the Mooseland Road to the Touquoy Mine Site, where although no road upgrades are necessary, truck traffic will increase. No purple loosestrife, a common invasive species known to impact wetland, was noted during field surveys in the Beaver Dam Mine Site or Haul Road. Refer to Section 6.10.4.3 and 6.10.8 for discussions on invasive species and mitigations.

Table 6.10-10: Direct and Indirect Impacts on Habitat and Flora

Impact Type	Direct Impact	Project Phase	Indirect Impact	Project Phase
Vegetative and Habitat Integrity	Direct loss of individual vegetation (vascular and non-vascular) and the habitats which support them. In some cases (particularly in the Beaver Dam Mine Site) forest stands (upland and wetland) will be removed. See Table 6.10-9 for impact by habitat type. Impact to Old Forest and Potential Old Growth through Haul Road construction.	C	Hydrologically connected upstream wetlands may also be at risk of indirect impacts as a result of downstream alteration activities (e.g., water outflow changes, land elevation changes, blasting, etc. causing dewatering). Inadvertent damming of up-gradient wetlands from construction related infrastructure (e.g., roads with lack of flow through infrastructure). Removal of tree cover in one area can increase risk of wind damage in immediately adjacent habitats. Edge effects from habitat fragmentation (including effects to interior forest) resulting in stress to vascular plants and non-vascular plants (including lichens) potentially resulting in harm to individuals and/or changes in vegetation community structure.	C, O, CL
	Extensive ground works, including activities such as blasting in and adjacent to wetlands has the potential to destabilize land surfaces and the root zone of vegetative areas, including wetland buffers.	C, CL	Introduction of invasive species can occur indirectly into wetlands when equipment or people move around the PA or via runoff or dust from the roads. Introduction of mine and Haul Road traffic during construction and operation can elevate this risk. Invasive species, such as purple loosestrife (*Lythrum salicaria*), can severely degrade wetland habitat and function. No purple loosestrife was noted during field surveys in the Beaver Dam Mine Site or Haul Road.	C, O, CL
	Introduction of invasive species. Seeds and roots of invasive species can be transferred from construction equipment, transportation vehicles, or workers into adjacent wetland habitat during construction and operational activities.	C, O, CL	Dust accumulation on vegetation can smother and stress plants and provide minerals and nutrients into the wetland habitat.	C, O, CL

Notes: C = Construction; O = Operations; CL = Active Closure; m = metre; PA = Project Area.

6.10.7.2 Touquoy Mine Site

The Touquoy Mine Site is currently operational. The use of the Touquoy Mine Site for the processing of Beaver Dam ore and tailings management (exhausted pit) will not involve modification to the current footprint or further direct impacts to habitat and flora. Moving the existing tailings pipeline from the permitted TMF to direct water to the exhausted pit will occur within the disturbed footprint of the permitted Touquoy Project and will not result in additional impacts. Potential interactions between Project activities and habitat and flora within the Touquoy Mine Site are outlined in Table 6.10-11.

Based on work completed as part of the 2007 Focus Report, air emissions are not anticipated to have an adverse effect on flora and lichens are not anticipated to be affected by the continued use of the Touquoy Mine Site for the processing of Beaver Dam ore. Lichens are susceptible to air pollution, including deposition of contaminants in air emissions and particulate matter. It was concluded in the Focus Report that total suspended particulate from the processing facility at Touquoy Mine Site will not have a significant adverse effect on any lichen species associated with the Project.

Project operations and trucking of ore from the Beaver Dam Mine Site to the Touquoy Mine Site, along the Haul Road, has the potential to spread invasive species. Invasive species are currently monitored at the Touquoy Mine Site during the existing wetland monitoring program (IR2 NSE-2-181).

Table 6.10-11: Potential Project Activities/Interactions with Flora at Touquoy Mine Site

Project Phase	Duration	Project Interactions
Construction	1 year	• N/A
Operations	5 years	• Generation of dust • Invasive species introduction or spread
Active Closure	2 years	• Generation of dust
Post-closure	+10 years (monitoring)	• N/A

Note: N/A = not applicable.

6.10.8 Mitigation

Th mitigation provided in Table 6.10-12 to reduce overall loss of function of habitat used by flora will be implemented by AMNS where direct impacts and potential indirect impacts to habitat and flora are expected.

Project activities will result in direct mortality of vascular and non-vascular flora within the PA, in both upland and wetland habitat. Compensation and mitigation for flora related to wetland habitat are described in Section 6.8 and for flora SOCI and SAR are described in Section 6.13. The long-term reclamation and remediation will involve re-vegetation of the Touquoy Mine Site and Beaver Dam Mine Site at the end of the life of the mine. Revegetation will involve establishment of native vegetation communities. Stockpiled soils will be used in reclamation efforts. This soil will contain a seedbank of native species to increase the establishment of native communities. Loss of individual plants within the Haul Road is expected to be permanent, as the Haul Road will not be decommissioned or reclaimed at the completion of the Project.

Table 6.10-12: Mitigation for Habitat and Flora

Project Phase	Mitigation Measure
Construction, Operation	Intact forest stands and wetlands will be avoided wherever practicable during detailed Project planning and design in favor of previously disturbed areas (e.g., stands disturbed by timber harvesting, roads, or other development).
	Where natural, intact habitat cannot be avoided, maintain existing vegetation cover whenever practicable and minimize overall areas of disturbance.
	A wetland alteration application will be submitted during Project planning and design to request an authorization to alter wetland habitat and to address loss of wetland function.
	Compensation for permanent loss of wetland function will be completed through wetland restoration activities to support no net loss of wetland function, subject to NSE approval.
	Topsoil will be salvaged and stored for use in site restoration where possible. Upland and wetland soils should be stockpiled separately.
	Conduct vegetation management by cutting (e.g., no use of herbicides)
	Implement Erosion and Sediment Control Plan and measures to ensure site runoff is not directed towards unaltered habitat where possible to ensure existing drainage patterns are maintained.
	Avoid frequent or unnecessary travel over erosion prone areas through communication with personnel and project planning
	Monitor dust conditions and implement dust suppression mitigation (refer to air mitigation) when normal precipitation levels are not enough to suppress fugitive dust. In addition to water suppression, provincially approvable chemical dust suppressants will be used along the Haul Road. Implement Dust Control Plan (Appendix C.3)
	Haul trucks will be equipped with spill kits and instructed on their use and spill prevention and appropriate site personnel will be trained in spill isolation, containment, and recovery.
	Winter road maintenance will include conventional snow clearing and deposition of sand for traction control where necessary.
	Employ measures to reduce the spread of invasive species (particularly by vehicles) and retain habitat integrity. Inspect vehicles regularly, particularly vehicles arriving from outside the PA. If necessary, cleaning will be undertaken at a designated cleaning station, away from wetlands and watercourses.
	Confirm Potential Old Growth areas with NSLF and asses possible avoidance through the alternative Haul Road route, dependant on NSLF findings.
	Consider on-site opportunities for progressive reclamation during construction and operations to avoid viability issues with long-term stockpiling of organic material.
Active Closure	Hydroseed areas that have erosion potential to return the area to pre-disturbance conditions in a timely fashion upon final reclamation
	Alternatives to traditional hydroseeding methods will be reviewed to advance vegetation re-establishment and reclamation methods. Consideration will be given to native species with Indigenous significance.
	Implement reclamation program within the Beaver Dam Mine Site to re-establish native vegetation communities
	Consider on-site opportunities for progressive reclamation during construction and operations to avoid viability issues with long-term stockpiling of organic material.
Post-closure	N/A

Construction of the Haul Road will involve decommissioning remnant pieces of the existing road, where appropriate. These remnant pieces of original road will be barricaded to prevent access and encouraged to revegetate through re-grading the soil and seeding with native seed mix, where necessary. Wetland restoration or creation will be incorporated into these areas, where appropriate.

AMNS will work with NSLF to confirm the classification of Old Forest Unit 582 and the locations of Old Growth through the Integrated Resources Management Process. Dependent on NSLF consultation and assessment, a potential alternative Haul Road route option is presented in Section 6.10.8 to avoid the Potential Old Growth, as delineated by the preliminary surveys. All biophysical surveys (i.e., wetlands, watercourse, habitat type, avifauna, fish and fish habitat, flora and fauna SOCI /SAR) have been conducted within this alternative route area (9.4 ha). No consequential biophysical constrains (i.e., SOCI or SAR, fish habitat) have been identified through these baseline surveys. Impacts will be assessed and evaluated for required VCs (e.g., wetlands) should this route be considered. However, it should be noted that this route is subject to engineering and safety constrains, which will also need to be assessed should this route be considered.

A comprehensive mitigation table for all VCs is provided in Section 9.

6.10.9 Residual Effects and Significance

The predicted residual environmental effects of Project development and production on habitat and flora are assessed to be adverse, but not significant. The overall residual effect of the Project on habitat and flora is assessed as not significant after mitigation measures have been implemented and are summarized in Table 6.10-13.

A significant adverse environmental effect for habitat and flora has not been predicted for the Project for the following reasons, with consideration of the ecological and social context of the LAA surrounding the Project:

- **During construction:** Direct impacts to habitat and flora will occur. However, these impacts are limited to the construction phase (12 months) and will be limited for Haul Road constructed as a result of the planned upgrade of an existing logging road for the majority of the route. The majority of the habitat present within the Beaver Dam Mine Site is considered poor habitat as a result of historical and current forestry activities.
  - Impacts will be avoided wherever practicable during detailed Project planning and design in favor of previously disturbed areas.
  - Dependant on NSLF consultation, Old Growth, if present, may be avoided through the proposed Haul Road re-alignment (Figure 6.10-8). This re-alignment will require detailed road design that is dependent on engineering and safety constraints.
  - Micro-sighting of Project infrastructure has allowed for avoidance of the species' updated critical/core habitat as outlined within the Amended Recovery Strategy (ECCC, 2018) and the NSLF adopted Recovery Plan for Boreal Felt Lichen (NSLF 2020).
- **During Operations:** Indirect impacts to habitat and flora will be reduced through erosion and sediment control measures and dust mitigation.
- **During Closure:** Reclamation will allow for site restoration of a native assemblage of plant communities.

Table 6.10-13: Residual Effects for Habitat and Flora

Project - VC Interactions	Mitigation and Compensation Measures	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction – Beaver Dam Mine Site and Haul Road (clearing and grubbing, and Haul Road widening and construction)	Limit habitat disturbance and minimize Project Area during detailed design, sediment and erosion control, best-management practices, spill preparedness, dust control, re-establish habitat and associated vegetation communities during closure.	M Direct loss to habitat and flora. Partial mitigation through restoration.	PA Effects confined to the PA.	N/A VC is not expected to be affected by timing.	MT (Beaver Dam Mine Site) Effects occur beyond 5 years when closure activities commence at Beaver Dam Mine Site. P (Haul Road) Closure of the Haul Road not expected.	O Effects occur once during the construction phase.	PR Mitigation and reclamation cannot guarantee a return to baseline conditions.	Disturbance, Habitat Loss	Not Significant
Operation – Beaver Dam Mine Site, Haul Road and Touquoy Mine Site (dust from haul trucks, heavy machinery and mine operations)	Dust control, sediment and erosion control, best management practices, and spill preparedness.	M	LAA Potential effects below guideline levels beyond the PA.	N/A VC is not expected to be affected by timing.	MT Effects may occur up to 5 years.	R Effects will occur at regular intervals.	R VC will return to baseline conditions.	Disturbance	Not Significant
Closure (Active) – Beaver Dam Mine Site (re-vegetate using stockpile materials)	N/A	L Minor change from baseline conditions.	LAA Potential effects beyond the PA.	N/A VC is not expected to be affected by timing.	LT Effects extend beyond active closure phase.	O Effects occur once during the closure phase.	PR Mitigation and reclamation cannot guarantee a return to baseline conditions.	Habitat Reclamation	Not Significant

Notes: See Section 6.10.6.2 and Section 5, Table 5.11-1 for definitions of the below characteristics.

Magnitude		Geographic Extent		Timing		Duration		Frequency		Reversibility	
N	Negligible	PA	Project Area	N/A	Not Applicable	ST	Short-Term	O	Once	R	Reversible
L	Low	LAA	Local Assessment Area	A	Applicable	MT	Medium-Term	S	Sporadic	IR	Irreversible
M	Moderate	RAA	Regional Assessment Area			LT	Long-Term	R	Regular	PR	Partially Reversible
H	High					P	Permanent	C	Continuous		

6.10.10 Proposed Compliance and Effects Monitoring Program

The monitoring of vascular plants will be encompassed within the Wetland Monitoring Plan. This plan will be established through the life cycle of the permitting process and will commit to monitoring during baseline/pre-construction to establish baseline conditions, and through the operational, closure and post closure phases (as determined to be required). Wetland monitoring will be completed for the Project on selected representative wetlands that have been predicted to have direct or indirect effects from project development to determine the effect on wetland plants. A Preliminary Wetland Compensation Plan, with proposed methods, timing, frequency, and locations, is presented in Appendix H.3.

6.11 Terrestrial Fauna

6.11.1 Introduction

6.11.1.1 Summary of Terrestrial Fauna Before the Updates

Baseline surveys confirmed presence of ten mammalian species, including mainland moose (NSESA Endangered, S1). Mainland moose tracks were observed in three locations within the Beave Dam Mine Site. No other observations or evidence of mainland moose were observed by the Project Team. Eighteen abandoned mine openings (AMOs) within the Beaver Dam Mine Site were evaluated for their potential to provide bat hibernacula. Of the 18 AMOs evaluated, all were determined to be inaccessible to bats, with the exception of one (BED-1-003), which was identified as a potential bat hibernaculum. The BED-1-003 AMO was later determined to be inaccessible to bats through field surveys. No bat hibernacula were identified within the Haul Road. No bats, or evidence of, where observed within the Beaver Dam Mine Site or Haul Road. Nine species of herpetofauna were observed during file surveys, either directly or indirectly (through vocalizations, egg masses, cast snake skins, etc.). Dedicated wood turtle surveys were conducted within the Beaver Dam Mine Site or Haul Road; however, none were observed. Snapping turtle had been previously observed near the Touquoy Mine Site outside field surveys. No Species of Conservation Interest (SOCI) or Species at Risk (SAR) herpetofauna were observed during field surveys. SOCI and SAR fauna and Beaver Dam Mine Project (the Project) related effects are further discussed in Section 6.13.

Project related effects to terrestrial fauna include direct loss of habitat, habitat fragmentation, direct mortality, and sensory disturbance. Mitigations are proposed to reduce overall loss of function of habitat used by terrestrial fauna and reduce direct impacts on fauna within the Beaver Dam Mine Site and Haul Road. As a result of mitigations and detailed design planning, the predicted residual environmental effects of Project development and production on terrestrial fauna are assessed to be adverse, but not significant.

6.11.1.2 Summary of Updates to Terrestrial Fauna

As a result of Project Area (PA) modifications and continued infrastructure micro-siting since the 2019 EIS submission, one additional species was observed during supplementary field surveys for the Updated 2021 EIS. A snapping turtle (SARA/COSEWIC SC, NSESA V, S3) and nest were observed adjacent to Wetland 59 within the Beaver Dam Mine Site. This species is further discussed in further discussed in Section 6.13.

Impacts to terrestrial fauna were reassessed based on changes to the PA and Project infrastructure. The fauna effects assessment was updated to include a species-specific habitat assessment and improved assessment of Project related sensory disturbance.

No new direct or indirect impacts to terrestrial fauna are expected. Project effects to fauna remain adverse, but not significant.

Table 6.11-1: Updated Subsections from the 2019 Revised Environmental Impact Statement – Terrestrial Fauna

2019 Revised EIS Submission (February 28, 2019)	Updated in 2021	Corresponding 2021 EIS Updated Section Number	Reason for Update
-	-	6.11.1 Introduction	• N/A
6.11.1 Rationale for Valued Component Selection	No	6.11.2 Rationale for Valued Component Selection	• N/A
6.11.2 Baseline Program Methodology	Yes	6.11.3 Baseline Program Methodology	• Addition of 2019 field surveys. • Additional survey areas as a result of PA modification for infrastructure micro-sitting. • Review and update priority species (IR NSE 2-184)
6.11.3 Baseline Conditions	Yes	6.11.4 Baseline Conditions	• Present results from 2019 field surveys. • Additional survey areas as a result of PA modification for infrastructure micro-sitting. • Review and update priority species (IR NSE 2-184)
6.11.4 Consideration of Consultation and Engagement Results	No	6.11.5 Consideration of Engagement Results	• N/A
6.11.5 Effects Assessment Methodology – **Boundaries**	Yes	6.11.6 Effects Assessment Methodology – **Boundaries**	• PA modification for infrastructure micro-sitting. • Adjusted PA description. • LAA was enlarged due to the modified PA. • RAA was enlarged where necessary due to the modified PA. Fauna assessment area changed to the RAA.
6.11.5 Effects Assessment Methodology – **Thresholds for Determination of Significance**	Yes	6.11.6 Effects Assessment Methodology – **Thresholds for Determination of Significance**	• Updated significance threshold and magnitude assessment. • Reflect changes in VC baseline conditions and improve significance assessment criteria. • Response to IR2 CEAA 2-02
6.11.6 Project Activities and Terrestrial Fauna Interactions and Effects	Yes	6.11.7 Project Activities/Interaction with Terrestrial Fauna	• Updated based on revised noise and light impact assessments. • Bolster discussion of direct and indirect impacts to fauna. Include species-specific habitat loss assessment. • Changes to project timelines
6.11.7 Preferred Alternative Haul Road	Yes	Section removed	• The Preferred Alternative Haul Road is no longer being considered and has been removed from the Project Description and EIS
6.11.8 Mitigation	Yes	6.11.8 Mitigation	• Updated based on field survey results and changes to effects assessment. • Reflects improved understanding of impacts.
6.11.9 Residual Effects and Significance	Yes	6.11.9 Residual Effects and Significance	• Updated based on field survey results and changes to significance threshold determination. • Change to magnitude determination. • Reflect changes to significance threshold and magnitude assessment.
6.11.10 Proposed Compliance and Effects Monitoring Program	No	6.11.10 Proposed Compliance and Effects Monitoring Program	• Updated monitoring program.

Notes: PA = Project Area; LAA = Local Assessment Area; RAA = Regional Assessment Area; - = no update; IR2 = Round 2, Information Requests; CEAA = Canadian Environmental Assessment Agency; EIS = environmental impact statement; N/A = not applicable.

6.11.2 Rationale for Valued Component Selection

Terrestrial fauna, and the habitat upon which they rely, may be altered either directly or indirectly by proposed Project activities. While this valued component includes understanding the potential effects of the Project on all fauna, the specific survey methods are mainly driven by identification of Species of Conservation Interest (SOCI) and Species at Risk (SAR).

6.11.3 Baseline Program Methodology

Data collection on various fauna species was from targeted field surveys and incidental observations. Beaver Dam Mine Site and Haul Road methods are discussed below. Information pertaining to Touquoy Mine Site has been brought forward from the Nova Scotia Environmental Assessment Registration Document (EARD) and Focus Report. Methods and results are summarized in subheadings within the applicable sections and are carried forward into the effects assessment, where deemed appropriate. Further information regarding fauna assessments undertaken at Touquoy Mine Site is provided in the EARD (CRA 2007a) and Focus Report (CRA 2007b).

Targeted surveys were completed for bats, mainland moose, and wood turtles, which are described in Section 6.13.4. Incidental observations were recorded for all other fauna species including mammals, reptiles and amphibians, and invertebrates (including freshwater molluscs, lepidopterans, and odonates). The goal of both targeted surveys and incidental observations was to understand species presents and habitat use within the PA, specifically the Beaver Dam Mine Site and Haul Road, to allow for a discussion of Project interactions and mitigation measures.

Incidental terrestrial fauna observations were collected throughout the field seasons in 2014, 2015, 2016, and during additional field surveys in 2019 and 2020 as a result of PA modifications (Section 2 Project Description). Incidental observations of mammals and various signs of mammals were documented and photographed during all field surveys across the Beaver Dam Mine Site and Haul Road. Signs included features such as dens and nests, scat, tracks, and forage evidence. Incidental observations for priority invertebrates occurred during all field programs, particularly wetland and watercourse delineation, and fish habitat surveys. Incidental observations of odonates and lepidopterans included live adults or larvae, or cast skins. Signs of molluscs included live or dead individuals, or shells. Other than surveys associated with the mainland moose and potential bat hibernacula (e.g., abandoned mine openings [AMOs]) described in the following sections, no targeted mammal surveys were undertaken.

Terrestrial biota methods for mainland moose, bat and wood turtle surveys are outlined in Sections 6.13.3.2.4, 6.13.3.2.5 and 6.13.3.2.6, respectively (Figures 6.11-1A to 6.11-1E). An initial habitat assessment was completed throughout the Beaver Dam Mine Site and Haul Road in October 2014, May 2015 and July/August 2019. This initial assessment combined with a desktop analysis of priority species and Atlantic Canada Conservation Data Centre (ACCDC) data, determined that additional specialized surveys (i.e., in addition to those mentioned above) for priority fauna species would not be required within the Beaver Dam Mine Site and Haul Road.

6.11.3.1.1 Touquoy Mine Site

Field surveys for terrestrial fauna were conducted concurrently with vegetation, birds, and wetlands and occurred from 2004 to 2006 (CRA 2007a). Refer to the Touquoy Mine Site EARD for detailed methodology.

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FIGURE 6.11-1 A

Beaver Dam Mine Project

Terrestrial Fauna Methods

Mud Lake

Cameron Flowage

Crusher Lake

- Abandoned Mine Openings
- NSTDB Mapped Watercourses
- Wood Turtle Surveys
- Moose Transect Surveys
- Local Road
- Dry Weather / Seasonal Road
- Track
- Proposed Infrastructure
- NSE Wetlands
- Project Area

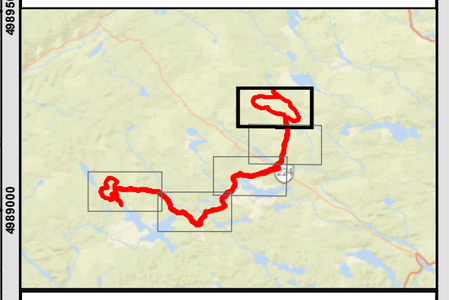

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FIGURE 6.11-1 B

Beaver Dam Mine Project

Terrestrial Fauna Methods

- NSTDB Mapped Watercourses
- Moose Transect Surveys
- Collector Road
- Local Road
- Dry Weather / Seasonal Road
- Diveways (>300 m)
- Track
- Proposed Infrastructure
- NSE Wetlands
- Project Area

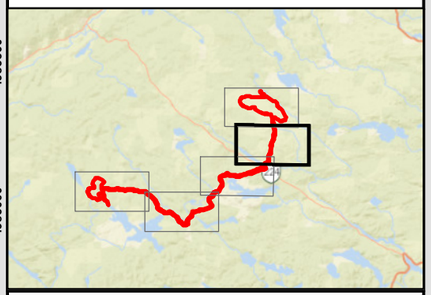

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FIGURE 6.11-1 C

Beaver Dam Mine Project

Terrestrial Fauna Methods

- NSTDB Mapped Watercourses
- Moose Transect Surveys
- Collector Road
- Local Road
- Dry Weather / Seasonal Road
- Diveways (>300 m)
- Track
- NSE Wetlands
- Project Area

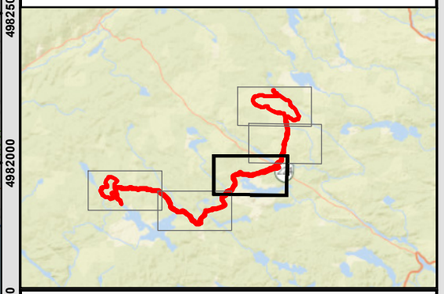

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FIGURE 6.11-1 D

Beaver Dam Mine Project

Terrestrial Fauna Methods

Prest Lake
Miller Lake
First Rocky Lake
Big Pond
Sandy Pond
Mink Lake
Johns Pond
Jackson Lake
Grassy Lake
Bear Lake

- NSTDB Mapped Watercourses
- Moose Transect Surveys
- Local Road
- Dry Weather / Seasonal Road
- Diveways (>300 m)
- Track
- NSE Wetlands
- Project Area

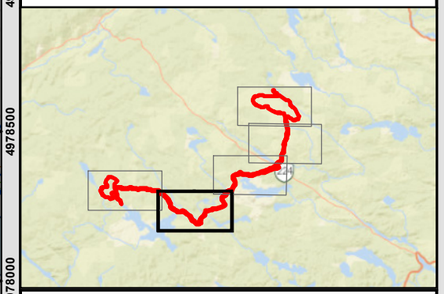

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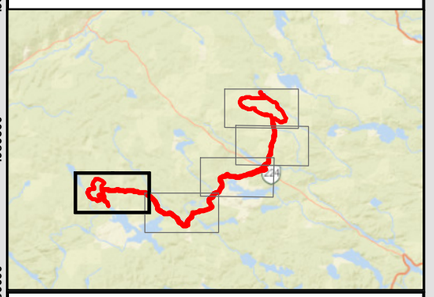
FIGURE 6.11-1 E

Beaver Dam Mine Project

Terrestrial Fauna Methods

Square Lake
Wire Lake
Loon Lake
Cope Lake
New Dam Flowage
Rocky Lake
Otter Dam Flowage
Camp Lake
Melvin Lake

- Abandoned Mine Openings
- NSTDB Mapped Watercourses
- Local Road
- Dry Weather / Seasonal Road
- Diveways (>300 m)
- Track
- Touquoy Infrastructure
- NSE Wetlands
- Project Area



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6.11.4 Baseline Conditions

6.11.4.1 Mammals

Incidental observations of mammal species were documented during all field surveys during 2014, 2015, 2016, 2019 and 2020 across the Beaver Dam Mine Site and Haul Road. Specific focus was given to priority species identified as having appropriate habitat within the Beaver Dam Mine Site and Haul Road. Species that were confirmed within the Beaver Dam Mine Site and Haul Road either visually or by sign (scat, footprints, etc.) are listed in Table 6.11-2. No additional mammal species were observed during 2019 and 2020 surveys. The presence of mainland moose, bats, and priority herpetofauna in the PA is described in Section 6.13.

Table 6.11-2: Observed Mammalian Species During 2014 to 2020 Field Surveys

Common Name	Scientific Name	Sign	COSEWIC, SARA, NSESA	S Rank
Coyote	*Canis latrans*	Tracks, scat	-	S5
American black bear	*Ursus americanus*	Tracks, scat, digs	-	S5
White-tailed deer	*Odocoileus virginianus*	Tracks, scat, browse	-	S5
Mainland moose	*Alces americana*	Tracks	NSESA Endangered	S1
American red squirrel	*Tamiasciursus hudsonicus*	Seen, tracks, middens	-	s5
American porcupine	*Erethizon dorsatum*	Seen, tracks, browse	-	S5
Snowshoe hare	*Lepus americanus*	Seen, tracks, scat	-	S5
American beaver	*Castor canadensis*	Seen, tracks, dams, lodges, felled trees	-	S5
Eastern chipmunk	*Tamias striatus*	Seen, tracks, middens	-	S5
Raccoon	*Procyon lotor*	Tracks	-	S5

Notes: The ACCDC works with provincial and federal experts to develop rarity ranks (i.e., S-ranks) for species in Nova Scotia, as well as the other Maritime Provinces, see http://www.accdc.com/en/rank-definitions.html for more information. An S-rank of S5 means that the species is Secure - Common, widespread, and abundant in the province.

COSEWIC = Committee on the Status of Endangered Wildlife in Canada; SARA = *Species at Risk Act*; NSESA = *Nova Scotia Endangered Species Act;* S Rank = Species Rank.

Other common mammal species, such as red fox (*Vulpes vulpes*), bobcat (*Lynx rufus*), raccoon (*Procyon lotor*), short-tailed weasel (*Mustela erminea*), American mink (*Neovison vison*), muskrat (*Ondatra zibethicus*), and striped skunk (*Mephitis mephitis*) are likely to inhabit the Beaver Dam Mine Site and Haul Road or surrounding areas, at least periodically.

6.11.4.1.1 Touquoy Mine Site

Evidence of red fox, American red squirrel (*Tamiasciursus hudsonicus*), coyote (*Canis latrans*), snowshoe hare (*Lepus americanus*), American black bear, and white-tailed deer (*Odocoileus virginianus*) were observed during field surveys in 2004, 2005, and 2006. Although not observed, suitable habitat was recognized for racoon, striped skunk, bobcat, meadow vole (*Microtus pennsylvanicus*), Southern red-backed vole (*Myodes gapperi*), Eastern chipmunk *(Tamias striatus*), and short-tailed shrew *(Blarina brevicauda*) (CRA 2007a).

6.11.4.1.2 Mainland Moose

Mainland moose have been recorded within 3.4 kilometres (km) of the Beaver Dam Mine Site, and within 7.5 km of the Haul Road (ACCDC; Appendix I.1). Tracking surveys were completed for the purpose of determining the presence of moose within the Beaver Dam Mine Site and Haul Road as per methodology described Section 6.13.3.2.4.

No mainland moose signs were observed incidentally or during dedicated moose surveys along the Haul Road, by the Project Team. While Project surveys did not confirm presence of moose along the Haul Road, a local Mooseland resident recorded a moose observation near the proposed Haul Road, which was published in the Halifax Examiner on December 23, 2020. The specific time and location of this observation was not confirmed.

Mainland moose tracks were observed within the Beaver Dam Mine Site during the dedicated PGI survey on May 24, 2015 in disturbed roadside habitat north of Wetland 56. Moose tracks were also observed incidentally in two locations on September 9, 2014. One set of tracks was observed in Wetland 210 and a second set of tracks was observed adjacent to Wetland 206, just north of the Beaver Dam Mine Site (Figure 6.11-2). These findings will be discussed further in Section 6.13.

6.11.4.1.3 Touquoy Mine Site

Mainland moose tracks were observed within the Touquoy Mine Site in a bog during field surveys to support the Touquoy EARD in 2006. Moose are known to the Tangier Grand Lake Wilderness Area, and evidence of moose is reported every year by NSL&F in the Moose River Gold Mines area during deer pellet surveys (CRA, 2007a).

6.11.4.1.4 Bats

According to the ACCDC reports, no known bat hibernaculum are present within 5 km of the Haul Road or Beaver Dam Mine Site (Appendix I.1). The closest known bat hibernacula is located at the Lake Charlotte Gold Mine, approximately 25 km southeast of the intersection of the proposed Haul Road and Mooseland Road (approximately 45 km from the Beaver Dam Mine Site) (Moseley, 2007).

Provincial government records of AMOs were reviewed within the boundary of the Beaver Dam Mine Site and Haul Road, as these AMOs potentially provide bat hibernacula. Eighteen AMOs were identified within the Beaver Dam Mine Site and 99 were identified within a 10 km buffer of the Haul Road. A desktop review (described above) identified that the cluster of 99 AMOs located 6.4 km from the Haul Road do not provide potential bat hibernacula. Eighteen AMOs within the Beaver Dam Mine Site were evaluated for their potential to provide bat hibernacula on September 18, 2014. Of the 18 AMOs evaluated at the site, all were either in-filled, contained a concrete cap blocking access, or were flooded, with the exception of one (BED-1-003), which was identified during the desktop evaluation as a potential bat hibernaculum. This AMO known as the J.H. Austin Main Shaft (AMO Database BED-1-003; NSDNR, 2010) is located on Beaver Dam Road, Halifax County at UTM Zone 20, 522256 Easting and 4990298 Northing. It is located just east of the Beaver Dam Mine Access Road at the western end of the existing settling pond southwest of Cameron Flowage. The locations of AMOs are shown in Figures 6.11-1A and 6.11-1E. It was determined to be inaccessible to bats, as described further in Section 6.13.4.4.2. No bats, or evidence thereof, were observed incidentally during biophysical surveys, particularly bird surveys which are conducted when bats are more active.

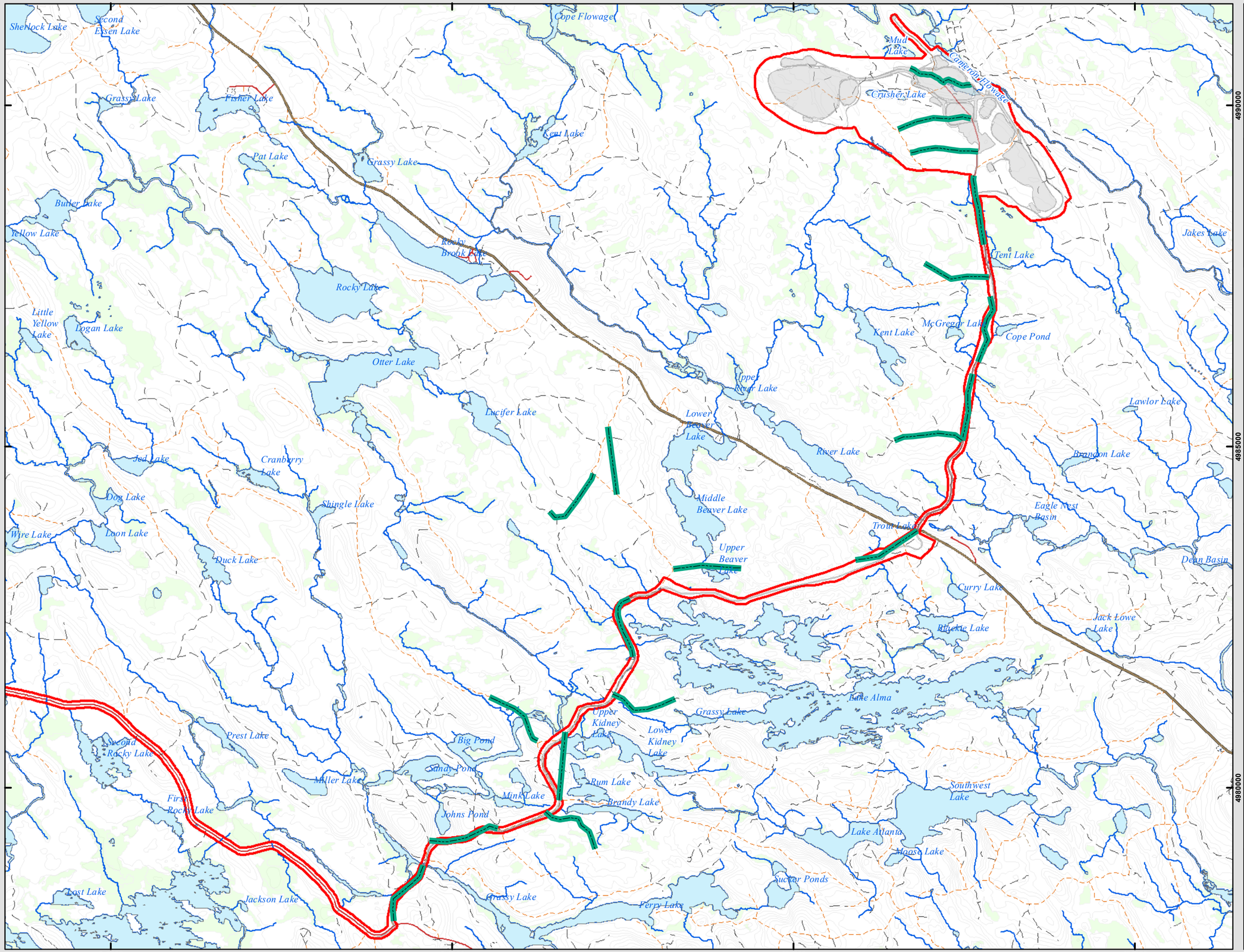

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FIGURE 6.11-2

Beaver Dam Mine Project

Mainland Moose Survey Transects

- Moose Survey Transects
- NSTDB Mapped Watercourses
- Collector Road
- Local Road
- Dry Weather / Seasonal Road
- Diveways (>300 m)
- Track
- Trail
- Topo Contours (5 m)
- Proposed Infrastructure
- NSE Mapped Wetlands outside PA
- Project Area



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 625 1,250 2,500 m

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6.11.4.1.5 Touquoy Mine Site

According to CRA (2007a), NSL&F has extensively surveyed more than 100 AMOs mapped in close proximity to the Touquoy Mine Site (within 500 metres (m) of the Moose River Gold Mines Provincial Park). As per communications cited with E. Hennick; NSL&F, these openings are either blocked or filled with water, therefore, suitable habitat for bat hibernacula is not present.

6.11.4.2 Herpetofauna

Herpetofauna species were inventoried within the Beaver Dam Mine Site and Haul Road through both targeted searches of appropriate habitats and through incidental observations during all field surveys during 2014, 2015, 2016, 2019 and 2020. One additional herpetofauna species, snapping turtle (*Chelydra serpentina*, SARA Special Concern, NSESA Vulnerable, S3), was observed within the Beaver Dam Mine Site in 2019. However, snapping turtle had been previously observed near the Touquoy Mine Site outside field surveys. Specialized survey methods used to identify wood turtles and their habitat are described in Section 6.13.

Species that have been observed, either directly or indirectly (through vocalizations, egg masses, cast snake skins, etc.) within the Beaver Dam Mine Site and Haul Road during the various field programs completed throughout the site, (primarily wetland and watercourse assessments) are provided in Table 6.11-3.

Suitable habitat for the snapping turtle was observed within the Beaver Dam Mine Site and Haul Road. One female snapping turtle and active nest was observed by DFO within the Bever Dam Mine Site on June 27, 2019 (Figure 6.13-1A). Previously, one snapping turtle was observed incidentally on the Haul Road on June 26, 2016, during avifauna surveys. This snapping turtle was observed along Mooseland Road near PC45 (UTM: 20T 507085E, 4981506N). Two other incidental snapping turtle observations were made within the vicinity of the Touquoy Mine Site, as discussed below (Figure 6.13-1G). These species are discussed further in Section 6.13.

Though not observed, it is likely that other common herpetile species use habitat within the Beaver Dam Mine Site and Haul Road, at least periodically. These species include the mink frog (*Rana septentrionalis*), pickerel frog (*Rana palustris*), yellow-spotted salamander (*Ambystoma maculatum*), northern red-bellied snake (*Storeria occipitomaculata occipitomaculata*), and northern ring-necked snake (*Diadophis punctatus edwardsii*).

Table 6.11-3: Observed Herpetofauna Species During 2014 to 2020 Field Surveys

Common Name	Scientific Name	S Rank	SARA/ COSEWIC	NSESA
Eastern American toad	*Anaxyrus americanus americanus*	S5	-	-
Smooth greensnake	*Opheodrys vernalis*	S4	-	-
Red-spotted newt	*Notophthalmus viridescens viridescens*	S5	-	-
Red-backed salamander	*Plethodon cinereus*	S5	-	-
Spring peeper	*Pseudacris crucifer*	S5	-	-
American bullfrog	*Lithobates catesbeiana*	S5	-	-
Green frog	*Lithobates clamitans*	S5	-	-
Northern leopard frog	*Lithobates pipiens*	S5	-	-
Wood frog	*Lithobates sylvatica*	S5	-	-
Maritime garter snake	*Thamnophis sirtalis pallidulus*	S5	-	-
Snapping turtle	*Chelydra serpentina*	S3	Special Concern	Vulnerable

COSEWIC = Committee on the Status of Endangered Wildlife in Canada; SARA = *Species at Risk Act*; NSESA = *Nova Scotia Endangered Species Act*; S Rank = Species Rank; - = not applicable.

6.11.4.2.1 Touquoy Mine Site

No wood turtle or suitable habitat were observed within the Touquoy Mine Site during wood turtle habitat surveys conducted in 2004 (CRA 2007a). No snapping turtles were recorded within the Touquoy Mine Site during the EARD process, however, on June 26, 2016 a snapping turtle was observed within the LAA by AMNS, north of the Touquoy Mine Site, on Moose River Road (20T 504304E, 4981602N). From June 19 to mid-July, 2017 two snapping turtles were frequently observed by AMNS. One was found along Moose River Road (20T 504304E, 4981602N), at the location identified above. The second snapping turtle was observed on Higgins Mines Road (20T 504380E, 4980699N) west of the PA, but within the LAA. Snapping turtles were frequently observed (16 observations) by AMNS between June 19, 2017 and July 2, 2020, primarily on roadsides near Moose River and Scraggy Lake.

6.11.4.3 Summary of Fauna and Habitat within the Project Area

The variety of both upland and wetland habitats identified throughout the Beaver Dam Mine Site and Haul Road support a range of terrestrial fauna. The PA is located in a relatively remote, undeveloped landscape. Timber harvesting and associated forestry roads form the dominant disturbance regime within the landscape surrounding the PA. This land use within and surrounding the PA has created edge habitats and openings in the canopy coverage to provide foraging opportunities for species such as white-tailed deer, black bears, and coyote. Evidence of these species, along with snowshoe hare and porcupine, were abundant in disturbed habitats throughout the Beaver Dam Mine Site. Beavers and beaver activity have been observed in multiple waterbodies within the Beaver Dam Mine Site, particularly within Crusher Lake. All of the mammal species identified are presumed to use parts of the Beaver Dam Mine Site and Haul Road for foraging, breeding, denning, and raising young, at least periodically.

Herpetofauna species were observed throughout the Beaver Dam Mine Site and Haul Road, generally in association with an aquatic ecosystem, such as wetlands, waterbodies, and watercourses. Where improperly installed culverts are present along the existing Haul Road, many wetlands have standing water which is backed up as a result of improper culvert installation. These open-water wetlands, and natural wetlands with similar hydrologic regimes, are known to support breeding and overwintering populations of a variety of herpetofauna observed.

Incidental sightings of fauna were recorded during all field programs throughout the Beaver Dam Mine Site and Haul Road during all seasons. Aside from mainland moose tracks and snapping turtle sightings, no priority fauna species or signs thereof were observed. ACCDC records show a monarch butterfly (*Danius plexippus*, SARA Special Concern, CSEWIC Endangered, NSE Endangered, S2B) observation with the Beaver Dam Mine Site ((ppendix I.1), however no monarchs or its' host breeding species (milkweed, *Asclepias syriaca*) were recorded through all field studies (Section 6.13.4.7). Given the mobility of fauna species, the absence of observation does not confirm absence of the species within the Beaver Dam Mine Site and Haul Road. The size of a species and a species' behaviour can result in a bias against detection. For instance, very small species, such as the maritime shrew (S3) and the rock vole (S2) have been documented within 5 km of the Beaver Dam Mine Site and Haul Road but were not observed by the Project Team. As another example, the fisher (Martes pennanti, S2) is a largely nocturnal hunter, with large home ranges and elusive behaviour. They prefer dense, mature to over-mature coniferous stands with large hollow snags for den sites. Their preferred habitat and prey items (porcupine, rabbits, squirrels and other small mammals) are present within the Beaver Dam Mine Site and Haul Road. The lack of observed evidence of fisher does not confirm absence of the species. Furthermore, weather conditions can affect the detectability of species. Rain or snow can wash away or cover animal tracks and scat, while temperature affects the activity levels of herpetofauna and, therefore, their detectability. When there is a thermal advantage to staying under water or immersed in wetland vegetation, herpetofauna can be more difficult to detect, compared with warmer days when they can be found basking in the sun.

6.11.5 Consideration of Engagement Results

Key issues raised during public and Mi'kmaq engagement relating to terrestrial fauna include potential effects on fauna from permanent loss of habitat associated with the footprint of the Beaver Dam Mine Site and Haul Road, as well as direct mortality associated with the hauling operation. Potential effects on traditional uses of land and resources by the Mi'kmaq were noted, including hunting and trapping of small game and deer.

The results of the public and Mi'kmaq engagement have been considered in the environmental effects assessment, including AMNS's commitments on mitigation and monitoring measures and proposed compliance and effects monitoring programs, as well as AMNS's broader commitment to ongoing public and Mi'kmaq engagement (Sections 3 and 4). Specific to evaluating the effect on terrestrial fauna, these are found within the following environmental effects assessment.

6.11.6 Effects Assessment Methodology

6.11.6.1 Boundaries

6.11.6.1.1 Spatial Boundaries

The spatial boundaries used for the assessment of Project effects to terrestrial fauna is described below.

- The PA (Section 5.5, Figure 5.5-1) consists of the three project components; Beaver Dam Mine Site, Touquoy Mine Site, and the Haul Road and extends from Marinette to Moose River Gold Mines, Halifax County, NS. The Beaver Dam Mine Site is located at the eastern end of the Beaver Dam Mines Road. The Haul Road spans from the Beaver Dam Mine Site to Moose River Gold Mines, where the Touquoy Mine Site [processing and exhausted pit (to be used to dispose Beaver Dam tailings)] is located. The PA has changed as a result of the expansion of the Beaver Dam Mine Site to accommodate micro-sitting of mine infrastructure and ongoing modifications to the Haul Road design, as described in Section 2. These changes have been captured under the existing and additional desktop and field evaluations.
- The LAA (Figure 6.11-3) consists of a 5 km buffer surrounding the Beaver Dam Mine Site and a 500 m buffer surrounding the Haul Road and Touquoy Mine Site components of the PA. The LAA boundaries were defined considering the maximum expected extent of direct and indirect impacts to terrestrial fauna. The LAA has been modified to reflect the changes in the PA.
- The RAA (Figure 6.11-3 encompasses NSL&F's Ecological Land Classification Ecodistrict 440 (Eastern Interior) within Halifax Regional Municipality (HRM), east and north of Lake Charlotte. Where the Ecodistrict boundary approached the northern extent of the Beaver Dam Mine Site, the RAA was enlarged to include a minimum 5 km buffer around the PA. This Ecodistrict spans an area broader than the expected Project impacts and considers other project boundaries as per cumulative effects methodology. These spatial boundaries will help to identify the direct or indirect impacts to terrestrial fauna species and habitats.

Assessment of terrestrial fauna will be completed in consideration of the RAA as the primary spatial boundary. All spatial boundaries will help to identify the direct or indirect impacts to terrestrial fauna and the effects of the Project on distribution and abundance of these species.

6.11.6.1.2 Temporal Boundaries

The temporal boundaries used for the assessment of effects to terrestrial fauna are the construction, operation, active closure, and post-closure phases.

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FIGURE 6.11-3

Beaver Dam Mine Project

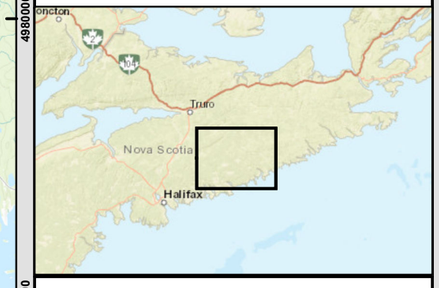
Spatial Boundaries: Terrestrial Fauna

Beaver Dam Mine Site

Touquoy Mine Site

Haul Road

- Project Area
- Terrestrial Fauna Local Assessment Area
- Terrestrial Fauna Regional Assessment Area



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Units: Meter

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6.11.6.1.3 Technical Boundaries

No technical boundaries were identified for the effects assessment of terrestrial fauna.

6.11.6.1.4 Administrative Boundaries

Administrative boundaries for management of terrestrial fauna include the *Nova Scotia Wildlife Act*, which protects wild species diversity and abundance, and the *Canada Wildlife Act*. Further protection is offered to SAR through the provincial *Nova Scotia Endangered Species Act* and the federal *Species at Risk Act*.

6.11.6.2 Thresholds for Determination of Significance

A significant adverse effect from the Project on terrestrial fauna is defined as an effect that is likely to cause a permanent, unmitigated, alteration to habitat that supports fauna species. An adverse effect that does not cause a permanent alteration of habitat is considered to be not significant. Significance criteria related to impacts to SOCI and SAR are presented in Section 6.13.

The following logic was applied to assess the magnitude of a predicted change in terrestrial fauna, based on the habitat analysis results described in Section 6.10.4.5:

- **Negligible** – the Project is predicted to result in less than 1% direct loss of habitat types used by observed species within the LAA.
- **Low** – the Project is predicted to result in 1 to 5% direct loss of habitat types used by observed species within the LAA, and the loss of habitat is mitigated in the long term through reclamation planning and other mitigation measures as determined to be necessary based on flora species and communities present.
- **Moderate** – the Project is predicted to result in 5 to 25% direct loss of habitat types used by observed species within the LAA and the loss of habitat is mitigated in the long term through reclamation planning and other mitigation measures as determined to be necessary based on flora species and communities present.
- **High** – the Project is predicted to result in greater than 25% direct loss of habitat types used by observed species within the LAA and the loss of habitat is not mitigated in the long term through reclamation planning and other mitigation measures as determined to be necessary based on flora species and communities present.

The Habitat and Flora LAA was used to determine habitat type and area, and resultant habitat loss for species (Section 6.10.7.1).

The timing of residual effects for terrestrial fauna considers when the residual environmental effect is expected to occur, considering seasonal aspects. The duration of residual effects considers the time frame over which the effects are likely to last, ranging from short-term to permanent. For the purpose of the effects assessment related to terrestrial fauna, long term reflects the commencement of reclamation activities. The frequency of residual effects considers the rate of recurrence of the effects, ranging from once to continuous. The reversibility of residual effects considers the time required for habitat to recover to naturalized conditions, or whether the changes to habitat, if identified, are permanent.

6.11.7 Project Activities/Interactions with Terrestrial Fauna

The assessment of potential adverse interactions and effects of the Project on this VC takes into account the potential for the Project to result in changes to:

- permanent and temporary habitat alteration and fragmentation;
- disturbance and/or displacement;
- potential for direct and indirect mortality to individuals; and
- sensory disturbance.

The potential interactions of the Project with terrestrial fauna and their habitat are presented in Tables 6.11-4 to 6.11-6.

6.11.7.1 Habitat Use and Direct Loss

Development of the Beaver Dam Mine Site infrastructure and upgrades to the Haul Road will cause direct impacts to habitat used by terrestrial fauna, including upland forested habitat and wetlands. This will occur mostly within the construction phase of the Project. Habitat within the PA and surrounding landscape currently exhibits disturbed and fragmented conditions based on historic mine operations, existing road and trail networks, and current and historic timber harvesting activity within and adjacent to the PA (Section 6.10.4). However, project activities are still likely to result in direct habitat loss, increased habitat fragmentation and a decrease in habitat quality for those species which rely especially on interior forest conditions (Sections 6.11.7.2 and 6.11.7.4), where intact interior forest remains. The level of disturbance within the Beaver Dam Mine Site disproportionately affects uplands over wetlands. There exists large, natural, wetland habitats within the Beaver Dam Mine Site (e.g., Wetlands 2 and 29) that are not anticipated to be impacted by the Project. The habitat types and areas, including anthropologic disturbances, that will be impacted by the Project are presented in Section 6.10.7.1.

Considering the terrestrial fauna observed and expected within the Beaver Dam Mine Site and Haul Road, many are generalist that use a variety of habitat types for different life stages and functions. Many of the observed species are adaptable and commonly use anthropogenically disturbed environments (e.g., coyote, black bear, raccoon, white-tailed deer). Coyotes utilize regenerating harvested forest stands and edges of disturbed forest as well as intact forests with abundant understory which represent foraging sites for prey, such as deer and rodents (Crimmins et al. 2012). Black bears are noted to use a variety of habitats, but predominantly inhabit deciduous and coniferous forests, including recently harvest areas with high fruit and berry production (Lariviere 2001). Denning species (e.g., coyote and black bear) favour more protected sites such as shrub or forested areas for denning (Quinn 1990; Lariviere 2001). Semiaquatic species, such as beaver, utilize wetland and aquatic habitats, and adjacent uplands, for critical life functions (Allen 1982). There is currently beaver activity and suitable habitat across the Beaver Dam Mine Site. There is a recent dam and active lodge within Wetland 59, which will be directly impacted by the open pit. Ungulate species (i.e., white-tailed deer and moose) use upland forests and shrub areas for cover and foraging, including early-successional and previously harvested stands. Dense conifer stands are preferred in the winter, which provide reduced snow depth and thermal protection (Timmermann and McNicol 1988). Moose also require aquatic and wetland habitat for summer thermoregulation, calving and foraging (Timmermann and McNicol 1988).

Table 6.11-4: Potential Project Activities/Interactions with Terrestrial Fauna at Beaver Dam Mine Site

Project Phase	Duration	Project Interactions
Construction	1 year	• Clearing, grubbing, and grading in preparation of construction • Rock blasting in preparation of construction (e.g., pre-stripping) • Till and waste rock from site preparation transport and storage • Watercourse and wetland alteration in preparation of construction, including open pit dewatering • Surface infrastructure installation and construction • Collection ditches and settling pond construction • Local traffic bypass road construction • Mine Site road construction and lighting • Culvert and bridge upgrades and construction • General noise and lighting from construction activities • Wildlife vehicle interactions/collisions
Operations and Maintenance	5 years	• Drilling and rock blasting to access and extract ore • Management of waste rock produced from crushing and preparing ore for transport • Till and waste rock from site preparation transport and storage • Open pit dewatering • Site maintenance • Treatment of site surface water runoff and surface mine pumped water • General management of wastes derived from operation and maintenance activities • Petroleum products management • Dust management • Culvert and bridge maintenance • General noise and lighting from construction activities • Wildlife vehicle interactions/collisions
Active Closure	2 years	• Site reclamation activities • Water treatment and management • Noise and lighting from decommissioning activities • Wildlife vehicle interactions/collisions
Post-closure	10+ years (monitoring)	• Water treatment and management

Table 6.11-5: Potential Project Activities/Interactions with Terrestrial Fauna along Haul Road

Project Phase	Duration	Project Interactions
Construction	1 year	• Clearing, grubbing, and grading in preparation of construction • Rock blasting in preparation of construction • Till and waste rock from site preparation transport and storage • Watercourse and wetland alteration in preparation of construction • Haul Road construction and upgrades • Auxiliary infrastructure installation and construction • Local traffic bypass road construction • Culvert and bridge upgrades and construction • General noise and light from construction activities • Wildlife vehicle collisions
Operations and Maintenance	5 years	• Ore extraction and transport form Beaver Dam Mine Site to Touquoy Mine Site • Haul Road maintenance and repairs, including snow removal and deposition of sand for traction control • Dust management • Noise and light from Haul Road activity • Wildlife vehicle interactions/collisions
Active Closure	2 years	• N/A[(a)]
Post-closure	10+ years (monitoring)	• N/A

[(a)] Decommissioning and Reclamation of the Haul Road is not expected. The Haul Road will be returned to owner for forestry industry.

Table 6.11-6: Project Interactions for Fauna

Impact Type	Direct Impact	Project Phase	Indirect Impact	Project Phase
Vegetative and Habitat Integrity	Loss of vegetative cover through clearing and grubbing decreases wildlife habitat availability and Project development also has the potential to reduce natural surface water drainage.	C	Habitat fragmentation may alter habitat suitability for those species which rely on interior forest conditions. Within the Haul Road, this change in habitat is expected to be permanent.	C, O, CL
Sensory Disturbance	Extensive ground works, including activities such as blasting will increase noise levels. Increase in vehicular traffic will add to sensory disturbance through increased noise. This has the potential to reduce habitat for fauna.	C, O, CL	Sensory disturbance (both lights and noise) may result in further avoidance of the PA by some species.	C, O
	The Beaver Dam Mine Site and Touquoy Mine Site will have lights which are operational at all times, which can alter habitat quality and circadian cycles within the immediate vicinity of the PA. This may decrease efficiency of nocturnal hunters.	C, O	Some opportunistic wild species may be attracted to the site as a result of increased access and available food sources (natural prey or anthropogenic food sources), potentially increasing interactions between site personnel and wildlife.	C, O
Direct Mortality	Increased traffic and general activity within the PA may result in direct mortality to wild species through vehicular collisions and construction.	C, O, CL	Improved access throughout the Beaver Dam Mne Site and as a result of Haul Road construction/upgrades may increase hunting activity of licensed hunters and/or illegal poachers.	C, O, CL

Notes: C = Construction; O – Operations; CL = Active Closure; m = metre; PA = Project Area.

Herpetofauna observed ranged from aquatic to terrestrial. Aquatic and semiaquatic herpetofauna require slow moving fresh water for all or critical life functions. Snapping turtle is generally more aquatic than other turtle species, and require shallow aquatic environments for overwintering/hibernations, breeding and cover. Snapping turtle can tolerate and utilize disturbed areas, such as systems with poor water quality and anthropogenic features for nesting (e.g., berms, roadsides; ECCC 2020). Observed terrestrial reptiles (i.e., smooth greensnake and Maritime garter snake) occupy a variety of habitat types for different life functions (e.g., thermoregulation, hibernation, hunting) including uplands, wetlands and disturbed areas (CWF 2021).

A habitat loss by observed fauna species (or species group) based on the habitat analysis described in Section 6.10.4.5 is presented in Table 6.11-7. Specific habitat requirements (i.e., wetland type) were not distinguished and, conservatively, the broader habitat types from Section 6.10.3.5 were used to assess habitat loss by observed species. Based on the definitions of magnitude of impact, it is anticipated that all impacts to habitat types used by observed terrestrial fauna will be low, with the exception to anthropogenic disturbances (Section 6.10.7.1.1, Table 6.10-9). Specific habitat requirements, loss and impacts to observed SAR and SOCI (i.e., mainland moose and snaping turtle) are further discussed in Section 6.8.7.2 and Section 6.13.

Table 6.11-7: Habitat Use and Loss within the Project Footprint and Magnitude of Impact

Species or Species Group	Habitat Type Used	Area within the LAA (Ha)	Area within Project Footprint (BD Mine Site and HR) (Ha)	% of habitat type within the LAA directly impacted by the Project	Magnitude of Impacts to Habitat within LAA
Coyote	Hardwood Dominant Stands Softwood Dominant Stands Other[a] Managed Forests[b]	4,857.6	217.7	4.5	Low
	Anthropogenic Disturbances[c]	20.3	13.4	66.0	N/A[d]
American black bear	Hardwood Dominant Stands Softwood Dominant Stands Other[a] Managed Forests[b] Barrens (includes rock barrens)	4,873.9	217.7	4.5	Low
	Anthropogenic Disturbances[c]	20.3	13.4	66.0	N/A[d]
White-tailed deer	Hardwood Dominant Stands Softwood Dominant Stands Other[a] Managed Forests[b]	4,857.6	217.7	4.5	Low
Mainland moose	Hardwood Dominant Stands Softwood Dominant Stands Other[a] Managed Forests[b] Lakes, Ponds, Beaver flowage Wetlands (includes all wetland classes)	5,910.5	230.5	3.9	Low
Terrestrial Rodents	Hardwood Dominant Stands Softwood Dominant Stands Other[a] Managed Forests[b]	4,857.6	217.7	4.5	Low
	Anthropogenic Disturbances[c]	20.3	13.4	66.0	N/A[d]

Table 6.11-7: Habitat Use and Loss within the Project Footprint and Magnitude of Impact (continued)

Species or Species Group	Habitat Type Used	Area within the LAA (Ha)	Area within Project Footprint (BD Mine Site and HR) (Ha)	% of habitat type within the LAA directly impacted by the Project	Magnitude of Impacts to Habitat within LAA
American beaver	Lakes, Ponds, Beaver flowage Wetlands (includes all wetland classes)	1,052.9	12.8	1.2	Low
Raccoon	Hardwood Dominant Stands Softwood Dominant Stands Other[a] Managed Forests[b]	4,857.6	217.7	4.5	Low
	Anthropogenic Disturbances[c]	20.3	13.4	66.0	N/A[d]
Aquatic/Semiaquatic Herpetofauna	Lakes, Ponds, Beaver flowage Wetlands (includes all wetland classes)	1,052.9	12.8	1.2	Low
	Anthropogenic Disturbances[c]	20.3	13.4	66.0	N/A[d]
Terrestrial Reptiles (snake species)	Hardwood Dominant Stands Softwood Dominant Stands Other[a] Managed Forests[b] Lakes, Ponds, Beaver flowage Wetlands (includes all wetland classes) Barrens (includes rock barrens)	5,926.8	230.5	3.9	Low
	Anthropogenic Disturbances[c]	20.3	13.4	66.0	N/A[d]

[a] Includes unmerchantable timber, often which is regenerative stands and stands which were not categorized as hardwood or softwood stands.

[b] Managed forests include plantations, cutblocks, selective cuts etc.

[c] Includes roads, railways, urban development, quarries, gravel pits, mining activity etc.

[d] Not carried forwarded into impact magnitude determination (see Section 6.10.4.5)

Note: The Habitat and Flora LAA was used to determine habitat type and area, and resultant habitat loss for species (Section 6.10.7.1).

6.11.7.2 Habitat Fragmentation

Connectivity can be defined as the basic ecological requirement to be able to move freely within areas that provide critical functions for a species, and habitat fragmentation is the disturbance of this movement. Connectivity is critical for maintaining biodiversity and healthy species populations and interior forests are often an important feature that supports this movement (NSDNR, 2015b).

The methodology described in Section 6.10.3.6 was used to simulate current conditions for interior forest at the RAA level as a proxy for habitat availability and fragmentation, and wildlife movement. Road density has been identified as an excellent indicator of ecological integrity and potential predictor of habitat suitability for large mammals, like moose, as roads are closely correlated with human development (Snaith et al, 2002). Mainland moose are particularly susceptible to habitat fragmentation as it constrains their movement and habitat use, while increasing other pressures like predator and human interference (Snaith et al, 2002). Snaith et al. (2002) found that road density had a significant negative correlation with the probability of mainland moose observations in Nova Scotia, and potentially more indicative of habitat selection than habitat composition alone.

The current condition of the Beaver Dam Mine Site is disturbed and fragmented habitat based on timber harvesting and historic mining activity. A network of roads and trails is present throughout the site, with parts of the Beaver Dam Mine Site characterized by un-vegetated gravel and crushed stone. The RAA is generally remote, with a moderate network of roads and forestry activity, though large tracts of forest landscape undisturbed by roads still exist in this region (NSDNR, 2015b). The extent of the simulated existing disturbance and edge effect and remaining predicted interior forest patches for the RAA is shown in Figure 6.10-6. A total of 72,663 hectares (ha) of predicted interior forest has been identified within the RAA. The maximum Project edge effect as discussed in Section 6.10.7.1.2, and will affect 237 ha of interior forest habitat, which accounts for 0.3% of predicted interior forest in the RAA.

While Project activities are expected to result in increased habitat fragmentation and a decrease in habitat quality (e.g., sensory disturbance), the level of new fragmentation associated with the Beaver Dam Mine Site is anticipated to be low, given the current level of disturbance within the PA. The Beaver Dam Mine Site infrastructure footprint is situated primarily on an area of high existing disturbance and is expected to only have fringe effects on the interior forest availability. There will be minimal isolation of habitat that is currently contiguous, limited to the patch of potential interior forest west of the NAG waste rock stockpile (Figure 6.10-6). Undisturbed, unfragmented habitat is present in the RAA, including large tracts maintained around the PA, particularly to the north. Accessible routes to provide movement through and across the region at the LAA and RAA level still exist for wildlife and are un-impacted by the development of the Project. Those species which prefer interior forest conditions (e.g., fisher, moose) are likely already avoiding the Beaver Dam Mine Site, while those species which prefer fragmented habitat (e.g., coyote, snowshoe hare, white-tailed deer) are not expected to be adversely affected by additional habitat fragmentation.

Road construction can decrease habitat quality through direct habitat loss, degradation, and fragmentation (Underhill and Angold, 2000). For some species (e.g., porcupine), the construction can be beneficial by providing new foraging opportunities, while species that rely on interior forest conditions (e.g., fisher) are likely to avoid areas with new construction in favor of more undisturbed habitats. Local level changes in abundance and distribution of species may occur as the result of Project activities, but it is not anticipated that any of these changes will result in changes in overall fauna populations.

Construction of the Haul Road will involve a combination of new road construction (4 km) and upgrades to the existing logging road. The majority of the proposed Haul Road (i.e., approximately 30 km) follows an existing road corridor, thereby limiting new habitat fragmentation. The existing Haul Road is used by lumber trucks, but the level of traffic varies seasonally and annually depending on which areas are undergoing timber harvesting. The 4 km section of new road immediately southwest of Highway 224 will add new habitat fragmentation to an area that has very little, if any, evidence of anthropogenic disturbance. Along this section of the Haul Road, 112 ha of potential interior forest will be impacted (Figure 6.10-6), which will increase habitat fragmentation and decrease the habitat quality for those species that rely on interior forest. Much of this area is classified as Old Forest, which can provide unique habitat functions for fauna. All efforts will be made during the detailed planning of the road layout to minimize impacts to this habitat (Section 6.10.8). Other documented Old Forest areas are present within the region, unimpacted by Project development, to the north and southwest of the PA

6.11.7.3 Direct Mortality

Direct mortality of fauna species could result from Project activities, particularly due to the increase in traffic during construction and operation of the facility. Increased traffic poses a risk to wildlife along mining roads within the Beaver Dam Mine Site and along the entire length of the Haul Road between the Beaver Dam Mine Site and the Touquoy Mine Site.

According to Fahrig and Rutwinski (2009), road construction can have greater impacts on amphibians and reptiles, and large mammals, compared with small mammals and birds. Road infrastructure and traffic have a negative impact on those species which are attracted to roads but lack the speed or reaction time to avoid traffic (e.g., turtles attracted to gravel roadsides for nesting). Small mammals and birds, on the other hand, are able to avoid collisions with vehicles in general. Amphibians in particular can benefit from culvert installation where wetlands and watercourses intersect roads, as an alternative to crossing the roads, because this group can experience high mortality (Bouchard et al., 2009).

The risk of collisions with wildlife will vary depending on the season and the species. For instance, during winters with deep snow conditions, white-tailed deer are more likely to use roads and trails, putting them at an elevated risk of collisions. During spring and summer, porcupine and skunk forage on roadside vegetation at dawn and dusk, increasing the risk of collisions with those species, and turtles are drawn to the roadside to nest in the gravelly shoulders in June. As such, the risk of wildlife collisions is present at any time of year.

Traffic volumes will also increase (Section 6.1.7) due to haul truck traffic and traffic from site personnel. The Project expects a maximum of 190 round trips along the length of the Haul Road up to 16 hours a day during the first two years of operation, decreasing in subsequent years. The increased level of traffic poses an increased risk to wildlife collisions, particularly along the Haul Road, where the speed limit is proposed to be 70 kilometres per hour (km/hr). The risk of collisions within the Beaver Dam Mine Site will be lower, as the speed limit will be reduced to 40 km/hr., giving both drivers and wildlife more reaction time to avoid collisions. While no obvious wildlife corridors were observed within the Beaver Dam Mine Site and Haul Road, it is anticipated that some wild species (e.g., herpetofauna) will use watercourses and wetland complexes as travel corridors, thereby increasing the risk of collisions with wildlife along these systems where they interact with the Haul Road and interior mining roads.

Indirect impacts or mortality could also result from exposure to contaminants or spills from unplanned incidents.

6.11.7.4 Sensory Disturbance

The indirect effects of the Project on terrestrial fauna can largely be attributed to decreased habitat quality through sensory disturbance, specialty noise and light. Sensory disturbance would result from rock blasting, clearing and grubbing, infrastructure construction, lighting and operations, internal mine traffic and traffic along the Haul Road during operations. Blasting will within the Beaver Dam Mine Site during the operation phase. This along with other construction and operation activities will increase sensory disturbance above current conditions and will, as described above, reduce the habitat quality for some species.

Sensory disturbance will likely result in the localized wildlife avoidance of the PA, particularly in close proximity to the Beaver Dam Mine Site infrastructure footprint and Haul Road. Overall, Project activities will likely cause a change in usage of the PA by wildlife, with some species tending to avoid the area, while others may be attracted to the increased activity, including opportunistic species such as coyotes, raccoons, skunks, or black bears. Sensory disturbance related to Project activity will occur within the Beaver Dam Mine Site, Haul Road, and within the Touquoy Mine Site, as the addition of material from the Beaver Dam mine will extend the life of the Touquoy Mine Site by five years.

6.11.7.4.1 Noise

Existing ambient noise (measured in 2014) around the Beaver Dam Mine Site had an average value of 33 decibels (dBA) ±. As such, in the noise model, baseline noise levels were assumed to be 33 dBA during the day and 27 dBA at night (Section 6.1.7, Table 6.1-3). The predicted noise levels at the boundaries of the Beaver Dam Mine Site during operations are presented in the Noise Impact Assessment and are expected to range between 55 to 65 dBA (Appendix B.2). It should be noted that the findings within the Noise Impact Assessment are worst case (most conservative) predictions.

The Environment Code of Practice for Metal Mines (Environment Canada, 2012b) has established parameters for ambient noise levels for wildlife. These parameters indicate that ambient noise observed above 55 dBA during the day and 45 dBA at night can affect wildlife. Although the auditory capabilities of fauna species varies (Shannon et al. 2016) and fauna behavior in response to noise is largely related to perceived threats as opposed to noise intensity (Bowles 1995), changes to ambient noise levels and the presence of periodic vibrations from blasting have the potential to adversely affect fauna. Noise may simply act as a sensory disturbance resulting in avoidance (Ware et al. 2015), However, noise can also affect fauna behavioral patterns (Patthey et al. 2008), stress levels (Knight and Swaddle, 2011), affect communication and hunting success (Barber et al. 2009). Combined, these effects can negatively impact the overall population health of a particular species (Ware et al. 2015). Maier et al. (1998) and Flydal et al (2001) observed that sounds at 46 dBA and 60 dBA elicited responses in caribou and reindeer, respectively. While Drolet et al. (2016) report no changes to density of white-tailed deer when a simulated drilling noise was played at 55 to 65 dBC, a literature review conducted by Shannon et al. (2016) found that an increase in stress and decrease in reproductive success in terrestrial mammals has the potential to occur at noise levels ranging from 52 to 68 dBA. Levels from these studies are higher than those cited by Environment Canada (2012).

The predicted noise levels presented in the Noise Impact Assessment (Appendix B.2) exceed the levels outlined by Environment Canada (2012) at the Project property boundary. According to the results of the Noise Impact Assessment, noise generated from Project activities diminishes to 45 dBA (the most conservative guideline) at approximate ranges of 0 to 1,000 m outside of the Beaver Dam Mine Site property boundary. At the Haul Road, noise at that same sound level is predicted to travel approximately 100 to 350 m from the center line of the road. At the Touquoy Mine Site, noise at 45 dBA is predicted to travel approximately 0 to 850 m outside the property boundary These ranges of noise distribution are due to changes in local topography. Terrestrial fauna within these approximate ranges of noise distribution surrounding the PA have the potential to be affected by noise during the day and overnight.

6.11.7.4.2 Light

Light effects on terrestrial fauna include changes to circadian patterns, seasonal patterns, movement and distribution, and community interactions and composition (Pauwels, 2018). These impacts can result in disorientation, attraction or avoidance, and behavioral changes that can affect the success of foraging, reproduction, and communication (Langcore and Rich, 2004). Artificial light can also disrupt habitat connectivity and indirectly create habitat fragmentation (Bliss-Ketchum et al. 2016). Schirmer et al. (2019) found that light had differing impacts on nocturnal and diurnal species. While both were impacted by increased artificial lighting, generally nocturnal species exhibited a delayed, compressed active period, while the active period for diurnal species was extended. These changes in circadian patterns can cause the suppression of melatonin in mammals, particularly in nocturnal species (Schroer and Holker, 2016). However, there is limited data is available for larger mammalian species.

While effects of light on wildlife are documented, it is still an emerging area of research and artificial lighting thresholds (e.g., duration, intensity, spectrum, etc.) for fauna are not well defined. Currently there is no globally recognized or generally agreed upon standard for measuring biologically relevant light for wildlife or sky glow, which results in difficulty and inaccuracy when

comparing between metrics and methods (DEE, 2020). Light is traditionally measured and quantified for human perception. However, this does not capture all light visible to wildlife. Furthermore, the visible spectrum and sensitivities differ by taxa and species (DEE, 2020).

Type of lighting may also impact fauna. Some lights can have increased effects on fauna due to the short wavelengths they emit (e.g., white or blue LEDs, metal halides). Wildlife is generally more sensitive to short, high energy UV/violet/blue wavelengths, particularly nocturnal species. Short wavelength light also scatters more in the atmosphere than long wavelength light, increasing the effects of sky glow (DEE, 2020; Pauwels, 2018). Yellow-orange light is typically associated with long wavelength lights (e.g., High Pressure Sodium, Low Pressure Sodium, Amber LED).

Light levels from the Project have been modeled in the Light Impact Assessment (Appendix D.1) and discussed in Section 6.3. While the calculated light levels at the sensitive receptors are below the guidelines recommended by the Institute of Lighting Engineers (ILE) guidelines, nighttime light propagation from the Project may still cause sensory disturbance to fauna. Project activities are likely to result in localized avoidance of the Beaver Dam Mine Site and Haul Road and directly surrounding areas by some species. This potential avoidance would be due to changes in ambient light levels. The impact distance will also be dependent on the type of lighting used. As studies suggest (i.e., DEE, 2020; Pauwels, 2018), lights that emit more blue shortwave light (e.g., LEDs, metal halides) show greater impacts to fauna at night. These distances have been considered in the delineation of the RAA.

Light impacts from trucks on the Haul Road are expected to be insignificant compared to baseline daylight illuminance and will be blocked by the surrounding natural buffers and topography. The impacts of Haul Road lighting on fauna is expected to be less than that of noise. No permanent lighting will be installed on the Haul Road.

6.11.7.5 Touquoy Mine Site

The potential interactions of the Project with terrestrial fauna within the Touquoy Mine Site is presented in Table 6.11-8.

Table 6.11-8: Potential Project Activities/Interactions with Terrestrial Fauna at Touquoy Mine Site

Project Phase	Duration	Relevant Project Activity
Construction	1 year	• Tailings pipeline, make-up water pipeline alteration, and relocation of reclaim infrastructure
Operations and Maintenance	5 years	• Environmental monitoring • General management of waste derived from processing activities • Accidents and malfunctions to include fuel and other spills, forest fires, and a haul truck accident • Heavy machinery operation • Vehicle activity • Project lighting
Closure	2 years	• Environmental monitoring • Accidents and malfunctions to include fuel and other spills and forest fires • Heavy machinery operation • Vehicle activity • Project lighting
Post-closure	10+ years (monitoring)	• N/A

N/A = not applicable.

The Project will have no new effects on terrestrial fauna at the Touquoy Mine Site. Continued sensory disturbance caused by noise and light will occur within the Touquoy Mine Site as a result of the extended life of the Touquoy Mine Site associated with the Project. The continued sensory disturbances to fauna from the Project have been considered in the previous sections and within the Noise and Light Impact Assessments (Appendix B.1, B.2 and D.1). Increased traffic at the Touquoy Mine Site poses an elevated risk to wildlife.

6.11.8 Mitigation

In order to mitigate and reduce overall loss of function of habitat used by terrestrial fauna, and reduce direct impacts on fauna, the actions provided in Table 6.11-9 will be implemented by Atlantic Mining NS Inc (AMNS) where direct loss of habitat is expected to support development of the Project. AMNS encourages the public to report mainland moose sightings to the province at https://novascotia.ca/natr/wildlife/sustainable/msform.asp.

Where direct impacts to habitat or fauna are not expected, the Beaver Dam Mine Site and Haul Road development may still potentially cause indirect impacts through construction, operation, and closure activities. The following actions will be implemented to reduce the potential for indirect impacts to adjacent undisturbed habitat:

- for species which rely on wetland habitat, maintain pre-construction hydrological flows into and out of downstream wetland habitats, to the extent possible (post alteration wetland monitoring may be required as a result of the provincial permitting process);
- in order to protect adjacent habitats from accidental spills, ensure that spill control and contingency planning is in effect, and its procedures fully communicated to staff;
- vegetation management will be conducted by cutting (i.e., no use of herbicides);
- ensure all development related activity (construction areas, access roads, etc.) are located within areas where biophysical field evaluations have been completed and approvals/written authorizations are in place as required;
- erosion control materials shall be clean, non-ore-bearing, non-watercourse derived and non-toxic materials;
- machinery and personnel will be instructed not to enter the habitats outside of approved Project footprint; and
- slopes will be re-vegetated to stabilize them and limit erosion and sedimentation into adjacent habitats.

Mitigations for SOCI and SAR fauna will be discussed in Section 6.13.8 comprehensive mitigation table for all VCs is provided in Section 9.

Table 6.11-9: Mitigation for Terrestrial Fauna

Project Phase	Mitigation Measure
Construction, Operation	Provide wildlife awareness training to site personnel to reduce interactions between site personnel and wildlife.
	Intact forest stands and wetlands will be avoided wherever practicable during detailed Project planning and design in favor of previously disturbed areas (e.g., stands disturbed by timber harvesting, roads, or other development). Micro-site Haul Road and mine infrastructure to avoid major fauna habitat.
	Where natural, intact habitat cannot be avoided, maintain existing vegetation cover whenever practicable and minimize overall areas of disturbance.
	Minimization of impact to old forest.
	For those species reliant on wetland habitat, a wetland alteration application will be submitted during Project planning and design to request an authorization to alter wetland habitat and to address loss of wetland function.

Table 6.11-9: Mitigation for Terrestrial Fauna (continued)

Project Phase	Mitigation Measure
	Compensation for permanent loss of wetland function will be completed through wetland restoration activities to support no net loss of wetland function, subject to NSE approval.
	Habitat fragmentation will be reduced by limiting the area of new roads, favoring upgrading of existing roads where possible instead.
	Site infrastructure will be fenced in, where practical, to reduce interactions between Project infrastructure and wildlife.
	A speed limit of 40 km/hr within the Beaver Dam Mine Site and 70 km/hr along the Haul Road (or not exceeding posted speed limits) will be implemented to reduce likelihood of collisions with fauna.
	Install signage where specific wildlife concerns have been identified. Vehicles will yield to wildlife on roads.
	Monitor and manage road conditions through dust suppression and traction control (sand on icy roads) to reduce potential for collisions with wildlife. Implement Dust Control Plan (Appendix C.3)
	An un-vegetated buffer of 10 m along roadsides will be maintained, where possible, to improve visibility along roadsides and reduce the potential for collisions with wildlife.
	Clearing and construction will be limited within wetlands that could support snapping turtles during winter hibernation period;
	Erosion and sediment control planning will be completed to ensure site runoff is not directed towards unaltered habitat. Implement Erosion and Sediment Control Plan.
	Culverts installed within wetlands and watercourses will provide an alternative crossing location to amphibians and reptiles, thereby reducing direct mortality of species attempting to cross a road. Upgrade culverts along the new and upgraded Haul Road sections to improve habitat connectivity.
	Implement Emergency Response and Spill Contingency Plans to protect fauna and their habitat from accidental spills
	Store hazardous and non-hazardous waste in designated locations, in appropriate containers to reduce potential for spills, and to prevent attracting wildlife (e.g., food waste in bear proof containers).
	Follow the Pit and Quarry Guidelines to reduce impact of noise and vibration on wildlife
	Limit use of lights to the amount necessary to ensure safe operation within the PA, with the recognition that excessive lighting can be disruptive to wildlife. Install lights facing downward and wherever practicable using motion-sensing lights.
	Consider limiting use of lights that emit more blue shortwave light (e.g., LEDs, metal halides) which have greater impacts to wildlife at night, where practicable and considering operational safety.
	Restrict blasting to a specific and regular daytime schedule during weekdays to allow time for wildlife to recover from potential noise disturbance.
	Implement Wildlife Mitigation and Monitoring Plan (Appendix P.7)
	Site-specific measures to protect wildlife will be addressed in the EPP.
Closure	Implement remediation plans to restore natural habitat and food source re-establishment to support fauna
	Install signage where specific wildlife concerns have been identified. Vehicles will yield to wildlife on roads.
Post-Closure	A deterrent system will be considered at the Touquoy Mine Site when the pit fills as tailing deposition will be present. This will deter wildlife from using the pit during and after filling which may have deleterious effects resulting from long-term exposure.

6.11.9 Residual Effects and Significance Update

The predicted residual environmental effects of Project development and production on terrestrial fauna are assessed to be adverse, but not significant. The overall residual effect of the Project on terrestrial fauna is assessed as not significant after mitigation measures have been implemented and are summarized in Table 6.11-10.

Table 6.11-10: Residual Effects for Terrestrial Fauna

Project - VC Interactions	Mitigation and Compensation Measures	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction – Beaver Dam Mine Site and Haul Road (habitat loss and fragmentation from clearing and grubbing)	Limit habitat disturbance and minimize Project footprint during detailed design, implement speed limits, install fences where necessary, and minimize lighting.	L < 5% direct loss of habitat types used by observed species within the LAA Partial mitigation through restoration.	RAA Potential adverse effect to fauna outside of the LAA (fragmentation)	A VC interaction may affect seasonal aspects of fauna.	MT (Beaver Dam Mine Site) Effects occur beyond 5 years when closure activities commence at Beaver Dam Mine Site. P (Haul Road) Closure of the Haul Road not expected.	O Effects occur once during the construction phase.	PR Mitigation and reclamation cannot guarantee a return to baseline conditions.	Habitat Loss	Not Significant
Construction – Beaver Dam Mine Site and Haul Road (sensory disturbance (noise, light, dust deposition) and wildlife vehicle collisions from construction activities)	Implement speed limits, install fences where necessary, and minimize lighting.	M	LAA Potential adverse effect to fauna outside of the PA	A VC interaction may affect seasonal aspects of fauna.	ST Effects are limited to occur from as little as 1 day to 12 months	R Effects occur at regular intervals during the construction phase	R VC will recover to baseline conditions	Disturbance	Not Significant
Operational – Beaver Dam Mine Site, Haul Road and Touquoy Mine Site (disturbance (noise, light, dust deposition and wildlife vehicle collisions) from haul trucks, heavy machinery and mine operations)	Implement speed limits, install fences where necessary, and minimize lighting.	M Moderate changes relative to baseline conditions in remaining and surrounding habitat.	LAA Potential adverse effect to fauna beyond the PA.	A VC interaction may affect seasonal aspects of fauna.	MT Effects may occur up to 5 years.	R Effects occur at regular intervals.	R VC will recover to baseline conditions	Disturbance	Not Significant
Closure (Active) – Beaver Dam Mine Site (re-establishment of habitat for fauna)	N/A	L Minor change from baseline conditions.	LAA Potential effect to fauna outside of the PA	A VC interaction may affect seasonal aspects of fauna.	LT Effects extend beyond active closure phase.	O Effects occur once during the closure phase.	PR Mitigation and reclamation cannot guarantee a return to baseline conditions.	Habitat Reclamation	Not Significant

Notes: See Section 5.11, Table 5.11-1 for definitions of the below characteristics.

Magnitude		Geographic Extent		Timing		Duration		Frequency		Reversibility	
N	Negligible	PA	Project Area	N/A	Not Applicable	ST	Short-Term	O	Once	R	Reversible
L	Low	LAA	Local Assessment Area	A	Applicable	MT	Medium-Term	S	Sporadic	IR	Irreversible
M	Moderate	RAA	Regional Assessment Area			LT	Long-Term	R	Regular	PR	Partially Reversible
H	High					P	Permanent	C	Continuous		

A significant adverse environmental effect for fauna has not been predicted for the Project for the following reasons, with consideration of the ecological and social context of the RAA surrounding the Project:

- During Construction:
  - Direct impacts to fauna habitat is expected, however, impacts will be minimized through on-going Project design and micro-sighting of infrastructure footprints where ever practicable.
  - The baseline habitat of the Beaver Dam Mine Site and Haul Road is a network of existing fragmentation due to historical and present forestry activities, and the presence of the logging road that is proposed for upgrade.
  - Less than 5% of the suitable habitat in the LAA for observed species will be directly impacted by Project development. Habitat loss will be mitigated in the long term through reclamation planning.
  - The majority of Haul Road construction is road upgrades, minimizing the loss of habitat for fauna.
  - Construction work will be considerate of the breeding patterns for fauna, wherever practicable.
  - Construction noise and light will be limited to a 12-month window.
- During Operations:
  - Noise will be elevated above baseline during this period and may cause a displacement of fauna in close proximity to the Haul Road and Beaver Dam Mine Site.
- During Active Closure:
  - Noise will be elevated above baseline during reclamation activities (2 years) involving mobile equipment and then drop to baseline for the post-closure period.
  - Appropriate mitigation such as wildlife deterrents will be implemented to deter wildlife species from entering the Touquoy TMF and open pits during Post-closure.

6.11.10 Proposed Compliance and Effects Monitoring Program

Monitoring of terrestrial fauna will be completed to verify the accuracy of the predicted environmental effects and the effectiveness of the mitigation measures specific to terrestrial fauna. Mitigations are outlined in Table 6.11-9. The Wildlife Mitigation and Monitoring Plan (WMMP; Appendix P.7) outlines protocols to minimize interactions between wildlife and Project activities. This document will evolve through the regulatory permitting process, as well as public and Mi'kmaw engagement. As part of the WMP, a Mainland Moose Management Plan (MMMP) will be developed and will commit to monitoring mainland moose during baseline/pre-construction to establish baseline conditions, and through the operational phase, closure, and post-closure (as determined to be required). Monitoring associated with the MMMP will be completed for the Project on selected transects within suitable mainland moose habitat.

6.12 Avifauna

6.12.1 Introduction

6.12.1.1 Summary of Avifauna Before the Updates

Baseline surveys confirmed presence of 103 avifauna species (6,193 individuals) during dedicated survey periods or incidentally within the Beaver Dam Mine Site and Haul Road. These observations included 25 potentially priority species, determined based on observation season and breeding status qualifiers. Priority avifauna determination and discussions are preened in Section 6.13 (Species of Conservation Interest [SOCI] and Species at Risk [SAR]). Dedicated avifauna surveys included, fall migration, spring migration, breeding season, winter wildlife surveys, spring diurnal raptor surveys, spring nocturnal owl surveys and common nighthawk surveys. Surveys were conducted at set survey locations, which included point count, watch count, and call back stations. Seventy-seven species were observed to be possible, probable, or confirmed breeders within the Beaver Dam Mine Site.

Project related effects to avifauna include direct loss of habitat, habitat fragmentation, direct mortality, and sensory disturbance. Mitigations are proposed to reduce overall loss of function of habitat used by avifauna, and reduce direct impacts on avifauna within the Beaver Dam Mine Site and Haul Road. As a result of mitigations and detailed design planning, the predicted residual environmental effects of Project development and production on avifauna are assessed to be adverse, but not significant. Species of Conservation Interest (SOCI) and Species at Risk (SAR) fauna and Project related effects are further discussed in Section 6.13.

6.12.1.2 Summary of Updates to Avifauna

Supplementary field surveys were conducted for the Updated 2021 Environmental Impact Statement (EIS) (AMNS, 2021), as a result of Project Area (PA) modifications and continued infrastructure micro-siting since the 2019 EIS submission. Additional breeding bird (n=10) and Common nighthawk (n=2) surveys were completed in southeastern expansion of the Beaver Dam Mine Site in 2019. In total 6,521 individuals were observed at 118 survey locations within the Beaver Dam Mine Site and Haul Road (including the Mooseland Road portion). No additional avifauna species were observed during the 2019 surveys; however, 35 species were determined to be possible priority species (Section 6.13).

Impacts to avifauna were reassessed based on changes to the PA and Project infrastructure. The avifauna effects assessment was updated to include a function group-specific habitat assessment and improved assessment of Project related sensory disturbance.

No new direct or indirect impacts to terrestrial fauna are expected. Project effects to fauna remain adverse, but not significant.

Table 6.12-1: Updated Subsections from the 2019 Revised Environmental Impact Statement – Avifauna

2019 Revised EIS Submission (February 28, 2019)	Updated in 2021	Corresponding 2021 EIS Update Section Number	Reason for Update
-	-	6.12.1 Introduction	• New
6.12.1 Rationale for Valued Component Selection	No	6.12.2 Rationale for Valued Component Selection	• N/A
6.12.2 Desktop Review	Yes	6.12.3 Desktop Review	• Addition of additional Maritime Breeding Bird Atlas area: • Additional survey areas as a result of PA modification for infrastructure micro-sitting. • Review and update priority species (IR NSE 2-184)
6.12.3 Baseline Program Methodology	Yes	6.12.4 Baseline Program Methodology	• Addition of 2019 field surveys: • Additional survey areas as a result of PA modification for infrastructure micro-sitting.
6.12.4 Baseline Conditions	Yes	6.12.5 Baseline Conditions	• Present results from 2019 field surveys: • Additional survey areas as a result of PA modification for infrastructure micro-sitting • Revise breeding bird qualifier assessment methods • Review and update priority species (IR NSE 2-184)
6.12.5 Consideration of Consultation and Engagement Results	No	6.12.6 Consideration Engagement Results	• N/A
6.12.6 Effects Assessment Methodology – Boundaries	Yes	6.12.7 Effects Assessment Methodology – **Boundaries**	• PA modification for infrastructure micro-sitting. • Adjusted PA description. • LAA was enlarged due to the modified PA. • RAA was enlarged where necessary due to the modified PA. Fauna assessment area changed to the RAA.
6.12.6 Effects Assessment Methodology – Thresholds for Determination of Significance	Yes	6.12.7 Effects Assessment Methodology – **Thresholds for Determination of Significance**	• Updated significance threshold and magnitude assessment: • Reflect changes in VC baseline conditions and improve significance assessment criteria • Response to IR2 CEAA 2-02
6.12.7 Project Activities and Avifauna Interactions and Effects	Yes	6.12.8 Project Activities/Interactions with Avifauna	• Updated based on revised noise and light impact assessments. • Bolster discussion of direct and indirect impacts to fauna. Include species-specific habitat loss assessment. • Changes to project timelines.
6.12.8 Preferred Alternative Haul Road	Yes	Section removed	• The Preferred Alternative Haul Road is no longer being considered and has been removed from the Project Description and EIS
6.12.8 Mitigation and Monitoring	No	6.12.9 Mitigation	• Updated based on field survey results and changes to effects assessment • Reflects improved understanding of impacts.

Table 6.12-1: Updated Subsections from the 2019 Revised Environmental Impact Statement – Avifauna (continued)

2019 Revised EIS Submission (February 28, 2019)	Updated in 2021	Corresponding 2021 EIS Update Section Number	Reason for Update
6.12.10 Residual Effects and Significance	Yes	6.12.11 Residual Effects and Significance	• Updated based on field survey results and changes to significance threshold determination. • Change to magnitude determination • Reflect changes to significance threshold and magnitude assessment.
6.12.11 Proposed Compliance and Effects Monitoring Program	No	6.12.11 Proposed Compliance and Effects Monitoring Program	• Updated monitoring program

Notes: PA = Project Area; LAA = Local Assessment Area; RAA = Regional Assessment Area; N/A = not applicable; IR2 = Round 2, Information Requests; CEAA = Canadian Environmental Assessment Agency; EIS = environmental impact statement.

6.12.2 Rationale for Valued Component Selection

Bird habitat may be altered or lost as a result of direct or indirect disturbances from the Project. Migratory birds and SAR are protected under federal legislation by the *Migratory Birds Convention Act* (MBCA) (Government of Canada, 1994) and SARA (Government of Canada, 2002). *The Nova Scotia Wildlife Act* protects all birds within the province by stating that, except with a permit issued by the minister, no person shall destroy, take, possess, buy or sell any egg of a bird or turtle or disturb the nest of a bird or turtle; or use a snare, net or trap to take any bird (Government of Nova Scotia, 1989, Section 51).

6.12.3 Desktop Review

A background review of potential avian species that could occur within the Beaver Dam Mine Site and Haul Road was completed prior to the start of the baseline monitoring programs. The data sources that were used are presented in Table 6.12-2. Results for priority species will be discussed in Section 6.13.

Table 6.12-2: Data Sources for the Background Review

Task	Source(s)	Product
Breeding Bird Identification	• Second MBBA	Identification of bird species considered confirmed breeders within 10 km of the Beaver Dam Mine Site and Haul Road.
Priority Species Assessment [(a)]	• ACCDC • Committee on the Status of Endangered Wildlife in Canada (COSEWIC) • SARA • Nova Scotia Endangered Species Act (NSESA) • Museum of Natural History report • Habitat mapping for the site	A priority list for SOCI and SAR with suitable habitat inside the Beaver Dam Mine Site and Haul Road and a list of species identify by ACCDC
Important Bird Areas	• Important Bird Areas of Canada	Description of nearest Important Bird Area to the Beaver Dam Mine Site and Haul Road.

(a) Priority species and the associated desktop analyses will be discussed in Section 6.13.

MBBA = Maritimes Breeding Bird Atlas; ACCDC = Atlantic Canada Conservation Data Centre; SAR = Species at Risk; SOCI = Species of Conservation Interest; km = kilometre.

6.12.3.1 Maritime Breeding Bird Atlas

The Beaver Dam Mine Site and Haul Road encompasses five MBBA squares: 20NQ17, 20NQ18, 20NQ19, 20NQ28, and 20NQ29 (Stewart et al., 2015). Square 20NQ19 was included as a result of the 2019 PA modifications to the Beaver Dam Mine Site. A summary of results for the five 10 kilometre (km) x 10 km MBBA (2006 to 2010) squares is presented in Table 6.12-3.

Table 6.12-3: Results Summary for Maritimes Breeding Bird Atlas Squares 20NQ17, 20NQ18, 20NQ19, 20NQ28, and 20NQ29

Atlas Squares[(a)]	Approximate Location in PA	Species (2nd Atlas)			
		No. Possible Breeders	No. Probable Breeders	No. Confirmed Breeders	Total
20NQ17	Southern end of the Haul Road, including Mooseland Road and the unnamed road that goes up to Highway 224, but only until near Rum Lake.	31	16	26	**73**
20NQ18	Includes Haul Road from near Rum Lake until Highway 224, about half of the new road section (western) and half the length of Highway 224 (western) between the unnamed road and Beaver Dam Mines Road.	11	19	52	**82**
20NQ19	Includes a small portion of the western-most side of the Beaver Dam Mine Site (NAG WARS).	29	13	23	**65**
20NQ28	Includes the eastern halves of Highway 224 and the new road section, as well as the southeast portion of the Beaver Dam Mine Site.	20	28	21	**69**
20NQ29	Includes most of the northern portion of the Beaver Dam Mine Site.	20	22	35	**77**

(a) Data is from the 2nd atlas (2006 to 2010).

No. = number; NAG = non-potentially acid generating; WRSA = Waste Rock Storage Area

The MBBA data summaries for squares 20NQ17, 20NQ18, 20NQ19, 20NQ28, and 20NQ29 can be found in Appendix L.1, along with avifauna species codes and breeding evidence codes.

6.12.3.2 Important Avifauna Areas

The nearest (Important Bird Area [IBA]) is the Eastern Shore Islands, located approximately 22 km southeast of the PA. The Eastern Shore Islands are situated along the southeast coast of central Nova Scotia, between 60 and 120 km east of Halifax. The site includes inshore islands roughly located between Clam Harbour and Ecum Secum. Within this rock-strewn stretch of sea are many low islands, islets, and reefs located between 2 and 15 km offshore. The vegetation on these islands varies from mostly wooded to treeless. The Eastern Shore Islands IBA supports large congregations of common eiders (*Somateria mollissima*), representing more than 2.5% of the subspecies population, as well as a wintering population of harlequin ducks (*Histrionicus histrionicus*). Other waterfowl frequent the site during spring migration, including thousands of scoters, and Leach's storm-petrels (*Oceanodroma leucorhoa*) also breed on some of the islands. (IBA Canada, n.d.). Habitat present within the PA is not consistent with habitat present on the Eastern Shore Islands. Furthermore, the PA is located a sufficient distance from the nearest IBA and is not located within a significant migratory flyway for species which rely on the Eastern Shore Islands.

6.12.4 Baseline Program Methodology

Avian baseline monitoring programs were completed by McCallum Environmental Ltd. (MEL) and included the surveys outlined in Table 6.12-4. In 2019, the PA, specify the Beaver Dam Mine Site, was modified to allow for the micro-siting of infrastructure, as described in Section 2 (Project Description). As a result, targeted avian surveys were conducted within the modified Beaver Dam Mine Site in July 2019 to identify and record additional avian species. Additional breeding bird (n=10) and Common nighthawk (n=2) surveys were completed in southeastern expansion of the Beaver Dam Mine Site. In total 118 survey locations were established within the Beaver Dam Mine Site and Haul Road (including the Mooseland Road portion). Haul Road point count stations HR-PC12 to HR-PC17 and nocturnal owl station HR-NO5 were located along an alternative Haul Road route no longer being considered. These observation locations have been removed from this assessment.

Table 6.12-4: Avian Baseline Monitoring within the Beaver Damn Mine Site and Haul Road

Survey Type	Project Area	
	Beaver Dam Mine Site	Haul Road[(a)]
Fall migration monitoring	September 17 to October 19, 2014 Thirty-two (32) point count stations Four (4) visits - weekly	N/A
Winter wildlife survey (including avifauna)	February 18, 2015 Incidental observations One (1) visit	March 2 and 31, 2016 Incidental observations Two (2) visits
Spring diurnal migrating raptor	April 15, 2015 One (1) watch count station One (1) visit	N/A
Spring nocturnal owl	April 15, 2015 Four (4) call playback stations One (1) visit	April 11, 2016 Eight (8) call playback stations One (1) visit
Spring migration monitoring	April 21 to June 4, 2015 Twelve (12) point count stations Six (6) visits - weekly	May 12 to 27, 2016 Forty-five (45) point count stations Three (3) visits - weekly
Breeding Bird	June 2015 Twenty-four (24) point count stations Two (2) visits - early and late	June 2016 Fifty (50) point count stations Two (2) visits - early and late
	July 2019 Ten (10) point count stations Two (2) visits – early and late	
Common Nighthawk	June 2015 Three (3) call playback stations Two (2) visits	June 2016 Twelve (12) call playback stations Two (2) visits
	July 2019 Two (2) call playback stations Two (2) visits	

(a) Includes the Mooseland Road portion of the Haul Road (Figure 6.12-1D and 6.12-1E).

Detailed descriptions of the survey methodologies for each of these baseline monitoring programs for the Beaver Dam Mine Site and Haul Road are provided in the following sections. Avifauna survey locations are presented in Figures 6.12-1A to 6.12-1E.

The Beaver Dam Mine Site was adjusted in 2019 to facilitate the micro-siting of Project infrastructure, which included a western expansion to include the western waste rock storage area and southeastern expansion to include the organics material stockpile. The western NAG waste rock storage area adjustment occurred after the completion of the additional 2019 avifauna surveys outlined in Table 6.12-4. Additional dedicated avifauna surveys were not completed in this area as a review of the additional habitat survey points (HSP43-49), the NSL&F Forestry Database and aerial imagery indicated that the additional area is comprised of similar cover and stand types present throughout the Beaver Dam Mine Site, and as such, the same avifauna species assemblages are expected to be present. Incidental avifauna observations were recorded during all survey efforts within this area. These general cover types include natural cover (mixed and soft wood), wetlands, clear cut and forestry roads.

Information pertaining to Touquoy Mine Site has been brought forward from the EARD and Focus Report. Methods and results are summarized in subheadings within the applicable sections and are carried forward into the effects assessment where appropriate. For further information regarding avifauna assessment undertaken at Touquoy Mine Site, are provided in the EARD (CRA 2007a) and Focus Report (CRA 2007b).

6.12.4.1 Fall Migration

Fall migration surveys were completed by McCallum Environmental Ltd. (MEL) biologists in accordance with the methods outlined by the Canadian Wildlife Service (CWS) in the Migratory Birds Environmental Assessment Guidelines (Milko, 1998). Thirty-two point count stations were established through all representative habitat types within the Beaver Dam Mine Site.

Four additional point count locations were established and surveyed during fall 2015 (Crusher Point count numbers 1 to 4, or CPC1 to CPC4). At this time, the Beaver Dam Mine Site consisted of two main areas: the pit and waste rock storage area were proposed in the current Beaver Dam Mine Site (Section 2, Figure 2.3-1), but the crusher was proposed to be in a separate area, approximately 4 km south of the Beaver Dam Mine Site along the existing Beaver Dam Mines Road. Through further detailed design of the Beaver Dam Mine Site layout, the separate crusher area was incorporated into the current Beaver Dam Mine Site. As such, the data collected in the crusher point count locations were not included in the analysis of fall 2015 migration data. Any priority species which were observed at these locations are included in the summary of priority species as incidental observations. Fall bird migration surveys were not conducted within the Haul Road because habitat types were generally similar to those observed within the Beaver Dam Mine Site. Point count locations are presented on Figures 6.12-1A to 6.12-1E.

Surveys began at, or within, half an hour of sunrise and were completed within four-and-a-half hours or by 10:00 a.m., whichever came first. Weather conditions (e.g., precipitation and visibility) were monitored and confirmed to be within the parameters required by monitoring programs such as Environment and Climate Change Canada's Breeding Bird Survey. Ten-minute point counts were conducted weekly between September 17 and October 19, 2014, during peak migration. Bird observations were recorded at four distance categories, within a 50 metre (m) radius, 50 to 100 m radius, outside the 100 m radius, and flyovers. For each point count, a record was made of the start time and a hand-held GPS unit was used to georeference its location. General observations, including the temperature, visibility, wind speed, date, start and end time, and location (UTM NAD83) were also recorded. Species recorded outside of the 100 m radius, between point counts, outside of the 10-minute survey window, and flyovers were recorded as incidentals. Bearings (in degrees) were taken for SOCI and SAR observed during dedicated survey periods and incidentally.

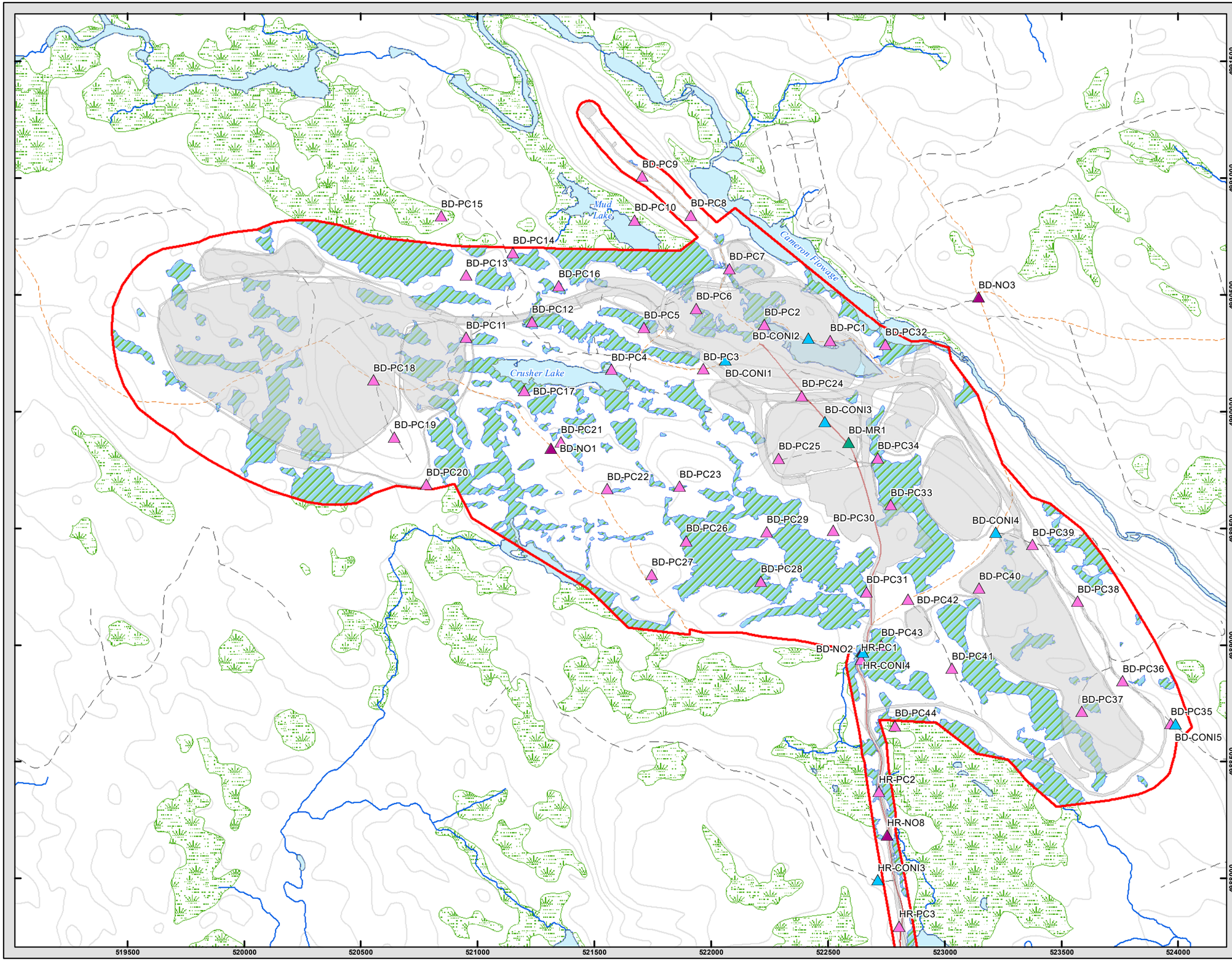

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FIGURE 6.12-1A

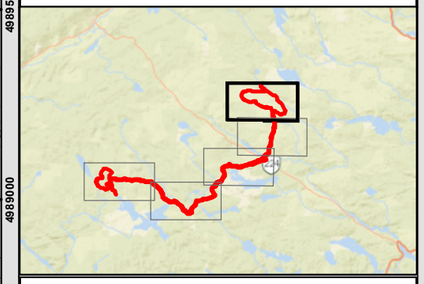
Beaver Dam Mine Project

Avifauna Methods

- NSTDB Mapped Watercourses
- Local Road
- Dry Weather / Seasonal Road
- Track
- Proposed Infrastructure
- NSE Wetlands
- Project Area

Avifauna Surveys

- Common Nighthawk
- Migratory Raptor
- Nocturnal Owl
- Point Count



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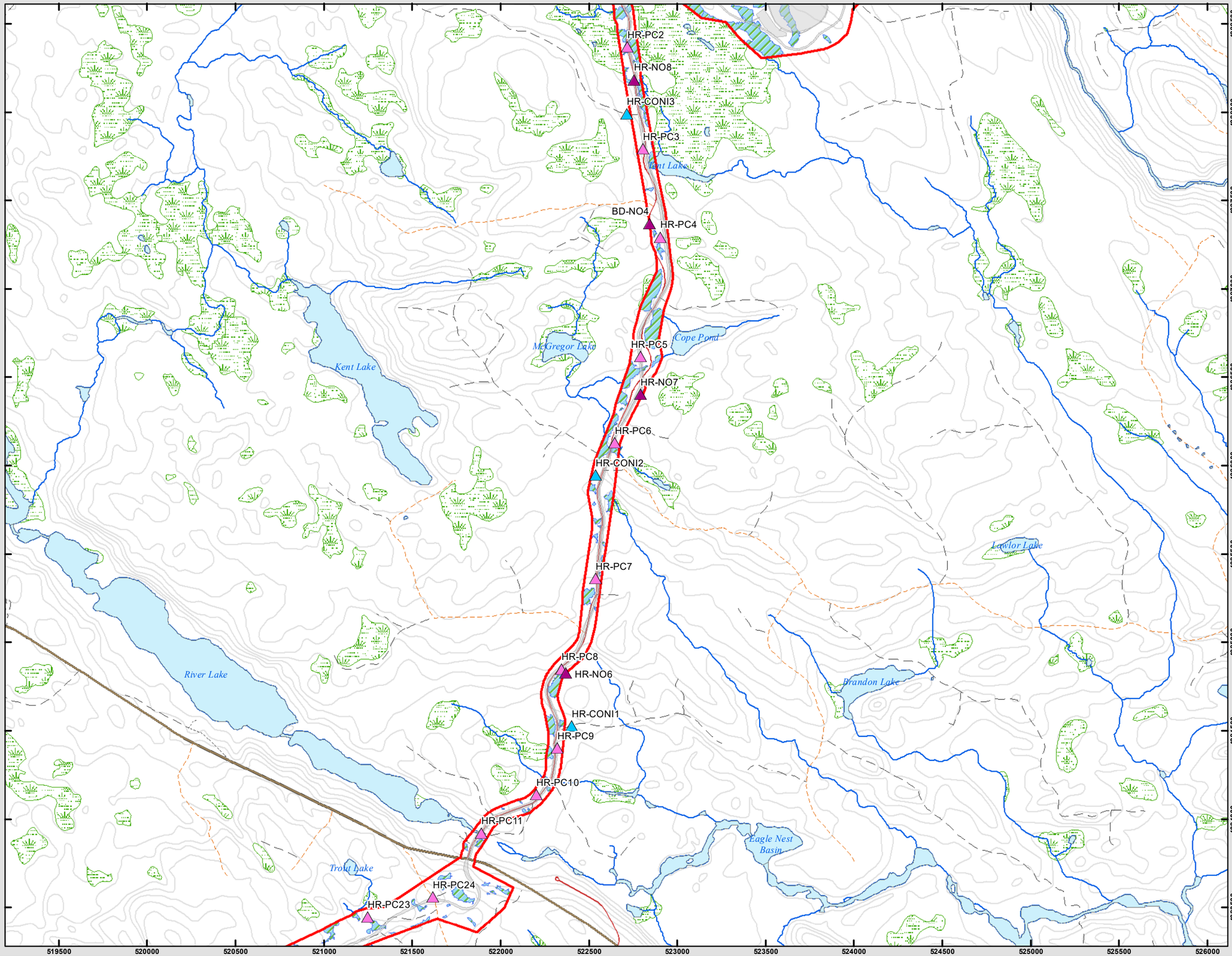

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FIGURE 6.12-1B

Beaver Dam Mine Project

Avifauna Methods

- NSTDB Mapped Watercourses
- Collector Road
- Local Road
- Dry Weather / Seasonal Road
- Diveways (>300 m)
- Track
- Proposed Infrastructure
- NSE Wetlands
- Project Area

Avifauna Surveys

- Common Nighthawk
- Nocturnal Owl
- Point Count

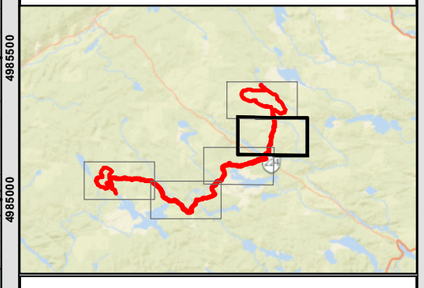

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FIGURE 6.12-1C

Beaver Dam Mine Project

Avifauna Methods

- NSTDB Mapped Watercourses
- Collector Road
- Local Road
- Dry Weather / Seasonal Road
- Diveways (>300 m)
- Track
- NSE Wetlands
- Project Area

Avifauna Surveys

- Common Nighthawk
- Nocturnal Owl
- Point Count

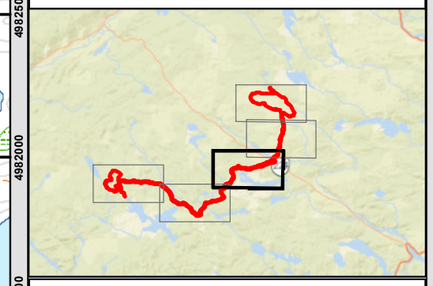

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FIGURE 6.12-1D

Beaver Dam Mine Project

Avifauna Methods

- NSTDB Mapped Watercourses
- Local Road
- Dry Weather / Seasonal Road
- Diveways (>300 m)
- Track
- NSE Wetlands
- Project Area

Avifauna Surveys

- Common Nighthawk
- Nocturnal Owl
- Point Count

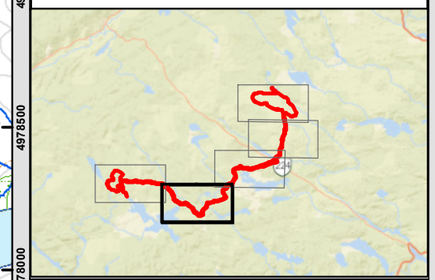

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FIGURE 6.12-1E

Beaver Dam Mine Project

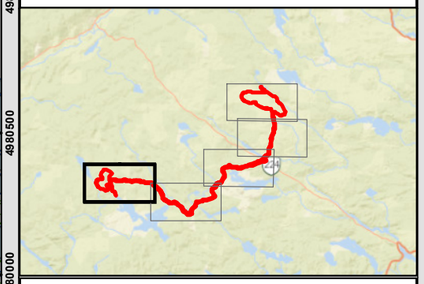
Avifauna Methods

Square Lake
New Dam Flowage
Wire Lake
Loon Lake
Cope Lake
HR-PC45
HR-PC44
Rocky Lake
Otter Dam Flowage
Camp Lake
Melvin Lake

- NSTDB Mapped Watercourses
- Local Road
- Dry Weather / Seasonal Road
- Diveways (>300 m)
- Track
- Touquoy Infrastructure
- NSE Wetlands
- Project Area

Avifauna Surveys

- Point Count



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6.12.4.2 Winter Birds

No dedicated surveys for winter birds took place within the Beaver Dam Mine Site and Haul Road; however, incidental observations of birds were recorded during winter wildlife (primarily moose) surveys.

6.12.4.3 Spring Diurnal Raptor Migration

The objectives of the baseline spring migrating raptor survey were to determine species composition and relative abundance and to record incidental observations of other SOCI and SAR. The survey was not conducted if visibility was reduced by rain, fog, or snow.

On April 15, 2015, two observers surveyed for migrating raptors at a fixed monitoring station within the Beaver Dam Mine Site using the double-observer method (Nichols et al., 2000). Observers used binoculars and the naked-eye to scan for migrating raptors. A map of the PA, including the location of the monitoring station and a compass were used to document flight paths and estimate distances. The survey started at 12:30 p.m. and ended at 4:30 p.m. The spring raptor migration survey station is presented on Figures 6.12-2A.

Before a raptor was officially tallied, it had to demonstrate a migratory pattern as opposed to a behavior indicative of a local bird. Raptors are counted as migrants if they are: using thermals, flying a straight course northeast, or are at a very high altitude. Raptors are not counted as migrants if they are: in view for extended periods of time, actively hunting, or flying the "wrong way".

All birds considered migratory were tallied by date and hour using the Hawk Monitoring Association of North America (HMANA) Daily Report Form (HMANA, 1998). In addition to count totals of each species, observers recorded the following data hourly on the HMANA Daily Report Form: temperature, maximum visibility, sky conditions (cloud cover, precipitation), wind speed and direction, flight speed, direction and altitude, number of observers, and minutes of observation. Categories and codes for these data and brief instructions for gathering the data are available on the back of the HMANA Daily Report Form.

6.12.4.4 Spring Nocturnal Owl

The objectives of the nocturnal owl survey were to gather information on the presence and distribution of owl species within the Beaver Dam Mine Site and Haul Road, determine the location of active nests, and record incidental observations of other SOCI and SAR.

Wind can limit the ability of owls to hear a call broadcast and/or the ability of the observer to hear an owl calling. It is recommended that a survey be suspended if wind speed is Beaufort 4 or higher (i.e., greater than 20 kilometres per hour (km/hr); Takats et al., 2001). However, if there are other circumstances affecting detection, it may be necessary to reduce the wind threshold; this is at the discretion of the observer. If conditions were not suitable for surveying, then the survey was deferred or moved to a more suitable location.

Owls have been observed to be less vocal when temperatures are significantly lower than average for the season, thus surveys were also delayed in this circumstance (Takats et al., 2001). Surveys were stopped in the case of heavy precipitation; light drizzle and flurries are not likely to reduce calling rates or detectability (Takats et al., 2001).

The methods for monitoring nocturnal owls followed the Guideline for Nocturnal Owl Monitoring in North America (Takats et al., 2001). The nocturnal owl surveys took place on April 15, 2015 (Beaver Dam Mine Site; n=4) and April 11, 2016 (Haul Road; n=8), once per year when vocal activity of the majority of owl species is greatest (Takats et al., 2001), for a total of 12 call playback

stations throughout the Beaver Dam Mine Site and Haul Road. According to Greg Campbell (Senior Project Biologist with the Atlantic Chapter of Bird Studies Canada), in Nova Scotia, data collected through the Nova Scotia Nocturnal Owl Survey program shows peaks in barred (*Strix varia*) and great horned (*Bubo virginiatus*) owls in early April, while northern saw-whet owls (*Aegolius acadicus*) are late April to mid-May. Other owl species have been observed at numbers that are too low to determine peak calling periods (G. Campbell, pers. comm., 9 April, 2015).

Prior to starting the survey, the broadcaster being used (Pyle-Pro Pwma50db 50-watt portable waist band PA system) was tested to ensure that the owl calls being broadcasted from it were audible and recognizable at a distance of 400 m (Takats et al., 2001). Ensuring that the broadcast could be heard beyond 400 m minimizes bias at the next survey station due to owls hearing the recording from the previous station (Takats et al., 2001). The aforementioned test was carried out under weather and noise conditions similar to those that were likely to be encountered during the survey.

The broadcast used by the Bird Studies Canada Nova Scotia Nocturnal Owl Survey program was used for the survey. It consists of a 9.5-minute broadcast, which includes alternating owl calls with silent listening periods (BSC Atlantic Region, 2007). Only the calls of two owl species, the boreal (Aegolius funereus) and barred owls, are used in the BSC Nova Scotia Nocturnal Owl Survey program broadcast because they are particularly rare and sensitive, respectively. To date, the boreal owl has only been reported as breeding in Nova Scotia four times (Lauff, 2009). The barred owl is targeted because it has been used as an indicator of ecosystem health due to its dependence on cavities in large trees for nesting (Allen, 1987) playback stations were spaced at least 1.6 km apart in order to reduce the chances of detecting the same owl at multiple stations (Takats et al., 2001). Some of the louder owls, such as the barred owl, can be heard at distances of two kilometers or more (Takats, 1998, as cited in Takats et al., 2001). However, most of the smaller owls cannot be heard as far or as clearly (Takats et al., 2001). Surveys were conducted between half an hour after sunset and midnight (Takats et al., 2001). There are five species of nocturnal owls that could potentially breed at the Project site: the great horned, barred, long-eared (Strix varia), boreal, and northern saw-whet owls. Nocturnal owl point count locations are presented on Figures 6.12-1A to 6.12-1E.

6.12.4.5 Spring Migration

Weekly spring migration surveys were conducted at 12 point count stations within the Beaver Dam Mine Site by MEL biologists from April 21 to June 4, 2015 (six visits), and 45 point count stations within the Haul Road were completed May 12 to 27, 2016 (three visits), for a total of 57 point count stations within the Beaver Dam Mine Site and Haul Road. The scope of the spring migration survey within the Beaver Dam Mine Site was reduced because poor weather conditions and a late spring melt restricted access within the PA that season.

The surveys were conducted using the same methodology as the fall migration survey. Early morning point count surveys were conducted from 30-minutes before sunrise until 10:00 a.m. Species and number of birds observed at each point count location were recorded. Point count stations are presented on Figures 6.12-1A to 6.12-1E.

6.12.4.6 Breeding Birds

Surveys for breeding avifauna were conducted in June 2015 at 24 point count stations within the Beaver Dam Mine Site and at 50 point count stations within the Haul Road in June 2016. The breeding bird survey within the Beaver Dam Mine Site was reduced to 24 point count stations (i.e., from 32 in the fall) because of minor modifications to the PA. Five additional point count stations were added for breeding surveys along the Haul Road (i.e., up from 45 in the fall) in order to cover additional area. Ten additional point count stations were surveyed within the southeast expansion of the Beaver Dam Mine Site in July 2019. Targeted surveys for common nighthawk were also conducted during breeding bird surveys, including two additional locations in July 2019. The methodologies for these surveys are described in the following sections.

6.12.4.6.1 Touquoy Mine Site

Breeding bird surveys were conducted in June 2005 at 11 point count stations within the Touquoy Mine Site as part of the EARD process. Full details on methodology can be found in the EARD document (CRA 2007a).

6.12.4.6.2 Breeding Birds

Breeding bird surveys were conducted by MEL biologists in 2015, 2016 and 2019. Two rounds of surveys were completed at 24 point count stations within the within the Beaver Dam Mine Site in 2015, from June 8 to 11 (early) and June 25 to 26 (late). Additional surveys were conducted in 2019, on July 3 and 13, at 10 point count stations within the southeast expansion of the Beaver Dam Mine Site. Two rounds of breeding surveys were conducted at 50 point count stations within the Haul Road from June 13 to 17 (early) and June 22 to 28 (late), 2016. The surveys were conducted using the same methods as the fall and spring migration surveys. Early morning point count surveys were conducted from 30-minutes before sunrise until 10:00 a.m. Species and number of avifauna observed at each point count location were recorded. Point count stations are presented in Figures 6.12-1A to 6.12-1E.

6.12.4.6.3 Common Nighthawk

The common nighthawk prefers to nest in gravelly substrates and is best detected while foraging for insects shortly after sunset. Suitable habitat is available for this species within the Beaver Dam Mine Site and Haul Road, therefore, dedicated surveys for the common nighthawk were conducted from mid- to end of June at either dawn (1 hour before sunrise to 30 minutes after sunrise) or dusk (30 minutes before sunset to an hour after sunset), as described in the Common Nighthawk Survey Protocol (Saskatchewan Ministry of Environment, 2015). Common nighthawk are crepuscular and were detectable at both dawn and dusk survey times. Stations were spaced at least 800 m apart and a point count survey with call playback was used to detect the presence of common nighthawk within the Beaver Dam Mine Site and Haul Road. A three-minute passive point count was conducted at each station, followed by a call playback which includes 30-seconds of the conspecific common nighthawk call followed by 30-seconds of silence (or passive surveying), repeated for three-minutes (i.e., three times). The total time spent at each survey point was a minimum of six-minutes. Dedicated common night surveys were conducted at the same time as breeding bird surveys. In 2015 three call playback stations were surveyed within the Beaver Dam Mine Site and 12 call playback stations were surveyed within the Haul Road. Two additional call back stations were surveyed July 3 and 13, 2019 within the southeast expansion of the Beaver Dam Mine Site. A total of 17 call playback stations were surveyed within the Beaver Dam Mine Site and Haul Road.

Common nighthawks require open ground or clearings for nesting. The species breeds in a wide range of open habitats, including sandy areas (e.g., dunes, eskers, and beaches), open forests (e.g., mixed wood and coniferous stands, burns, and clear cuts), grasslands (e.g., short-grass prairies, pastures, and grassy plains), wetlands (e.g., bogs, marshes, lakeshores, and riverbanks), gravelly or rocky areas (e.g., outcrops, barrens, gravel roads, gravel rooftops, railway beds, mines, quarries, and bare mountain tops and ridges), and some cultivated or landscaped areas (e.g., parks, military bases, airports, blueberry fields, orchards, cultivated fields) (New Hampshire Fish and Wildlife Department, 2015; Campbell et al., 2006; and COSEWIC, 2007a).

Within both the Beaver Dam Mine Site and the Haul Road, habitats surveyed for common nighthawk breeding activity were located at widened roadsides with expansive gravel areas and clear-cuts. Common nighthawk survey points are presented on Figures 6.12-1A to 6.12-1E.

6.12.5 Baseline Conditions

Baseline assessments for avifauna were completed from September 2014 through June 2016 and July 2019 by MEL biologists. A total of 4,990 minutes (83 hours) of dedicated surveys were completed over six seasons. These surveys resulted in the observation of 4,900 individuals during the dedicated survey periods, representing 94 identified species observed within the Beaver Dam Mine Site and Haul Road. Including incidental observations 6,521 individuals and 103 species were observed within the Beaver Dam Mine Site and Haul Road. Within each survey, observations determined to be 'incidental' were not included in the analysis. These included individuals observed at a distance greater than 100 m, those which simply flew over the point count location, those observed outside of the 10-minute survey window, and those observed outside of a designated point count location.

During the fall 2014 surveys, individuals observed at any of the four crusher point count locations (CPC1 to CPC4) were determined to be incidental observations. Those point count locations are outside of the current Beaver Dam Mine Site and are not relevant to the current design of the Project. As such, the proportion of incidentals in the fall 2014 survey is relatively higher than in other seasons. Priority species observed at these locations are still included in the priority species summaries (Section 6.13.4.8). The total number of individuals and species observed in each season, the number carried forward to analysis in the upcoming sections (column titled 'Included in Analysis'), and a list of species that were only observed incidentally are identified in Table 6.12-5.

Table 6.12-5: Summary of Avifauna Observations for each Survey

Survey	Total # of Individuals	Total # of Species	Individuals Observed During Surveys	Incidental Individuals (Not Included in Analysis)	Species Observed Only Incidentally
Fall Migration 2014	950	45	534	418	American black duck, Canada goose, common loon, great horned owl, pine siskin, purple finch, red crossbill, rusty blackbird
Spring Migration 2015	874	57	550	324	Common raven, wood duck, common merganser, American crow
Spring Raptor Migration 2015	3	3	3	0	N/A
Winter Wildlife Survey (including avifauna) 2015	7	7	7	0	N/A
Breeding 2015	424	51	332	92	Canada goose, northern parula, olive-sided flycatcher
Common Nighthawk 2015	4	4	4	0	N/A
Spring Migration 2016	2269	71	1702	567	American crow, barn swallow, common goldeneye, common loon, red crossbill, mourning dove, northern waterthrush, pine siskin, ring-necked pheasant
Spring Nocturnal Owl 2015 and 2016	0	0	0	0	N/A
Breeding 2016	1,772	68	1,539	233	Northern harrier, common loon, eastern wood-pewee, olive-sided flycatcher.
Breeding 2019	218	35	217	0	N/A
Common Nighthawk 2019	0	0	0	0	N/A

Across all survey seasons, a total of 34 possible priority species, including nine SAR, were observed either during dedicated survey periods or incidentally:

- Common nighthawk (*Chordeiles minor*);
- Chimney swift (*Chaetura pelagica*);
- Wilson's snipe (*Gallinago delicate*);
- Greater yellowlegs (*Tringa melanoleuca*);
- Northern harrier (*Circus cyaneus*);
- Northern goshawk (*Accipiter gentilis*);
- Black-backed woodpecker (*Picoides arcticus*);
- Peregrine falcon (*Falco peregrinus*);
- Eastern wood-pewee (*Contopus virens*);
- Olive-sided flycatcher (*Contopus cooperi*);
- Yellow-bellied flycatcher (*Empidonax flaviventris*);
- Canada jay (*Perisoreus canadensis*);
- Barn swallow (*Hirundo rustica*);
- Boreal chickadee (*Poecile hudsonicus*);
- Red-breasted nuthatch (*Sitta canadensis*);
- Ruby-crowned kinglet (*Regulus calendula*);
- Swainson's thrush (*Catharus ustulatus*);
- Gray catbird (*Dumetella carolinensis*);
- Red crossbill (*Loxia curvirostra*);
- Pine siskin (*Spinus pinus*);
- Tennessee warbler (*Oreothlypis peregrine*);
- Bay-breasted warbler (*Setophaga castanea*);
- Blackpoll warbler (*Setophaga striata*);
- American robin (*Turdus migratorius*);
- Brown-headed cowbird (*Molothrus ater*);
- Purples finch (*Hemorhous purpereus*);
- American coot (*Fulica Americana*);
- American kestrel (*Falco sparverius*);
- Evening grosbeak (*Coccothrautes vespertinus*);
- Spotted sandpiper (*Actitis macularius*);

- Pine grosbeak (*Pinicola enucleator*);
- Common goldeneye (*Bucephala clangula*);
- Canada warbler (*Cardellina canadensis*); and
- Rusty blackbird (*Euphagus carolinus*).

During data analysis, the Project Team uses breeding status qualifiers to identify which avian species are considered SOCI, based on the season in which they were observed. Breeding status qualifiers are defined by the Maritime Breeding Bird Atlas and assigned to each species by the ACCDC. SAR are considered priority species, regardless of the seasonality of their observation. For instance, a bird with an S-Rank of S2S3B, S5N (such as the pine grosbeak) would not be considered a priority species if observed overwintering (the N qualifier represents a non-migratory, or overwintering population). Conversely, a species ranked S5B, S3N (such as the American robin) would not be considered a priority species if observed during migration or breeding season and would only be considered a priority species if observed overwintering. Some species do not have a compound rank assigned with varying seasonal considerations, such as the turkey vulture (ranked S2S3B). This species has no alternate ranking status for migratory or overwintering populations, therefore this species, by default, would be considered a priority species regardless of its' observation date.

The above listed species and their breeding status qualifications are discussed in detail in the SOCI and SAR section (Section 6.13).

Avifauna species were identified based on functional groups to understand how each group of avifauna is using the Beaver Dam Mine Site and Haul Road and to help identify trends in the data. These functional groups include:

- **Waterfowl**: Ducks, geese, or other large aquatic birds, especially when regarded as game;
- **Shorebirds**: Waders, from the Order Charadriiformes;
- **Other waterbirds:** Includes seabirds (i.e., marine birds), grebes (Order Podicipediformes), loons (Order Gaviiformes), Ciconiiformes (i.e., storks, herons, egrets, ibises, spoonbills, etc.), pelicans (Order Pelicaniformes), flamingos (Order Phoenicopteriformes), Gruiformes (i.e., cranes and rails), kingfishers, gulls and dippers (the only family of passerines considered waterbirds);
- **Diurnal Raptors:** Avifauna within the families Accipitridae (i.e., hawks, eagles, buzzards, harriers, kites and old-world vultures), Pandidonidae (i.e., Osprey), Sagittariidae (i.e., Secretary bird), Falconidae (i.e., falcons, caracaras, and forest falcons), Cathartidae (i.e., new world vultures), and one species from the Order Strigiformes (i.e., Hawk Owl);
- **Nocturnal Raptors:** Avifauna of the Order Strigiformes (i.e., owls; with exception of the Hawk Owl, which is a diurnal species of owl);
- **Passerines:** Any avifauna of the Order Passeriformes, which includes more than half of all avifauna species. This is with exception of the dippers, which are a passerine considered a waterbird; and
- **Other Landbirds:** Avifauna within the Orders Galliformes (i.e., quail, pheasant, and grouse), Columbiformes (i.e., pigeons and doves), Cuculiformes (i.e., cuckoos), Caprimulgiformes (i.e., nighthawks and whip-poor-wills), Apodiformes (i.e., swifts and hummingbirds), and Piciformes (i.e., woodpeckers, flickers and sapsuckers).

All species observed during seasonal dedicated avifauna surveys (excluding incidental observations), including seasonal and total abundance is presented in Table 6.12-6. Species exclusively observed during species-specific avifauna surveys (raptor, nocturnal owl, common nighthawk) are discussed in the following respective sections. The relative abundance of avian species is also provided in Appendix L.2.

Table 6.12-6: Seasonal and Total Abundances of Avian Species Identified during the 2014, 2015, 2016 and 2019 Baseline Assessments for Dedicated Fall Migration, Spring Migration, and Breeding Surveys

Common name	Scientific name	Code	Group	Fall (2014)	Spring (2015)	Breeding (2015)	Spring (2016)	Breeding (2016)	Breeding (2019)	Total
Alder flycatcher	*Empidonax alnorum*	ALFL	6	0	5	7	1	39	3	55
American black duck	*Anas rubripes*	ABDU	1	0	1	0	1	11	0	13
American coot	*Fulica Americana*	AMCO	3	0	0	0	2	0	0	2
American crow	*Corvus brachyrhynchos*	AMCR	6	3	0	0	0	5	4	12
American goldfinch	*Spinus tristis*	AMGO	6	0	6	1	21	50	1	79
American kestrel	*Falco sparverius*	AMKE	4	0	0	0	2	0	0	2
American redstart	*Setophaga ruticilla*	AMRE	6	0	6	17	46	13	8	90
American robin	*Turdus migratorius*	AMRO	6	3	22	3	23	25	11	87
Barred owl	*Strix varia*	BADO	5	0	0	0	0	1	0	1
Bay-breasted warbler[(a)]	*Setophaga castanea*	BBWA	6	0	0	0	19	2	1	22
Belted kingfisher	*Megaceryle alcyon*	BEKI	3	4	1	0	0	5	0	10
Black-and-white warbler	*Mniotilta varia*	MAWW	6	0	19	22	111	60	7	219
Black-backed woodpecker[(a)]	*Picoides arcticus*	BBWO	7	0	0	0	3	2	0	5
Blackburnian warbler	*Setophaga fusca*	BLBW	6	0	0	0	4	13	0	17
Black-capped chickadee	*Poecile atricapillus*	BCCH	6	69	2	4	23	40	2	140
Blackbird sp.			6	0	5	0	0	0	0	5
Blackpoll warbler[(a)]	*Setophaga striata*	BPWA	6	11	0	0	2	11	0	24
Black-throated blue warbler	*Setophaga caerulescens*	BTBW	6	0	0	0	3	3	2	8
Black-throated green warbler	*Setophaga virens*	BTNW	6	0	18	20	153	80	18	289
Blue jay	*Cyanocitta cristata*	BLJA	6	7	0	1	8	8	1	25
Blue-headed vireo	*Vireo solitarius*	BHVI	6	6	6	1	79	41	11	144
Boreal chickadee[(a)]	*Poecile hudsonicus*	BOCH	6	9	4	0	2	0	1	16
Brown creeper	*Certhia Americana*	BRCR	6	0	0	0	3	7	0	10
Brown-headed cowbird	*Molothrus ater*	BHCO	6	0	1	0	0	0	0	1
Canada goose	*Branta canadensis*	CAGO	1	0	0	0	2	0	0	2
Canada jay[(a)]	*Perisoreus canadensis*	GRAJ	6	28	0	1	11	0	0	40

Table 6.12-6: Seasonal and Total Abundances of Avian Species Identified during the 2014, 2015, 2016 and 2019 Baseline Assessments for Dedicated Fall Migration, Spring Migration, and Breeding Surveys (continued)

Common name	Scientific name	Code	Group	Fall (2014)	Spring (2015)	Breeding (2015)	Spring (2016)	Breeding (2016)	Breeding (2019)	Total
Canada warbler[(a)]	*Cardellina canadensis*	CAWA	6	0	0	2	10	4	0	16
Cedar waxwing	*Bombycilla cedrorum*	CEDW	6	5	0	2	0	10	0	17
Chestnut-sided warbler	*Setophaga pensylvanica*	CSWA	6	0	1	0	0	12	7	20
Chimney swift[(a)]	*Chaetura pelagica*	CHSW	6	0	0	2	0	0	0	2
Chipping sparrow	*Spizella passerina*	CHSP	6	0	1	1	0	6	2	10
Common grackle	*Quiscalus quiscula*	COGR	6	7	110	15	12	2	0	146
Common loon	*Gavia immer*	COLO	3	0	1	1	0	0	0	2
Common nighthawk[(a)]	*Chordeiles minor*	CONI	7	0	0	0	0	1	0	1
Common raven	*Corvus corax*	CORA	6	8	0	0	3	2	0	13
Common yellowthroat	*Geothlypis trichas*	COYE	6	4	25	31	93	141	13	307
Dark-eyed junco	*Junco hyemalis*	DEJU	6	21	38	8	62	104	7	240
Downy woodpecker	*Picoides pubescens*	DOWO	7	1	1	0	0	2	0	4
Duck sp.	.		1	0	2	0	0	0	0	2
Eastern phoebe	*Sayornis phoebe*	EAPH	6	0	0	2	0	0	0	2
European starling	*Sturnus vulgaris*	EUST	6	0	0	0	0	4	0	4
Evening grosbeak	*Coccothraustes vespertinus*	EVGR	6	0	0	0	2	0	0	2
Golden-crowned kinglet	*Regulus satrapa*	GCKI	6	68	14	2	63	53	0	200
Gray catbird[(a)]	*Dumetella carolinensis*	GRCA	6	0	0	0	0	1	0	1
Great horned owl	*Bubo virginianus*	GHOW	5	0	0	0	1	0	0	1
Greater yellowlegs[(a)]	*Tringa melanoleuca*	GRYE	2	0	13	2	3	5	2	25
Hairy woodpecker	*Picoides villosus*	HAWO	7	3	1	0	6	3	0	13
Hermit thrush	*Catharus guttatus*	HETH	6	6	11	4	62	99	31	213
Hooded merganser	*Lophodytes cucullatus*	HOME	1	0	2	1	0	0	0	3
Least flycatcher	*Empidonax minimus*	LEFL	6	0	17	14	9	13	1	54
Lincoln's sparrow	*Melospiza lincolnii*	LISP	6	0	4	1	21	4	3	33
Magnolia warbler	*Setophaga magnolia*	MAWA	6	0	46	34	167	95	14	356

Table 6.12-6: Seasonal and Total Abundances of Avian Species Identified during the 2014, 2015, 2016 and 2019 Baseline Assessments for Dedicated Fall Migration, Spring Migration, and Breeding Surveys (continued)

Common name	Scientific name	Code	Group	Fall (2014)	Spring (2015)	Breeding (2015)	Spring (2016)	Breeding (2016)	Breeding (2019)	Total
Mallard	*Anas platyrhynchos*	MALL	1	6	0	0	0	0	0	6
Mourning dove	*Zenaida macroura*	MODO	7	1	0	0	0	3	0	4
Mourning warbler	*Geothlypis philadelphia*	MOWA	6	0	0	0	0	5	0	5
Nashville warbler	*Oreothlypis ruficapilla*	NAWA	6	0	3	8	12	0	0	23
Northern flicker	*Colaptes auratus*	NOFL	7	8	9	4	11	8	4	44
Northern goshawk[(a)]	*Accipiter gentilis*	NOGO	4	0	0	0	1	0	0	1
Northern harrier[(a)]	*Circus cyaneus*	NOHA	4	0	0	1	0	0	0	1
Northern parula	*Setophaga americana*	NOPA	6	0	1	0	8	27	0	36
Northern waterthrush	*Parkesia noveboracensis*	NOWA	6	0	1	2	9	2	1	15
Olive-sided flycatcher[(a)]	*Contopus cooperi*	OSFL	6	0	0	0	0	2	0	2
Ovenbird	*Seiurus aurocapilla*	OVEN	6	0	0	1	33	29	3	66
Palm warbler	*Setophaga palmarum*	PAWA	6	18	17	22	134	52	8	251
Peregrine falcon[(a)]	*Falco peregrinus*	PEFL	4	1	0	0	0	0	0	1
Pileated woodpecker	*Dryocopus pileatus*	PIWO	7	3	3	0	6	1	0	13
Pine siskin[(a)]	*Spinus pinus*	PISI	6	120	0	0	0	0	0	120
Purple finch	*Haemorhous purpureus*	PUFI	6	0	0	0	11	4	0	15
Red-breasted nuthatch[(a)]	*Sitta canadensis*	RBNU	6	1	1	0	6	14	0	22
Red-eyed vireo	*Vireo olivaceus*	REVI	6	0	5	9	0	40	4	58
Red-tailed hawk	*Buteo jamaicensis*	RTHA	4	3	0	0	0	2	0	5
Red-winged blackbird	*Agelaius phoeniceus*	RWBL	6	0	8	0	0	0	0	8
Ring-necked duck	*Aythya collaris*	RNDU	1	2	3	0	0	0	0	5
Ruby-crowned kinglet[(a)]	*Regulus calendula*	RCKI	6	5	23	8	70	71	0	177
Ruffed grouse	*Bonasa umbellus*	RUGR	7	7	9	5	19	2	0	42
Savannah sparrow	*Passerculus sandwichensis*	SAVS	6	0	0	1	2	0	0	3
Sharp-shinned hawk	*Accipiter striatus*	SSHA	4	0	0	0	1	0	0	1
Shorebird spp.			2	0	2	0	0	0	0	2

Table 6.12-6: Seasonal and Total Abundances of Avian Species Identified during the 2014, 2015, 2016 and 2019 Baseline Assessments for Dedicated Fall Migration, Spring Migration, and Breeding Surveys (continued)

Common name	Scientific name	Code	Group	Fall (2014)	Spring (2015)	Breeding (2015)	Spring (2016)	Breeding (2016)	Breeding (2019)	Total
Song sparrow	*Melospiza melodia*	SOSP	6	4	5	3	2	1	0	15
Spotted sandpiper	*Actitis macularius*	SPSA	2	0	2	0	0	0	0	2
Spruce grouse	*Falcipennis canadensis*	SPGR	7	6	4	1	7	0	1	19
Swainson's thrush[a]	*Catharus ustulatus*	SWTH	6	0	3	10	32	16	8	69
Swamp sparrow	*Melospiza georgiana*	SWSP	6	8	2	5	33	11	4	63
Tennessee warbler[a]	*Oreothlypis peregrina*	TEWA	6	0	0	1	0	0	0	1
Tree swallow	*Tachycineta bicolor*	TRES	6	0	19	8	15	2	0	44
White-throated sparrow	*Zonotrichia albicollis*	WTSP	6	12	29	18	66	133	18	276
White-winged crossbill	*Loxia leucoptera*	WWCR	6	0	0	0	13	1	0	14
Wilson's snipe[a]	*Gallinago delicata*	WISN	2	0	3	1	1	0	1	6
Winter wren	*Troglodytes hiemalis*	WIWR	6	0	2	2	23	15	3	45
Wood duck	*Aix sponsa*	WODU	1	1	0	0	1	0	0	2
Woodpecker sp.	.		7	2	5	0	5	6	0	18
Yellow warbler	*Setophaga petechia*	YEWA	6	6	1	3	1	33	6	50
Yellow-bellied flycatcher(a)	*Empidonax flaviventris*	YBFL	6	0	1	8	14	37	6	66
Yellow-bellied sapsucker	*Sphyrapicus varius*	YBSS	7	0	1	0	0	2	0	3
Yellow-rumped warbler	*Setophaga coronata*	YRWA	6	57	18	12	140	49	0	276
Total	92 species[b]			532	550	332	1,702	1,539	217	4874[b]

[a] Priority species observed during dedicated surveys.

[b] Total counts only include observations during Spring Migration, Fall Migration and Breeding surveys. Total counts do not include unidentified or incidental species.

Notes: Species numbers in the table are only for those observed within the 100 m point count radius and within the dedicated point count periods. Avifauna observed during owl, common nighthawk, diurnal migrating raptor, and winter wildlife surveys are not included, but discussed below.

6.12.5.1 Winter Birds

Seven confirmed species and two unidentified species (i.e., a woodpecker and a sparrow) were observed incidentally during winter wildlife surveys along the Haul Road: black-capped chickadee (*Poecile atricapillus*), ruffed grouse (*Bonasa umbellus*), dark-eyed junco (*Junco hyemalis*), cedar waxwing (*Bombycilla cedrorum*), black duck *(Anas rubripes*), common grackle (*Quiscalus quiscula*), and goldencrowned kinglet (*Regulus satrapa*). Five species were observed within the Beaver Dam Mine Site during winter wildlife surveys: black-capped chickadee, cedar waxwing, northern saw-whet owl (*Aegolius acadicus*), downy woodpecker (*Picoides pubescens*), and American crow (*Corvus brachyrhynchos*). No priority overwintering bird species were observed.

6.12.5.2 Spring Diurnal Raptor Migration

Three raptors were observed during the dedicated spring migrating raptor survey that took place on April 15, 2015 within the Beaver Dam Mine Site. The first raptor was a migrating adult bald eagle (*Haliaeetus leucocephalus*), which was observed flying southeast at high altitude, though it could still be identified easily with the unaided eye. The other two raptors, which were determined to be local non-migrating birds due to their behaviours (actively hunting and in view for extended periods of time), were an adult male northern harrier (*Circus cyaneus*) and an adult female American kestrel (*Falco sparverius*). None of the species observed were priority species. The northern harrier is considered a priority species when observed during breeding season surveys (S-Rank is S3S4B). A targeted survey for spring diurnal raptor migration was not conducted within the Haul Road. Targeted surveys within the Beaver Dam Mine Site completed in 2015 suggest that the broader PA does not fall within a major migration route for spring migrating raptors, and thus targeted surveys for raptors were not necessary within the Haul Road in 2016.

6.12.5.3 Nocturnal Owl

No owls were observed during the dedicated nocturnal owl call playback surveys within the Beaver Dam Mine Site or along the Haul Road. However, owls were observed in the Beaver Dam Mine Site and Haul Road (Table 6.12-5) during other dedicated avian surveys, including the great horned owl (*Bubo virginianus*), northern saw-whet owl (*Aegolius acadicus*; observed outside avifauna surveys), and barred owl (*Strix varia*).

6.12.5.4 Fall Migration

The fall migration survey consisted of 32 point count stations and dedicated surveys were conducted weekly from September 17th to October 19th, 2014, for a total of four visits within the Beaver Dam Mine Site. During fall migration, 830 individuals representing 44 species were observed. Following the removal of incidental observations (Table 6.12-5; including all individuals identified in the CPC1 to CPC2 point counts) 412 individuals from 36 species, were carried forward for analysis. Relative species abundance can be found in Appendix L.2. An additional eight species were observed incidentally, listed in Table 6.12-5. In total, six priority species were observed during fall migration surveys. Priority species observed during spring migration monitoring is discussed in Section 6.13.

The most commonly observed species were black-capped chickadee (*Poecile atricapillus*; n=69), followed by golden-crowned kinglet (*Regulus satrapa*; n=68), and yellow-rumped warbler (*Setophaga coronata*; n=57). Most observations documented groups of up to two individuals, though there were a few groups ranging between three and six individuals. Two observations of obvious migrants were documented on September 30, 2014. On this date, one flock of 50 pine siskins and another flock of 25 were observed at PC24 and PC26, respectively. These observations are the only obvious migrants noted based on their abundance. These observations are recorded as incidentals and not included in the analysis provided herein because they were identified as flyovers.

The most abundant group observed on site during the fall migration period was passerines (songbirds), which accounted for 62.2% of species and 88.4% of individuals. Non-passerine landbirds were the next most abundant group on-site, followed by waterfowl.

Fall migration surveys were not conducted within the Haul Road because habitat types identified within this section of the PA were generally similar to those observed within the Beaver Dam Mine Site. Overall Project interactions with migrating avifauna are expected to be low along the Haul Road due to the linear nature of the Haul Road and its proposed upgrade to support mine development and trucking of ore from Beaver Dam Mine Site to Touquoy Mine Site for processing. There are no known significant migratory flyways, nor were there any observed during surveys along the Haul Road or the Beaver Dam Mine Site. Wetlands, often habitat considered important for avifauna, are also consistent in type and habitat characteristics along the Haul Road and within the Beaver Dam Mine Site.

6.12.5.5 Spring Migration

Due to poor weather conditions (delayed spring thaw and melt), significant snow cover, and access challenges, the 2015 spring migration survey had a reduced scope of 12 point count stations within the Beaver Dam Mine Site. Spring migration surveys were conducted weekly from April 21 to May 24, 2015, for a total of five visits. During spring migration, 873 individuals, representing 56 species were observed. Following the removal of incidental observations (Table 6.12-5) 549 individuals from 52 species were carried forward for analysis. Four priority species were observed during spring migration surveys within the Beaver Dam Mine Site. Priority species observed during spring migration monitoring is discussed in Section 6.13.

During spring migration surveys completed in 2015 within the Beaver Dam Mine Site, common grackle was the most commonly observed species (*Quiscalus quiscula*, n= 110), followed by magnolia warbler (*Setophaga magnolia*, n=46), Dark-eyed Junco (*Junco hyemalis*, n=38), and white-throated sparrow (*Zonotricha albicollis*, n= 29). The most abundant and diverse group of avifauna observed during spring surveys in the Beaver Dam Mine Site was passerines, which accounted for 88.8% of individuals, followed by non-passerine land birds (5.86%), and shorebirds (3.55%).

Within the Haul Road, 45 point count stations were surveyed during the spring bird migration period. Spring bird migration surveys were conducted from May 12 to 27, 2016, for a total of three visits. During spring migration, 2,269 individuals representing 71 species were observed Following the removal of incidental observations (Table 6.12-5) 1,702 individuals from 62 species, were carried forward for analysis. Nine priority species were observed during spring migration surveys completed within the Haul Road. Priority species observed during spring migration monitoring is discussed in Section 6.13.

The species most commonly observed was magnolia warbler (Setophaga magnolia; n=167), followed by black-throated green warbler (Setophaga virens; n= 153), and yellow-rumped warbler (Setophaga coronata; n=140). No obvious concentration of ducks or shorebirds was observed. The most abundant and diverse group of birds observed in spring migration surveys within the Haul Road is passerines, which accounted for 95.9% of individuals, followed by non-passerine land birds (3.34%).

The majority of observations were of single individuals and the largest groups of birds observed were two flocks of common grackle in 2015. One flock contained 50 individuals and was observed on June 4th and the second flock contained 30 individuals and was observed on May 1, both in 2015 within the Beaver Dam Mine Site. No obvious migrants were documented within the Haul Road. The abundances of species observed during spring migration surveys completed in 2015 and 2016 within the Beaver Dam Mine Site and the Haul Road are presented in Appendix L.2.

6.12.5.6 Breeding Birds

The 2015 breeding survey consisted of 24 point count stations, which were surveyed twice in the month of June 2015 within the Beaver Dam Mine Site. A total of 442 species representing 50 species were recorded during breeding season in the Beaver Dam Mine Site. Following the removal of incidental observations (Table 6.12-5) 330 individuals from 47 species were carried forward for analysis. Thirty-four possible priority species were observed during the breeding season surveys completed within the Beaver Dam Mine Site, which are discussed in detail in Section 6.13.4.3.

The most abundant species observed was the magnolia warbler (Setophaga magnolia, n=34), followed by the common yellowthroat (*Geothylpis trichas*, n=31), the black-and-white warbler (*Mniotilta varia*, n = 22), and the palm warbler (*Setophaga palmarum*, n=22). Passerines represented the most abundant and diverse group of avifauna observed, accounting for 95.2% of all individuals, followed by non-passerine landbirds (3.0%).

In June 2016, 50 point count stations were surveyed within the Haul Road. A total of 1,772 individuals representing 68 species were observed during the breeding season within the Haul Road. Following the removal of incidental observations (Table 6.12-5) 1,539 individuals representing 64 species were carried forward for analysis. Fourteen priority species were observed during breeding season surveys within the Haul Road, which are discussed in detail in Section 6.13.4.8.

The most commonly observed species in the breeding season of 2016 was the common yellowthroat (*Geothylpis trichas*, n=141), followed by the white-throated sparrow (*Zonotricha albicollis*, n=133), and the dark-eyed junco (*Junco hyemalis*, n=104). Similar to results obtained in the breeding season in 2015, passerines represented the greatest abundance and diversity of all avifauna groups in the breeding season of 2016. Passerines accounted for 96.5% of individuals, followed by non-passerine landbirds, which accounted for 1.9% of individuals.

Ten additional point count stations were surveyed in July 2019 within the Beaver Dam Mine Site. A total of 217 individuals representing 35 species were observed and carried forward for analysis. Six priority species were observed during the 2019 breeding surveys, which are discussed in detail in Section 6.13.4.8.

The most abundant species observed was the Hermit thrush (*Catharus guttatus*, n=31), followed by the White-throated Sparrow (*Zonotrichia alicollis*, n=18), the Black-throated Green Warbler *(Setophaga virens*, n=18), and the Magnolia Warbler (*Setophaga magnolia*, n=14). Passerines represented the most abundant and diverse group of avifauna observed, accounting for 96%, followed by non-passerine landbirds (2%). This trend is similar to what was observed during both 2015 and 2016 breeding season surveys.

Breeding evidence was recorded for all species observed during 2015, 2016 and 2019 breeding season surveys, in accordance with guidance provided by the Maritime Breeding Bird Atlas (see breeding codes, Appendix L.1). Since the surveyed area is a relatively small part of the surrounding area, it is not possible to confirm that all species listed were actually nesting within the boundaries of the PA. For instance, if a bird was observed carrying food (i.e., example of confirmed breeding evidence, based on MBBA, Bird Studies Canada, n.d.), it is possible that the bird was nesting on an adjacent parcel of land. A summary table is presented below (Table 6.12-7), which identifies the highest breeding evidence recorded for each species in surveys completed in 2015 and 2019 in the Beaver Dam Mine Site and 2016 in the Haul Road. Breeding evidence codes were determined for all species observed during each annual survey, including those observed incidentally during avifauna surveys.

Table 6.12-7: Breeding Summary within the Beaver Dam Mine Site and Haul Road

Code	Common Name	2015 Breeding Evidence	2016 Breeding Evidence	2019 Breeding Evidence
ABDU	American black duck	-	Confirmed	-
ALFL	Alder flycatcher	Probable	Probable	Possible
AMCR	American crow	-	Possible	Possible
AMGO	American goldfinch	Possible	Probable	Possible
AMRE	American redstart	Probable	Probable	Probable
AMRO	American robin	Probable	Probable	Probable
BADO	Barred owl	-	Possible	-
BAWW	Black-and-white warbler	Probable	Probable	Probable
BBWA	Bay-breasted warbler*	-	Possible	Possible
BBWO	Black-backed woodpecker*	-	Possible	-
BCCH	Black-capped chickadee	Possible	Probable	Possible
BEKI	Belted kingfisher	-	Possible	-
BHVI	Blue-headed vireo	Possible	Probable	Probable
BLBW	Blackburnian warbler	-	Possible	-
BLJA	Blue jay	Possible	Possible	Possible
BOCH	Boreal chickadee*	-	-	Possible
BPWA	Blackpoll warbler*	-	Possible	-
BRCR	Brown creeper	-	Possible	-
BTBW	Black-throated blue warbler	-	Possible	Possible
BTNW	Black-throated green warbler	Probable	Probable	Probable
CAGO	Canada goose	Confirmed	-	-
CAWA	Canada warbler*	Probable	Probable	-
CEDW	Cedar waxwing	Possible	Possible	-
CHSP	Chipping sparrow	Possible	Possible	Possible
COGR	Common grackle	Probable	Probable	-
COLO	Common loon	Possible	Possible	-
CONI	Common nighthawk*	-	Possible	-
CORA	Common raven	-	Possible	-
COYE	Common yellowthroat	Probable	Probable	Probable
CSWA	Chestnut-sided warbler	-	Possible	Probable
DEJU	Dark-eyed junco	Possible	Probable	Probable
DOWO	Downy woodpecker	-	Possible	-
EAPH	Eastern phoebe	Possible	-	-
EUST	European starling	-	Possible	-
GCKI	Golden-crowned kinglet	Possible	Probable	-
GRCA	Gray catbird*	-	Possible	-
GRJA	Canada jay*	Possible	-	-
GRYE	Greater yellowlegs*	Probable	Probable	Possible
HAWO	Hairy woodpecker	-	Possible	-

Table 6.12-7: Breeding Summary within the Beaver Dam Mine Site and Haul Road (continued)

Code	Common Name	2015 Breeding Evidence	2016 Breeding Evidence	2019 Breeding Evidence
HETH	Hermit thrush	Possible	Probable	Probable
HOME	Hooded merganser	Possible	-	-
LEFL	Least flycatcher	Probable	Possible	Possible
LISP	Lincoln's sparrow	Possible	Possible	Probable
MAWA	Magnolia warbler	Probable	Probable	Confirmed
MODO	Mourning dove	-	Possible	-
MOWA	Mourning warbler	-	Possible	-
NAWA	Nashville warbler	Probable	-	-
NOFL	Northern flicker	Probable	Probable	Possible
NOHA	Northern harrier*	Possible	Possible	-
NOPA	Northern parula	Possible	Probable	-
NOWA	Northern waterthrush	Possible	Possible	Possible
OSFL	Olive-sided flycatcher*	Possible	Possible	-
OVEN	Ovenbird	Possible	Probable	Probable
PAWA	Palm warbler	Probable	Probable	-
PIWO	Pileated woodpecker	-	Possible	-
PUFI	Purple finch	-	Possible	-
RBNU	Red-breasted nuthatch*	-	Probable	-
RCKI	Ruby-crowned kinglet*	Probable	Probable	-
REVI	Red-eyed vireo	Probable	Probable	Possible
RTHA	Red-tailed hawk	-	Probable	-
RUGR	Ruffed grouse	Probable	Confirmed	-
SAVS	Savannah sparrow	Possible	-	-
SOSP	Song sparrow	Probable	Possible	-
SPGR	Spruce grouse	Probable	-	Possible
SWSP	Swamp sparrow	Probable	Possible	Probable
SWTH	Swainson's thrush*	Confirmed	Probable	Possible
TEWA	Tennessee warbler*	Possible	-	-
TRES	Tree swallow	Probable	Possible	-
UNBB	Blackbird spp.	Possible	-	-
UNWO	Woodpecker sp.	Possible	Probable	-
WISN	Wilson's snipe*	Possible	-	Possible
WIWR	Winter wren	Possible	Probable	Possible
WTSP	White-throated sparrow	Probable	Confirmed	Probable
WWCR	White-winged crossbill	-	Possible	-
YBFL	Yellow-bellied flycatcher*	Probable	Probable	Possible
YBSS	Yellow-bellied sapsucker	-	Confirmed	-
YEWA	Yellow warbler	Probable	Possible	Possible
YRWA	Yellow-rumped warbler	Probable	Probable	-

Note: - = indicates no observation. * = Priority species, see Section 6.13.

All of the species identified are native species expected to be found in this area of Nova Scotia and the province in general, and within the typical and common habitat associated with the Project and surrounding landscape. The majority of observations were of a single individual. The largest flock observed was common grackle (n=10). The most abundant group observed on site during the breeding bird period was passerines (songbirds), non-passerine landbirds were the next most abundant group on-site, followed by waterfowl, shorebirds, and raptors, which were all observed in small numbers. No incidental observations of raptor nests were made on either the Beaver Dam Mine Site or Haul Road.

Results of spring and fall migration and breeding bird surveys are provided in Appendix L.2. Priority species avifauna observations are shown in Section 6.13, Figures 6.13-1A to 6.13-1G.

6.12.5.6.1 Touquoy Mine Site

The 2005 breeding bird surveys of the Touquoy Mine Site found 398 birds representing 52 species over 11 point count stations. The most abundant species were the magnolia warbler (Setophaga magnolia, 7.5% of the total) and the common grackle (*Quiscalus quiscula*, 7.3%) (CRA 2007). Ten of the 52 species observed are priority species. They are as follows; pine grosbeak (*Pinicola enucleator*), willow flycatcher (*Empidonax traillii*), yellow-bellied flycatcher, barn swallow, boreal chickadee, ruby-crowned kinglet, rusty blackbird, bay-breasted warbler, Swainson's thrush, and pine siskin.

6.12.5.7 Common Nighthawk

Four common nighthawks were observed within the Haul Road. One observation was recorded during a breeding bird survey at Haul Road PC26, while three were observed during dedicated call playback surveys along the Haul Road in 2016. None were observed within the Beaver Dam Mine Site. No additional observations of common nighthawk occurred in 2019 during dedicated common nighthawk surveys or incidental observations.

Common nighthawks were observed calling, but no evidence of breeding behavior was documented (i.e., booming, or displaying females). Common nighthawks were observed within the Haul Road, in habitats with expansive gravelly areas adjacent to clear cuts, or disturbed areas (Haul Road PC26, CONI1, CONI9). Suitable habitat is present within the Beaver Dam Mine Site and Haul Road for this species, so their presence during the breeding season indicates that breeding is likely to be occurring within these areas.

6.12.5.8 Discussion

Of the 92 avian species observed during dedicated fall migration, spring migration and breeding surveys (excluding incidentals) within the Beaver Dam Mine Site and Haul Road, 77 (75% of species) are protected under the *Migratory Bird Convention Act* (1994). Avifauna observed that are not protected under the Migratory Bird Convention Act (1994) were from the Accipitridae (e.g. harriers and hawks), Alcedinidae (e.g., kingfisher), Corvidae (e.g., jays, crows and ravens), Phasianidae (e.g., grouse and pheasants), and Strigidae (e.g., owls) families. Two species, bald eagle and northern saw-whet owl, were only observed during dedicated raptor and winter surveys, respectively.

Avian diversity was relatively higher along the Haul Road than within the Beaver Dam Mine Site. This is likely attributable to the fact that the Beaver Dam Mine Site is more extensively disturbed and fragmented as a result of historic mine operations and current and historic timber harvesting practices. Overall, avian diversity and abundance was moderate and fell within expectations for the habitats available and for forests in Halifax County in general.

Passerines were the dominant species group across all seasons within the Beaver Dam Mine Site and Haul Road accounting for 67% of total observations, which is expected based on the variety of suitable habitats present. The order Passeriformes includes more than half of all avifauna species, so their relative abundance within the Beaver Dam Mine Site and Haul Road falls within expectation. Furthermore, the Passerine family contains the highest diversity of species. Preferred stand age and density can vary be species and life stage. Generally passerine species inhabit forested areas with access to wetlands and water features. The landscape across the Beaver Dam Mine Site and Haul Road is dominated by forest cover (both deciduous and coniferous of different maturity levels) with harvested areas at different stages of regeneration and wetlands interspersed throughout. Passerine species such as American crow, common raven and blue jay can tolerate and use anthropogenically disturbed environments, which are present within Beaver Dam Mine Site and Haul Road (i.e., historical mining, timber harvesting, road and trail networks).

Non-passerine landbirds were the second most abundant species group observed within the Beaver Dam Mine Site and Haul Road, accounting for 12% of total observations, and consisted primarily of grouse and woodpecker species. Habitats for these species are present throughout the Beaver Dam Mine Site and Haul Road. Woodpecker habitat preferences differ depending on the species; therefore, the variety of species observed (n=6) is an indicator of habitat types and diversity within the Beaver Dam Mine Site and Haul Road. For example, northern flickers (*Colaptes auratus*) are ground feeders and favour woodland edges near open areas, downy woodpeckers (*Picoides pubescens*) favour riparian woodlands, and pileated woodpeckers (*Dryocopus pileatus*) prefer mature hardwood and coniferous forests. Two species of grouse, the ruffed (Bonasa umbellus) and spruce grouse (*Falcipennis canadensis*), were observed. The ruffed grouse is considered to be dependent on subclimax deciduous forests, whereas the spruce grouse is considered dependent on climax coniferous forests (Pietz and Tester, 1982).

Waterfowl and shorebirds were observed in lesser abundance, 8% and 4% of total observations, respectively. No large congregations of waterfowl or shorebirds were observed roosting or staging within the Beaver Dam Mine Site and Haul Road during either the spring or fall migration periods. Wetland habitats suitable for migrating shorebirds and waterfowl were limited within the Beaver Dam Mine Site and Haul Road (open water wetlands with shallow areas for foraging). The only shorebird that was likely breeding within the Beaver Dam Mine Site and Haul Road was the greater yellowlegs; this species breeds in muskeg, wet bogs with small wooded islands, and forests with abundant clearings (Elphick and Tibbits, 1998). The only waterfowl species observed during the breeding season within the Beaver Dam Mine Site and Haul Road was the American black duck (*Anas rubripes*) and its habitat preferences during the breeding season are influenced by wetland fertility, cover, and invertebrate densities (Merendino and Ankney, 1994). In Nova Scotia, American black ducks commonly nest along streams and contiguous freshwater marshes (Seymour, 1984), as well as coastal salt marsh (Reed and Moisan, 1971).

Raptors, both diurnal and nocturnal, were observed in low numbers within the Beaver Dam Mine Site and Haul Road throughout the year, totaling 9% of total observations. Throughout the migration period, this suggests that there are no major migration corridors over the PA. As for the breeding season, suitable breeding habitat is present for several forest raptors, including northern goshawk, Cooper's hawk, sharp-shinned hawk, red-tailed hawk, merlin, American kestrel, great horned owl, barred owl, and northern saw-whet owl. Raptor species generally prefer open habitat (i.e., meadows, cut blocks, wetlands, open water) with adjacent mature forest. Many of these forest raptor species are difficult to census; therefore, it is not surprising that documented species richness and abundance were low within the Beaver Dam Mine Site and Haul Road.

6.12.6 Consideration Engagement Results

Key issues raised during public and Mi'kmaq engagement relating to birds include potential for direct mortality associated with the hauling operation and indirect effects on other VCs, such as dust, noise and light, as well as potential effects on birds associated with permanent loss of habitat from construction of the Beaver Dam Mine and the Haul Road. Potential effects on traditional uses of land and resources by the Mi'kmaq were noted, including fowling.

The results of the public and Mi'kmaq engagement have been considered in the environmental effects assessment, including AMNS's commitments on mitigation and monitoring measures and proposed compliance and effects monitoring programs, as well as AMNS's broader commitment to ongoing public and Mi'kmaq engagement. Specific to evaluating the effect on birds, these are found within the following environmental effects assessment.

6.12.7 Effects Assessment Methodology

6.12.7.1 Boundaries

6.12.7.1.1 Spatial Boundaries

The spatial boundaries used for the assessment of Project effects to terrestrial fauna is described below.

- The PA (Section 5.5, Figure 5.5-1) consists of the three project components; Beaver Dam Mine Site, Haul Road and Touquoy Mine Site and extends from Marinette to Moose River Gold Mines, Halifax County, NS. The Beaver Dam Mine Site is located at the eastern end of the Beaver Dam Mines Road. The Haul Road spans from the Beaver Dam Mine Site to Moose River Gold Mines, where the Touquoy Mine Site [processing and exhausted pit (to be used to dispose Beaver Dam tailings)] is located. The PA has changed as a result of the expansion of the Beaver Dam Mine Site to accommodate micro-sitting of mine infrastructure and ongoing modifications to the Haul Road design, as described in Section 2 (Project Description). These changes have been captured under the existing and additional desktop and field evaluations.
- The LAA (Figure 6.12-2) consists of a 5 km buffer surrounding the Beaver Dam Mine Site and a 500 m buffer surrounding the Haul Road and Touquoy Mine Site components of the PA. The LAA boundaries were defined considering the maximum expected extent of direct and indirect impacts to avifauna. The LAA has been modified to reflect the changes in the PA
- The RAA (Figure 6.12-2) encompasses NSL&F's Ecological Land Classification Ecodistrict 440 (Eastern Interior) within Halifax Regional Municipality, east and north of Lake Charlotte. Where the Ecodistrict boundary approached the northern extent of the Beaver Dam Mine Site, the RAA was enlarged to include a minimum 5 km buffer around the PA. This Ecodistrict spans an area broader than the expected Project impacts and considers other project boundaries as per cumulative effects methodology.

Assessment of avifauna will be completed in consideration of the LAA as the primary spatial boundary. All spatial boundaries will help to identify the direct or indirect impacts to terrestrial fauna and the effects of the Project on distribution and abundance of these species.

6.12.7.1.2 Temporal Boundaries

The temporal boundaries used for the assessment of effects to birds are the construction phase, operational phase, and decommissioning and reclamation phases.

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Atlantic Gold

FIGURE 6.12-2

Beaver Dam Mine Project

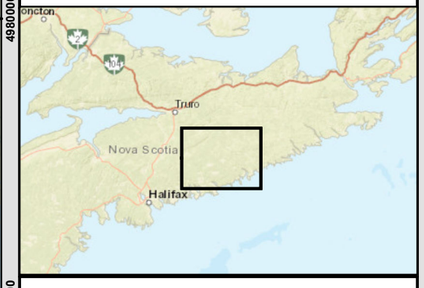
Spatial Boundaries: Avifauna

Beaver Dam Mine Site

Touquoy Mine Site

Haul Road

- Project Area
- Terrestrial Fauna Local Assessment Area
- Terrestrial Fauna Regional Assessment Area



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 2.5 5 10 km

1:200,000 Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed By: XX

Date: 2/23/2021

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Document Name: BD_EIS_Figure6-11-XSpatialBound

6.12.7.1.3 Technical Boundaries

No technical boundaries were identified for the effects assessment of avifauna.

6.12.7.1.4 Administrative Boundaries

Administrative boundaries for evaluation and management of birds include the *Nova Scotia Wildlife Act*, which protects all birds within the province and the *Migratory Birds Convention Act* (MBCA) which offers protection for migratory birds. Further protection is offered to SAR through the provincial *Nova Scotia Endangered Species Act* and the federal SARA.

A significant adverse effect from the Project on birds is defined as an effect that is likely to cause a permanent alteration to any bird species distribution or abundance. An adverse effect that does not cause a permanent alteration in distribution or abundance of any bird species is considered to be not significant.

6.12.7.2 Thresholds for Determination of Significance

A significant adverse effect from the Project on avifauna is defined as an effect that is likely to cause a permanent, unmitigated, alteration to habitat that supports avian species. An adverse effect that does not cause a permanent alteration in distribution of any avifauna species is considered to be not significant. Significance criteria related to impacts to SOCI and SAR are presented in Section 6.13.

The following logic was applied to assess the magnitude of a predicted change in avifauna, based on the habitat analysis results described in Section 6.10.4.5:

- **Negligible** – the Project is predicted to result in less than 1% direct loss of habitat types used by observed species within the LAA.
- **Low** – the Project is predicted to result in 1 to 5% direct loss of habitat types used by observed species within the LAA, and the loss of habitat is mitigated in the long term through reclamation planning and other mitigation measures as determined to be necessary based on flora species and communities present.
- **Moderate** – the Project is predicted to result in 5 to 25% direct loss of habitat types used by observed species within the LAA and the loss of habitat is mitigated in the long term through reclamation planning and other mitigation measures as determined to be necessary based on flora species and communities present.
- **High** – the Project is predicted to result in greater than 25% direct loss of habitat types used by observed species within the LAA and the loss of habitat is not mitigated in the long term through reclamation planning and other mitigation measures as determined to be necessary based on flora species and communities present.

The Habitat and Flora LAA was used to determine habitat type and area, and resultant habitat loss for species (Section 6.10.7.1).

The timing of residual effects for avifauna considers when the residual environmental effect is expected to occur, considering seasonal aspects and sensitive time periods for avifauna. The duration of residual effects considers the time frame over which the effects are likely to last, ranging from short-term to permanent. For the purpose of the effects assessment related to avifauna, long term reflects the commencement of reclamation activities. The frequency of residual effects considers the rate of recurrence of the effects, ranging from once to continuous. The reversibility of residual effects considers the time required for habitat to recover to baseline conditions, or whether the changes to habitat, if identified, are permanent.

6.12.8 Project Activities/Interactions with Avifauna

The assessment of potential adverse interactions and effects of the Project on this VC takes into account the potential for the Project to result in changes to:

- permanent and temporary habitat alteration and fragmentation;
- disturbance and/or displacement;
- potential for direct and indirect mortality to individuals; and
- sensory disturbance.

The potential interactions of the Project with avifauna and avifauna habitat is presented in Tables 6.12-8 to 6.12-10.

Table 6.12-8: Potential Project Activities/Interactions with Avifauna at Beaver Dam Mine Site

Project Phase	Duration	Project Interactions
Construction	1 year	• Clearing, grubbing, and grading in preparation of construction • Rock blasting in preparation of construction (e.g., pre-stripping) • Till and waste rock from site preparation transport and storage • Watercourse and wetland alteration in preparation of construction, including open pit dewatering • Surface infrastructure installation and construction • Collection ditches and settling pond construction • Local traffic bypass road construction • Mine Site road construction and lighting • Culvert and bridge upgrades and construction • General noise and lighting from construction activities • Wildlife vehicle interactions/collisions
Operations and Maintenance	5 years	• Drilling and rock blasting to access and extract ore • Management of waste rock produced from crushing and preparing ore for transport • Till and waste rock from site preparation transport and storage • Open pit dewatering • Site maintenance • Treatment of site surface water runoff and surface mine pumped water • General management of wastes derived from operation and maintenance activities • Petroleum products management • Dust management • Culvert and bridge maintenance • General noise and lighting from construction activities • Wildlife vehicle interactions/collisions
Active Closure	2 years	• Site reclamation activities • Water treatment and management • Noise and lighting from decommissioning activities • Wildlife vehicle interactions/collisions
Post-closure	+10 years (monitoring)	• Water treatment and management

Table 6.12-9: Potential Project Activities/Interactions with Avifauna along Haul Road

Project Phase	Duration	Project Interactions
Construction	1 year	• Clearing, grubbing, and grading in preparation of construction • Rock blasting in preparation of construction • Till and waste rock from site preparation transport and storage • Watercourse and wetland alteration in preparation of construction • Haul Road construction and upgrades • Auxiliary infrastructure installation and construction • Local traffic bypass road construction • Culvert and bridge upgrades and construction • General noise and light from construction activities • Wildlife vehicle collisions
Operations and Maintenance	5 years	• Ore extraction and transport form Beaver Dam Mine Site to Touquoy Mine Site • Haul Road maintenance and repairs, including snow removal and deposition of sand for traction control • Dust management • Noise and light from Haul Road activity • Wildlife vehicle interactions/collisions
Active Closure	2 years	• N/A[(a)]
Post-closure	+10 years (monitoring)	• N/A

[(a)] Decommissioning and Reclamation of the Haul Road is not expected. The Haul Road will be returned to owner for forestry Industry.

Table 6.12-10: Impacts of the Project on Avifauna

Impact Type	Direct Impact	Project Phase	Indirect Impact	Project Phase
Vegetative and Habitat Integrity	Loss of vegetative cover through clearing and grubbing decreases bird habitat availability and Project development also has the potential to reduce natural surface water drainage.	C	Habitat fragmentation may alter habitat suitability for those species which rely on interior forest conditions. Within the Haul Road, this change in habitat is expected to be permanent.	C, O, CL
Sensory Disturbance	Extensive ground works, including activities such as blasting will increase noise levels. Increase in vehicular traffic will add to sensory disturbance through increased noise. This has the potential to reduce habitat for fauna.	C, O, CL	Sensory disturbance (both lights and sounds) may result in further avoidance of the PA by some species.	C, O
	Birds may become attracted to or disoriented by open pit lighting at night, particularly during periods of migration, which could lead to mortality (Jones and Francis, 2003).	C, O	Artificial lighting at night has been shown to influence the seasonal start of bird vocalizations, which could affect individual fitness (Da Silva et al., 2014).	C, O
Direct Mortality	Increased traffic and general activity within the PA may result in direct mortality to wild species through vehicular collisions and construction.	C, O, CL	Improved access throughout the Beaver Dam Mne Site and as a result of Haul Road construction/upgrades may increase hunting activity of licensed hunters and/or illegal poachers.	C, O, CL

Notes: C = Construction; O = Operations; CL = Active Closure; m = metre; PA = Project Area.

6.12.8.1 Habitat Use and Direct Loss

Development of the mine infrastructure and upgrades to the Haul Road will cause direct impacts to habitat used by avifauna, including upland forested habitat and wetlands. This will occur mostly within the construction phase of the Project. Habitat within the PA and surrounding landscape currently exhibits fragmented conditions based on historic mine operations, existing road and trail networks, and current and historic timber harvesting activity within and adjacent to the PA. However, project activities are still likely to result in direct habitat loss, increased habitat fragmentation and a decrease in habitat quality (e.g., sensory disturbance) for those species which rely especially on interior forest conditions (Sections 6.11.7.2.3 and 6.11.7.4), where intact interior forest remains. The level of disturbance within the Beaver Dam Mine Site disproportionately affects uplands over wetlands. There exists large, natural, wetland habitats within the Beaver Dam Mine Site (e.g., Wetlands 2 and 29) that are not anticipated to be impacted by the Project. Section 6.10.7.1 presents the habitat types and areas, including anthropologic disturbances, that will be impacted by the Project.

Habitat descriptions for each observed avifauna functional group are described in Section 6.12.5.8. Habitat loss by functional groups based on the group's preferred habitat type(s) and PA habitat analysis described in Section 6.10.4.5 is presented in Table 6.12-11. Due to the diversity of species within the Passerine functional group, this group was further divided by habitat preference for this assessment. Specific habitat requirements (i.e., wetland type) were not distinguished and, conservatively, the broader habitat types from Section 6.10.3.5 were used to assess habitat loss by observed species. Based on the definitions of magnitude of impact, it is anticipated that all impacts to habitat types used by observed avifauna will be low, with the exception to anthropogenic disturbances (Table 6.10-6). Specific habitat requirements, loss and impacts to observed SOCI and SAR are further discussed in Section 6.8.7.2 and Section 6.13.

Table 6.12-11: Habitat Use and Loss within the Project Area and Magnitude of Impact

Functional Groups	Habitat Type Used	Area within the LAA (Ha)	Area within Project Area (BD Mine Site and HR) (Ha)	% of habitat type within the LAA directly impacted by the Project	Magnitude of Impacts to Habitat within LAA
Waterfowl	Lakes, Ponds, Beaver flowage Wetlands (includes all wetland classes)	1,052.9	12.8	1.2	Low
Shorebirds	Lakes, Ponds, Beaver flowage Wetlands (includes all wetland classes)	1,052.9	12.8	1.2	Low
Other Waterbirds	Lakes, Ponds, Beaver flowage Wetlands (includes all wetland classes)	1,052.9	12.8	1.2	Low
Diurnal Raptors	Hardwood Dominant Stands Softwood Dominant Stands Managed Forests[b] Lakes, Ponds, Beaver flowage Barrens (includes rock barrens)	4,631.0	148.5	3.2	Low
	Anthropogenic Disturbances[c]	20.3	13.4	66.0	N/A[d]

Table 6.12-11: Habitat Use and Loss within the Project Area and Magnitude of Impact (continued)

Functional Groups	Habitat Type Used	Area within the LAA (Ha)	Area within Project Area (BD Mine Site and HR) (Ha)	% of habitat type within the LAA directly impacted by the Project	Magnitude of Impacts to Habitat within LAA
Nocturnal Raptors	Hardwood Dominant Stands Softwood Dominant Stands Managed Forests[b] Lakes, Ponds, Beaver flowage Wetlands (includes all wetland classes)	5,440.1	156.7	2.9	Low
Passerines					
Stands of different maturity levels (including mature forests), wetlands (e.g., warblers, flycatchers)	Hardwood Dominant Stands Softwood Dominant Stands Other[a] Managed Forests[b] Wetlands (includes all wetland classes)	5,683.0	217.7	3.9	Low
Open canopy and regenerating stands, wetlands (e.g., sparrows, blackbirds)	Other[a] Managed Forests[b] Wetlands (includes all wetland classes)	1964.4	91.6	4.7	Low
Stands of different maturity levels, disturbed areas (e.g., American crow, common raven)	Hardwood Dominant Stands Softwood Dominant Stands Other[a] Managed Forests[b]	4,857.6	217.1	4.5	Low
	Anthropogenic Disturbances[c]	20.3	13.4	66.0	N/A[d]
Other Landbirds	Hardwood Dominant Stands Softwood Dominant Stands Other[a] Managed Forests[b] Barrens (includes rock barrens	4,873.9	217.1	4.5	Low
	Anthropogenic Disturbances[c]	20.3	13.4	66.0	N/A[d]

[a] Includes unmerchantable timber, often which is regenerative stands and stands which were not categorized as hardwood or softwood stands.

[b] Managed forests include plantations, cutblocks, selective cuts etc.

[c] Includes roads, railways, urban development, quarries, gravel pits, mining activity etc.

[d] Not carried forwarded into impact magnitude determination (Section 6.12.7.2).

Note: The Habitat and Flora LAA was used to determine habitat type and area, and resultant habitat loss for species (Section 6.10.7.1).

6.12.8.2 Habitat Fragmentation

Connectivity can be defined as the basic ecological requirement to be able to move freely within areas that provide critical functions for a species, and habitat fragmentation is the disturbance of this movement. Connectivity is critical for maintaining biodiversity and healthy species populations and interior forests are often an important feature that supports this movement (NSDNR, 2015). Interior forests are defined as an area within a forest that is sheltered from edge effects; interior and mature forest mapping is discussed in Section 6.10.3.6. As described in Section 6.10.3.6 there is a mapped Old Forest patch along the Haul Road and interior forest throughout the Beaver Dam Mine Site and Haul Road (Section 6.10, Figure 6.10-5).

The LAA is covered with a network of roads, historical mining and forestry activities, and forestry trails creating a largely disturbed forest landscape. The extent of the simulated existing disturbance and edge effect largely covering the majority of the LAA is presented in Figure 6.10-6. As presented in Section 6.10.4, the Project will affect 237 hectares (ha) of interior forest habitat, which accounts for 9% of the predicted interior forest area within the respective LAA. While Project activities are expected to result in increased habitat fragmentation and a decrease in habitat quality (e.g., sensory disturbance), the level of new fragmentation associated with the Beaver Dam Mine Site is anticipated to be low, given the current level of disturbance as discussed. The Beaver Dam Mine Site infrastructure footprint is situated primarily on an area of high existing disturbance and will only have fringe effects on the majority of available interior forest. There will be minimal isolation of habitat that is currently contiguous, limited to the patch of potential interior forest west of the NAG waste rock stockpile (Figure 6.10-6).

Construction of the Haul Road will involve a combination of new road construction (4.0 km) and upgrades to the existing logging road. The majority of the proposed Haul Road (99%) follows an existing road corridor, thereby limiting new habitat fragmentation. The existing Haul Road is used by lumber trucks, but the level of traffic varies seasonally and annually depending on which areas are undergoing timber harvesting. The 4 km section of new road immediately southwest of Highway 224 will add new habitat fragmentation to an area that has very little, if any, evidence of anthropogenic disturbance. Along this section of the Haul Road, 112 ha of potential interior forest will be impacted (Section 6.10.4, Figure 6.10-6), which will increase habitat fragmentation and decrease the habitat quality for those species that rely on interior forest.

Common migratory avifauna species that require old forest or interior forest habitats include; ovenbird, wood thrush, hermit thrush, magnolia warbler, black-throated blue warbler, black-throated green warbler, and white-throated sparrow. Additionally, avifauna species identified within the priority species list (Appendix K.1) that prefer mature or interior forest are outlined in Table 6.12-12.

Field observations have confirmed that some of the species listed in Table 6.12-12 (red-breasted nuthatch, black-backed woodpecker, ruby-crowned kinglet, boreal chickadee, yellow-bellied flycatcher, and Swainson's thrush) were observed at survey locations (Figures 6.12-1A to 6.12-1G) in close proximity to the Old Forest polygon. None of these species were reported exclusively within this Old Forest habitat.

6.12.8.3 Direct Mortality

Direct mortality of avifauna species could result from Project activities, particularly due to the increase in traffic during construction and operation of the facility (Section 6.1.4). Increased traffic poses a risk to avifauna along the length of the Haul Road between the Beaver Dam Mine Site and the Touquoy Mine Site. The Project expects a maximum of 190 round trips along the length of the Haul Road over 16 hours a day during the first two years of operation, decreasing in subsequent years. The increased level of traffic poses an increased risk to wildlife collisions, particularly along the Haul Road, where the speed limit is proposed to be 70 km/hr. The risk of collisions within the Beaver Dam Mine Site will be lower, as the speed limit will be reduced to 40 km/hr.

Indirect impacts or mortality could also result from exposure to contaminants or spills from incidents and accidents. Migratory avifauna may be indirectly impacted as a result of the surface water quality in the pit lake created in the Touquoy Mine Site open pit to store tailings from Beaver Dam Mine Site. if they were to land in the water. Mitigation measures, such as avifauna deterrents are currently in place at Touquoy Mine Site and they will be applied to reduce the potential environmental impacts of the Project on migratory avifauna at the Touquoy facility as per existing approvals.

Table 6.12-12: Bird Species within the Priority Species List that Rely on Mature and Interior Forest

Common Name	SARA	COSEWIC	NSESA	SRank	Habitat Requirements
Black-backed woodpecker				S3S4	Coniferous forest
Boreal chickadee				S3	Coniferous forest
Cape may warbler				S2B	Northern coniferous forest, mature spruce
Canada warbler	T	T	E	S3B	Dense understory vegetation of mature to mid-aged mixed forest
Eastern wood-pewee	SC	SC	V	S3S4B	Interior forests
Evening grosbeak				S3S4B, S3N	Breed in mature and second-growth coniferous forests
Canada jay				S3	Coniferous forest
Northern goshawk		NAR		S3S4	Nest in mature mixed hardwood forests
Pine grosbeak				S2S3B, SN5	Open coniferous forests.
Pine siskin				S2S3	Open coniferous forests, mixed forest and deciduous forests
Red-breasted nuthatch				S3	Deciduous and coniferous forests
Red crossbill				S3S4	Mature coniferous forests
Ruby-crowned kinglet				S3S4B	Coniferous and deciduous forests
Rusty blackbird	SC	SC	E	S2B	Wet coniferous and mixed wood forests
Swainson's thrush				S3S4B	Closed canopy forests, breeding habitat includes deciduous and coniferous forests
Yellow-bellied flycatcher				S3S4B	Conifer forests and peatlands. It nests in typically cool, moist conifer or mixed forests, bogs, swamps, and muskegs

6.12.8.4 Sensory Disturbance

The effect of the Project on avifauna can largely be attributed to sensory disturbance, specialty noise and light. Sensory disturbance would result from rock blasting, clearing and grubbing, infrastructure construction, lighting and operations, internal mine traffic and traffic along the Haul Road during operations. Blasting will occur within the Beaver Dam Mine Site during the operational phase. This along with other construction and operational activities will increase sensory disturbance above current conditions and will, as described above, reduce the habitat quality for some species.

Sensory disturbance will likely result in the localized wildlife avoidance of the PA, particularly in close proximity to the Beaver Dam Mine Site infrastructure footprint and Haul Road. Overall, Project activities will likely cause a change in usage of the PA by avifauna, with some species tending to avoid the area, while others may be attracted to the increased activity, including opportunistic species such as coyotes, raccoons, skunks, or black bears. Sensory disturbance related to Project activity will occur within the Beaver Dam Mine Site, Haul Road, and within the Touquoy Mine Site, as the addition of material from the Beaver Dam mine will extend the life of the Touquoy Mine Site by five years.

6.12.8.4.1 Noise

Changes to ambient noise levels and the presence of periodic vibrations from blasting have the potential to adversely affect fauna and avifauna by influencing migration and behavioral patterns. Noise and vibration are provincially regulated via the Workplace Health and Safety Regulations and the Pit and Quarry Guidelines, which protect the health of site workers and the general public at PA boundaries, respectively.

Existing noise (measured in 2014) around the Beaver Dam Mine Site had an average value of 33 decibels (dBA) ±. As such, in the noise model, baseline noise levels were assumed to be 33 dBA during the day and 27 dBA at night (Section 6.1.7, Table 6.1-8). The predicted noise levels at the property boundary of the Beaver Dam Mine Site are presented in the Noise Impact Assessment and expected to meet compliance at the Property Boundary (Appendix B.2). It should be noted that the findings within the Noise Impact Assessment are worst case (most conservative) predictions.

The Environment Code of Practice for Metal Mines (Environment Canada, 2012b) has established parameters for ambient noise levels for wildlife. These parameters indicate that ambient noise observed above 55 dBA during the day and 45 dBA at night can affect wildlife. The predicted noise levels presented in the Noise Impact Assessment (Appendix B.1 [Beaver Dam Mine Construction Noise Assessment] and Appendix B.2 [Updated Noise Impact Assessment Technical Report]) exceed the levels outlined by Environment Canada (2012b). Additionally, a literature review conducted by Shannon et al. (2016) found that avifauna have the potential to exhibit changes in song characteristics, reproduction, abundance, stress levels, and species richness at levels greater than 45 dBA, on average. Specially, studies showed biological responses commenced at 40 to 45 dBA, with a decline in species diversity (i.e., avoidance by sensitive species) and reproductive success at 43 to 58 dBA. Changes in song frequency and length were observed at 45 dBA. Francis et al (2009) notes noise pollution can lead to changes in avian communities and altered species interactions. However, a study of the impact of logging truck traffic on avifauna reports no observed effects on nesting at noise levels of 53 dbA (Grubb et al. 1998). It was also found that noise tolerant species had increased nest success through decreasing nest predation (Francis et al, 2009).

Impacts can also differ between acute and chronic noise sources. Chronic exposure may degrade auditory cues, feedback and vocal development over time, important for predator/prey detection, communication and orientation (Shannon et al, 2016; Bickley and Patricelli, 2010; Marler et al, 1973). A direct physiological impact causing a temporary decrease in auditory sensitivity can

occur at acute noise levels above 93 dBA, while permanent damage to avian auditory systems is not recorded until 125 to 140 dBA (Bickley and Patricelli, 2010). Routine Project operations are not predicated to reach these noise levels.

Elevated noise above background concentrations around the PA may cause avoidance within 400 m (S, W, E) to 1,000 m (N) of the Beaver Dam Mine Site, less than 500 m on either side of the Haul Road and within 850 m the Touquoy Mine Site property boundaries, based on the most conservative guideline (45 dBA) identified for potential broad wildlife effects (Environment Canada, 2012b). These ranges of noise distribution are due to changes in local topography. Avifauna within these approximate ranges of noise distribution surrounding the PA have the potential to be affected by noise during the day and overnight. However, it should be noted that noise effects are rarely isolated from other disturbances and impacts likely coincide with habitat suitability changes that accompany increased noise levels (Shannon et al, 2016).

6.12.8.4.2 Light

Light can impact avifauna by potentially causing disorientation or by causing attraction or avoidance (Langcore and Rich, 2004). Avifauna may be attracted to or disoriented by open pit lighting at night, particularly during migration periods, leading to mortality (Jones and Francis 2003). In turn, these behavioral changes can affect the success of foraging, reproduction, and communication of wildlife (Langcore and Rich, 2004) and can disrupt habitat connectivity (Bliss-Ketchum et al. 2016). Artificial lighting at night has been shown to influence the seasonal start of avifauna vocalizations, which could affect individual fitness and reproductive success (Da Silva et al. 2014).

While effects of light on wildlife are documented, it is still an emerging area of research and artificial lighting thresholds (e.g., duration, intensity, spectrum, etc.) for wildlife are not well defined. Currently there is no globally recognized or generally agreed upon standard for measuring biologically relevant light for wildlife or sky glow, which results in difficulty and inaccuracy when comparing between metrics and methods (DEE, 2020). Light is traditionally measured and quantified for human perception. However, this does not capture all light visible to wildlife. Furthermore, the visible spectrum and sensitivities differ by taxa and species (DEE, 2020).

Type of lighting may also impact fauna. Some lights can have increased effects on fauna due to the short wavelengths they emit (e.g., white or blue LEDs, metal halides). Wildlife is generally more sensitive to short, high energy UV/violet/blue wavelengths, particularly nocturnal species. Short wavelength light also scatters more in the atmosphere than long wavelength light, increasing the effects of sky glow (DEE, 2020; Pauwels, 2018). Yellow-orange light is typically associated with long wavelength lights (e.g., High Pressure Sodium, Low Pressure Sodium, Amber LED).

Light levels from the Project have been modeled in the Light Impact Assessment (Appendix D.1). While the calculated light levels at the residential receptors are below the limits recommended by the Institute of Lighting Engineers (ILE) guidelines, nighttime light prorogation from the Project may still cause sensory disturbance to avifauna. The Light Impact Assessment shows that the light levels from the Beaver Dam Mine Site reach background levels within 5 km of the source. While some Project-related light impacts will fall within natural variability (Appendix D.1), light sources from the Beaver Dam Mine site will have impacts to avifauna. These impacts will likely be experienced closer to the Beaver Dam Mine Site. The impact distance will also be dependent on the type of lighting used. As studies suggest (i.e., DEE, 2020; Pauwels, 2018), lights that emit more blue shortwave light (e.g., LEDs, metal halides) show greater impacts to fauna at night. These distances have been considered in the delineation of the LAA.

Light impacts from trucks on the Haul Road are expected to be insignificant compared to baseline daylight illuminance and will be blocked by the surrounding natural buffers and topography. In the evening, until 11 pm (when truck traffic ceases), light propagation from Haul Road traffic reaches background levels within 279 m. The impacts of Haul Road lighting on fauna is expected to be less than that of noise along the Haul Road. No permanent lighting will be installed on the Haul Road. Within the Beaver Dam Mine

Site, light impacts on avifauna will be reduced by installing lights facing downward and wherever practicable using motion-sensing lights.

6.12.8.5 Touquoy Mine Site

The potential interactions of the Project with avifauna within the Touquoy Mine Site is presented in Table 6.12-13.

Table 6.12-13: Potential Project Activities/Interactions with Avifauna at Touquoy Mine Site

Project Phase	Duration	Relevant Project Activity
Construction	1 year	• Tailings pipeline, make-up water pipeline alteration, and relocation of reclaim infrastructure
Operations and Maintenance	5 years	• Management of tailings produced from processing ore • Lighting of facilities and Mine Site roads • Waterfowl and other birds landing in pit lake
Active Closure	2 years	• Waterfowl and other birds landing in pit lake
Post-closure	+10 years (monitoring)	• N/A

N/A = not applicable.

The Project will have no new effects on Avifauna at the Touquoy Mine Site. Continued sensory disturbance caused by noise and light will occur within the Touquoy Mine Site as a result of the extended life of the Touquoy Mine Site associated with the Project. The continued interactions between fauna and the Touquoy Mine Site have been considered in the previous sections and within the Noise and Light Impact Assessments (Appendices B.1, B.2, and D.1).

6.12.9 Mitigation

In order to mitigate and reduce overall loss of function of habitat used by avifauna, and reduce direct impacts on avifauna, the actions provided in Table 6.12-14 will be implemented by AMNS where direct loss of habitat is expected to support development of the Project.

To verify the accuracy of the environmental assessment and the effectiveness of mitigation measures, a follow-up monitoring program is recommended. It is recommended that monitoring be conducted from the start of construction until the end of the active closure phase:

- conduct routine inspections as directed by regulators. Inspections are anticipated to be conducted daily by operators, and as required by qualified avian experts during construction, operation and active closure activities to identify and remove any trapped or injured avifauna; and
- notify Environment and Climate Change Canada within 24 hours in the event of the mortality or injury of ten or more migratory avifauna in a single event or in the event of the mortality or injury of a migratory avifauna SAR.

The mitigation measures outlined above are also applicable to the Touquoy Mine Site for the processing of Beaver Dam ore. Mitigation measures will be applied to reduce the potential environmental impacts of the Project on migratory avifauna at the Touquoy Mine Site as per existing operational approvals. Audio (Bird Gard Super Pro Amp:S4657) and visual deterrents (reflector tape) are currently being utilized at Touquoy Mine Site to dissuade avifauna from landing in the TMF. Each of the two audio deterrents employed has an effective range of 12 ha and is equipped with customizable calls from birds of prey. Due to the success of these deterrents, their use will continue when the tailings from Beaver Dam Mine Site are deposited in the Touquoy Mine Site open pit.

Regarding mature and interior forest; there is no significant impact expected from the Project to these habitat types, overall and in the greater adjacent area.

In instances where mature and interior forest cannot be avoided the following mitigation measures are proposed to identify and reduce indirect impacts to migratory avifauna that rely on this habitat throughout the PA:

- grubbing and clearing activities will be avoided during nesting season if possible;
- the Project will limit further disruptions to interior forests by utilizing existing roads and disturbed sites where possible;
- where possible, to avoid this habitat, adjustments will be made to infrastructure locations during detailed design phase; and
- monitoring of the effectiveness of mitigation is recommended as noted in Section 6.10.

Mitigations for SOCI and SAR avifauna will be discussed in Section 6.13. A comprehensive mitigation table for all VCs is provided in Section 9.

Table 6.12-14: Mitigation for Avifauna

Project Phase	Mitigation Measure
Construction	Avoid construction on native vegetation during the regional breeding season for migratory avifauna where practicable (beginning of April to end of August for migratory avifauna; ECCC 2015). Where this is not practicable, an avifauna nest mitigation plan will be developed
	If a raptor nest is found within the forested areas to be cleared, a buffer zone appropriate to the species (as determined in consultation with NSL&F) would be placed around the nest
Construction, Operation	Limit the amount of exposed soil during nesting season
	Discourage ground-nesting or burrow-nesting species (such as common nighthawk and bank swallows), by limiting large piles or patches of bare soil during the breeding season, wherever practicable
	Should any ground- or burrow-nesting species initiate breeding activities on stockpiles or exposed areas, AMNS will work with ECCC and NSE to develop buffer zones that incorporate adaptive management
	Maintain speed limits on mine roads (max. 40 km/hr. within Beaver Dam Mine Site, 70 km/hr. along Haul Road) to minimize collisions with avifauna
	Implement Dust Control Plan (Appendix C.3)
	Install downward-facing lights on site infrastructure and mine site haul roads. Wherever practicable, install motion-sensing lights to ensure lights are not turned on when they are not necessary
	Consider limiting use of lights that emit more blue shortwave light (e.g., LEDs, metal halides) which have greater impacts to wildlife at night, where practicable and considering operational safety.
	Conduct mobile refueling at least 30 m from any identified breeding locations
	Monitor known nests around stockpiles and exposed areas from a distance with a spotting scope or binoculars to verify the effectiveness of an identified buffer until the nests are inactive
	Conduct routine inspections of the open pit area to remove any trapped or injured avifauna. If identified, determine a plan for removal in consultation with an avian expert
	Notify ECCC within 24 hours in the event of the mortality or injury of ten or more migratory avifauna in a single event or in the event of the mortality or injury of a migratory avifauna SAR
Active Closure	Continued monitoring, as described in the above section.

NSL&F = Nova Scotia Lands and Forests; AMNS = Atlantic Mining NS Inc.;ECCC = Environment and Climate Change Canada; NSE = ; km/hr = kilometres per hour; m = metres; SAR = Species at risk.

6.12.10 Residual Effects and Significance

The predicted residual environmental effects of Project development and production on terrestrial fauna are assessed to be adverse, but not significant. The overall residual effect of the Project on terrestrial fauna is assessed as not significant after mitigation measures have been implemented and are summarized in Table 6.12-15.

A significant adverse environmental effect for avifauna has not been predicted for the Project for the following reasons, with consideration of the ecological and social context of the LAA surrounding the Project:

- During Construction:
  - Direct impacts to avifauna habitat is expected, however, impacts will be minimized through on-going Project design and micro-sighting of infrastructure footprints where ever practicable.
  - The baseline habitat of the Beaver Dam Mine Site and Haul Road is a network of existing fragmentation due to historical and present forestry activities, and the presence of the logging road that is proposed for upgrade.
  - Less than 5% of the suitable habitat in the LAA for observed species will be directly impacted by Project development. Habitat loss will be mitigated in the long term through reclamation planning.
  - The majority of Haul Road construction is road upgrades, minimizing the loss of habitat for avifauna.
  - Construction work will be considerate of the breeding bird season wherever practicable.
  - Construction noise and light will be limited to a 12-month window.
- During Operations:
  - Noise will be elevated above baseline during this period and may cause a displacement of avifauna in close proximity to the Haul Road and Mine Sites.
- During Closure:
  - Noise will be elevated above baseline during reclamation activities (2 years) involving mobile equipment and then drop to baseline for the post-closure period.
  - Appropriate mitigation such as wildlife deterrents will be implemented to deter wildlife species from entering the TMF and open pits during post-closure.

Table 6.12-15: Residual Effects for Avifauna

Project - VC Interactions	Mitigation and Compensation Measures	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction – Beaver Dam Mine Site and Haul Road (habitat loss from clearing and grubbing)	Limit habitat disturbance and minimize Project Area during detailed design, implement speed limits and minimize lighting.	L < 5% direct loss of habitat types used by observed species within the LAA Partial mitigation through restoration.	LAA Potential adverse effect to avifauna outside of the PA	A Although clearing and grubbing will occur outside of the sensitive period for avifauna, other activities will not.	MT (Beaver Dam Mine Site) Effects occur beyond 5 years when closure activities commence at Beaver Dam Mine Site. P (Haul Road) Closure of the Haul Road not expected.	O Effects occur once during the construction phase.	PR Mitigation and reclamation cannot guarantee a return to baseline conditions.	Habitat Loss	Not Significant
Construction – Beaver Dam Mine Site and Haul Road (sensory disturbance (noise, light, dust deposition) and wildlife vehicle collisions from construction activities)	Implement speed limits and minimize lighting.	M	LAA Potential adverse effect to avifauna outside of the PA	A VC interaction may affect seasonal aspects of avifauna.	ST Effects are limited to occur from as little as 1 day to 12 months	R Effects occur at regular intervals during the construction phase	R VC will recover to baseline conditions	Disturbance	Not Significant
Operational – Beaver Dam Mine Site, Haul Road and Touquoy Mine Site (disturbance (noise, light, dust deposition and wildlife vehicle collisions) from haul trucks, heavy machinery and mine operations)	Implement speed limits, install fences where necessary, and minimize lighting.	M Moderate changes relative to baseline conditions in remaining and surrounding habitat.	LAA Potential adverse effect to avifauna outside of the PA	A VC interaction may affect seasonal aspects of fauna.	MT Effects may occur up to 5 years.	R Effects occur at regular intervals.	R VC will recover to baseline conditions	Disturbance	Not Significant
Operations – Touquoy Mine Site Tailings deposition	Best management practices, Bird Deterrent Program implementation	L Change in habitat for avifauna	PA VC interaction is confined to the PA.	A VC interaction may occur during sensitive period for avifauna.	LT Effects may extend beyond 5 years	R VC interaction will occur at regular intervals	PR Mitigation cannot guarantee a return to baseline conditions	Creation of potential open water habitat; decreased water quality	Not Significant
Closure (Active) – Beaver Dam Mine Site (re-establishment of habitat for fauna)	N/A	L Minor change from baseline conditions.	LAA Potential effect to avifauna outside of the PA	A VC interaction may affect seasonal aspects of fauna.	LT Effects extend beyond active closure phase.	O Effects occur once during the closure phase.	PR Mitigation and reclamation cannot guarantee a return to baseline conditions.	Habitat Reclamation	Not Significant

Notes: For definitions of the below characteristics see Section 5.11, Table 5.11-1.

Magnitude	
N	Negligible
L	Low
M	Moderate
H	High

Geographic Extent	
PA	Project Area
LAA	Local Assessment Area
RAA	Regional Assessment Area

Timing	
N/A	Not Applicable
A	Applicable

Duration	
ST	Short-Term
MT	Medium-Term
LT	Long-Term
P	Permanent

Frequency	
O	Once
S	Sporadic
R	Regular
C	Continuous

Reversibility	
R	Reversible
IR	Irreversible
PR	Partially Reversible

6.12.11 Proposed Compliance and Effects Monitoring Program Update

Monitoring of avifauna will be completed to verify the accuracy of the predicted environmental effects and the effectiveness of the mitigation measures specific to avifauna. Mitigations are outlined in Table 6.12-14. The Wildlife Mitigation and Monitoring Plan (WMMP, Appendix P.7) outlines protocols to minimize interactions between wildlife and Project activities. This document will evolve through the regulatory permitting process as well as public and Mi'kmaw engagement. In addition to the WMP, a Landbird SAR Mitigation and Monitoring Plan (Appendix A of Appendix P.7) has been developed to monitoring for avifauna SAR during Project development phases, assess the effectiveness of applied mitigation measures and propose adaptive management strategies as required. While this plan has been specifically developed for observed avifauna SAR, the mitigations and adaptive management strategies will be beneficial to many of the avifauna species present within the PA.

6.13 Species of Conservation Interest and Species at Risk

6.13.1 Introduction

6.13.1.1 Summary of Species of Conservation Interest and Species at Risk Before the Updates

Priority species were carried forward from all Valued Components (VCs) (fish, flora, fauna and avifauna) and assessed separately based on their elevated importance. Priority species or taxa specific baseline surveys were conducted within the Beaver Dam Mine Site and Haul Road based on findings from a detailed desktop study to examine potential for or historic presence of priority species within the Project Area (PA).

Two priority species of fish were identified during field surveys within and in proximity to the PA. American eel and brook trout were confirmed in watercourses and waterbodies within and downgradient of the PA. While Atlantic salmon have been documented within the West River Sheet Harbour and the Killag River, none were observed. No other fish Species of Conservation Interest (SOCI) were observed. No fish Species at Risk (SAR) were observed within or in proximity to the PA.

Mainland moose tracks were observed in three locations within the Beave Dam Mine Site. No other observations or evidence of mainland moose were observed. Dedicated wood turtle surveys were conducted within the Beaver Dam Mine Site or Haul Road; however, none were observed. No priority herpetofauna were observed during dedicated field surveys Snapping turtle had been previously observed near the Touquoy Mine Site outside field surveys. No bats, or evidence of, were observed during field surveys. Twenty-five priority avifauna species (17 SOCI, eight SAR) were observed within the Beaver Dam Mine Site and Haul Road.

A monarch butterfly was identified during the desktop review; however, no observations of milkweed were documented during field surveys. No other priority invertebrate species were observed during field surveys.

Five SOCI and no SAR vascular flora species were observed within the Beaver Dam Mine Site and Haul Road. Eleven priority lichen species were observed within the Lichen Study Area (LSA) and Haul Road. Of the eleven species observed, three are SAR (i.e., boreal felt lichen, blue felt lichen, frosted glass-whiskers lichen) and eight are SOCI.

Priority species identified within the PA represent a diversity of taxa, habitat preferences, and, represent a diversity of Project interactions, effects, mitigation, and monitoring and therefore are discussed in terms of each taxa, rather than individual species. A focus is placed on SAR, recognizing that an assessment of SAR impacts and mitigations will be generally appropriate for identified SOCI, and in consideration of assessments of broad taxonomic group in previous chapters. No SAR are assessed to be lost due to the Project and as a result of mitigations and detailed design planning, the predicted residual environmental effects of Project development and production on priority species are assessed to be adverse, but not significant.

6.13.1.2 Summary of Update to Species of Conservation Interest and Species at Risk

Supplementary field surveys were conducted for each taxa for the Updated 2021 EIS as a result of PA modifications and continued infrastructure micro-siting since the Revised 2019 EIS submission.

In 2020, four Atlantic salmon parr were identified in the Killag River, outside the PA, which was not previously sampled. Prior to 2020, Atlantic salmon was not observed during any Project fish sampling programs. In total three SOCI fish species were identified during field surveys within and in proximity to the PA.

In consideration of their breeding status qualifiers, it was determined that 32 priority avifauna species (23 SOCI, nine SAR) were observed within the Beaver Dam Mine Site and Haul Road, which includes an additional SAR due to status change in 2019 (evening grosbeak, SARA Special Concern).

An additional priority vascular flora species, Nova Scotia Agalinis (*Agalinis neoscotica*, S3S4), was observed during supplementary field surveys in 2019. A total of six SOCI flora species were observed within the Beaver Dam Mine Site and Haul Road. Additional targeted lichen surveys were completed in the western and southeastern expansions of the Beaver dam Mine Site in 2019. No new priority lichen species were observed.

Impacts to priority species were reassessed based on changes to the PA and Project infrastructure. The taxa specific effects assessments were updated based on improved understanding and evaluation of Project related impacts, as identified for the broad taxonomic group in previous chapters. Project mitigation measures have been reassessed based on the new design, additional baseline surveys and updated effects assessments, and include SAR specific monitoring plans (e.g., draft Landbird SAR Mitigation and Monitoring Plan and Preliminary Lichen Mitigation and Monitoring Plan), as per the Round 2, Information Requests (IR2) issued by the Impact Assessment Agency of Canada (IAAC, formerly the Canada Environmental Assessment Agency [CEAA 2019]) and Nova Scotia Environment (NSE 2019).

No new direct or indirect impacts to priority species are expected. Project effects to priority species remain adverse, but not significant.

Table 6.13-1: Updated Subsections from the 2019 Revised Environmental Impact Statement – Species of Conservation Interest and Species at Risk

2019 Revised EIS Submission (February 28, 2019)	Updated in 2021	Corresponding 2021 EIS Update Section Number	Reason for Update
-	-	6.13.1 Introduction	• New
6.13.1 Rationale for Valued Component Selection	No	6.13.2 Rationale for Valued Component Selection	• N/A
6.13.2 Baseline Program Methodology	Yes	6.13.3 Baseline Program Methodology	• Addition of 2019 field surveys: • Additional survey areas as a result of PA modification for infrastructure micro-sitting. • Review and update priority species (I2R NSE 2-184)
6.13.3 Baseline Conditions	Yes	6.13.4 Baseline Conditions	• Present results from 2019 field surveys: • Additional survey areas as a result of PA modification for infrastructure micro-sitting. • Review and update priority species (IR2 NSE 2-184)
6.13.4 Consideration of Consultation and Engagement Results	No	6.13.5 Consideration Engagement Results	• N/A
6.13.5 Effects Assessment Methodology – **Boundaries**	Yes	6.13.6 Effects Assessment Methodology – **Boundaries**	• PA modification for infrastructure micro-sitting. • Adjusted PA description. • LAA was enlarged due to the modified PA. • RAA was enlarged where necessary due to the modified PA. Fauna assessment area changed to the RAA.

Table 6.13-1: Updated Subsections from the 2019 Revised Environmental Impact Statement – Species of Conservation Interest and Species at Risk (continued)

2019 Revised EIS Submission (February 28, 2019)	Updated in 2021	Corresponding 2021 EIS Update Section Number	Reason for Update
6.13.5 Effects Assessment Methodology – **Thresholds for Determination of Significance**	Yes	6.13.6 Effects Assessment Methodology – **Thresholds for Determination of Significance**	• Updated significance threshold and magnitude assessment: • Reflect changes in VC baseline conditions and improve significance assessment criteria • Response to IR2 CEAA 2-02
6.13.6 Project Activities and Species of Conservation Interest and Species at Risk and Effects	Yes	6.13.7 Project Activities/Interactions with Species of Conservation Interest and Species at Risk	• Updated based on revised noise and light impact assessments. • Bolster discussion of direct and indirect impacts to priority species • Changes to project timelines.
6.13.7 Preferred Alternative Haul Road	Yes	Section Removed	• The Preferred Alternative Haul Road is no longer being considered and has been removed from the Project Description (Section 2) and EIS
6.13.8 Mitigation and Monitoring	Yes	6.13.9 Mitigation	• Updated based on field survey results and changes to effects assessment • Reflects improved understanding of impacts.
6.13.9 Residual Effects and Significance	Yes	6.13.10 Residual Effects and Significance	• Updated based on field survey results and changes to significance threshold determination. • Change to magnitude determination • Reflect changes to significance threshold and magnitude assessment.
6.13.10 Proposed Compliance and Effects Monitoring Program	No	6.11.11 Proposed Compliance and Effects Monitoring Program	• Updated monitoring programs • Response to IR2 NSE-2-02, NSE-2-13, CEAA-2-24 and CEAA-2-26

Notes: PA = Project Area; LAA = Local Assessment Area; RAA = Regional Assessment Area- = no update; IR2 = Round 2, Information Requests; CEAA = Canadian Environmental Assessment Agency; EIS = Environmental Impact Statement.

6.13.2 Rationale for Valued Component Selection

Species at Risk (SAR) are protected under federal or provincial endangered species legislation. These pieces of legislation outline protection of these species and their habitats in the form of species-specific recovery strategies and action plans, where available. The level of protection offered to a listed species varies depending on its designation. Species of conservation interest (SOCI) represent species whose populations are either currently or potentially threatened by natural or anthropogenic factors. These species are listed as S1-S3 (or any combination thereof, inclusive of S3S4) by the Atlantic Canada Conservation Data Centre (ACCDC) and are not designated by federal or provincial endangered species legislation. Natural systems and ecological processes often depend on healthy, diverse ecosystems. As such, understanding the distribution and diversity of rare species present within a PA is key to proper risk assessment, Project planning, and mitigation of risks posed to rare species.

6.13.3 Baseline Program Methodology

6.13.3.1 Desktop Priority Species List Methodology

A detailed desktop study to examine potential for presence of and effects on SAR within the vicinity of the PA was completed. This desktop evaluation for SOCI and SAR was completed in advance of field programs to advise the field methodologies described in the following section. Assessment of wildlife, vegetation, and habitat was completed based on the requirements outlined in the NSE Guide to Addressing Wildlife Species and Habitat in an EA Registration Document (NSE 2009b). The priority species list was used throughout the biophysical assessments to inform the field programs as it identified a broad list of priority species which have the potential to be present within the PA (Appendix K.1). The desktop priority list was based on general species habitat requirements and the broad geographic area in which individual species are known to occur.

Development of a priority list of species for each taxonomic group was completed based on a compilation of listed species from the following sources:

- Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and the Federal *Species at Risk Act* (SARA 2002). All species listed as Endangered, Threatened, or of Special Concern.
- Nova Scotia *Endangered Species Act* (NSESA 1999). All species listed as Endangered, Threatened, or Vulnerable.
- Conservation Rank: All species with designated status ranks (S-Ranks) S1, S2 or S3 or any combination thereof (i.e., S3S4 is considered a Priority Species) as defined by the ACCDC.

Collectively, this group of species is known as priority species. This umbrella grouping includes SOCI that are not listed species under provincial or federal legislation (such as COSEWIC species and ACCDC S1, S2 and S3 species or any combination thereof), and SAR which are listed on SARA or NSESA. Additional guidance was provided by NSL&F SAR biologist, Mark Elderkin. As per conversations with Mr. Elderkin during the early spring of 2015, it was requested that all priority species lists be built using S-Ranks (S1, S2, S3, S3S4) rather than general S-Ranks (GS-Ranks Red and Yellow).

The priority species list is referenced across the various biophysical assessments and is provided in Appendix K.1. S-Rank definitions (ACCDC 2017) are provided in Table 6.13-2.

As outlined above, the compilation of a priority species list is habitat driven, rather than observation driven (based on information provided in reports from ACCDC or the MBBA, for example). This is based on the recognition that observation-based datasets are not comprehensive lists of species identified in any given area. A habitat-driven list forms a comprehensive list of all possible priority species that may be present on the landscape, based on habitat expectations for each species and presence of that habitat within the PA. As such, the information provided by observation-driven sources are supplementary to the priority species list, rather than forming the basis of the priority species list.

A list of all SOCI and SAR as defined above was compiled with habitat preferences and geographic distribution (if known) included. To complete the Project-specific priority species list, the province-wide list was narrowed based on:

- broad geographic area (for this Project, the broad geographic area considered is central mainland Nova Scotia);
- habitat preferences; and
- presence of preferred habitat within the PA based on habitat survey results.

Table 6.13-2: Provincial Status Ranks Definitions

S-rank	Definition
SX	**Presumed Extirpated** - Species or community is believed to be extirpated from the province. Not located despite intensive searches of historical sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered.
S1	**Critically Imperiled** - Critically imperiled in the province because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state/province.
S2	**Imperiled** - Imperiled in the province because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the nation or state/province.
S3	**Vulnerable** - Vulnerable in the province due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.
S4	**Apparently Secure** - Uncommon but not rare; some cause for long-term concern due to declines or other factors.
S5	**Secure** - Common, widespread, and abundant in the province.
SNR	**Unranked** - Nation or state/province conservation status not yet assessed.
SU	**Unrankable** - Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.
SNA	**Not Applicable** - A conservation status rank is not applicable because the species is not a suitable target for conservation activities.
S#S#	**Range Rank** - A numeric range rank (e.g., S2S3) is used to indicate any range of uncertainty about the status of the species or community. Ranges cannot skip more than one rank (e.g., SU is used rather than S1S4).
Not Provided	Species is not known to occur in the province.
Breeding Status Qualifiers	
Qualifier	**Definition**
B	**Breeding** - Conservation status refers to the breeding population of the species in the province.
N	**Nonbreeding** - Conservation status refers to the non-breeding population of the species in the province.
M	**Migrant** - Migrant species occurring regularly on migration at particular staging areas or concentration spots where the species might warrant conservation attention. Conservation status refers to the aggregating transient population of the species in the province.

A single desktop priority species list is developed for all seasons for the Project using this methodology. The seasonality of mobile species is not used to screen species into, or out of, the desktop priority species list. The final priority list of species used for field assessments are highlighted in Appendix K.1.

Once the priority species list was completed, the Project Team reviewed a series of additional data sources. Sightings of priority species recorded within 5 km and 100 km by ACCDC were reviewed (reports included in Appendices I.1 and I.2). Original reports were prepared for the Beaver Dam Mine Site on September 8, 2014, for the Haul Road on June 3, 2016, and an additional report was prepared for the Touquoy Mine Site on September 10, 2015. An updated ACCDC report was attained and reviewed for the Beaver Dam Mine Site and Haul Road on January 4, 2021 in order to consider new species occurrences and potential impacts (IR2 NSE 2-184).

When the ACCDC prepares a rare species report, they provide the user with georeferenced shapefile points of rare species records within 5 km of the center of the study area. However, NSL&F has classified several species as 'location sensitive', meaning that ACCDC is not permitted to provide specific location data for these species in their reports. Concern about exploitation of location-sensitive species precludes inclusion of coordinates in the rare species reports. Location sensitive species in Nova Scotia include black ash (*Fraxinus nigra*), blandings turtle (*Emydoidea blandingii*), wood turtle (*Glyptemys insculpta*), peregrine falcon anatum/tundrius populations (*Falco peregrinus*, pop.1), and any bat hibernaculum. If any of these species are present within 5 km of the center of the study area, the ACCDC report will simply identify that they are present, but will not provide specific location data. No location sensitive species were documented within 5 km of the PA in any of the ACCDC reports.

The Nova Scotia Department of Communities, Culture and Heritage provided an Environmental Screening Report including a list of flora and fauna SAR and SOCI documented by their staff within the vicinity of the Beaver Dam Mine Site and Haul Road. The Nova Scotia Special Places Environmental Screening report is provided in Appendix I.3. Two additional datasets were reviewed for priority invertebrates. These include the Maritime Butterfly Atlas and Odonata Central. These datasets provide records of butterfly and odonate observations, respectively.

Additional SAR and SOCI lichen data were received from the Mersey Tobeatic Research Institute in 2019, and incorporated in the desktop evaluation. This data was used to advise field methodology and targeted lichen surveys for additional field programs completed, as well as inform Project impact assessments and mitigation approaches.

The compilation of the priority species list and the review of all other available desktop resources for priority species observations is done primarily to advise field methodology, and they inform field staff to the species they are likely to encounter during field surveys. The desktop review for priority species provided the study team with information that directly guided the methods and the timing of all field programs. All field staff reviewed the desktop evaluation for priority species prior to commencing field work. This allowed field staff to review field identification guides and ensured that they were familiar with priority species identification and their status ranks.

6.13.3.2 Field Program Methodologies

Field program methodologies for each taxonomic group are outlined in previous sections of this EIS (Section 6.9 Fish and Fish Habitat, Section 6.10 Flora and Habitat, Section 6.11 Terrestrial Fauna, and Section 6.12 Avifauna). This section describes the detailed and specific field program methods for SOCI and SAR, where applicable, within the Beaver Dam Mine Site and Haul Road. Specific biophysical field program methods are shown on Figures 6.13-1A to 6.13-1G.

In 2019, the PA was modified to allow for the micro-siting of infrastructure within the Beaver Dam Mine Site, as described in Section 2 (Project Description). As a result, additional targeted priority species surveys were conducted within the modified PA areas. to identify and record additional flora species and ecosystem habitats.

Methods and results from SAR/SOCI surveys at the Touquoy Mine Site are summarized in subheadings within the applicable sections of this EIS, however, the data is not being re-evaluated. For further information regarding Touquoy Mine Site, refer to the EARD (CRA 2007a) and Focus Report (CRA 2007b).

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FIGURE 6.13-1A

Beaver Dam Mine Project

Priority Fauna & Avifauna Species

Peregrine falcon, Greater yellowlegs, Nothern harrier, Ruby-crowned kinglet, Swainson's thrush, Yellow-bellied flycatcher

Peregrine falcon, Greater yellowlegs, Wilson's snipe, Yellow-bellied flycatcher

Canada jay, Ruby-crowned kinglet, Wilson's snipe, Yellow-bellied flycatcher

Swainson's thrush, Yellow-bellied flycatcher

Canada jay

Boreal chickadee, Canada jay, Greater yellowlegs, Ruby-crowned kinglet, Swainson's thrush

Mud Lake

Cameron Flowage

Boreal chickadee

Canada jay

Bay-breasted warbler, Canada jay, Greater yellowlegs, Red-breasted nuthatch, Swainson's thrush, Yellow-bellied flycatcher

Canada jay, Greater yellowlegs, Pine siskin, Swainson's thrush, Wilson's snipe

Greater yellowlegs, Swainson's thrush, Yellow-bellied flycatcher

Canada jay

Pine siskin, Swainson's thrush

Canada jay, Greater yellowlegs, Pine siskin

Canada jay, Greater yellowlegs, Ruby-crowned kinglet, Swainson's thrush

Crusher Lake

Olive-sided flycatcher, Canada jay, Greater yellowlegs, Pine siskin, Swainson's thrush, Yellow-bellied flycatcher

Canada jay

Canada jay, Greater yellowlegs, Pine siskin, Swainson's thrush

Canada jay, Pine siskin, Swainson's thrush, Yellow-bellied flycatcher

Chimney swift, Boreal chickadee, Yellow-bellied flycatcher

Boreal chickadee, Canada jay, Greater yellowlegs, Red-breasted nuthatch, Ruby-crowned kinglet, Swainson's thrush

Blackpoll warbler

Olive-sided flycatcher, Canada jay, Pine siskin

Canada warbler

Canada jay, Ruby-crowned kinglet, Swainson's thrush, Yellow-bellied flycatcher

Boreal chickadee, Canada jay, Ruby-crowned kinglet

Boreal chickadee, Canada jay, Greater yellowlegs, Pine siskin, Ruby-crowned kinglet, Swainson's thrush

Boreal chickadee, Canada jay, Pine siskin, Ruby-crowned kinglet, Swainson's thrush

Canada jay, Swainson's thrush

Boreal chickadee, Canada jay, Greater yellowlegs, Red-breasted nuthatch, Ruby-crowned kinglet, Swainson's thrush

Canada jay, Greater yellowlegs, Swainson's thrush, Yellow-bellied flycatcher

Ruby-crowned kinglet

Blackpoll warbler, Greater yellowlegs, Northern goshawk, Swainson's thrush

Canada warbler, Blackpoll warbler, Red-breasted nuthatch, Ruby-crowned kinglet, Swainson's thrush

Greater yellowlegs

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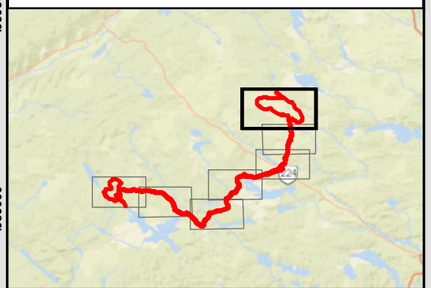
- Priority Bird Survey Locations
- Field Delineated Watercourses
- NSTDB Mapped Watercourses
- Local Road
- Dry Weather / Seasonal Road
- Track
- Field Delineated Wetlands
- NSE Wetlands
- Proposed Infrastructure
- Project Area

Priority Species

- Brook trout (S3)
- Mainland moose (NSESA E, S1)
- Snapping turtle (COSEWIC/SARA SC, NSESA V, S3)
- Canada warbler (COSEWIC SC, SARA T, NSESA E, S3B)
- Olive-sided flycatcher (COSEWIC SC, SARA/NSESA T, S2B)
- Rusty Blackbird (COSEWIC/SARA SC, NSESA E, S2B)
- Canada jay (S3)
- Boreal chickadee (S3)
- Ruby-crowned kinglet (S3S4B)
- Red-breasted nuthatch (S3)



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Reviewed By: XX

Date: 2021-04-25

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Document Name: BD_EIS_Figure6-13-XPrioritySpecies

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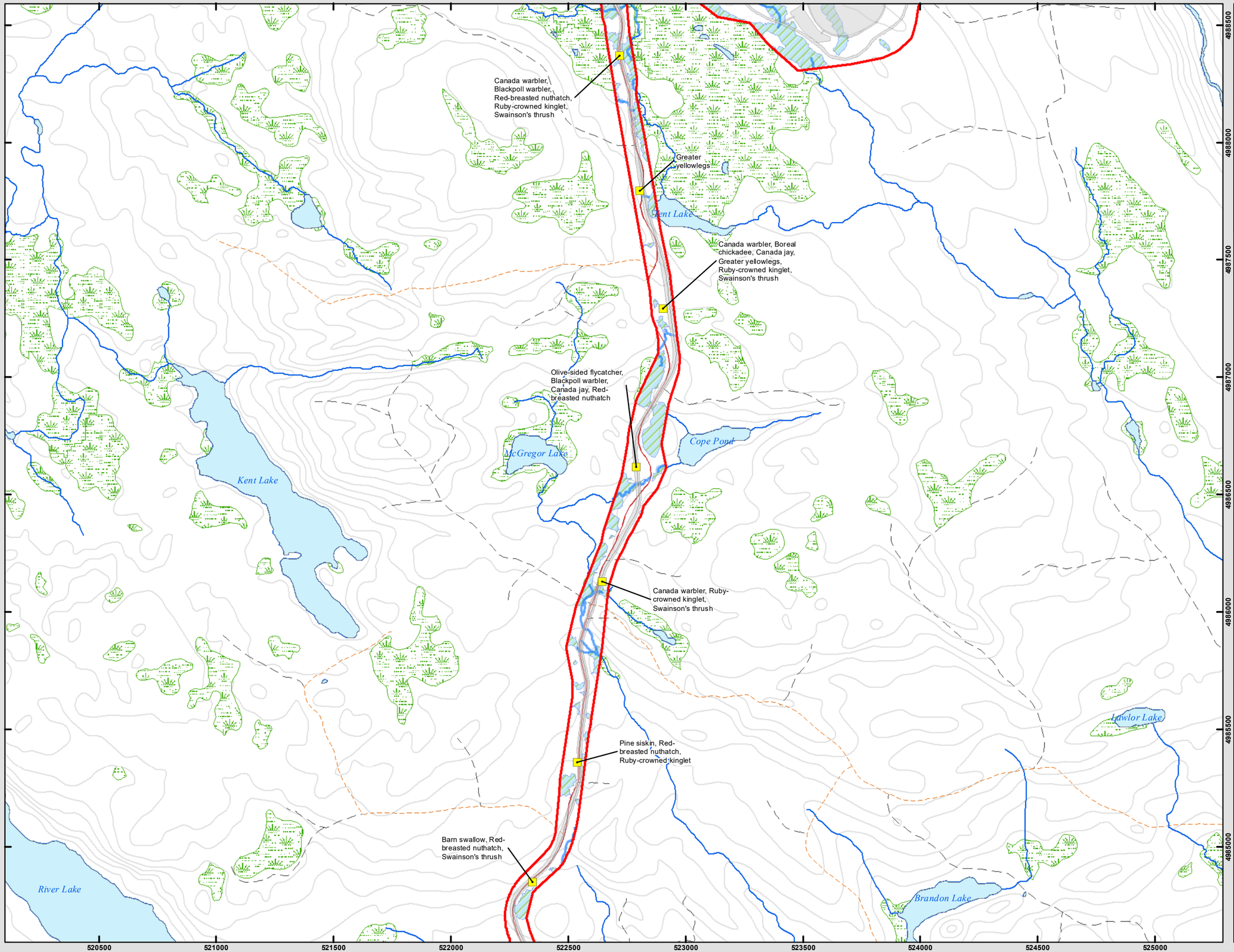
Atlantic Gold

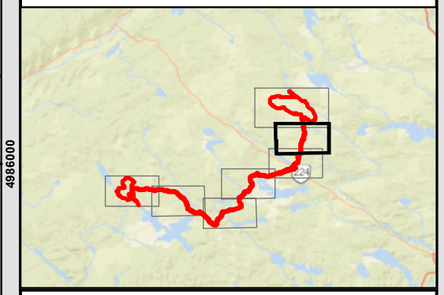
FIGURE 6.13-1B

Beaver Dam Mine Project

Priority Fauna & Avifauna Species



- Priority Bird Survey Locations
- Field Delineated Watercourses
- NSTDB Mapped Watercourses
- Local Road
- Dry Weather / Seasonal Road
- Track
- NSE Wetlands
- Field Delineated Wetlands
- Proposed Infrastructure
- Project Area



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Document Name: BD_EIS_Figure6-13-XPrioritySpecies_pgA

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FIGURE 6.13-1C

Beaver Dam Mine Project

Priority Fauna & Avifauna Species

Pine siskin, Red-breasted nuthatch, Ruby-crowned kinglet

Barn swallow, Red-breasted nuthatch, Swainson's thrush

Common nighthawk

Swainson's thrush

Gray catbird, Ruby-crowned kinglet

Canada warbler, Ruby-crowned kinglet

Blackpoll warbler, Ruby-crowned kinglet, Swainson's thrush

Boreal chickadee, Ruby-crowned kinglet, Yellow-bellied flycatcher

Red-breasted nuthatch, Yellow-bellied flycatcher

Ruby-crowned kinglet, Yellow-bellied flycatcher

Black-backed woodpecker, Red crossbill, Red-breasted nuthatch, Swainson's thrush, Yellow-bellied flycatcher

Red-breasted nuthatch, Ruby-crowned kinglet

River Lake

Brandon Lake

Trout Lake

Eagle Nest Basin

Curry Lake

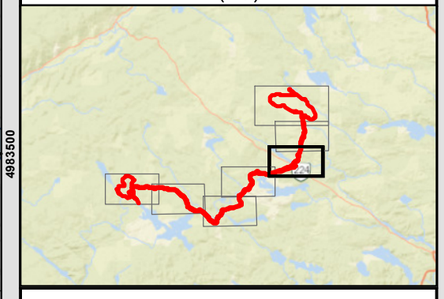
Blackie Lake

Jack Lowe Lake

- Priority Bird Survey Locations
- Field Delineated Watercourses
- NSTDB Mapped Watercourses
- Collector Road
- Local Road
- Dry Weather / Seasonal Road
- Diveways (>300 m)
- Track
- Field Delineated Wetlands
- NSE Wetlands
- Beaver Dam Haul Road
- Project Area

Priority Species

- Brook trout (S3)



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Reviewed By: XX

Date: 2021-04-25

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FIGURE 6.13-1D

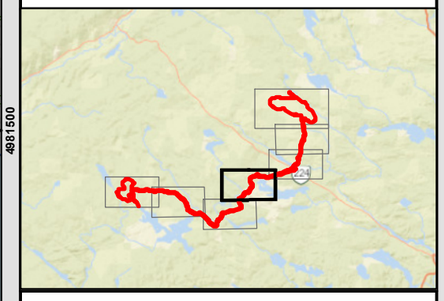
Beaver Dam Mine Project

Priority Fauna & Avifauna Species

- Priority Bird Survey Locations
- Field Delineated Watercourses
- NSTDB Mapped Watercourses
- Dry Weather / Seasonal Road
- Track
- Field Delineated Wetlands
- NSE Wetlands
- Beaver Dam Haul Road
- Project Area

Priority Species

- Eastern wood-pewee (COSEWIC/SARA SC, NSESA V, S3S4B)



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Document Name: BD_EIS_Figure6-13-XPrioritySpecies_pgD

Middle Beaver Lake
Upper Beaver Lake
Grassy Lake
Upper Kidney Lake
Lower Kidney Lake
Big Pond

Black-backed woodpecker, Canada jay, Red-breasted nuthatch, Ruby-crowned kinglet, Swainson's thrush, Yellow-bellied flycatcher
Ruby-crowned kinglet
Boreal chickadee, Canada jay, Yellow-bellied flycatcher
Ruby-crowned kinglet, Yellow-bellied flycatcher
Common nighthawk, Ruby-crowned kinglet, Swainson's thrush
Canada warbler, Boreal chickadee, Red-breasted nuthatch, Ruby-crowned kinglet
Black-backed woodpecker, Red-breasted nuthatch
Ruby-crowned kinglet, Yellow-bellied flycatcher
Red-breasted nuthatch, Yellow-bellied flycatcher
Canada jay, Ruby-crowned kinglet, Yellow-bellied flycatcher
Canada warbler, Canada jay, Yellow-bellied flycatcher
Olive-sided flycatcher, Black-backed woodpecker, Canada jay, Red-breasted nuthatch, Ruby-crowned kinglet, Swainson's thrush
Olive-sided flycatcher, Bay-breasted warbler, Red-breasted nuthatch
Bay-breasted warbler

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Olive-sided flycatcher, Bay-breasted warbler, Red-breasted nuthatch

Bay-breasted warbler

Canada jay, Yellow-bellied flycatcher

Common nighthawk

Canada warbler, Red-breasted nuthatch, Ruby-crowned kinglet, Yellow-bellied flycatcher

Blackpoll warbler, Red-breasted nuthatch, Yellow-bellied flycatcher

Blackpoll warbler, Ruby-crowned kinglet, Yellow-bellied flycatcher

Red-breasted nuthatch

Ruby-crowned kinglet

Blackpoll warbler, Ruby-crowned kinglet

Canada warbler, Black-backed woodpecker, Canada jay, Ruby-crowned kinglet, Swainson's thrush

Red-breasted nuthatch, Ruby-crowned kinglet, Swainson's thrush, Yellow-bellied flycatcher

Big Pond
Sandy Pond
Miller Lake
Mink Lake
Johns Pond
Upper Kidney Lake
Lower Kidney Lake
Rum Lake
Brandy Lake
Grassy Lake
Ferry Lake

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Atlantic Gold

FIGURE 6.13-1E

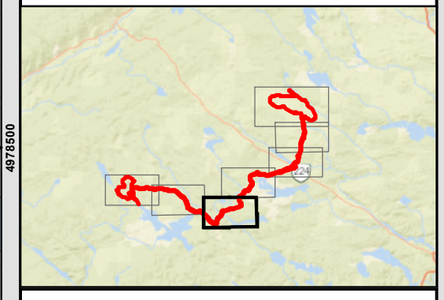
Beaver Dam Mine Project

Priority Fauna & Avifauna Species

- Priority Bird Survey Locations
- Field Delineated Watercourses
- NSTDB Mapped Watercourses
- Local Road
- Dry Weather / Seasonal Road
- Diveways (>300 m)
- Track
- Field Delineated Wetlands
- NSE Wetlands
- Beaver Dam Haul Road
- Project Area

Priority Species

- Northern harrier (S3S4B)



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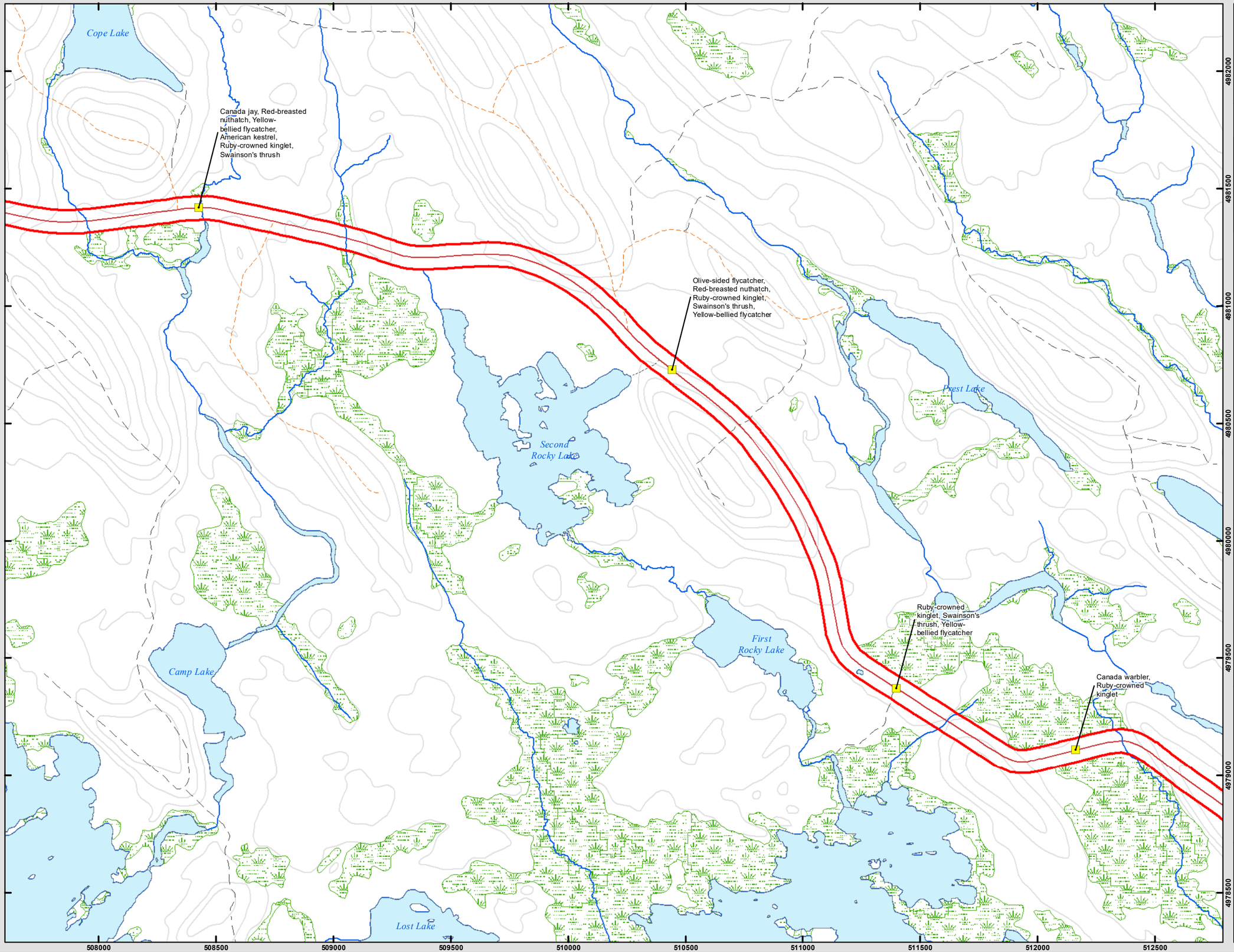

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FIGURE 6.13-1F

Beaver Dam Mine Project

Priority Fauna & Avifauna Species

- Priority Bird Survey Locations
- NSTDB Mapped Watercourses
- Local Road
- Dry Weather / Seasonal Road
- Diveways (>300 m)
- Track
- NSE Wetlands
- Project Area

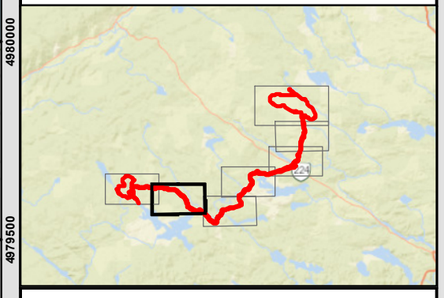

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FIGURE 6.13-1G

Beaver Dam Mine Project

Priority Fauna & Avifauna Species

Square Lake

Cope Lake

New Dam Flowage

Moose River

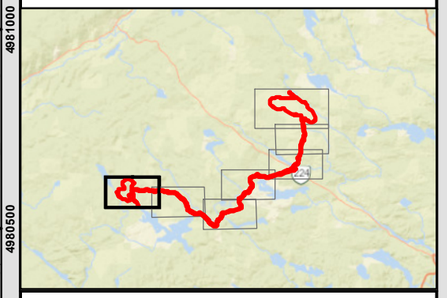
Rocky Lake

Canada warbler, Red-breasted nuthatch, Swainson's thrush, Yellow-bellied flycatcher, Ruby-crowned kinglet

- Priority Bird Survey Locations
- NSTDB Mapped Watercourses
- Local Road
- Dry Weather / Seasonal Road
- Diveways (>300 m)
- Track
- Touquoy Infrastructure Layout
- NSE Wetlands
- Project Area

Priority Species

- Snapping turtle (COSEWIC/SARA SC, NSESA V, S3)



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6.13.3.2.1 Priority Fish Survey Methodology

No targeted methods were employed specifically for priority fish species. The diversity of fish survey methods employed (eel pots, fyke nets, minnow traps, and electrofishing) were used with the goal of capturing the broadest diversity of fish species present within the PA. Detailed fish survey methods used in the PA is outlined in Section 6.9.3. The baseline fish and fish habitat survey methods have been updated, as reflected in Section 6.9.3 to reflect the revisions to the Fisheries Act; to increase the level of fish sampling effort, and to be able to quantify (in m^2) the impacts of the Project on fish habitat due to both direct and indirect project interactions. Evaluations for indirect impacts to fish habitat in Cameron Flowage/Killag River were selected to identify potential indirect effects of the Project to understand the extent of any indirect impacts on Atlantic salmon.

6.13.3.2.2 Priority Vascular Flora Survey Methodology

No specific targeted surveys for priority vascular plant species were completed. Botanical surveys were completed in all habitats throughout the Beaver Dam Mine Site and Haul Road to compile a comprehensive list of vascular flora species present. Botanists conducting vascular plant surveys thoroughly reviewed the results of the desktop evaluation for vascular flora priority species. This allowed the botanical surveys to focus on habitats with elevated potential for any priority vascular flora species. Vascular flora survey methods are outlined in Section 6.10.3.3.

Vascular plant assessments occurred early and late in the growing season to capture plant species with different phenology (IR2 NSE-2-185). Spring surveys to capture spring ephemerals and early developers were completed on June 22-23, 2015 at the Beaver Dam Mine Site and on June 22-23, 2016 along the Haul Road. Late season surveys to capture late developing species were completed on September 8, 12, and October 9, 2014 at the Beaver Dam Mine Site and on September 11-12, 2016 along the Haul Road. An additional vascular plant survey was conducted within the western expansion to the Beaver Dam Mine Site on September 18, 2018. Further vascular plant surveys were conducted in 2019 as a result of the PA modification, within the further western and southeastern expansions of the Beaver Dam Mine Site. Decorated surveys were conducted on August 22 and 23, 2019, as well as during habitat and wetland survey efforts from May to October 2019.

The following information was collected for any priority vegetation species identified during field surveys: site location, date, scientific name, count, size, habitat, location (UTM NAD83 CSRS), along with a photograph and any relevant comments. Any specimens that could not be identified in the field were photographed in order to aid in identification.

6.13.3.2.3 Priority Lichen Survey Methodology

Prior to undertaking the field assessment, a detailed desktop review of known lichen observations and potential habitat for rare lichens within and surrounding the PA was conducted. The desktop review involved a review of the following four components:

- the priority species list,
- predictive habitat mapping for boreal felt lichen (provided by NSL&F), a review of the extant populations of boreal felt lichen, vole ears (*Erioderma mollissimum*) and lichen datasets provided by ACCDC and MTRI;
- existing and proposed critical/core habitat mapping for vole ears and boreal felt lichen provided by ECCC-CWS and adopted by NSE; and
- results of wetland and habitat mapping.

To develop the predictive habitat maps for boreal felt lichen, NSL&F used an algorithm which identifies all forest stands in the provincial forestry database in which balsam fir (*Abies balsamea*) is listed as a primary or secondary species and which occur within 80 m of a mapped bog or fen. The model further confines the search to only those forest stands located within 30 km of the Atlantic Coast. This was used to predict areas with a higher potential of locating boreal felt lichen. This data set was reviewed in advance of field assessment and was uploaded onto the GPS units during field assessments. Other habitats identified by the Project Team as suitable for rare lichens were surveyed for lichens as well.

While the specific habitat requirements of each of priority lichen species varies slightly, they all require mature to over-mature forests. Stand age is one of the greatest determinants of lichen diversity (McMullin, Duinker, Cameron, Richardson, & Brodo, 2008). Within the PA, mature to over-mature stands are infrequent, with the majority of the PA having been harvested for timber production. Intact, natural, mature stands are more frequent within the Haul Road than within the Beaver Dam Mine Site. Lichen surveys throughout the Beaver Dam Mine Site and Haul Road were focused on undisturbed stands, particularly those located near mapped wetlands, as these habitats have elevated potential for identifying priority lichen species.

All suitable habitats within and surrounding the Beaver Dam Mine Site and within the Haul Road were originally surveyed in May 2015 and May 2016, respectively, for priority lichen species. The survey area was extended beyond the PA boundary in the vicinity of the Beaver Dam Mine Site and defined as the lichen study area (LSA; Figures 6.13-2A), so the Project Team could understand the distribution of rare lichens in a broader context. This broadened LSA allowed the Project Team to form conclusions based on lichen populations, rather than individual lichens. An additional priority lichen survey was conducted in conjunction with vascular plant surveys in the 2018 western extension to the Beaver Dam Mine Site on September 18, 2018 and in a small area directly north of the Beaver Dam Mine Site on October 29, 2018. As a result of continued PA modifications, in 2019, additional priority lichen surveys, were conducted within the further western and southeastern expansions of the Beaver Dam Mine Site. The LSA has been expanded to include these areas (Figure 6.13-2A).

Mature trees that are appropriate for hosting priority lichen species were visually inspected. The visual inspection focused on tree trunks, but included branches and twigs where it was determined to be safe and appropriate. The following information was collected for any priority lichen species identified during field surveys: site location, date, scientific name, count, size, habitat (host tree and general habitat), location (waypoint in UTM NAD83), height of the specimen, direction that the specimen was facing, along with a photograph and any relevant comments. Any specimens that could not be identified in the field were photographed in order to aid in identification.

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FIGURE 6.13-2A

Beaver Dam Mine Project

Priority Flora Species

Mud Lake

Crusher Lake

Cameron Flowage

- Boreal Felt Lichen (COSEWIC/SARA/NSESA E, S1)
- Frosted Glass-Whiskers Lichen (COSEWIC/SARA SC, S1?)
- Blue Felt Lichen (COSEWIC/SARA SC, NSESA V, S3)
- Blistered Jellyskin Lichen (S3)
- Blistered Tarpaper Lichen (S3)
- Eastern Candlewax Lichen(S2S3)
- Fringe Lichen (S3S4)
- Peppered Moon Lichen (S3)
- Powdered Fringe Lichen (S3)
- Salted Shell Lichen (S3S4)
- Slender Monk's Hood Lichen (S3S4)
- Lesser Rattlesnake Plantain (S3)
- Nova Scotia Agalinis (S3S4)
- Wiegand's Sedge (S3)
- Field Delineated Watercourses
- Local Road
- Dry Weather / Seasonal Road
- Track
- NSTDB Mapped Watercourses
- Lichen Study Area (Estimated)
- Proposed Infrastructure
- Boreal Felt Lichen Critical Habitat (Proposed 2016)
- Boreal Felt Lichen Predictive Habitat
- Field Delineated Wetlands
- NSE Wetlands
- Project Area

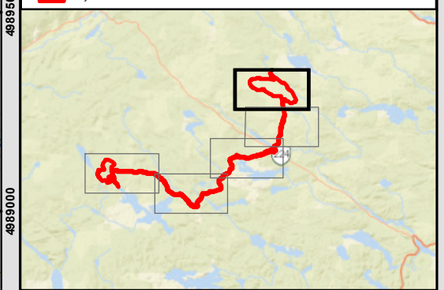

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FIGURE 6.13-2B

Beaver Dam Mine Project

Priority Flora Species

- Blue Felt Lichen (COSEWIC/SARA SC, NSESA V, S3)
- Southern Twayblade (S3)
- Field Delineated Watercourses
- Collector Road
- Local Road
- Dry Weather / Seasonal Road
- Diveways (>300 m)
- Track
- NSTDB Mapped Watercourses
- Lichen Study Area (Estimated)
- Proposed Infrastructure
- Boreal Felt Lichen Critical Habitat (Proposed 2016)
- Boreal Felt Lichen Predictive Habitat
- Field Delineated Wetlands
- NSE Wetlands
- Project Area

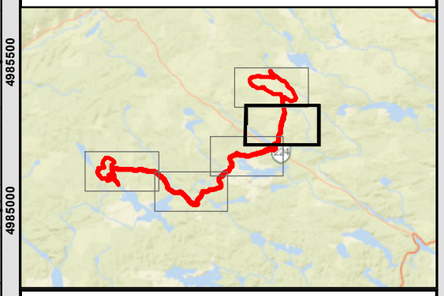

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FIGURE 6.13-2C

Beaver Dam Mine Project

Priority Flora Species

- Blue Felt Lichen (COSEWIC/SARA SC, NSESA V, S3)
- Appalachian Polypody (S3)
- Highbush Blueberry (S3S4)
- Southern Twayblade (S3)
- Field Delineated Watercourses
- Collector Road
- Local Road
- Dry Weather / Seasonal Road
- Diveways (>300 m)
- Track
- NSTDB Mapped Watercourses
- Boreal Felt Lichen Predictive Habitat
- Field Delineated Wetlands
- NSE Wetlands
- Project Area

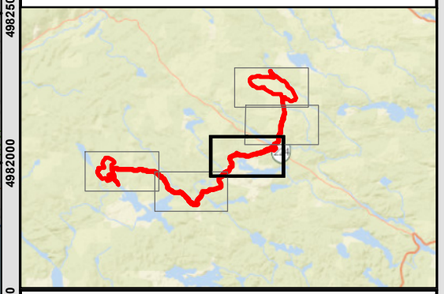

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FIGURE 6.13-2D

Beaver Dam Mine Project

Priority Flora Species

- Highbush Blueberry (S3S4)
- Southern Twayblade (S3)
- Field Delineated Watercourses
- Local Road
- Dry Weather / Seasonal Road
- Diveways (>300 m)
- Track
- NSTDB Mapped Watercourses
- Boreal Felt Lichen Critical Habitat (Proposed 2016)
- Boreal Felt Lichen Predictive Habitat
- Field Delineated Wetlands
- NSE Wetlands
- Project Area

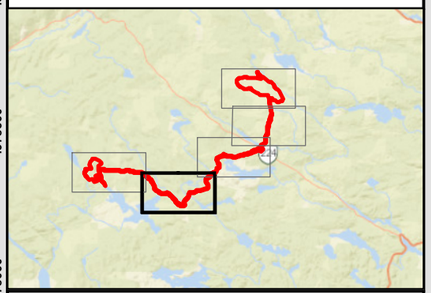

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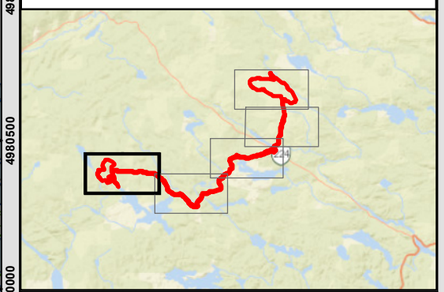
FIGURE 6.13-2E

Beaver Dam Mine Project

Priority Flora Species

- Local Road
- Dry Weather / Seasonal Road
- Diveways (>300 m)
- Track
- NSTDB Mapped Watercourses
- Boreal Felt Lichen Critical Habitat (Proposed 2016)
- Boreal Felt Lichen Predictive Habitat
- NSE Wetlands
- Project Area



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6.13.3.2.4 Mainland Moose Survey Methodology

To determine the level of concern associated with mainland moose, the Project team commenced by consulting with the Endangered Mainland Moose Special Management Practices report (NSDNR, 2012) and the Status Report on the Eastern Moose (Parker, 2003). In addition, on January 5, 2015, the Project team consulted with Regional Wildlife Biologist, Shavonne Meyer, to request a record of all mainland moose sightings identified within a broad vicinity of the PA.

Tracking surveys were completed to determine if mainland moose are present within the Beaver Dam Mine Site. Six transects, totaling nine-kilometers in length, were established through representative habitat types. An observer capable of identifying moose and deer tracks, browse and scat completed the moose track surveys. Three winter tracking surveys were completed along these transects on January 14, February 18, and March 17, 2015. One moose pellet group inventory (PGI) survey was completed along these same transects on May 25, 2015.

Winter and spring moose surveys, consisting of eight one-kilometer transects, were completed within the Haul Road in March and April 2016. Typically, winter track surveys would be completed three times, following the same transects, in suitable winter tracking conditions, followed by a single round of spring PGI surveys. Winter track conditions and a lack of snow cover during the late winter of 2016 prevented the repetition of winter track surveys for Moose. On February 26, 2016, the Project team consulted with the Regional Wildlife Biologist, Shavonne Meyer, the provincial Large Mammal Biologist, Peter MacDonald, and with the provincial SAR Biologist, Mark Elderkin to discuss a change in methodology to reflect the lack of snow cover. Through this consultation, the Project team determined that one winter track survey would be complemented by repeated spring PGI surveys. Each PGI survey would be completed along a different series of transects, thereby increasing the coverage of the surveys, while still obtaining the data that would be necessary to make conclusions related to moose activity within the Haul Road. In total, 18 one-kilometer transects were established along the Haul Road. One winter track survey was completed on transects 1-8 on March 2, 2016. This was complemented by two sets of PGI surveys completed on March 16th, 2016 (Transects 9-18) and on April 26th, 2016 (Transects 1-8). Locations of moose and deer tracks, browse, and scat were recorded using a handheld GPS unit. Incidental observations of other wildlife species, tracks, and scat were also recorded. The placement of moose survey transects through the Beaver Dam Mine Site and Haul Road reflected a mixture of existing roads and intact forest, and were determined in consultation with NSL&F staff identified above. Mainland moose survey transects are identified in Section 6.11.4.1, Figure 6.11-3.

6.13.3.2.5 Bat Survey Methodology

A desktop analysis of potential bat habitat was conducted to determine level of concern associated with the Project and to determine whether field assessments were necessary. The desktop analysis started with a review of bat occurrences, as noted in the ACCDC reports. The Significant Species and Habitat Database was also searched for known potential bat hibernacula. According to NSL&F SAR Biologist, Mark Elderkin, bats are sensitive to activity up to 1 km away during hibernation. As such, a minimum of 1 km buffer is recommended when assessing risk to bat SAR. Provincial government records for Abandoned mine openings (AMOs) were reviewed (Hennick and Poole, 2016) within a 10 km radius of the site, as these AMOs potentially provide bat hibernacula. These records were reviewed for mine shaft type, access, original depth, and presence of water in the shaft to determine likelihood that the AMO is potential bat hibernacula. The records identified 18 AMOs within the Beaver Dam Mine Site. The 18 AMOs within the Beaver Dam Mine Site were evaluated in the field on September 18, 2014 for their potential to provide bat hibernacula. During all other surveys completed within the PA by the Project team, biologists were trained to evaluate landscapes for potential hibernacula including natural caves or anthropogenic mine openings or abandoned wells.

6.13.3.2.6 Priority Herpetofauna Survey Methodology

Wood turtles and snapping turtles have been identified as priority species with the potential to be present within the PA based on habitat preference and known distribution. The wood turtle is listed as threatened by COSEWIC, NSESA and SARA. This species prefers clear rivers, streams, or creeks with moderate current and sandy or gravelly substrate (ECCC, 2016c). The snapping turtle is listed as vulnerable in NS and is listed as a species of special concern by COSEWIC and SARA. This species occurs in almost any freshwater habitat, though it is most often found in slow-moving water with a soft mud or sand bottom and abundant vegetation (ECCC, 2016d).

Seven wood turtle surveys were conducted from May 17 to June 4, 2015 along the watercourse that runs between Crusher Lake and Mud Lake (part of watercourse 5) within the Beaver Dam Mine Site. No other suitable wood turtle habitat was identified across the Beaver Dam Mine Site and Haul Road that warranted a detailed survey for wood turtles. MEL biologists continued to look for signs of turtle usage during all other site surveys, particularly suitable nesting habitat along watercourse crossings throughout the Haul Road.

Wood turtles are often associated with some form of vegetative structure, therefore, MEL field staff searched for turtles at the base of woody shrubs, under or near deadfall, and amongst grasses or leaf litter. The ground and undergrowth was searched from the water's edge inland to 20 m along one side of the watercourse.

Wood turtles are active in temperatures over 9 °C, but best results are found when temperatures range from 15 to 20 °C. Wood turtle observations drop off significantly when temperatures exceed 25 °C. Ambient temperature appears to be as good an indicator of the probability of detection as sunlight so surveys can occur on cloudy days. As long as the air temperature is warmer than the water, there is a thermal advantage in basking on land (ECCC, 2016c). Surveys were completed between 10:00 and 18:00 hours.

Opportunistic observations for snapping turtle, painted turtle and their respective suitable habitat were documented through all field programs, particularly wetland and watercourse evaluations. Biologists conducting field assessments searched for turtles in aquatic ecosystems with slow moving water, mucky substrate, and dense vegetation. During June, particular attention was paid to identifying snapping turtles or signs thereof (i.e., scrapes, depredated nests) along exposed gravel including roadside shoulders, when snapping turtles move to these habitats to nest.

The PA was also surveyed for herpetofauna during other field programs, particularly wetland and watercourse assessments, with special attention paid towards identifying any signs of turtle usage. Signs such as animal sightings, vocalizations, amphibian egg masses, cast snake skins, turtle nest scrapes, or depredated nests were recorded during any field programs by biologists capable of recognizing these signs.

6.13.3.2.7 Priority Invertebrate Survey Methodology

A desktop review for rare invertebrates was completed. This included reviewing species records in the vicinity of the PA provided by Odonata Central, the Maritime Butterfly Atlas, and the ACCDC reports (Appendices I.1, I.2 and I.4) for Odonates, Lepidopterans and all other invertebrates, respectively. The PA falls within five 10 km^2 Maritime Butterfly Atlas survey squares (20NQ17, 20NQ18, 20NQ19, 20NQ28, 20NQ29), reports for which are provided in Appendix I.4. Incidental observations for priority invertebrates occurred during all field programs, particularly wetland and watercourse delineation, and fish habitat surveys. Incidental observations of odonates and lepidopterans include live adults or larvae, or cast skins. Signs of molluscs include live or dead individuals and shells.

6.13.3.2.8 Priority Avifauna Survey Methodology

The second atlas of the MBBA was reviewed to determine possible, probable, and confirmed records of breeding avian SAR and SOCI in proximity to the PA. The PA falls within five 10 km^2 MBBA survey squares (20NQ17, 20NQ18, 20NQ19, 20NQ28, 20NQ29). The results of MBBA surveys are presented in Section 6.12.3 and provided in Appendix L.2.

Targeted surveys for the common nighthawk were completed throughout the Beaver Dam Mine Site and Haul Road, as described in Section 6.12.4.6. Suitable habitat is available for this species within the PA, therefore, dedicated surveys for the common nighthawk were conducted within June (2015 and 2016) and July (2019) at either dawn (1 hour before sunrise to 30 minutes after sunrise) or dusk (30 minutes before sunset to an hour after sunset), as described in the Common Nighthawk Survey Protocol (Saskatchewan Ministry of Environment, 2015). Common nighthawk are crepuscular and were detectable at both dawn and dusk survey times. Stations were spaced at least 800 m apart and a point count survey with call playback was used to detect the presence of common nighthawk within the PA. A three-minute passive point count was conducted at each station, followed by a call playback which includes 30-seconds of the conspecific common nighthawk call followed by 30-seconds of silence (or passive surveying), repeated for three-minutes (i.e., three times). The total time spent at each survey point was a minimum of six-minutes. Three call playback stations were surveyed within the Beaver Dam Mine Site and 12 call playback stations were surveyed within the Haul Road, for a total of 15 call playback stations.

No other targeted surveys for priority bird species were conducted, as all other species are anticipated to be detectable during standard methods for bird surveys.

During data analysis, the Project Team uses breeding status qualifiers to identify which avian species are considered SOCI, based on the season in which they were observed. Breeding status qualifiers are defined by the Maritime Breeding Bird Atlas, and assigned to each species by the ACCDC. SAR are considered priority species, regardless of the seasonality of their observation. For instance, a bird with an S-Rank of S2S3B, S5N (such as the pine grosbeak) would not be considered a priority species if observed overwintering (the N qualifier represents a non-migratory, or overwintering population). Conversely, a species ranked S5B, S3N (such as the American robin) would not be considered a priority species if observed during migration or breeding season, and would only be considered a priority species if observed overwintering. Some species do not have a compound rank assigned with varying seasonal considerations, such as the turkey vulture (ranked S2S3B). This species has no alternate ranking status for migratory or overwintering populations, therefore this species, by default, would be considered apriority species regardless of its' observation date.

6.13.4 Baseline Conditions

Updates to priority species (total number, location etc.) reflected within this section are as a result of additional surveys required by changes to the PA in order to incorporate the micro-siting of Project infrastructure.

6.13.4.1 Priority Fish Species

A desktop evaluation for priority fish species revealed that four priority species have been identified within 5 km of the SA. These include Atlantic salmon (*Salmo salar*), American eel (*Anguilla rostrata*), alewife (*Alosa pseudoharengus*) and brook trout (*Salvelinus fontinalis*) (ACCDC, 2021). Priority fish species identified as having an elevated potential to be located within the PA, based on habitat preferences, and broad geographic range, include American eel, Atlantic salmon, brook trout, brook stickleback (*Culaea inconstans*), and landlocked rainbow smelt (*Osmerus mordax*). No location sensitive species of fish have been identified within 5 km of either the Beaver Dam Mine Site or the Haul Road, according to the ACCDC reports (Appendix I.1). The following priority

fish species are identified as having an elevated potential to be located within the PA, based on habitat preferences, and broad geographic area (Table 6.13-3).

Table 6.13-3: Priority Fish Species with Elevated Potential to Occur in the Project Area

Common Name	Scientific Name	SARA	COSEWIC	NSESA	S-Rank
Alewife	*Alosa pseudoharengus*	-	-	-	S3
American eel	*Anguilla rostrata*	-	Threatened	-	S2
Atlantic salmon – Southern Uplands Population	*Salmo salar pop. 6*	-	Endangered	-	S1
Brook stickleback	*Culaea inconstans*	-	-	-	S3
Landlocked Rainbow smelt	*Osmerus mordax (landlocked)*	-	-	-	S3
Brook trout	*Salvelinus fontinalis*	-	-	-	S3

As described in Section 6.9.3, all fish survey methods were designed to identify the diversity of species within the diversity of habitats present within the PA, including any priority species. Field survey locations for various fish programs are presented in Figures 6.9-2 to 6.9-4 and in Appendix J.4, Figure J.4-5. No species-specific targeted surveys were completed for priority fish species.

Within, or in proximity to, the Beaver Dam Mine Site, three priority species were identified – brook trout, Atlantic salmon, and American eel. Brook trout (S3), was identified within Watercourses 5, 12, 13, 23, the Killag River, Cameron Flowage, Crusher Lake, Mud Lake/WC27, and WL59. Atlantic salmon (COSEWIC, Endangered) was identified only within the Killag River. American eel (COSEWIC, Threatened) was identified in WC13, the Killag River, Cameron Flowage, and Mud Lake/WC27. Two priority species were identified within watercourses within the Haul Road. American eel and brook trout were both observed in Watercourses N, V, and AH.

According to the Nova Scotia Salmon Association (pers. comm. 2016), rainbow smelt and brook stickleback are not known to be present within the West River Sheet Harbour or Tangier River systems. Therefore, the likelihood of these species being present within the PA is very low.

Alewife (S3) are anadromous fish that spend most of its life in the marine environment, migrating into freshwater to spawn. In freshwater, alewife are found in open water habitats over all bottom types (Page and Burr, 2011). They spawn almost exclusively in lakes and large still waters and genetic differentiation between populations suggests that they typically return to their river of origin for spawning (DFO, 2016). Alewife do not migrate into fresh water until river temperatures start to warm and spawning usually occurs in June (NSSA 2005b; Gilhen 1974). Adults between their downstream migration back to the sea within a few days of spawning.

According to the Nova Scotia Freshwater Fish Species Distribution Records, alewife has been historically (1960s-1980s) within the Tangier River secondary watershed, specifically Bear, Forth, River, Third, and Tangier Lakes (NSFA, 2016). As such, it is anticipated that alewife may use watercourses within the Haul Road as migration corridors to upstream spawning areas (e.g., WC-AD). However, no lakes or large still waters fall within the Haul Road footprint. The ACCDC report (2021) provides one record of Alewife within the West River Sheet Harbour, approximately 1.7 km below the confluence of the Killag and West Rivers (no date provided). No other records of alewife within the West River Sheet Harbour secondary watershed could be identified through a desktop review (Alexander, Kerekes, & Sabean, 1986; Halfyard, 2007; NSAF, 2016), nor were any alefwife captured through extensive fishing efforts within and in proximity to the PA. Therefore, the likelihood of alewife being present within the Beaver Dam Mine Site and Haul Road watercourses within the West River Sheet Harbour watershed is considered low.

No fish SAR were documented during any fish surveys within the PA.

The Project Team received a letter from Lisa Poan, Fisheries Protection Biologist at Fisheries and Oceans Canada on April 20, 2015 (Entitled: DFO response to notification letter pursuant to subsection 79(1) of the *Species At Risk Act* for the Proposed Beaver Dam Mine Project). This letter indicated that the American eel and the Atlantic salmon (Southern Upland population) are under review for protection under SARA. If designated under Schedule 1 of SARA as proposed, prohibitions would immediately come into effect under Sections 32 and 33 of SARA. As such, the Project Team is moving forward with the Projects' effects assessment, with the assumption that these species may soon be protected under SARA. At the time of submission of this updated 2021 EIS, no change in status has been realized for either species.

6.13.4.1.1 Brook Trout

Across all survey years, a total of 191 brook trout (S3) were captured within the Beaver Dam Mine Site and a total of 8 were captured within the Haul Road during both electrofishing and trapping surveys.

Within the Beaver Dam Mine Site, brook trout were confirmed within the following watercourses:

- Watercourse 5 north of Crusher Lake between Crusher Lake and Mud Lake;
- Watercourse 12 between Wetlands 56 and 59;
- Watercourse 13 within the tributary between Cameron Flowage and Wetland 59;
- Watercourse 23 south of the western waste rock stockpile extension;
- Wetland 59;
- Killag River;
- Cameron Flowage;
- Crusher Lake; and
- Mud Lake and its Outlet (WC27).

Fish abundance and population estimates for watercourses and waterbodies within the PA are presented in the Baseline Fish and Fish Habitat 2020 Technical Report (Appendix J.3).

Based on the confirmed brook trout presence in Crusher Lake, it is expected that this species would be present and utilizing open water wetland habitat in Wetland 8 and Wetland 44 on the south side of Crusher Lake. Similarly, brook trout is expected to be present in open water habitat in Wetland 17 (brook trout confirmed in Mud Lake) and the open water portion of WL59, 61, Cameron Flowage and the Killag River. There is low potential for brook trout to access open water habitats within WL56 based on a 2015 observation of brook trout in WC12; however, during all sample events completed in 2020, water levels in WC12 were dry and are expected to seasonally limit passage of brook trout into WL56.

Along the Haul Road (2016), one individual brook trout was captured in a minnow trap within Watercourse V. Electrofishing surveys identified brook trout within Watercourses N (one individual), V (six individuals), and AH (one individual). There are no wetlands directly associated with any of these watercourses within the Haul Road.

Brook trout are known to inhabit a wide range of cool, freshwater environments, from small headwater streams to large lakes. If the river habitat is suitable for brook trout and they do not experience any stressors throughout the year, they tend not to travel large distances. Most of the populations existing in larger rivers act this way, not moving until the fall at the onset of spawning. Even then, if the river has adequate habitat diversity, they tend not to travel large distances. Other populations have adapted to various river conditions. They travel very large distances (greater than 120 km) in search of thermal refuge and/or spawning habitat. Some spawn in the main stem of rivers, while others utilize tributaries (NSDAF, 2005). Though typically not anadromous, brook trout require free passage along streams to move between areas of use, including spawning grounds, overwintering, summer rearing areas.

In Nova Scotia, mature brook trout migrate to spawn in lakes or streams in the fall of the year. Trout spawning sites are usually near groundwater upwelling or spring seeps and within a lake or stream with gravel substrate (NSDFA 2005). Optimal spawning conditions for brook trout include clear substrate 3 to 8 mm in size with limited fines (less than 5%), and velocities of 25 to 75 cm/s (Raleigh 1982).

Juvenile rearing areas require cold water, stable flow, and an abundance of cover. Optimal temperature for juvenile growth is 10 to 16°C, while cover in the form of deep water, overhanging and in-stream vegetation, undercut banks, woody debris, and rocky substrate should account for a minimum of 15% of total stream area (Raleigh 1982). In winter, brook trout aggregate in pools beneath silt-free rocky substrate and close to point sources of groundwater discharge (Raleigh 1982; Cunjak and Power 1986). Adult fish use both pools and riffles, with more than 25% in-stream cover being optimal (Raleigh 1982). Brook trout respond negatively to flashy or hydrologically dynamic systems and require stable flow for all life stages (Raleigh 1982). According to Scott and Crossman (1973), brook trout "will eat any living creature its mouth can accommodate", including prey items encompassing over 80 genera of aquatic insects, terrestrial insects, fishes (including other brook trout and eggs), amphibians, and even small reptiles and mammals. As such, they are generalized feeders which can take advantage of an available prey source.

Aquatic features within the Beaver Dam Mine Site and Haul Road are considered to provide suitable habitat for a variety of life stages of brook trout. Brook trout spawning habitat in the form of clean, gravel substrates or areas of possible groundwater upwelling were identified within Watercourses 5, 12, 13, and 14 within the Beaver Dam Mine Site. Along the Haul Road, potential brook trout spawning habitat was identified in Watercourses E, K, L, N, S, T, V, Z, AE, AF, and AH. Potential young of year and juvenile rearing areas in the form of complex habitat types, moderate velocities, and an abundance and variety of cover types were also identified within these watercourses, along with WC23 in the Beaver Dam Mine Site, and Watercourses I, H, P, Q, and AG within the Haul Road. However, the extents of these habitats are mostly intermittent, small-scale, and access through some watercourses is limited by seasonal dryness (in particular WC12, WC14, and WC23).

Low velocity, homogenous systems characterized by abundant in-stream vegetation and soft substrates (e.g., WC26 and WC27 within the Beaver Dam Mine Site) may support adult life stages brook trout, but lack the habitat complexity to support earlier life stages of this species. Similarly, wetland habitat with deeper, contiguous open water habitat (Wetlands 8, 17, 44, 56, 59, and 61) may provide areas of refuge and foraging for adult brook trout, but are not considered to provide suitable spawning or juvenile rearing habitats.

6.13.4.1.2 American Eel

Across all survey years, 17 American eel (COSEWIC, Threatened) were captured within the Beaver Dam Mine Site and a total of 36 were captured within the Haul Road through electrofishing and trapping surveys.

Within the Beaver Dam Mine Site, American eel were confirmed within WC13, the KIllag River, Cameron Flowage, and Mud Lake/WC27. Within the Haul Road, American eel were identified in WC-N (West River Sheet Harbour), WC-V (tributary to Lake Alma), and WC-AH (tributary to the Morgan River). These watercourses and waterbodies are located within both the West River Sheet Harbour (Watercourse 13, the Killag River, Cameron Flowage, Mud Lake/WC27, and Watercourses N and V) and Tangier River (Watercourse AH) secondary watersheds. Wetlands contiguous with watercourses and waterbodies which are confirmed to or potentially support American eel, may also support American eel. American eel (COSEWIC, Threatened) is not currently listed under SARA or NSESA, however, American eel have the Nova Scotia provincial S-Rank of S2, by ACCDC.

As a catadromous species, eels spend the majority of their lives in freshwater, moving to the Sargasso Sea to spawn. Their distribution includes marine waters of the western Atlantic Ocean and some freshwater systems connected to the Atlantic Ocean in South America, North America, and Greenland. Within freshwater environments, American eel are habitat generalists that can tolerate a wide range of water temperatures and pH levels. American eel are frequently found in watercourses that offer structural complexity and shade in the form of coarse woody debris, varied substrate, in-stream vegetation for daytime cover, and an available food source of forage fish, invertebrates, molluscs and vegetation.

American eel are widely distributed throughout the province. Eel densities in freshwater typically diminish with distance from the sea (COSEWIC 2006), but their presence in freshwater systems is also highly dependent on the eels' capacity to migrate upstream. Barriers, such as hydroelectric dams, can severely limit or impede the upstream passage of young eels. However, American eel, particularly immature adult yellow eels, are capable of climbing vertical surfaces, provided they are rough and wet (GOMC 2007). It has been documented that American eel are not restricted to contiguous watercourses as they possess the ability to traverse over land in wet, low lying grass habitats (MacGregor 2011). As such, all hydrologically connected watercourses within the PA are believed to be potentially accessible to the American eel, even if habitat provision in those watercourses is low.

Aside from watercourses and waterbodies with confirmed presence, American eel would likely find suitable areas to mature and overwinter within the open water features and streams within the Beaver Dam Mine Site and Haul Road, particularly those systems with dominant muck substrate, a diverse benthic food source, and cover in the form of large boulders, in-stream vegetation, and coarse woody-debris. This includes Watercourses 5, 14, 25, and 26, and open water features associated with Wetlands 59 and 61 within the Beaver Dam Mine Site, and Watercourses A, B, C, D, E, F, G, J, M, N, O, Q, R, S, T, U, V, W, X, Y, Z, AA, AB, AC, AC, AD, AE, AF, AG, AH, and AI within the Haul Road. However, habitat assessments, particularly along the Haul Road, are based in some cases on very short sections of watercourses evaluated within the PA only and, therefore, should be considered as preliminary summaries of fish habitat potential, with detailed evaluation necessary during the permitting stages of this Project to confirm fish habitat.

According to COSEWIC (COSEWIC, 2013), the Maritimes region falls within the American eel's Freshwater Ecological Area 3 (FEA3). This population has had some recorded population level fluctuations, lacking an overall trend between 1989 and 2002. The St. Lawrence River and Great Lakes (FEA1) population has experienced significant reduction in populations since the early 1980s. Given that the entire population spawns in the Sargasso Sea, the reduction of any individual population or reduction in range can affect the total abundance of the species, even if all populations are not experiencing the same decline.

Threats to the abundance and distribution of the American eel include a variety of natural and anthropogenic factors that result in direct mortality or indirect impacts to quality and access to habitat. Some hydroelectric dams can prevent or limit upstream migration of eels, while resulting in direct mortality to downstream migrants. Overfishing has contributed to population reduction, as well as the spread of an introduced parasite (*Anquillicola crassus*), changes to accessibility of habitat through installation of barriers, and potential impact to quality of habitat from land use practices and climate change (COSEWIC, 2013).

6.13.4.1.3 Atlantic Salmon

The Southern Uplands Population of Atlantic salmon (*Salmo salar*) is listed as endangered by COSEWIC (2010) and is provincially ranked as S1 by the ACCDC. This population is not currently protected under SARA or NSESA. Atlantic salmon are divided into unique populations, based on genetic distinction and range. For the purposes of this discussion, we are considering only the Southern Uplands (SU) Population, as outlined by DFO in the Recovery Potential Assessment for the Southern Uplands population of Atlantic salmon (Fisheries and Oceans Canada, 2013).

The SU Population of Atlantic Salmon has experienced significant reductions over the last few decades, with adult abundance declining from 88% to 99% from observed abundances in the 1980s (DFO, 2013). Current adult and juvenile abundance has been assessed as critically low in most rivers, and there is strong evidence for river-specific extirpations – only 54% of rivers in the SU region were found to contain salmon in 2000 (Amiro et al., 2000) and only 38% were found to contain salmon in 2008 (Gibson et al., 2010). The main contributing factors to these declines are considered to be degradation of freshwater habitat, acidification, and poor marine survival (Bowlby et al., 2014).

The WRSH watershed is one of 72 watersheds within the SU region. The main river channel, the West River, is approximately 30 km long and has two main tributaries – the Killag and Little Rivers. Of particular research interest has been the presence and provision of salmon and salmon habitat within these rivers. According to Ducharme (1972), the Killag River is the most important of the three rivers for Atlantic salmon production due to the presence of excellent spawning grounds. Ducharme (1972) also identified that most of the salmon spawning within the watershed takes place in the Killag River.

Atlantic salmon are considered extirpated from the Tangier River (DFO, 2009).

Southern Upland (SU) Atlantic salmon have been found along the entire coast of Nova Scotia, from the Bay of Fundy to Cape Breton. However, the full extent of the range of SU population is not fully known. The SU Atlantic salmon spawn in fresh water from October to November and spend one to four years as juveniles in the fresh water. The majority of the juveniles migrate to the sea after two years of being in fresh water. In spring, the salmon leave the rivers and by mid-summer migrate to the Atlantic Ocean by Newfoundland and Labrador. They spend one to three years in the Atlantic Ocean before returning as adults to fresh water to spawn. The majority of adults leave the rivers in spring after spawning and recondition out at sea before spawning in freshwater again. Within the freshwater environment, the SU Atlantic salmon is found in cool, clear, well-oxygenated waters which support a reliable food source of aquatic invertebrates. Gravel and cobble is the preferred substrate for spawning (Fisheries and Oceans Canada, 2013; Fisheries and Oceans Canada, 2016a).

Prior to 2020, Atlantic salmon was not observed during any fish sampling programs. In 2020, four Atlantic salmon parr ranging in size from 98 to 111 mm were identified during electrofishing surveys in the Killag River, which was not previously sampled. The observations were outside the PA, in a reach of the Killag River east of the Beaver Dam Mine Site downstream of the lime doser (Appendix J.4, Figure J.4-1). No Atlantic Salmon have been observed within the Beaver Dam Mine Site and Haul Road throughout extensive fishing surveys (2015-2020).

Atlantic salmon have been extensively documented within the West River Sheet Harbour, the Killag River, and the Little River by the Nova Scotia Salmon Association and is presumed to be present in several tributaries to these watercourses. Within the Beaver Dam Mine Site, Atlantic salmon may travel into the most downstream ends of direct tributaries to the Killag River and Cameron Flowage, which includes WC13 and 25. However, these small first- and second-order tributaries are not considered to provide valuable habitat for salmon life cycle requirements (i.e., spawning, juvenile rearing, overwintering). In proximity to the Beaver Dam Mine Site, Atlantic salmon may access the lower ends of WC26 and WC27 from the Killag River. Like WC13 and 25, though the species may access these systems, they are not considered to provide quality habitat. Detailed habitat descriptions for these systems are summarised in Section 6.9.4.2; and fully detailed in the Baseline Fish and Fish Habitat 2020 Technical Report (Appendix J.3).

Two higher order watercourses are likely to support habitat for Atlantic salmon within the Haul Road: the West River Sheet Harbour (WC-N), and Keef Brook (WC-H). The West River Sheet Harbour is considered to provide suitable habitat for all life stages of Atlantic salmon, with clean gravel and cobble substrate in well aerated areas, to deeper holding pools for adults. Keef Brook is considered to provide suitable habitat for older juveniles, but high velocities, limited water depths, and a lack of gravel substrate limits habitat suitability for spawning, young of year, and adults. It should be emphasized that the fish habitat characterizations described for Haul Road watercourses are only applicable to the length of watercourse surveyed.

Atlantic salmon are considered extirpated from the Tangier River and are therefore not considered to inhabit watercourses within the Haul Road that fall within the Tangier River secondary watershed.

Atlantic salmon are highly sensitive to fluctuations in habitat conditions, particularly pH and temperature. As such, many land use practices and impacts to the freshwater ecosystem can affect the abundance and distribution of salmon. Summer water temperatures were identified as a limiting factor within the Cameron Flowage/Killag River system for Atlantic salmon during baseline surveys. By mid-July, shoreline temperatures within Cameron Flowage were above the optimal range for cold-water fishes, and temperatures were observed to exceed 20°C in the Killag River by late August. The pH range for many aquatic features sampled during baseline surveys are also considered limiting to Atlantic salmon habitat. However, aquatic features within the Killag River tertiary watershed were generally less acidic than those sampled in other tertiary watersheds, for example Cope Brook.

The Nova Scotia Salmon Association, recognizing the impact low pH on salmon in the West River Sheet Harbour, has been operating an acid mitigation project on the West River for over 15 years. This involves two lime dosing stations, and terrestrial (helicopter based) liming, which increase the pH of the water to a suitable range for juvenile salmon. This project has resulted in significant increase in smolt populations and improved overall habitat quality within the West River Sheet Harbour.

The Nova Scotia Salmon Association is currently using lime dosers in order to offset the acidity of watercourses and improve water quality for Atlantic salmon. Two lime dosers are currently in use, they are located within the West River Sheet Harbour and the Killag River (Appendix J.4, Figure J.4-1). Terrestrial liming programs have been implemented in the Paul Brook, Tent Brook and Keef Brook watersheds as well. Maintenance of surface water quality and quantity is imperative to the continued success of ongoing salmon restoration efforts in the West River Sheet Harbour, Killag River and their tributaries. For more information regarding The Nova Scotia Salmon Associations acid rain mitigation project refer to Section 6.9.4.1.4.

6.13.4.1.4 Priority Fish Summary

No fish SAR were observed within or in proximity to the PA. Three priority species of fish were identified during field surveys within and in proximity to the PA. American eel and brook trout were confirmed in watercourses and waterbodies within and downgradient of the PA, while Atlantic salmon was confirmed only in the Killag River, east of the Beaver Dam Mine Site and downstream of the lime doser. No other fish SOCI were observed. Alewife, while not identified during fish surveys, may use watercourses within the Haul Road (specifically the Tangier River secondary watershed) as migration corridors. No other priority species are expected based on habitat, species distribution, and survey effort completed within the PA.

6.13.4.1.5 Touquoy Mine Site

Moose River, within the Touquoy Mine Site, provides habitat for Atlantic salmon and brook trout. Good juvenile and rearing habitat and potential spawning habitat is available for Atlantic salmon. Several juvenile Atlantic salmon were observed; however, these species were believed to be from the landlocked population known to Scraggy Lake. Good adult and juvenile brook trout feeding habitat, fair rearing habitat, and potential spawning habitat is available within Moose River (CRA 2007a,b).

The Nova Scotia Department of Agriculture and Fisheries conducted a fisheries resource study in Scraggy Lake in July of 1975. Fish captured included; brook trout and American eel. Atlantic salmon smolts were recorded during creel census in 1979. Fingerling landlocked Atlantic salmon and brook trout were stocked in Scraggy Lake between 1998-2000 and 1994-1996, respectively (CRA 2007a,b).

6.13.4.2 Priority Vascular Flora Species

The desktop evaluation for priority species of vascular flora revealed that none were identified within 5 km of the PA by ACCDC reports. NSL&F has classified several species as 'location sensitive', meaning their exact locations cannot be provided to proponents in ACCDC reports. Instead, ACCDC will simply indicate whether a location sensitive species is documented within 5 km of the PA. Black ash (*Fraxinus nigra*), a location sensitive vascular flora species, was not documented within 5 km of the PA in any of the three ACCDC reports (Beaver Dam Mine Site, Haul Road, and Touquoy Mine Site).

A list of vascular plant priority species which have elevated potential to be located within the PA based on habitat preferences and known distribution is provided in Table 6.13-4. Species which have been documented within the vicinity of the PA by the Nova Scotia Department of Communities, Culture and Heritage Environmental Screening Report (Appendix I.3) are highlighted in bold text.

Table 6.13-4: List of Priority Vascular Flora Species with Elevated Potential to Occur in the Project Area

Latin Name	Common Name	SARA, COSEWIC, NSESA Status	S Rank
Lachnanthes caroliniana	Redroot	SARA & COSEWIC Special Concern, NSESA Vulnerable	S2
Potamogeton pulcher	Spotted pondweed	NSESA Vulnerable	S2S3
Fraxinus nigra	Black ash	NSESA Threatened	S1S2
Agalinis neoscotica	Nova Scotia Agalinis		S3S4
Agalinis paupercula	Small-flowered agalinis		S1
Allium burdickii	Narrow-leaved wild leek		S1?
Allium schoenoprasum	Wild chives		S2

Table 6.13-4: List of Priority Vascular Flora Species with Elevated Potential to Occur in the Project Area (continued)

Latin Name	Common Name	SARA, COSEWIC, NSESA Status	S Rank
Allium tricoccum	Wild leek		S1
Amelanchier nantucketensis	Nantucket serviceberry		S1
Anemone Canadensis	Canada anemone		S2
Arabis drummondii	Drummond's rockcress		S2
Asclepias incarnata ssp. Pulchra	Swamp milkweed		S3?
Barbarea orthoceras	American yellow rocket		S1
Bartonia virginica	Yellow bartonia		S3
Betula borealis	Northern birch		S2
Betula pumila var. pumila	Bog birch		S2S3
Betula pumila var. renifolia	Bog birch		S1?
Betula michauxii	**Michaux's dwarf birch**		**S2**
Botrychium lanceolatum var. angustisegmentum	Lance-leaf grape-fern		S2S3
Botrychium lunaria	Common moonwort		S1
Bromus latiglumis	Broad-glumed brome		S1
Cardamine pratensis var. angustifolia	Cuckoo flower		S1
Carex adusta	Lesser brown sedge		S2S3
Carex alopecoidea	Foxtail sedge		S1
Carex foenea	Fernald's hay sedge		S3?
Carex granularis	Limestone meadow sedge		S1
Carex grisea	Inflated narrow-leaved sedge		S1
Carex haydenii	Hayden's sedge		S1
Carex lapponica	Lapland sedge		S1?
Carex peckii	White-tinged sedge		S2?
Carex plantaginea	Plantain-leaved sedge		S1
Carex rosea	Rosy sedge		S3
Carex tribuloides	Blunt broom sedge		S3?
Carex tribuloides var. tribuloides	Blunt broom sedge		S3?
Carex vacillans	Estuarine sedge		S1S3
Carex viridula var. elatior	Greenish sedge		S1
Caulophyllum thalictroides	Blue cohosh		S2
Crataegus robinsonii	Robinson's hawthorn		S1?
Crataegus submollis	Quebec hawthorn		S1?
Cyperus lupulinus	Hop flatsedge		S1
Cyperus lupulinus ssp. Macilentus	Hop flatsedge		S1
Cypripedium parviflorum	Yellow lady's-slipper		S2S3
Cypripedium reginae	**Showy lady's-slipper**		**S2**
Dichanthelium acuminatum var. lindheimeri	Woolly panic grass		S1?
Eleocharis erythropoda	Red-stemmed spikerush		S1

Table 6.13-4: List of Priority Vascular Flora Species with Elevated Potential to Occur in the Project Area (continued)

Latin Name	Common Name	SARA, COSEWIC, NSESA Status	S Rank
Eleocharis ovata	Ovate spikerush		S2?
Empetrum eamesii	Pink crowberry		S3
Empetrum eamesii ssp. Atropurpureum	Pink crowberry		S2S3
Empetrum eamesii ssp. Eamesii	Pink crowberry		S2S3
Epilobium strictum	Downy willowherb		S3
Equisetum hyemale	Common scouring-rush		S3S4
Equisetum hyemale var. affine	Common scouring-rush		S3S4
Equisetum palustre	Marsh horsetail		S1
Equisetum variegatum	Variegated horsetail		S3
Erigeron philadelphicus	Philadelphia fleabane		S2
Eriophorum gracile	Slender cottongrass		S2
Eupatorium dubium	Coastal plain joe-pye-weed		S2
Festuca prolifera	Proliferous fescue		S1S2
Fraxinus pennsylvanica	Red ash		S1
Galium aparine	Common bedstraw		S2S3
Galium obtusum ssp. Obtusum	Blunt-leaved bedstraw		S2S3
Geocaulon lividum	Northern comandra		S3
Geranium bicknellii	Bicknell's crane's-bill		S3
Goodyera pubescens	Downy rattlesnake-plantain		S2
Halenia deflexa ssp. brentoniana	Spurred gentian		S1?
Hieracium paniculatum	Panicled hawkweed		S3
Hieracium scabrum var. leucocaule	Rough hawkweed		S1
Hordeum brachyantherum	Meadow barley		S1
Humulus lupulus var. lupuloides	Common hop		S1?
Hypericum dissimulatum	Disguised St John's-wort		S2S3
Hypericum majus	Large St John's-wort		S2
Impatiens pallida	Pale jewelweed		S2
Isoetes acadiensis	Acadian quillwort		S3
Juncus dudleyi	Dudley's rush		S3
Juncus subcaudatus	Woods-rush		S3
Juncus subcaudatus var. planisepalus	Woods-rush		S3
Limosella australis	Southern mudwort		S3
Liparis loeselii	Loesel's twayblade		S3S4
Listera australis (syn. Neottia bifolia)	Southern twayblade		S3
Lycopodium complanatum	Northern clubmoss		S3S4
Lycopodium sabinifolium	Ground-fir		S3?
Lysimachia quadrifolia	Whorled yellow loosestrife		S1
Minuartia groenlandica	Greenland stitchwort		S3

Table 6.13-4: List of Priority Vascular Flora Species with Elevated Potential to Occur in the Project Area (continued)

Latin Name	Common Name	SARA, COSEWIC, NSESA Status	S Rank
Myriophyllum farwellii	Farwell's water milfoil		S2
Ophioglossum pusillum	Northern adder's-tongue		S2S3
Panicum dichotomiflorum var. puritanorum	Fall panic grass		S1?
Panicum tuckermanii	Tuckerman's panic grass		S3S4
Pilea pumila	Dwarf clearweed		S1
Pilea pumila var. pumila	Dwarf clearweed		S1
Piptatherum canadense	Canada rice grass		S2
Plantago rugelii	Rugel's plantain		S2S3
Plantago rugelii var. rugelii	Rugel's plantain		S2S3
Platanthera flava var. herbiola	Pale green orchid		S2
Platanthera grandiflora	Large purple fringed orchid		S3
Polygala sanguinea	Blood milkwort		S2S3
Polygonum careyi	Carey's smartweed		S1
Polypodium appalachianum	Appalachian polypody		S3?
Potamogeton obtusifolius	Blunt-leaved pondweed		S3
Potamogeton zosteriformis	Flat-stemmed pondweed		S2S3
Potentilla Canadensis	Canada cinquefoil		S2S3
Potentilla canadensis var. Canadensis	Canada cinquefoil		S2S3
Proserpinaca palustris	Marsh mermaidweed		S3
Pyrola asarifolia	Pink pyrola		S3
Pyrola asarifolia ssp. Asarifolia	Pink pyrola		S3
Ranunculus gmelinii+	Gmelin's water buttercup		S3
Ranunculus pensylvanicus	Pennsylvania buttercup		S1
Ranunculus sceleratus	Cursed buttercup		S1S2
Ranunculus sceleratus var. sceleratus	Cursed buttercup		S1S2
Rhamnus alnifolia	**Alder-leaved buckthorn**		**S3**
Rhinanthus minor ssp. groenlandicus	Little yellow rattle		S1
Rosa acicularis	Prickly rose		S1
Rosa acicularis ssp. Sayi	Prickly rose		S1
Rudbeckia laciniata	Cut-leaved coneflower		S1S2
Rudbeckia laciniata var. gaspereauensis	Cut-Leaved coneflower		S1S2
Rumex persicarioides	Peach-leaved dock		S2?
Salix pedicellaris	Bog willow		S2
Salix sericea	Silky willow		S2
Salix serissima	Autumn willow		S1
Saxifraga cernua	Nodding saxifrage		S1
Schizaea pusilla	Little curlygrass fern		S3
Sisyrinchium atlanticum	Eastern blue-eyed-grass		S3S4

Table 6.13-4: List of Priority Vascular Flora Species with Elevated Potential to Occur in the Project Area (continued)

Latin Name	Common Name	SARA, COSEWIC, NSESA Status	S Rank
Sisyrinchium fuscatum	Coastal plain blue-eyed-grass		S1
Solidago latissimifolia	Elliott's goldenrod		S3S4
Spiraea septentrionalis	Northern meadowsweet		S1?
Stellaria crassifolia	Fleshy stitchwort		S1
Stellaria crassifolia var. crassifolia	Fleshy stitchwort		S1
Stellaria longifolia	Long-leaved starwort		S2
Stellaria longifolia var. longifolia	Long-leaved starwort		S2
Symphyotrichum boreale	Boreal aster		S2?
Symphyotrichum undulatum	Wavy-leaved aster		S2
Thalictrum venulosum	Northern meadow-rue		S1
Torreyochloa pallida var. pallida	Pale false manna grass		S1
Trichostema dichotomum	Forked bluecurls		S1
Trisetum spicatum	Narrow false oats		S3S4
Utricularia ochroleuca	Yellowish-white bladderwort		S1
Vaccinium caespitosum	Dwarf bilberry		S3
Vaccinium ovalifolium	Oval-leaved bilberry		S1
Vaccinium uliginosum	Alpine bilberry		S3
Vallisneria Americana	Wild celery		S2
Veratrum viride	Green false hellebore		S1
Veronica serpyllifolia ssp. Humifusa	Thyme-leaved speedwell		S2S3
Viola nephrophylla	**Northern bog violet**		**S2**
Viola sagittata	Arrow-leaved violet		S3S4
Viola sagittata var. ovata	Arrow-leaved violet		S3S4
Zizia aurea	**Golden alexanders**		**S1**

6.13.4.2.1 Priority Vascular Flora Observed within the Beaver Dam Mine Site and Haul Road

A total of 295 species of vascular flora have been identified in field assessments within the Beaver Dam Mine Site and Haul Road. A comprehensive list of species identified is provided in Appendix K.1 and discussed in Section 6.10.4. No SAR vascular plant species were observed. A total of six flora are SOCI species, based on provincial status ranks (S3 and S3S4), including an additional vascular plant species, Nova Scotia Agalinis (*Agalinis neoscotica*, S3S4), observed during additional field surveys in 2019. These SOCI identified within the Beaver Dam Mine Site and Haul Road are outlined in Table 6.13-5.

Table 6.13-5: Priority Vascular Flora Observed within the Beaver Dam Mine Site and Haul Road

Common Name	Scientific Name	COSEWIC/ SARA/NSESA	S-Rank	Habitat in Project Area
Wiegand's sedge	*Carex wiegandii*	-	S3	Observed in three locations, all within the Beaver Dam Mine Site. Within Wetlands 12 and 33, and in one upland location between Wetlands 48 and 13.
Lesser rattlesnake plantain	*Goodyera repens*	-	S3	Observed in one location on the upland margin of Wetland 29, within the Beaver Dam Mine Site.
Southern twayblade	*Listera australis (syn. Neottia bifolia)*	-	S3	Observed along the Haul Road in Wetlands 80, 115, 129, 135, 137, 147, 161 and within the upland between 137 and 136. Twayblade was typically observed in clumps of 1-5 individuals.
Appalachian polypody	*Polypodium appalachianum*	-	S3	Observed in one location immediately adjacent to Wetland 137 growing on a boulder within the Haul Road.
Highbush blueberry	*Vaccinium corymbosum*	-	S3S4	Observed in one location within Wetland 157 within the Haul Road.
Nova Scotia Agalinis	*Agalinis neoscotica*	-	S3S4	Observed in two locations along existing access roads in the southeast expansion of the Beaver Dam Mine Site.

6.13.4.2.2 Wiegand's Sedge

Wiegand's sedge (*Carex wiegandii*) was identified in three locations within Beaver Dam Mine Site. This species is a member of the Stellulatae section of the genus Carex. This species grows in a tuft formation in acidic peatlands, black spruce and larch bogs, and conifer and alder thickets. Within the PA, it was located in two wetlands and one nearby upland area. Wetland 12 is an open treed swamp with mixed canopy coverage and organic soils up to 35 cm deep. The wetland has some disturbance from timber harvesting, resulting in an open canopy. Wetland 33 is a coniferous treed swamp with organic soils exceeding 40 cm depth. This wetland has also experienced some timber harvesting yet has a relatively diverse vegetation community including *Carex Wiegandii*. The upland habitat in which Wiegand's sedge was identified is a disturbed habitat as well, adjacent to a watercourse which connects wetlands 48 and 13. In Nova Scotia, Wiegand's sedge is considered vulnerable by ACCDC (S3). Wiegand's sedge grows in clumps or clusters of many individual plants. Where *C. wiegandii* was observed, the population consisted of one to five clumps of individuals, covering approximately 0.5 to 1 m^2.

6.13.4.2.3 Lesser Rattlesnake Plantain

Lesser rattlesnake plantain (*Goodyera repens*) is a small, inconspicuous member of the orchid family (*Orchidaceae*), found in coniferous forests throughout Nova Scotia. Within the PA, two individuals were identified on the upland edge of wetland 29, in a coniferous forest, adjacent to recent timber harvesting. Ground cover was sparse, which is typical habitat for this species. Within Nova Scotia, it is infrequent, but can be numerous where found based on its rhizomatous grown pattern. In Nova Scotia, lesser rattlesnake plantain is considered vulnerable by ACCDC (S3).

6.13.4.2.4 Southern Twayblade

Southern twayblade *(Listera australis, syn. Neottia bifolia*) is a small inconspicuous member of the orchid family (Orchidaceae), which has been found in eight locations within the Haul Road: Wetlands 80, 115, 129, 135, 137, 147, and 161, and in upland habitat between Wetland 136 and 137. This species belongs to the Atlantic Coastal Plain Flora community and its primary habitat is shaded sphagnum mosses in bogs or coniferous treed swamps. Within the PA, it was typically found in clusters of 5-10 individual plants at the base of small sphagnum hummocks in treed swamps. Its distribution is scattered throughout Nova Scotia and it is considered vulnerable by the ACCDC (S3).

6.13.4.2.5 Appalachian Polypody

Appalachian polypody (*Polypodium appalachianum*) is a member of the Polypody fern family (Polypodiaceae). Its habitat is restricted to cliffs, rocky slopes, bedrock outcrops, and boulders. A population of approximately seven individuals was identified in upland habitat adjacent to wetland 137 (a mixed wood treed swamp) within the Haul Road. The distribution throughout the province is unclear and it is considered vulnerable by the ACCDC (S3).

6.13.4.2.6 Highbush Blueberry

Highbush blueberry (*Vaccinium corymbosum*) is an ericaceous shrub (family Ericaceae) in the Atlantic Coastal Plain Flora community. This species is usually limited to bogs, rock barrens, and lakeshores around Digby and Queens Counties, but it can be found in other locations with remnant populations of Atlantic Coastal Plain Flora. Within the Haul Road, two individuals were identified in wetland 157. This wetland is a treed swamp which is immediately adjacent to Upper Kidney Lake. This species is considered vulnerable to apparently secure by the ACCDC (S3S4).

6.13.4.2.7 Nova Scotia Agalinis

Nova Scotia Agalinis (*Agalinis neoscotica*) is a flowering plant part of the figwort family (Scrophulariaceae) within the Atlantic Coastal Plain Flora community. This species is typically found on saturated sandy or peaty soils, commonly within freshwater (bogs) and saline wetland and along lake and seashores. Two individuals were observed along existing access roads in the southeast expansion of the Beaver Dam Mine Site. This species is considered vulnerable to apparently secure by the ACCDC (S3S4).

6.13.4.2.8 Priority Vascular Flora Summary

Six vascular flora SOCI were identified within the Beaver Dam Mine Site and Haul Road. Three vascular flora SAR were identified as having elevated potential to be located within the Beaver Dam Mine Site and Haul Road based on habitat preference and known distribution, however no vascular flora SAR were identified. These species, listed in Table 6.13-5, are redroot (*Lachnanthes caroliniana*, SARA & COSEWIC Special Concern, NSESA Vulnerable), spotted pondweed (*Potamogeton pulcher*, NSESA

Vulnerable), and black ash *(Fraxinus nigra*, NSESA Threatened). The preferred habitats for each of these species were focused on during all vegetation, habitat, and wetland delineation surveys. All priority vascular plant species identified in the Beaver Dam Mine Site and Haul Road are shown on Figures 6.13-2A to 6.13-2E.

6.13.4.2.9 Touquoy Mine Site

No SOCI plants were observed during vascular plant surveys conducted in August 2004, May and June 2005, and September 2006 as part of the EARD process (CRA 2007a).

One black ash (Fraxinus nigra) was discovered within the Touquoy Mine Site incidentally during wetland surveys in September 2015. The permitted loss of the Black Ash as part of Touquoy Mine Site development occurred in the Spring of 2016, after the Mi'kmaq of Nova Scotia were consulted.

6.13.4.3 Priority Lichen Species

The desktop evaluation for priority lichen species revealed that boreal felt lichen (*Erioderma pedicellatum*) has been documented within 5 km of the PA in both the Beaver Dam Mine Site/Haul Road and Touquoy Mine Site ACCDC reports (Appendices I.1 and I.2). Boreal felt lichen is listed as Endangered by COSEWIC, SARA, and NSESA, and ranked S1 by the ACCDC. NSL&F has not determined any lichen species to be 'location sensitive'. A list of lichen priority species which have elevated potential to be located within the PA, based on habitat preferences and known distribution is provided in Table 6.13-6. No lichen species were documented by the Nova Scotia Department of Communities, Culture and Heritage Environmental Screening Report (Appendix I.3). Species provided by MTRI are bolded.

Table 6.13-6: Priority Lichen Species with Elevated Potential to Occur in the Project Area

Common Name	Scientific Name	SARA	COSEWIC	NSESA	S-Rank
Boreal felt lichen - Atlantic pop.	***Erioderma pedicellatum (Atlantic pop.)***	**Endangered**	**Endangered**	**Endangered**	**S1**
Graceful felt lichen (Vole ears lichen)	*Erioderma mollissimum*	Endangered	Endangered	Endangered	S1S2
Blue felt lichen	***Pectania plumbea***	**Special Concern**	**Special Concern**	**Vulnerable**	**S3**
Black-foam lichen	*Anzia colpodes*	Threatened	Threatened	Threatened	S3
Frosted glass-whiskers	*Sclerophora peronella*	Special Concern	Special Concern		S1?
Black-footed reindeer lichen	*Cladina stygia*	-	-	-	S3?
Blistered tarpaper lichen	*Collema furfuraceum*	-	-	-	S3
White-rimmed shingles lichen	*Fuscopannaria leucosticte*	-	Threatened	-	S2S3
Blistered jellyskin lichen	***Leptogium corticola***	**-**	**-**	**-**	**S3**
Bottlebrush frost lichen	*Physconia detersa*	-	-	-	S3S4
Peppered moon lichen	*Sticta fuliginosa*	-	-	-	S3
Salted shell lichen	***Coccocariai palmicola***	**-**	**-**	**-**	**S3**

Surveys for lichen were completed on February 19, May 2-5, May 8, and 23, 2015 as well as September 18, 2018 and October 29, 2018 within the Beaver Dam Mine Site and surrounding Lichen Study Area (LSA) and May 25th and 26th, 2016 within the Haul Road. Additional targeted surveys were completed in the western and southeastern expansions of the Beaver dam Mine Site on July 10 and August 26, 2019. Eleven priority lichen species occurrences were observed within the LSA and Haul Road. Of the eleven species observed, three are SAR and eight are SOCI, as provided in Table 6.13-7. Of the three SAR identified, two are located within the PA. Blue felt lichen was observed in the Beaver Dam Mine Site and Haul Road and in the broader LSA, while frosted glass whiskers was identified within the Beaver Dam Mine Site. Boreal felt lichen was identified in the LSA originally by the Project Team, but not within the PA. However, upon return in 2016 and 2017, the three observed locations of the boreal felt lichen were no longer present. Locations where lichen SAR and SOCI species were observed are shown on Figures 6.13-2A to 6.13-2E.

Table 6.13-7: Priority Lichen Observed within the Beaver Dam Mine Site, Haul Road and Lichen Study Area

Common Name	Scientific Name	SARA/COSEWIC/ NSESA	S-Rank	Location in the Project Area
Blistered jellyskin lichen	*Leptogium corticola*	-	S3	Six locations observed within the Beaver Dam Mine Site, east of Wetland 29, upland island in Wetland 2, adjacent to Wetland 61, within Wetland 4 and two within/adjacent to Wetland 205. One individual observed north of the PA, in the LSA.
Blistered tarpaper lichen	*Collema nigrescens*	-	S3	Identified in one location northeast of Cameron Flowage, outside the PA, in the LSA.
Blue felt lichen	*Pectania plumbea*	SARA/COSEWIC Special Concern NSESA Vulnerable	S3	Identified in 33 locations within the Beaver Dam Mine Site (17), broader LSA (12), and along the Haul Road (4).
Boreal felt lichen	*Erioderma pedicellatum*	Endangered	S1	Historically identified by the Project Team in three locations to the southwest of Beaver Dam Mine Site, in the LSA, within an un-delineated portion of Wetland 29. Follow up surveys in 2016 and 2017 confirmed its absence.
Frosted glass-whiskers lichen	*Sclerophora peronella*	SARA/COSEWIC Special Concern	S1?	Identified in eight locations within the Beaver Dam Mine Site, adjacent to Wetlands 2 and 29 and one individual east of Wetland 216.
Peppered moon lichen	*Sticta fuliginosa*	-	S3	Identified in four locations within the Beaver Dam Mine Site: two north of Wetland 2, one within Wetland 17 and one north of Crusher Lake. One individual was observed southwest of the PA, in the LSA.
Eastern candlewax lichen	*Ahtiana aurescnes*	-	S2S3	Two locations of three individuals were identified within Wetlands 10 and 14 within the Beaver Dam Mine Site.
Slender monk's hood lichen	*Hypogymnia vittata*	-	S3S4	Identified in four locations within the Beaver Dam Mine Site: one within Wetland 222, one within Wetland 64 and two locations (five individuals) within Wetland 212.
Salted shell lichen	*Coccocarpia palmicola*	-	S3S4	Fifteen locations were identified within the Beaver Dam Mine Site. Seven other observations were made outside the PA, in the LSA.
Powdered fringe lichen	*Heterodermia speciosa*	-	S3	One individual located east of Wetland 216 within the Beaver Dam Mine Site.
Fringe lichen	*Heterodermia neglecta*	-	S3S4	One individual located northeast of Wetland 216 within the Beaver Dam Mine Site.

6.13.4.3.1 Blistered Jellyskin Lichen

Blistered jellyskin lichen (*Leptogium corticola*) was observed in seven locations growing on red maple along the edges of wetlands and lacustrine habitats. This species is a foliose lichen belonging to the Collemataceae family. This lichen is found primarily on the base of hardwood trees in moist environments, but occasionally can be found growing on rocks and boulders. Six observations occurred within the Beaver Dam Mine Site while one was observed outside the PA in the broader LSA. Of the six found in the Beaver Dam Mine Site, two occurrences were observed in Wetlands 4 and 205, both mixed-wood swamps or swamp-fen complexes. Four occurrences were directly adjacent to Wetlands 2, 29, 61 and 205, also mixed-wood wetland complexes. In Nova Scotia, blistered jellyskin lichen is considered uncommon in the province by the ACCDC (S3). All observations were associated with the Beaver Dam Mine Site and broader LSA; none were observed within the Haul Road.

6.13.4.3.2 Blistered Tarpaper Lichen

Blistered tarpaper lichen (*Collema nigrescens*) was observed at one location spreading over a length of 4 m over a red maple on a slope leading to a lake/clear-cut, approximately 200 m northeast of the northern extent of Cameron Flowage, outside of the PA within the broader LSA. This species is a foliose lichen belonging to the Collemataceae family. This species is typically found growing on the bark of poplar trees and other hardwood trees in mature forests. None were observed within the Haul Road. In Nova Scotia, blistered tarpaper lichen is considered uncommon in the province by the ACCDC (S3).

6.13.4.3.3 Blue Felt Lichen

Blue felt lichen (*Pectania plumbea*) was observed in 33 locations on mature red maple trees in a variety of habitats, including wetland edges, edges of clear-cut, and lacustrine habitat, which were within and in proximity to the PA. This species is typically found in mature hardwood forests in varying moisture regimes. This species is a foliose lichen and a member of the Pannariaceae family.

Of the 33 observations, 17 were located within the Beaver Dam Mine Site and 12 observations were in the broader LSA surrounding the Beaver Dam Mine Site. Four occurrences were located along the section of Haul Road where new road construction will be required. Within the Beaver Dam Mine Site, seven observations were documented on the edge of and within Wetland 14 (swamp-bog-fen complex), three within the delineated portion of Wetland 17 (tall-shrub swamp-treed bog complex), one within Wetland 4 (treed swamp-fen complex) and one within Wetland 205 (mixed-wood swamp). Additional occurrences were observed in wetland-adjacent upland habitat 17 m southwest of Wetland 61 (shrub-fen complex), 9 m north of Wetland 2 (bog), 4 m south of Wetland 1 (bog) and 5 m south of Wetland 29 (swamp-fen-bog complex). The four occurrences found along the Haul Road were found on mature red maple trees in a mature mixed wood forest or treed swamps (i.e., Wetland 112). Three occurrences were just beyond the Haul Road, 350 and 170 m northwest of Wetland 126 and 90 m south of Wetland 116. This species is listed as special concern by COSEWIC and SARA and vulnerable by NSESA and S3 by the ACCDC.

An At-Risk-Lichens Special Management Practices (SMP) was released by NSL&F on May 23, 2018. The At-Risk-Lichens SMP lists blue felt lichen as a rare and sensitive species (NSRNR, 2018).

6.13.4.3.4 Boreal Felt Lichen

Boreal felt lichen (*Erioderma pedicellatum*) was observed in three locations on mature balsam fir stands on the edges of the undelineated portion of Wetland 29, outside of the Beaver Dam Mine Site but within the broader LSA, on May 8, 2015. Typically, this species is found on mature balsam fir stands, but it has been documented on spruce, red maple and birch. Habitat within portions of the PA appeared to be suitable for this species as indicated by two foliose lichen species commonly found in boreal felt lichen habitat which were present throughout the LSA and within the PA. These two foliose lichens were salted shell lichen (*Coccocarpia palmicola*) and textured lungwort (*Lobaria scrobiculata*). However, boreal felt lichen was not observed with the PA. Additionally, a follow up survey conducted in the fall of 2016 determined that all three observed thalli in wetland 29 were no longer present. Their absence was reconfirmed on December 4, 2017. ACCDC has noted an additional eight occurrences of boreal felt lichen within the defined critical/core habitat in the LAA.

Boreal felt lichen is a red-listed, critically endangered species worldwide. It is listed as endangered by COSEWIC, SARA, NSESA, and S1 by the ACCDC. The Amended Recovery Strategy for the Boreal Felt lichen (*Erioderma pedicellatum*) Atlantic population, in Canada (ECCC, 2018) was released in 2018. Micro-siting of Project infrastructure was completed based on the identification of the species' updated critical/core habitat as outlined within the Amended Recovery Strategy (ECCC, 2018) and the NSE adopted Recovery Plan for Boreal Felt Lichen (NSE, 2020). Boreal felt lichen is also listed within the NSL&F At-Risk-Lichens SMP (NSDNR, 2018). This SMP updated and replaced the previous SMP (2012).

6.13.4.3.5 Frosted Glass-whickers Lichen

Frosted glass-whiskers lichen (*Sclerophora peronella*) was observed in eight locations on red maple trees primarily in upland habitat, adjacent to wetlands 2, 29 and 216 within the Beaver Dam Mine Site. This species belongs to the Coniocybaceae family and is a very small (1 mm) fruticose lichen and typically grows in old growth forests with relatively stable humidity levels and usually on the heartwood of hardwood trees. It very rarely grows on bark. Four separate populations were found scattered along the edge of the central inland inclusion within wetland 2. Populations ranged from approximately 10 individual lichens covering less than 0.5 cm^2 to an excess of 200 individuals over an area measuring 240 cm^2. This species was also found west of wetland 2 in upland forests. An additional two observations were documented 20 m east of wetland 29 and 20 m north of the southern wetland/upland boundary of the central upland inclusion in wetland 29. Areas within the Beaver Dam Mine Site and Haul Road contained moderately suitable habitat for this species, primarily along the proposed new section of the Haul Road (Section 2, Figure 2.3-1) where more mature hard wood stands with exposed heartwood were found. Despite the presence of suitable habitat within the Haul Road, no specimens were observed. This species is listed as special concern by COSEWIC and SARA.

This species was not identified as having a high likelihood to be present within the PA during the desktop evaluation for rare lichens. This is because it is outside of the previously documented range of this species. According to the Identification and Information Guide to Species at Risk in Nova Scotia (Mersey Tobeatic Research Institute, 2008), Frosted glass whiskers had only been documented in two locations in northwestern Cape Breton Island (Inverness County). This presumed range of this species meant it was excluded from the priority species list, based on known distribution at the time of the desktop review. Since the publication of this Guide, the number of records of this species in Nova Scotia has increased. According to the ACCDC (J. Churchill, Pers. Comm., 2016), this species currently has 30 confirmed records in the database, throughout the province. The Project Team confirmed with the lichen specialist that completed the Beaver Dam surveys that he has submitted another 35 records to ACCDC for inclusion into their database. He also confirmed that this species is largely over looked and under-reported, because of the very small size and cryptic nature of the species.

Similarly, to blue felt lichen, The At-Risk-Lichens SMP (NSDNR, 2018) lists frosted glass-whiskers lichen as a rare and sensitive species.

6.13.4.3.6 Peppered Moon Lichen

Peppered moon lichen (*Sticta Fuliginosa*) was observed primarily on mature red maples near the boundary and within wetland habitat. Four populations were observed within the Beaver Dam Mine Site and one was observed outside the PA within the broader LSA. Within the PA, *S. fuliginosa* was observed in two locations north of Wetland 2, north of Wetland 10, and inside wetland 17. Wetland 2 is a large complex consisting of a treed-bog, graminoid bog, and low shrub bog, Wetland 10 is a low shrub fen, and Wetland 17 is a complex consisting of a tallshrub swamp and coniferous treed bog. In Nova Scotia, peppered moon lichen is considered vulnerable by ACCDC (S3). No observations of this species were documented within the Haul Road.

6.13.4.3.7 Eastern Candlewax Lichen

Eastern candlewax lichen (*Ahtiana aurescnes*) was observed on balsam fir along the edge habitat of Wetlands 10 and 14, both within the Beaver Dam Mine Site. Wetland 10 is a low shrub fen and Wetland 14 is a complex comprised of shrub bog, mixed wood treed swamp, and low shrub fen. The observation of eastern candlewax lichen in Wetland 14 occurred in the shrub bog portion of this complex. The ACCDC identifies eastern candlewax lichen as S2S3. No observations of this species were documented within the Haul Road.

6.13.4.3.8 Slender Monk's Hood Lichen

Four locations of slender monk's hood lichen (*Hypogymnia vittata*) were within Wetlands 64, 222 and 212 (two locations of five individuals) within the Beaver Dam Mine Site. Occurrences were found on black spruce within mixed-wood tree and shrub dominated swamps. Slender monk's hood lichen is a foliose lichen ranked as S3S4 by the ACCDC. This lichen was not observed incidentally or during dedicated surveys along the Haul Road.

6.13.4.3.9 Salted Shell Lichen

Salted shell lichen (*Coccocarpia palmicola*) was observed within the Beaver Dam Mine Site and beyond the PA, within the LSA. No observations of this species were documented within the Haul Road. Within the Beaver Dam Mine Site fifteen locations of salted shell lichen were identified; three within Wetland 220, three west of Wetland 231, two within Wetland 205, two within Wetland 212, one within Wetland 4, one within Wetland 64, one west of Wetland 236, one adjacent to Wetland 219 and one on an upland island within Wetland 29. One of the two populations within Wetland 212 appeared to be unhealthy and was observed on a dying black spruce. Seven additional occurrences were observed within the broader LSA. According to Nash et al. (2002), salted shell lichen inhabit rocks and soil in moist habitats as well as trees. Salted shell lichen is listed as S3S4 by the ACCDC.

6.13.4.3.10 Powdered Fringe Lichen

According to Nash et al. (2002), powdered fringe lichen *(Heterodermia speciosa*) are primarily found on moist rocks or on tree trucks in humid climates. Within Beaver Dam Mine Site, this lichen was found on a mature red maple, east of Wetland 216. No observations of this species were documented within the Haul Road. Powdered fringe lichen is ranked as S3 by the ACCDC.

6.13.4.3.11 Fringe Lichen

An individual fringe lichen (*Heterodermia neglecta*) was found northeast of Wetland 216, 13 m south of the Killag River on a red maple. No observations of this species were documented within the Haul Road. Fringe lichen is ranked as S3S4 by the ACCDC.

6.13.4.3.12 Priority Lichen Summary

While the specific habitat requirements of each of these priority species varies slightly, the common thread between each of these species' habitat requirements is mature to over-mature forests. Stand age is one of the greatest determinants of lichen diversity (McMullin, Duinker, Cameron, Richardson, & Brodo, 2008). Within the Beaver Dam Mine Site, mature to over-mature stands are infrequent, with the majority of the PA having been harvested for timber production. Mature to over-mature forests within the Beaver Dam Mine Site that remain are typically associated with large wetland complexes, which are often avoided during timber harvesting. Mature to over-mature forest suitable for rare lichens is present within the Haul Road, primarily where the proposed route involves new construction. No other species of priority non-vascular flora were identified within the PA.

In total, 11 priority lichen species were observed during lichen surveys, three SAR and eight SOCI. Of the three SAR identified, two are located within the PA. Blue felt lichen was observed in the Beaver Dam Mine Site, Haul Road and in the broader LSA, while Frosted Glass Whiskers was only identified within the Beaver Dam Mine Site. Boreal felt lichen was identified beyond the PA, in the LSA. As discussed, the three occurrences observed by the Project Team may no longer be extant and their status will be verified through the Preliminary Lichen Mitigation and Monitoring Plan (Appendix P.6). The locations of all priority lichen species documented within and adjacent to the PA are provided on Figures 6.13-2A to 6.13-2E.

6.13.4.3.13 Touquoy Mine Site

Lichen surveys conducted in the Touquoy Mine Site in 2004 and 2005 as part of the EARD process found the presence of blue felt lichen (*Degelia plumbea*). An additional lichen survey in 2007 found seven additional SOCI including; salted shell lichen (*Coccocarpia palmicola*), corrugated shingles lichen (*Fuscopannaria ahlneri*), powdered fringe lichen (*Heterodermia speciosa*), blistered jellyskin lichen (*Leptogium corticola*), blue-gray moss shingle lichen (*Moelleropsis nebulosa*), naked kidney lichen (Nephroma bellum), and peppered moon lichen (*Sticta fuliginosa*) (CRA 2007a).

6.13.4.4 Priority Terrestrial Mammal Species

The desktop evaluation for priority species of terrestrial fauna revealed that mainland moose (*Alces americanus*) has been documented within 5 km of the PA by the ACCDC reports (Appendices I.1 and I.2). Three records were available for moose within 5 km of the Beaver Dam Mine Site, while the mainland moose was not documented within 5 km of the Haul Road or Touquoy Mine Site. Mainland moose are listed as Endangered under the NSESA and is provincially ranked as rare by ACCDC (S1).

NSL&F has determined that bat hibernacula sites are 'location sensitive', meaning that their exact locations cannot be provided to proponents in ACCDC reports. No bat hibernaculum were documented within 5 km of the PA by the ACCDC reports. The Project Team reviewed the Recovery Strategy for Little Brown Myotis, Northern Myotis, and Tri-colored Bat in Canada (2015), which confirmed that no known critical habitat (hibernacula) is located in the vicinity of the PA.

A list priority mammal species which have elevated potential to be located within the PA, based on habitat preferences and known distribution is provided in Table 6.13-8. No mammal species were documented by the Nova Scotia Department of Communities, Culture and Heritage Environmental Screening Report (Appendix I.3).

Table 6.13-8: Priority Terrestrial Fauna Species with Elevated Potential to Occur in the Project Area

Common Name	Scientific Name	SARA	COSEWIC	NSESA	S-Rank
Eastern pipistrelle (Tri-coloured bat)	*Perimyotis subflavus*	Endangered	Endangered	Endangered	S1
Eastern red bat	*Lasiurus borealis*	-	-	-	S1S2B, S1M
Hoary bat	*Lasiurus cinereus*	-	-	-	S1S2B, S1M
Little brown myotis	*Myotis lucifugus*	Endangered	Endangered	Endangered	S1
Maritime shrew	*Sorex maritimensis*	-	-	-	S3
Mainland moose	*Alces alces americanus*	-	-	Endangered	S1
Northern long-eared myotis	*Myotis septentrionalis*	Endangered	Endangered	Endangered	S1
Rock vole	*Microtus chrotorrhinus*	-	-	-	S2
Silver-haired bat	*Lasionycteris noctivagans*	-	-	-	SUB, S1M

6.13.4.4.1 Mainland Moose

The mainland moose (*Alces alces americana*) is listed as endangered under NSESA and considered S1, or critically imperiled, by the ACCDC. The moose is the largest member of the deer family (Cervidae), which prefers boreal forest and mixed wood habitats with an abundant food source of young twigs and stems from deciduous trees and shrubs. As a large mammal, they are prone to thermal stress in the summer, often seeking refuge in coniferous forests with full canopy cover. As adept swimmers, they often forage for submerged aquatic vegetation during the summer as well, which provide minerals critical for antler growth. During winter, their long legs and large bodies allow them to move through deep snow, relatively unhindered by cold weather, which may be restrictive to smaller Cervids such as white-tailed deer.

While moose habitat preferences can change as the abundance of available habitat changes (Osko, Hiltz, Hudson, & Wasel, 2004), and habitat selection shows a high degree of variability among individuals (McLaren, Taylor, & Luke, 2009), moose generally require large areas with diverse habitat types (Snaith & Beazley, 2004). Moose habitat preferences are correlated with forage and cover requirements, as well as breeding behaviours (Peek, Urich, & Mackie, 1976). Early successional deciduous vegetation is the main source of moose forage, food types often associated with open or disturbed areas (Snaith, Beazley, MacKinnon, & Duinker, 2002; Snaith & Beazley, 2004; Parker, 2003). The presence of such early successional trees and shrubs is particularly important during the winter months (Parker, 2003). Regenerating vegetation provides good moose browse for 5 to 40 years following disturbances, such as fire, disease, timber harvest, and wind-throw (Snaith, Beazley, MacKinnon, & Duinker, 2002; Snaith & Beazley, 2004). Fire appears to be the most important disturbance in terms of providing quality moose habitat (Parker, 2003 and references therein). Critical habitat for moose in Alberta was described as open lowlands providing high quality food early in the spring (Hauge & Keith, 1981).

In Nova Scotia, the most important food species are red, sugar, and mountain maple, as well as yellow and white birch (Snaith & Beazley, 2004). In the summer months, particularly in June, aquatic vegetation can be an important component of the diet of moose (Peek, Urich, & Mackie, 1976; Fraser, Arthur, Morton, & Thompson, 1980), but the fact that moose have persisted in areas containing infrequent or unsuitable wetlands suggests that these areas are not essential foraging grounds for moose in Nova Scotia (Snaith & Beazley, 2004). This is supported by the findings of Telfer (1967a) who observed no feeding of moose on aquatic vegetation in the Cobequid region. Water bodies such as streams, ponds, and lake shorelines can be important for relief from heat stress in the summer months (Parker, 2003) because moose are not well adapted for temperatures above 14 to 20°C (Snaith & Beazley, 2004). Moose have also been shown to preferentially select dense, mature forests with a closed canopy in the summer

months (Schwab and Pitt 1991) because the canopy provides shade and heat relief. Dussault et al. (2004) determined that moose showed behavioural adaptations to avoid heat stress in the summer, including using thermal shelters during the day and increasing nocturnal activity.

When female moose give birth to their calves in the spring of the year, they often select islands or peninsulas because of the protection from predators they afford, or areas of high elevation because of visibility in availability of escape routes (Wilton & Garner, 1991). In mountainous regions of British Columbia, however, only 52% of 31 GPS-collared female moose climbed to higher elevations to calve, while the other 48% changed little in elevation (Poole, Serrouya, & Stuart-Smith, 2007). These researchers found that those females that remained at lower elevations preferentially selected areas with increased forage, decreased slope, and in closer proximity to water. Langley & Pletscher (1994) characterized calving areas in Montana and British Columbia as having dense hiding cover and open patches with bare ground. Cederlund, Sandegren, & Larsson (1987) found that all cows returned to the same summer range each spring, and Bogomolova and Kurochkin (2002) determined that cows returned to the same area of the forest every year before giving birth.

Although not considered critical habitat (Balsom, Ballard, & Whitlaw, 1996), mature, conifer forests are extremely important for moose in Nova Scotia during the late winter months (Telfer, 1967a; Peek, Urich, & Mackie, 1976; Parker, 2003) because they provide protection from extreme weather and the canopy prevents snow from accumulating to depths hindering moose movement (Snaith & Beazley, 2004). Travelling in areas where they sink into the snow can cause moose to expend a significant amount of energy (Lundmark and Ball, 2008) at a time when adequate forage may be scarce. Ideal winter habitat also includes regenerating mixed woods that provide both hardwood and softwood browse (Parker, 2003). In the winter months, moose in northern Nova Scotia concentrate in small areas known as "yards" and move very little (winter range of 2.6 km^2), particularly when the yard is contains good browse as in the Cobequid region (Telfer, 1967a,b). In Quebec, the vast majority of these winter yards were less than 0.5 km^2 in area (Guertin, Doucet, & Weary, 1984). Prescott (1968) determined that the use of winter yards by moose in northeastern Nova Scotia was influenced most heavily by having a variety of vegetation types and that food availability was more important than cover in determining the attractiveness of winter habitat to moose (summarized from Parker, 2003). Moose yards in Quebec were characterized by gentle slopes with southern exposure, with pure or mixed stands of black spruce and adjacent patches of white birch, young balsam fir, and alder (Guertin, Doucet, & Weary, 1984). Other important winter food items include willow, which accounted for 35% of the winter diet of moose in northern British Columbia (Goulet, 1985).

A similarly restricted winter range of moose was determined from studies in Minnesota (Van Ballenberghe and Peek, 1971; Phillips, Berg, & Siniff, 1973). Phillips, Berg, & Siniff (1973) that found that the late winter ranges of all tracked moose were distinct in habitat from the areas used at other time of year and that the summer-fall and early winter ranges were much larger. Furthermore, they determined that most moose returned to the same wintering area each year and that they used similar travel routes each year between seasonal habitats. Geist (1963) suggested that moose return every year to their accustomed summer range. Seasonal movements between winter and summer ranges were reported in moose in Alberta, with individual movement of up to 20 km observed (Hauge & Keith, 1981). Even greater migrations between winter and non-winter ranges of up to 75 km were observed in British Columbia, with non-winter ranges being twice as large as winter ranges (Demarchi, 2003). If the habitat in an area is diverse and provides the necessary interspersion of open areas for foraging and dense, mature forests for cover and relief from snow, seasonal ranges need not be widely separated (Snaith & Beazley, 2004). For example, only 22% and 38% of adult moose in Michigan migrated between distinct summer and winter ranges in 1999 and 2000, respectively. In Alaska, 43% of bulls and cows had distinct winter and summer ranges and distance between ranges were up to 17 km (Bangs, Bailey, & Portner, 1984). In southwestern Nova Scotia, however, the mean home range of moose was found to be large (55.2 km^2) because the rocky, barren conditions mean the moose must range farther to obtain resources (see Snaith & Beazley, 2004). When moving between seasonal ranges, moose use well established routes and travel corridors (Neumann, 2009). In terms of activity within seasons, daily movement rates of moose are higher in the summer than in the winter (McLaren, Taylor, & Luke, 2009).

Two sub-species of moose are present within Nova Scotia. The Cape Breton population (*Alces andersoni*) is an introduced species from Alberta and their population is abundant and stable. According to NSL&F (2007), the mainland moose (Alces americana) population has been reduced to approximately 1200 individuals, restricted to small, isolated sub-populations. The Recovery Plan for Moose in Mainland Nova Scotia (NSDNR, 2007) identifies several limiting factors to moose abundance and distribution. These include disease and parasites, poaching, access to habitat, development, forest practices, acid rain, and climate change. Of highest concern are threats related to disease and parasites, poaching, access to moose habitat, and development.

The primary parasite threatening survival of mainland moose is a parasitic worm *(Parelaphostrongylus tenuis*), known as brainworm. Approximately 65% of white-tailed deer in Nova Scotia are carriers of this parasite; however, it is not lethal to deer. According to NSL&F (2007, p.14), "Where moose and deer range overlap, brainworm is a significant mortality factor". Because the abundance of white-tailed deer can have an influence on the health of mainland moose, signs of white-tailed deer are documented during mainland moose surveys.

The threats of poaching and access to moose habitat are correlated, as increased access to moose habitat can ultimately increase the level of poaching. These threats can result in lowered viability of individual populations of moose by direct mortality and reduction in range. Similarly, land development of various types can result in increased access to moose habitat, fragmentation of habitat, and direct loss of habitat, while (potentially) further isolating sub-populations from one another.

According to the Recovery Plan for Mainland Moose in Nova Scotia (NSDNR, 2007, p. 30), core habitat means "specific areas of habitat essential for the long-term survivability and recovery of endangered or threatened species and that are designated as core habitat" under the Nova Scotia Endangered Species Act. Mainland moose use a wide variety of habitat types, over relatively large home ranges. The specific spatial and temporal use of the landscape and habitat is not well known in Nova Scotia. As such, 'core habitat' has not been defined or designated under the Endangered Species Act. The PA lies within a significant Mainland Moose Concentration Area, as identified in Endangered Mainland Moose Special Management Practices (NSDNR, 2012).

Within the PA, mainland moose tracks were observed within the Beaver Dam Mine Site in disturbed, roadside habitat north of Wetland 56 on May 24th, 2015 during a targeted PGI survey. Moose tracks were observed incidentally in two locations on September 9th, 2014, in Wetland 210 and just beyond the Beaver Dam Mine Site, adjacent to Wetland 206. No signs of mainland moose were observed during any survey within Haul Road.

6.13.4.4.2 Bats

A single abandoned mine opening (AMO) (BED-1-003) was identified as a potential bat hibernaculum. The remaining AMOs when surveyed were either infilled, contained a concrete cap, or were flooded with water, which all limit the potential for bat hibernacula. The Beaver Dam Gold Mining Company J.H. Austin Main Shaft (BED-1-003) (Hennick et al 2016) is located on the Beaver Dam Road, Halifax County at UTM Zone 20, 522256 east, and 4990298 north. It is located just east of the Beaver Dam Road at the western end of an open historical settling pond (wetland 59) southwest of Cameron Flowage.

The J.H. Austin Main Shaft was originally 67 m deep. It has a concrete collar and cap. The installation date of the collar and concrete cap are unknown, but they have since collapsed and the AMO appears to be filled with rocks. The opening appeared to be less than 5 m deep, with no water observed. The potential for usage of the opening by bats was determined to be very low; however, it could not be visually confirmed because the Project Team could not safely inspect the opening for any internal complexities. A second abandoned mine opening was observed 9 m west of BED-1-003. This opening is described in the NSL&F database as BED-1-002 as an air shaft for the main J.H. Austin Shaft (BED-1-003). This mine opening was clear of debris and backfill and groundwater was observed in BED-1-002 approximately four meters below the ground surface and one-meter below the top of the mine shaft infrastructure.

As a result of the observed groundwater in the opening nine meters away (BED-1-002), it was hypothesized that groundwater was likely quite close to the surface within BED-1-003 even though it was not observed due to debris and backfill. LiDAR data collected by GHD was used to evaluate the potential of BED-1-003 as a bat hibernaculum. Results derived from LiDAR data (provided on Figure 6.13-5 shows the grade elevation at BED-1-002 (open AMO) to be 134.38 m while the elevation of the BED-1-002 mine shaft opening is 131.43 m. The data also shows the elevation of a pond 40 m downslope of BED-1-002 to be 130.43 m (all elevations are of ±0.15 m accuracy). Based on these elevations and the distance to the pond, the percent grade of the slope on which BED-1-002 and BED-1-003 are located is 9.88%. At this percent slope, the maximum elevation level of the grade at BED-1-003 (located nine-meters from BED-1-002) would be 135.27 m. This would infer that the water is present in BED-1-003 five-meters below (135.27 m minus 130.43 m) the surface, which places it at or just below the location of the debris in the mine shaft. The inferred proximity of water to the top of the mine shaft (approximately five-meters) reduces the potential of BED-1-003 as a bat hibernaculum.

No AMOs were identified along the Haul Road, although a cluster of 99 AMOs is present approximately 6.4 km southeast of the Haul Road, along the Mooseland Road, within the Mooseland Gold District. A desktop evaluation for potential bat hibernacula was completed within this cluster of AMOs. The Project Team screened out AMOs with opening types of trench and pit, and stope, flooded, infilled, and capped AMOs, and those with an original depth of less than 10 m. According to this desktop review, none of the AMOs reviewed (in the cluster of 99) have the potential to support bat hibernacula. As a result, no bat hibernacula were identified along the Haul Road. Additionally, no potential bat hibernacula were identified through desktop evaluation within 10 km of the PA.

6.13.4.5 Priority Terrestrial Mammal Summary

Through all targeted surveys and incidental observations, evidence of a single mammalian priority species was observed. One set of moose tracks observed within the Beaver Dam Mine Site on May 24th, 2015 during a targeted PGI survey. Two sets of mainland moose tracks were observed incidentally within and directly adjacent to the Beaver Dam Mine Site on September 9, 2014. No other moose signs (tracks, scat, browse) were observed during targeted moose surveys (tracks or PGI) completed within the Beaver Dam Mine Site or the Haul Road. Suitable habitat for mainland moose is present within, and adjacent to the PA. Although no core habitat has been defined for mainland moose in Nova Scotia, the PA is located within a Significant Mainland Moose Concentration Area.

Determination of the presence of several bat SAR was completed and included both desktop and field components. This evaluation for bat SAR determined that the PA does not contain suitable habitat for bat hibernacula, and no evidence was found that indicates any usage of the PA by priority bat species. No bat hibernaculum are known to be present within a 10 km radius of the PA. No bats, or evidence thereof, were observed incidentally during biophysical surveys, particularly bird surveys which are conducted when bats are more active.

Incidental sightings of mammals were completed during all field programs throughout the PA during all seasons. Aside from mainland moose tracks, no priority mammals or signs thereof were observed. Given the mobility of mammal species, the absence of observation does not confirm absence of the species within the PA. The size of a species and a species' behavior can result in a bias against detection. For instance, very small species such as the maritime shrew (S3) and the rock vole (S2) have been documented within 5 km of the PA, but were not observed by the Project Team within the PA. As another example, the fisher (Martes pennanti, S2) is a largely nocturnal hunter, with large home ranges and elusive behavior. They prefer dense, mature to over-mature coniferous stands with large hollow snags for den sites. Their preferred habitat and prey items (porcupine, rabbits, squirrels and other small mammals) are present within the PA. The lack of observed evidence of fisher does not confirm absence of the species.

6.13.4.5.1 Touquoy Mine Site

Mainland moose tracks were observed within the Touquoy Mine Site in a bog during field surveys to support the Touquoy Environmental Assessment in 2006. Moose are known to the Tangier Grand Lake Wilderness Area, and evidence of moose is reported every year by NSL&F in the Moose River Gold Mines area during deer pellet surveys (CRA, 2007a).

No suitable bat hibernating areas were found within the Touquoy Mine Site during environmental screening to support the Touquoy Environmental Assessment (CRA, 2007a).

6.13.4.6 Priority Herpetofauna Species

The desktop evaluation for priority herpetofauna species revealed that no priority species were documented within 5 km of the Beaver Dam Mine Site or Haul Road by the ACCDC report (Appendix I.1). Wood turtle (SARA/COSEWIC/NSESA Threatened; S2) has been classified as 'location sensitive'. The ACCDC reports a wood turtle observation more than 20 km from the Project. While wood turtle may be present within the watershed, it was confirmed that this observation was located outside the West River Sheet Harbour watershed, in which the Project is located (NSLF, pers. comm. 2021).

The following priority herpetofauna species are identified as having an elevated potential to be located within the PA, based on habitat preferences, and broad geographic area (Table 6.13-9). No amphibians or reptiles were documented by the Nova Scotia Department of Communities, Culture and Heritage Environmental Screening Report (Appendix I.3).

Table 6.13-9: Priority Herpetofauna Species with Elevated Potential to Occur in the Project Area

Common Name	Scientific Name	SARA/COSEWIC/NSESA	S-Rank	Habitat Preference
Snapping turtle	*Chelydra serpentina*	SARA/COSEWIC Special Concern NSESA Vulnerable	S3	Southern New Brunswick and parts of mainland Nova Scotia in ponds, lakes, slow-moving streams, and sometimes in brackish water if these water bodies have soft mud bottoms and abundant aquatic vegetation
Wood turtle	*Glyptemys insculpta*	SARA/COSEWIC/NSESA Threatened	S2	Lives along permanent streams during much of each year, but in summer may roam widely overland and can be found in a variety of terrestrial habitats adjacent to streams, from deciduous woods, cultivated fields, and woodland bogs, to marshy pastures. Use of woodland bogs and marshy fields is most common in the northern part of the range
Eastern painted turtle	*Chrysemys picta picta*	COSEWIC Special Concern	S4S5	Occupies slow moving, relatively shallow and well-vegetated wetlands and waterbodies, particularly with organic substrates. Semi-tolerant of anthropogenic landscapes.

Targeted turtle surveys within the Beaver Dam Mine Site did not reveal any sightings of wood turtles, painted turtle or suitable nesting habitat. No opportunistic observations of wood turtles, painted turtle or suitable nesting habitat were documented during any wetland or watercourse surveys throughout the PA.

One female snapping turtle (SARA/COSEWIC, Special Concern; NSESA, Vulnerable; S3) and nest was observed by DFO within the Beaver Dam Mine Site on June 27, 2019. The observation was on a rocky, man-made berm east of Wetland 59 (historic settling pond; Figure 6.13-1A. Previously, there were only incidental observations of this species, one on June 26, 2016 where the Mooseland Road section of the Haul Road crosses Fish River (during bird surveys, near PC45), and two adjacent to the Touquoy Mine Site (see following section; Figure 6.13-1G). Similar to the wood turtle, snapping turtle populations are threatened by low juvenile recruitment and high juvenile mortality. Snapping turtles have a life span of approximately 50 years, however, sexual maturity it not reached until the age of 15 to 20 years, and survival rates (form embryo through to sexual maturity) are estimated to be as low as 0.1%. According to Environment and Climate Change Canada (2016), the very low juvenile recruitment means that high adult survivability is required to maintain a viable population. As such, a single adult mortality due to natural or anthropogenic factors can be significant to the population.

Snapping turtles can be found in a variety of freshwater ecosystems, such as slow-moving rivers, wetlands, lakes, streams and ponds. Hibernation occurs in freshwater systems deep enough to prevent freezing through during the winter, with a mucky or muddy substrate. They are the most aquatic of freshwater turtles in Nova Scotia, but they do travel through upland habitat and use gravelly areas to nest. The preference for gravelly substrate during nesting is a threat to turtles, as gravid females are attracted to roadsides to nest in the gravelly shoulders of roads. This can result in direct mortality of reproductive females and emerging hatchlings from vehicular collisions. This type of direct mortality, along with direct loss of freshwater and riparian habitats, poses significant threats to the viability of snapping turtle populations in Nova Scotia. Additional threats include an increase in human-subsidized predators such as foxes, coyotes, raccoons, and skunks (Environment and Climate Change Canada, 2016).

Suitable habitat for snapping turtles has been observed in Wetlands 8, 10, 14, 17, 29, 44, 56, 59, 61, 64, 66, 68, 69, 159, 168, 171, and 207. These wetlands provide standing water to a depth exceeding 0.5 m and muddy substrate (e.g., lentic and lotic wetlands and wetlands with open water features), which provide potential overwintering habitat.

6.13.4.6.1 Touquoy Mine Site

No wood turtle, painted turtle or suitable habitat were observed within the Touquoy Mine Site during wood turtle habitat surveys conducted in 2004 (CRA 2007a). No snapping turtles were recorded within the Touquoy Mine Site during the EARD process, however, two snapping turtles were observed in the vicinity, within the LAA. One observation was north of the Touquoy Mine Site on Moose River Road (20T 504304E, 4981602N), and the second was on Higgins Mines Road (20T 504380E, 4980699N) west of the Touquoy Mine Site. Snapping turtles were frequently observed (16 observations) by AMNS between June 19, 2017 and July 2, 2020, primarily on roadsides near Moose River and Scraggy Lake.

6.13.4.7 Priority Invertebrate Species

The desktop evaluation for priority invertebrate species revealed that one monarch butterfly was identified within 5 km of the PA by the ACCDC reports. NSL&F has not identified any invertebrate species as 'location sensitive' species and no invertebrate species were documented by the Nova Scotia Department of Communities, Culture and Heritage Environmental Screening Report (Appendix I.3). The Maritime Butterfly Atlas was reviewed (20NQ17, 20NQ18, 20NQ19, 20NQ28, 20NQ29) for observations of priority Lepidopterans (Appendix I.4). Additionally, Odonata Central (n.d.) was reviewed for records of priority odonates within the vicinity of the PA. A list of priority invertebrate species which have elevated potential to be located within the PA, based on habitat preferences and known distribution is provided in Table 6.13-10.

Table 6.13-10: Priority Invertebrate Species with Elevated Potential to Occur in the Project Area

Common Name	Scientific Name	SARA/COSEWIC/ NSESA	S-Rank	Habitat Preference
Monarch	*Danaus plexippus*	SARA Special Concern COSEWIC Endangered NSESA Endangered	S2B	Almost anywhere during the spring (northward) migration; near the larval food plants during the breeding season; in the fall commonly near the coast, often in large numbers, all heading south. Larvae are found feeding on the following milkweed species: common milkweed and swamp milkweed, neither of which are abundant plants in Nova Scotia. Common milkweed: very common in lower Saint John river valley and possibly north central Nova Scotia.
Skillet clubtail	*Gomphus ventricosus*	SARA/COSEWIC Endangered	S1	The larvae inhabit large rivers where they burrow in the soft mud of deep pools.
Triangle floater	*Alasmidonta undulata*	-	S2S3	Frequently found in stream and rivers in sand and gravel substrates.
Pepper and salt skipper	*Amblyscirtes hegon*	-	S2S3	Found on the edges of forests and streams. Larvae found feeding on a variety of grass species.
Common roadside-skipper	*Amblyscirtes vialis*	-	S3S4	Found in trails, roads in wooded areas, and often near streams. Larvae are found feeding off of a variety of grass species.
Baltimore checkerspot	*Euphydryas phaeton*	-	S2S3	Found in fresh-water marshes, wet roadsides and meadows. Larvae found feeding on turtlehead and has been reported to feed on beardtongue.
Grey comma	*Polygonia progne*	-	S3S4	Found in woods and aspen parklands. Larvae found feeding on currants and gooseberries and sometimes elm.
Striped hairstreak	*Satyrium liparops*	-	S2S3	Found in deciduous forest edges, gardens and roadsides. Larvae found feeding off of members of the Rose family such as plum and cherries. Occurrences with oak, willow, and blueberry.

Surveys for benthic invertebrates were completed as part of the fish habitat assessment, following CABIN protocol methodologies. No priority invertebrate species were identified through sampling for benthic invertebrates (as described in Section 6.9.3.2). Field staff searched for signs of aquatic invertebrates, such as freshwater mussels during all wetland and watercourse related programs. None were observed. According to Fisheries and Oceans Canada (2016b), the brook floater (*Alasmidonta varicosa*) has not been documented in any watersheds within the PA.

The desktop review of damselflies and dragonflies through Odonata Central did not confirm presence of any priority species in the vicinity of the PA nor were any priority species observed during surveys completed within the PA.

A review of data provided by the Maritime Butterfly Atlas and ACCDC confirmed that one monarch butterfly was observed within the Beaver Dam Mine Site, adjacent to Wetland 59 (square 20NQ29). Monarch butterflies rely on milkweed as a host plant for their larvae; as such, it is a key indicator for presence of the monarch. Surveys for vascular plants were conducted throughout the PA, and staff were instructed to identify any suitable habitat for monarchs based on presence of milkweed. No milkweed was documented during surveys for vascular flora, or opportunistically during any other surveys. It is possible that the monarch uses the Beaver Dam Mine Site, at least periodically, during migration.

No other targeted surveys were completed for invertebrates; however, no opportunistic observations of priority invertebrate species were recorded. No other priority invertebrate species were identified during the desktop review.

6.13.4.8 Priority Avifauna Species

A desktop review for priority species revealed that 33 priority bird species were identified as having the potential to occur within the Beaver Dam Mine Site and Haul Road based on habitat availability and geographic distribution. Eighteen species have been documented within 5 km of the Beaver Dam Mine Site and Haul Road by the ACCDC reports. These species are underlined in Table 6.13-11.

NSL&F has classified one species, the peregrine falcon, as 'location sensitive', meaning that their exact locations cannot be provided to proponents in ACCDC reports. Instead, ACCDC indicates whether a location sensitive species is documented within 5 km of the PA. The peregrine falcon (*Anatum/tundrius pop.*) has not been documented within 5 km of the PA in the ACCDC reports.

The Nova Scotia Department of Communities, Culture and Heritage Environmental Screening Report (Appendix I.3) reported nesting records or probable nesting records for 16 priority species within the vicinity of the PA. These species are bolded in Table 6.13-11.

A list of priority avifauna species which have elevated potential to be located within the PA, based on habitat preferences and known distribution is provided in Table 6.13-11.

Table 6.13-11: Priority Avifauna Species with Elevated Potential to Occur in the Project Area

Common Name	Scientific Name	SARA	COSEWIC	NSESA	S-Rank
Blue-winged teal	*Anas discors*	-	-	-	S2S3B
Common nighthawk	*Chordeiles minor*	Threatened	Special Concern	Threatened	S2B
Killdeer	*Charadrius vociferous*	-	-	-	S3B
Wilson's snipe	*Gallinago delicate*	-	-	-	S3B
Spotted sandpiper	*Actitis macularius*	-	-	-	S3S4B
Greater yellowlegs	*Tringa melanoleuca*	-	-	-	S3B, S3S4M
American bittern	*Botaurus lentiginosus*	-	-	-	S3S4B
Northern goshawk	*Accipiter gentilis*	-	NAR	-	S3S4
Black-backed woodpecker	*Picoides arcticus*	-	-	-	S3S4
American kestrel	*Falco sparverius*	-	-	-	S3B
Peregrine falcon - anatum	*Falco peregrinus pop. 1*	Special Concern	NAR	Vulnerable	S1B, SNAM
Olive-sided flycatcher	*Contopus cooperi*	Threatened	Special Concern	Threatened	S2B
Eastern wood-pewee	*Contopus virens*	Special Concern	Special Concern	Vulnerable	S3S4B
Yellow-bellied flycatcher	*Empidonax flaviventris*	-	-	-	S3S4B
Willow flycatcher	*Empidonax traillii*	-	-	-	S2B
Eastern kingbird	*Tyrannus tyrannus*	-	-	-	S3B
Philadelphia vireo	*Vireo philadelphicus*	-	-	-	S2?B

Table 6.13-11: Priority Avifauna Species with Elevated Potential to Occur in the Project Area (continued)

Common Name	Scientific Name	SARA	COSEWIC	NSESA	S-Rank
Warbling vireo	*Vireo gilvus*	-	-	-	S1B
Canada jay	*Perisoreus canadensis*	-	-	-	S3
Barn swallow	*Hirundo rustica*	Threatened	Threatened	Endangered	S2S3B
Boreal chickadee	*Poecile hudsonica*	-	-	-	S3
Red-breasted nuthatch	*Sitta canadensis*	-	-	-	S3
Ruby-crowned kinglet	*Regulus calendula*	-	-	-	S3S4B
Eastern bluebird	*Sialia sialis*	-	NAR	-	S3B
Swainson's thrush	*Catharus ustulatus*	-	-	-	S3S4B
American robin	*Turdus migratorius*	-	-	-	S5B, S3N
Gray catbird	*Dumetella carolinensis*	-	-	-	S3B
Northern mockingbird	*Mimus polyglottos*	-	-	-	S1B
Pine grosbeak	*Pinicola enucleator*	-	-	-	S2S3B, S5N
Purple finch	*Haemorhous purpureus*	-	-	-	S4S5B, S3S4N
Red crossbill	*Loxia curvirostra*	-	-	-	S3S4
Pine siskin	*Carduelis pinus*	-	-	-	S2S3
Evening grosbeak	*Coccothraustes vespertinus*	Special Concern	Special Concern	Vulnerable	S3S4B, S3N
Tennessee warbler	*Vermivora peregrine*	-	-	-	S3S4B
Cape May warbler	*Dendroica tigrina*	-	-	-	S2B
Bay-breasted warbler	*Dendroica castanea*	-	-	-	S3S4B
Canada warbler	*Wilsonia canadensis*	Threatened	Threatened	Endangered	S3B
Wilson's warbler	*Wilsonia pusilla*	-	-	-	S3B
Rose-breasted grosbeak	*Pheucticus ludovicianus*	-	-	-	S2S3B
Rusty blackbird	*Euphagus carolinus*	Special Concern	Special Concern	Endangered	S2B
Baltimore oriole	*Icterus galbula*	-	-	-	S2S3B
Bank swallow	*Riparia riparia*	Threatened	Threatened	Endangered	S2S3B
Northern harrier	*Circus hudsonius*	NAR			S3S4B

6.13.4.8.1 Priority Avifauna Observed within the Beaver Dam Mine Site and Haul Road

During field assessments within the Beaver Dam Mine Site and Haul Road, a total of 32 priority bird species, 23 SOCI and nine SAR, were observed, in consideration of their breeding status qualifiers. These species are presented in Table 6.13-12. These results include species observed during the additional 2019 surveys within the Beaver Dam Mine Site.

Table 6.13-12: Priority Avifauna Observed within the Beaver Dam Mine Site and Haul Road

Common name	SARA	COSEWIC	NSESA	S-Rank*	Season observed	Number in the Beaver Dam Mine Site								Number in Haul Road						All PA
						Spring migration		Breeding		Fall migration		Total in Beaver Dam Mine Site		Spring migration		Breeding		Total in Haul Road		Total
						#	Location	#	Location	#	Location	#	Location	#	Location	#	Location	#	Location	
Barn swallow	-	T	E	S2S3B	SM-1	.	.	.	.	.	.	**0**		1	8 (Inc.)	.	.	**1**	**8 (Inc.)**	**1**
Canada warbler	T	T	E	S3B	SM, B, B-I	.	.	4	33, Inc.	.	.	**4**	**33, Inc.**	10	2, 4, 6, 10, 28, 35, 39, 41, 45	2	25	**12**	**2, 4, 6, 10, 25, 28, 35, 39, 41, 45**	**16**
Chimney swift	T	T	E	S2B, S1M	B-I	.	.	2	23	.	.	**2**	**23**	.	.	.	.	**0**	**.**	**2**
Common nighthawk	T	SC	T	S2B	B	.	.	.	.	.	.	**0**		.	.	4	26, CONI1, CONI9	**4**	**26, CONI1, CONI9**	**4**
Olive-sided flycatcher	T	SC	T	S2B	B, B-I	.	.	5	3, 22, Inc.	.	.	**5**	**3, 22**	.	.	5	5, 29, 30, 43	**5**	**5, 29, 30, 43**	**10**
Eastern wood-pewee	SC	SC	V	S3S4B	B-1	.	.	1	Inc.	.	.	**1**	**Inc.**	.	.	1	Inc.	**1**	**Inc.**	**2**
Evening grosbeak	SC	SC	V	S3S4B ,S3N	SM							**0**		2	7			**2**	**7**	**2**
Peregrine falcon	SC	NAR	V	S1B	FM, FM-I	.	.	.	.	2	9, 10	**2**	**9, 10**	.	.	.	.	**0**	**.**	**2**
Rusty blackbird	SC	SC	E	S2B	FM-I	.	.	.	.	1	15 (Inc.)	**1**	**15 (inc.)**	.	.	.	.	**0**	**.**	**1**
American coot	-	-	-	S1B	SM							**0**		2	6, 8			**2**	**6, 8**	**2**
American kestrel	-	-	-	S3B	SM							**0**		2	26, 44			**2**	**26, 44**	**2**
Bay-breasted warbler	-	-	-	S3S4B	B, SM	.	.	.1	.6	.	.	**1**	**6**	20	4, 7, 10, 12, 14, 17, 18, 23, 25, 26, 31, 32, 36, 37, 38,	2	30, 31	**2**	**30, 31**	**23**
Black-backed woodpecker	-	-	-	S3S4	SM, B, B-I	.	.	.	.	.	.	**0**		3	19, 29	3	18, 22, 39	**6**	**18, 19, 22, 29, 39**	**6**
Blackpoll warble	-	-	-	S3S4B	B, FM, SM	.	.	.	.	11	1, 4, 5, 20, 21, 24, 25, 30	**11**		2	26, 30	11	1, 2, 5, 24, 33, 36, 38	**13**	**1, 2, 5, 24, 33, 36, 38**	**24**
Boreal chickadee	-	-	-	S3	SM, SM-I, B-I	4	30	3	7, Inc.	14	14, 21, 23, 25, 26, 30, 31, Inc.	**21**	**7, 14, 21, 23, 25, 26, 30, 31,**	4	20, 23, 35	1	Inc.	**5**	**4, 20, 23, 25, Inc.**	**26**
Brown-headed cowbird	-	-	-	S2B	SM	1	25					**1**	**25**					**0**		**1**
Canada jay	-	-	-	S3	SM, SM-I, B, FM	.	.	1	22	44	2, 3, 4, 5, 6, 7, 11, 13, 15, 16, 17, 18, 21, 24, 25, 26, 27, 28, 29, 30, 31,	**45**	**2, 3, 4, 5, 6, 7, 11, 13, 15, 16, 17, 18, 21, 22, 24, 25, 26, 27, 28, 29, 30, 31,**	19	4, 5, 18, 27, 28, 29, 32, 39, 44	.	.	**19**	**4, 5, 18, 20, 27, 28, 29, 32, 39, 44**	**64**
Common golden eye	-	-	-	S2B, S5N	SM-1	1	7 (Inc.)					**1**	**7 (Inc.)**					**0**		**1**
Gray catbird	-	-	-	S3B	B	.	.	.	.	.	.	**0**		.	.	1	11	**1**	**11**	**1**
Greater yellowlegs	-	-	-	S3B, S3S4M	SM, B, B-I	29	1, 2, 4, 5, 6, 7, 24, 25, 28, 30, 31	8	1, 3, 9, 10, Inc.	.	.	**37**	**1, 2, 3, 4, 5, 6, 7, 9, 10, 24, 25, 26, 28, 30, 31**	3	1, 3, 4	5	1, 3	**8**	**1, 3, 4**	**45**
Northern goshawk	-	NAR	-	S3S4	SM	.	.	.	.	.	.	**0**		1	1	.	.	**1**	**1**	**1**
Northern harrier	-	-	-	S3S4B	SM, B, B-1	1	MR-1	1	10	.		**2**	**10, MR-1**	.	.	.1	Inc.	**1**	**Inc.**	**3**
Pine siskin	-	-	-	S2S3	FM, I-FM	.	.	.	.	119	2, 3, 5, 17, 22, 24, 26, 30, 32,	**119**	**2, 3, 5, 17, 22, 24, 26, 30, 32,**	1	7	.	.	**1**	**7**	**120**
Pine grosbeak	-	-	-	S2S3B, S5N	SM-1							**0**		1	Inc.			**1**	**Inc.**	**1**
Red crossbill	-	-	-	S3S4	SM-I	.	.	.	.	.	.	**0**		3	22	.	.	**3**	**22**	**3**

Table 6.13-12: Priority Avifauna Observed within the Beaver Dam Mine Site and Haul Road (continued)

Common name	SARA	COSEWIC	NSESA	S-Rank*	Season observed	Number in the Beaver Dam Mine Site								Number in Haul Road						All PA
						Spring migration		Breeding		Fall migration		Total in Beaver Dam Mine Site		Spring migration		Breeding		Total in Haul Road		Total
						#	Location	#	Location	#	Location	#	Location	#	Location	#	Location	#	Location	
Red-breasted nuthatch	-	-	-	S3	SM, SM-I, B, B-I	3	6, 31	.	.	1	25	**4**	**6, 25, 31**	**7**	2, 7, 18, 19, 29, 30, 40	**24**	5, 8, 18, 19, 21, 22, 25, 33, 35, 37, 43, 44, 45, 46, 50	**31**	**2, 5, 7, 8, 18, 19, 21, 22, 25, 29, 30, 33, 35, 37, 40, 43, 44, 45, 46, 50**	**35**
Ruby-crowned kinglet***	-	-	-	S3S4B	B, SM	**47**	**1, 2, 3, 4, 5, 6, 7, 22, 24, 25 28, 30, 31, 35**	14	4, 7, 10, 16, 21, 25, 26, 29, 30, 31	**5**	**7, 9, 14, 21**	**66**	**1, 2, 3, 4, 5, 6, 7, 10, 16, 21, 22, 24, 25, 26, 28, 29, 30, 31, 35**	**112**	**1,2,3,4,5,6,7,8, 9, 10,12, 14, 15, 16, 17, 18, 20, 21,22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 39, 40, 41, 42, 43, 44, 45,**	82	2, 4, 6, 7, 10, 11, 18, 21, 23, 24, 25, 26, 27, 29, 34, 35, 36, 38, 39, 40, 41, 42, 43, 47, 48, 49	**194**	**1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 14, 15, 16, 17, 18, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 47, 48, 49**	**260**
Swainson's thrush***	-	-	-	S3S4B	B, B-I, SM	**6**	**2, 6, 7, 28, 30**	**28**	1, **2**, 3, **4**, **6**, **7**, **8**, 10, 17, 24, 25, 26, 27, 28, 29, 30, 31, 32	.	.	**34**	**1, 2, 3, 4, 6, 7, 8, 10, 17, 24, 25, 26, 27, 28, 29, 30, 31, 32**	**59**	**1, 2, 3, 4, 6, 8, 9, 10, 11, 12, 13, 14, 15, 16, 23, 24, 25, 27, 29, 30, 32, 33, 34, 36, 40, 42, 43, 44, 45,**	34	1, 2, 4, 6, 8, 9, 18, 22, 24, 26, 29, 39, 40, 42, 45	**93**	**1, 2, 3, 4, 6, 8, 9, 10, 11, 12,13, 14, 15,16, 18, 22, 23, 24, 25, 26, 27, 29, 30, 32, 33, 34, 39, 40, 42, 43, 44, 45**	**127**
Tennessee warbler	-	-	-	S3S4B	B	.	.	1	25	.	.	**1**	**25**	.	.		.	**0**	**.**	**1**
Wilson's snipe***	-	-	-	S3B	B, I-B, SM	**13**	**1, 2, 5, 6, 24, 31**	**4**	2, **9**, 16, 30	**.**	.	**17**	**1, 2, 5, 6, 9, 16, 24, 30, 31**	**5**	**1, 2, 44**	.	.	**5**	**1, 2, 44**	**22**
Yellow-bellied flycatcher***	-	-	-	S3S4B	B, B-I, SM	**3**	**4, 28**	**12**	**1, 3, 6, 8, 9, 10,** 16, 17, 23, 28, 29, 30	.	.	**15**	**1, 3, 4, 6, 8, 9, 10, 16, 17, 23, 28, 29, 30**	**16**	**1, 4, 5, 16, 17, 22, 23, 27, 28, 33, 40, 43, 44**	39	18, 20, 22, 23, 27, 28, 29, 32, 33, 35, 36, 40, 42, 44, 45, 46, 47, 49, 50	**55**	**1, 4, 5, 16, 17, 18, 20, 22, 23, 27, 28, 29, 32, 33, 35, 36, 40, 42, 43, 44, 45, 46, 47, 49, 50**	**70**
Spotted sandpiper	-	-	-	S3S4B	B	-	-	2	2	-	-	**2**	**2**	-	-	-	-	-	-	**2**
Totals						**108**		**87**		**197**		**392**		**273**		**255**		**528**		**920**

Notes: SC=Special Concern, T=Threatened, E= Endangered and V=Vulnerable. SM=Spring Migration, B=Breeding, FM=Fall Migration, I-B= Observed incidentally during breeding, I-FM= Observed incidentally during fall migration and I-SM=Observed incidentally during spring migration.

The ACCDC works with provincial and federal experts to develop rarity ranks (i.e., S-ranks) for species in Nova Scotia, as well as the other maritime provinces, see http://www.accdc.com/en/rank-definitions.html for more information.

Crusher Point Counts (CPC) waypoints were part of the Beaver Dan Mine Site in Fall 2014, but that area of the Beaver Dam Mine was removed following that season due to changes in the design of the Project footprint. Therefore, data from these point counts were not included in analyses of results for the dedicated surveys, but priority species are included here as incidental observations.

NPS Indicates that the species was observed in that season but based on breeding status; it is not a priority species during that season. Inc. indicates that the species was observed incidentally, i.e., outside of a designated point count location.

HR-PC12-PC17 were located along an alternate Haul Road design, which is no longer being consider. These point count stations have been removed from this assessment.

Observed avifauna species with a single S-rank (i.e., ACCDC only provides a breeding status rank), which have no alternate seasonal ranking status, are considered, by default, a priority species regardless of its' observation date. Furthermore, if an avifauna species with compound ranks, but no migratory rank, has a priority status during breeding season (e.g., S3B, S4N), this species would be considered a priority species if observed during migration (spring or fall). Conversely, American robin (S5B, S3N) and purple finch (S4S5B, S3S4N) were only observed during breeding and migration seasons. These species are only considered a priority species if observed overwintering and are therefore not classified as a priority species herein.

Given the abundance of priority bird species observed, SOCI are only described in tabular form above, which identifies the location, abundance, and seasonality of observations. The nine avifauna SAR observed in the Beaver Dam Mine Site and Haul Road are described in further detail below.

6.13.4.8.2 Common Nighthawk

The common nighthawk is a medium-sized bird, with large eyes, a small bill, and a large mouth on its large flattened head. They have long slender pointed wings and a long slightly notched tail. Preferred breeding habitats include areas devoid of vegetation, such as sand dunes, beaches, logged areas, burned-over areas, forest clearings, peat bogs, and pastures. Common nighthawks were not detected during the dedicated species surveys completed within the Beaver Dam Mine Site in 2015; however, preferred breeding habitat, specifically logged areas, peat bogs and forest clearings, were observed within the Beaver Dam Mine Site.

Suitable breeding habitats were observed within the Haul Road and four common nighthawks were observed during both breeding bird (n=1) and dedicated species surveys (n=3) in 2016. Common nighthawks were observed within the Haul Road, in habitats with expansive gravelly areas adjacent to clear cuts or disturbed areas (Haul Road PC26, CONI1, and CONI9). There were no signs of breeding evidence (e.g., booming display) observed, but breeding is still possible as these birds were observed near suitable nesting habitat, specifically clear cuts and gravel on expanded roadsides. Common nighthawk populations have been on the decline; however, the reasons for the decline have not been determined. Large-scale pesticide use, which has reduced the numbers of insect prey, is a likely factor for the decline in common nighthawk populations (COSEWIC, 2007a). Habitat loss and alteration, including fire suppression and intensive agriculture, may also have contributed to these declines (COSEWIC, 2007a). The common nighthawk is federally listed as threatened by COSEWIC and SARA, provincially listed as threatened by NSESA, and the breeding population in Nova Scotia is ranked as Imperiled (i.e., S-rank S2B) by ACCDC.

6.13.4.8.3 Peregrine Falcon

The peregrine falcon is a medium to large falcon with long, pointed wings. Peregrine falcons use a wide variety of habitats, including Arctic tundra, sea coasts, prairies, and urban centers. They nest on cliff ledges, in crevices, and near bridges. Suitable breeding habitat was not present within the Beaver Dam Mine Site and Haul Road. Two peregrine falcons were observed incidentally (n=1) and during the dedicated fall migration surveys (n=1) adjacent to the Beaver Dam Mine Site, in 2014. Both observations were documented immediately north of the Beaver Dam Mine Site, between Mud Lake and Cameron Flowage. The peregrine falcon populations have seen a decline due to exposure to organochlorine pesticides, particularly DDT, causing reproductive failure (these compounds continue to be used in parts of the wintering range of Anatum and Tundrius peregrine falcons; COSEWIC, 2007b). Human disturbance at nest sites, including illegal harvest of eggs and nestlings also contribute to a decline in the populations (COSEWIC, 2007b). The peregrine falcon is federally listed as special concern under COSEWIC and SARA, provincially listed as vulnerable under NSESA, and the breeding population in Nova Scotia is ranked as critically imperiled (i.e., S-rank S1B) by the ACCDC.

6.13.4.8.4 Chimney Swift

The chimney swift is often mistaken for a swallow; however, it is easily distinguished by its cigar-shaped body, short tail, and long narrow pointed wings. Chimney swifts mainly use chimneys for nesting and roosting, since hollow trees in old growth forests have become rare, however, they will also nest in other artificial sites with vertical surfaces and low light (including air vents, old wells, abandoned cisterns, outhouses, boathouses, garages, silos, barns, lighthouses, and firewood sheds; Cornell Lab of Ornithology, n.d.). They are aerial foragers and are often found near water where insects are abundant. No suitable chimneys for roosting and nesting were observed within the PA; however, waterbodies used for foraging are present within the Beaver Dam Mine Site and Haul Road. Two chimney swifts were observed incidentally during the breeding season in 2015, within the Beaver Dam Mine Site (Figure 6.13-1A). They were observed from wetland 53, which is in the center of the Beaver Dam Mine Site, south of Crusher Lake. There were no signs observed of chimney swifts breeding.

The main cause for the decline of the chimney swift is unknown; however, factors such as a decrease in insect prey due to pesticides and habitat loss are likely involved in the decline (COSEWIC, 2007c). The chimney swift is federally listed as threatened under COSEWIC and SARA, provincially listed as endangered under NSESA, and the breeding population in Nova Scotia is ranked as imperiled (i.e., S2B), whereas the aggregating transient population is ranked as critically imperiled by the ACCDC (i.e., S-rank SM1).

6.13.4.8.5 Olive-sided Flycatcher

The olive-sided flycatcher is a medium-sized songbird, with deep brown olive-gray on the sides and flanks. Suitable habitat for the olive-sided flycatcher includes open areas with tall trees or snags, forest openings, forest edges near natural openings, or human-made openings. Suitable habitat also includes coniferous or mixed coniferous forests, likely near wetland areas. Suitable habitat, including logged areas.

and forest edges near natural and human-made openings, are present within the Beaver Dam Mine Site and Haul Road. No evidence of breeding was observed; however, 10 males were heard singing within the Beaver Dam Mine Site during the 2015 breeding bird surveys, and incidentally within Haul Road in 2016, suggesting possible breeding within the associated habitats (Figure 6.13-2A). Olive-sided flycatcher observations were sparse, yet scattered across the Beaver Dam Mine Site and Haul Road. This species was documented near wetland boundaries, typically with disturbed habitats nearby.

The decrease in the population of olive-sided flycatchers is puzzling due to its preference for sparse canopy cover; it may respond positively to forest management practices, such as timber harvesting. A contributing factor to the population declines may be due to habitat alteration and loss in migration stopover and wintering grounds (Cornell Lab of Ornithology, n.d). The olive-sided flycatcher is federally listed as threatened under COSEWIC and SARA, provincially listed as threatened under NSESA, and the breeding population in Nova Scotia is ranked as imperiled (i.e., S-rank S2B) by ACCDC.

6.13.4.8.6 Canada Warbler

The Canada warbler is a small brightly coloured songbird; the males have blue-gray upperparts and tail with a contrasting yellow throat and breast. The Canada warbler has a wide range of suitable habitats, including deciduous, coniferous, and mixed forests and wetlands with a well-developed shrub layer. Their preferred habitat is moist mixed forests (COSEWIC, 2008). They also use regenerating stands after natural and human-caused disturbances (COSEWIC, 2008). The Canada warbler's preferred habitat, was observed within the Beaver Dam Mine Site and Haul Road. Regenerating forest stands, mixed forests and shrub dominated wetlands are predominant on the landscape within the PA. Eighteen Canada warblers were observed during the 2015, 2016 and 2019 breeding bird surveys within the Beaver Dam Mine Site and Haul Road. Within the Beaver Dam Mine Site, probable breeding

behavior (i.e., agitated behavior and anxiety calls of an adult) was observed by one Canada warbler and possible breeding was exhibited by singing males during breeding season. Along the Haul Road, an observation of this species in the same location in two subsequent breeding bird surveys indicates that an individual may have established a territory, which is evidence of probable breeding.

The factors for population decline of the Canada Warbler are unknown. One likely reason is habitat degradation and loss of wintering ranges. Habitat loss includes agricultural activities and road development and conversion of swamp forests (COSEWIC, 2008). The Canada warbler is federally listed as Threatened under COSEWIC and SARA, provincially listed as Endangered under NSESA, and the breeding population in Nova Scotia is ranked as Vulnerable (S3B) by ACCDC.

6.13.4.8.7 Rusty Blackbird

The rusty blackbird is a medium-sized songbird with pale yellow eyes, a black slightly curved bill, and a slightly rounded tail. Rusty blackbird breeding habitat is forested wetlands, including peat bogs, sedge meadows, marshes, swamp, beaver ponds, slow moving streams, and pasture edges. One rusty blackbird was observed incidentally within Beaver Dam Mine Site during the 2014 fall migration survey in a large wetland complex to the northwest of Beaver Dam Mine Site (PC15). Breeding habitat, including forested wetlands, swamps, and peat bogs are present within the Beaver Dam Mine Site and Haul Road, however, no evidence of breeding was observed (no birds were observed in Haul Road).

The biggest threat to the rusty blackbird is degradation of the primary wintering range in the Mississippi Valley (i.e., conversion of flood plain forests to agricultural land and urban zones; COSEWIC, 2006). The rusty blackbird is federally listed as special concern under COSEWIC and SARA, provincially listed as endangered under NSESA, and the breeding population in Nova Scotia is ranked as imperiled (i.e., S2B) by ACCDC.

6.13.4.8.8 Barn Swallow

The barn swallow is a medium-sized songbird, which is easily distinguishable by the steely-blue upperparts and cinnamon underparts, chestnut throat and forehead, and the deeply forked tail. Caves, holes, crevices, and ledges in cliff faces were the most common nesting habitats of barn swallows prior to European colonization; however, they have since shifted to nesting in and on artificial structures (e.g., barns and other outbuildings, garages, houses, bridges and road culverts; COSEWIC, 2011). Nesting habitat is available within the Beaver Dam Mine Site and Haul Road, particularly artificial structures including a cabin, bridges, and road culverts. One barn swallow was observed within the Haul Road during the 2016 spring migration surveys, near wetland 159, between Highway 224 and the Beaver Dam Mine Site, shown on Figures 6.13-1A to 6.13-1G. None were observed during the breeding bird surveys completed in the Beaver Dam Mine Site.

6.13.4.8.9 Eastern Wood-pewee

The eastern wood-pewee is a small insectivore belonging to the “tyrant flycatchers” (Tyrannidae) family. Visually, this species can often be confused by other fly catchers and male and females are not sexually dimorphic. Despite this species looking very similar to its cousin species, it can often be distinguished by its “pee-ah-wee” song (COSEWIC 2012). The breeding range of this species covers the majority of south-central and eastern North America and in the winter months, this species is found primarily in South America.

This species, like many other avifauna insectivores have been experiencing a decline in populations despite being resilient to many habitat changes (COSEWIC 2012). According to the data, declines in the eastern-wood pewee have been occurring over the past

40 years in both Canada and the United States (COSEWIC 2012). Over the past ten years, there has been an observed population decline by 25% (COSEWIC 2012).

In Canada, the eastern wood-pewee is often associated with forested edge habitats often surrounding cut blocks, wetlands, lakes and rivers or in close proximity to these features. The eastern wood-pewee is listed as special concern by COSEWIC and SARA, vulnerable by NSESA and vulnerable/apparently secure (S3S4B) by the ACCDC.

Two individuals were incidentally observed during the breading season, one at the outlet of Cameron Flowage, to the east of the Beaver Dam Mine Site, and one along the Haul Road, east of Wetland 114. Suitable breeding habitat is present within the PA.

6.13.4.8.10 Evening Grosbeak

Evening grosbeaks are a member of the true finch family (Fringillidae), are a short stocky, vibrant coloured and equipped with a large yellowish-green bill (COSEWIC 2016). This species breeds in Mexico, Canada and the United States. In the winter months, their range can vary widely depending on the food source available and is often found in backyards feeding off feeders. Breeding habitat is typically in open, mature mixedwood upland forests often dominated by balsam fir and white spruce and where their main food source, the spruce budworm (*Choristoneura spp.)* is present (COSEWIC 2016).

Since the 1970's, a significant long-term decline in the Evening Grosbeak population as occurred. According to some reports, a decline of nearly 40% has occurred since the 1970's (COSEWIC 2016). Leading factors which may be contributing to the decline of this species include: fluctuations in spruce budworm populations, mortalities by window strike and road collisions, ingestion of sodium chloride from road sides and the effects of climate change. The evening grosbeak is listed as special concern by SARA and COSEWIC, vulnerable by NSESA and vulnerable/apparently secure (S3S4B) in the breeding season and vulnerable (S3N) in the winter months.

Two individuals were observed during the spring along the Haul Road, in upland habitat, adjacent to cut blocks. No breeding evidence was observed. Suitable breeding habitat is present within the PA.

6.13.4.8.11 Priority Avifauna Summary

Across all survey seasons, a total of 26 priority species, 18 SOCI and eight SAR, were observed either during dedicated survey periods or incidentally within the Beaver Dam Mine Site and Haul Road. The presence of wetlands, forested uplands, watercourses, clearings and fragmented habitats (resulting in edge habitats) provided suitable habitat for many of the priority bird species in Nova Scotia.

During all breeding bird surveys, evidence of breeding behavior was recorded for all species, with particular attention towards SAR and SOCI. Breeding evidence was recorded in accordance with guidance provided by Bird Studies Canada (2016), which defines behavior in terms of possible, probable, and confirmed breeders. Any species observed during breeding season singing in suitable habitat is identified as a possible breeder. Signs of probable breeding observed are agitation and established territories. Evidence of confirmed breeders observed includes distraction displays, feeding young or carrying food, nests with young, or recently fledged young. Breeding evidence was observed for 18 priority avifauna species. The highest evidence of breeding status recorded for all priority bird species observed during breeding season is presented in Table 6.13-13 (SAR are bolded). Two SAR are identified as possible breeders (olive-sided flycatcher and common nighthawk), and one as probable (Canada warbler). Nine SOCI are identified as possible breeders, while five show evidence of probable breeding and one was confirmed breeding (Swainson's thrush).

Table 6.13-13: Breeding Evidence for Priority Avifauna within the Beaver Dam Mne Site and Haul Road

Code	Common Name	2015 Breeding Evidence	2016 Breeding Evidence	2019 Breeding Evidence
BBWA	Bay-breasted warbler	-	Possible	Possible
BBWO	Black-backed woodpecker	-	Possible	-
BOCH	Boreal chickadee	-	-	Possible
BPWA	Blackpoll warbler	-	Possible	-
CAWA	**Canada warbler**	**Probable**	**Probable**	**-**
CONI	**Common nighthawk**	**-**	**Possible**	**-**
GRCA	Gray catbird	-	Possible	-
GRJA	Canada jay	Possible	-	-
GRYE	Greater yellowlegs	Probable	Probable	Possible
NOHA	Northern harrier	Possible	Possible	-
OSFL	**Olive-sided flycatcher**	**Possible**	**Possible**	**-**
RBNU	Red-breasted nuthatch	-	Probable	-
RCKI	Ruby-crowned kinglet	Probable	Probable	-
SWTH	Swainson's thrush	Confirmed	Probable	Possible
TEWA	Tennessee warbler	Possible	-	-
WISN	Wilson's snipe	Possible	-	Possible
YBFL	Yellow-bellied flycatcher	Probable	Probable	Possible

6.13.4.8.12 Touquoy Mine Site

The 2005 breeding bird surveys of the Touquoy Mine Site found ten priority species. They are as follows; pine grosbeak (*Pinicola enucleator*), willow flycatcher (*Empidonax traillii*), yellow-bellied flycatcher, barn swallow, boreal chickadee, ruby-crowned kinglet, rusty blackbird, bay-breasted warbler, Swainson's thrush, and pine siskin.

6.13.5 Consideration of Engagement Results

Key issues raised during public and Mi'kmaq engagement relating to SOCI and SAR include potential direct effects on rare flora and fauna associated with construction of the Beaver Dam Mine Site and Haul Road and potential indirect effects associated with changes to other VCs, such as wetlands, surface water and groundwater. Potential effects on traditional uses of land and resources by the Mi'kmaq were noted, including SOCI / SAR species of significance to the Mi'kmaq such as moose and American Eel.

The results of the public and Mi'kmaq engagement have been considered in the environmental effects assessment, including AMNS's commitments on mitigation and monitoring measures and proposed compliance and effects monitoring programs, as well as the AMNS's broader commitment to ongoing public and Mi'kmaq engagement. Specific to evaluating the effect on SOCI and SAR, these are found within the following environmental effects assessment.

6.13.6 Effects Assessment Methodology

6.13.6.1 Boundaries

6.13.6.1.1 Spatial Boundaries

The spatial boundaries used for the assessment of Project effects to SAR and SOCI are described below.

The PA (Section 5.5, Figure 5.5-1) consists of the three project components; Beaver Dam Mine Site, Touquoy Mine Site, and the Haul Road and extends from Marinette to Moose River Gold Mines, Halifax County, NS. The Beaver Dam Mine Site is located at the eastern end of the Beaver Dam Mines Road. The Haul Road spans from the Beaver Dam Mine Site to Moose River Gold Mines, where the Touquoy Mine Site [processing and exhausted pit (to be used to dispose Beaver Dam tailings)] is located. The PA has changed as a result of the expansion of the Beaver Dam Mine Site to accommodate micro-sitting of mine infrastructure and ongoing modifications to the Haul Road design, as described in Section 2 (Project Description). These changes have been captured under the existing and additional desktop and field evaluations.

The LAA and RAA are specific to each taxa and are provided herein:

- Fish:
  - The LAA (Section 6.7, Figures 6.7-4 and 6.7-11) consists of portions of downstream aquatic habitats and headwaters where appropriate, depending on project activities, up to the maximum size of the tertiary watershed(s). The LAA boundaries were defined considering the maximum expected extent of direct and indirect impacts to the aquatic environment as well as the location of Project activities across all PA components.
  - The RAA (Section 6.7, Figures 6.7-4 and 6.7-11) encompasses the three secondary watersheds that the PA is located within. These watersheds are the West River Sheet Harbour secondary watershed, the Tangier River secondary watershed, and the Fish River secondary watershed. The RAA is broader than the expected Project impacts and considers other Project boundaries as per the cumulative effects methodology.
- Vascular Flora and Lichens:
  - The LAA (Section 6.10, Figure 6.10-7) consists of a 2 km buffer surrounding the Beaver Dam Mine Site and a 500 m buffer surrounding the Haul Road (excluding Mooseland Road). The LAA includes the focused LSA surrounding the Beaver Dam Mine Site. This area encompasses the maximum expected extent of Project direct and indirect impacts to habitat and flora. The LAA has been modified to reflect the changes in the PA. The Touquoy Mine Site and the Mooseland Road portion of the Haul Road were not included in the LAA because there is not expected to be a change to habitat and flora from current conditions.
  - The RAA (Section 6.10, Figure 6.10-7) encompasses NSL&F's Ecological Land Classification Ecodistrict 440 (Eastern Interior) within Halifax Regional Municipality (HRM), east and north of Lake Charlotte. Where the Ecodistrict boundary approached the northern extent of the Beaver Dam Mine Site, the RAA was enlarged to include a 5 km buffer around the PA. This Ecodistrict spans an area broader than the expected Project impacts and considers other project boundaries as per cumulative effects methodology.

- Terrestrial Fauna:
  - The LAA (Section 6.11, Figure 6.11-1) consists of a 5 km buffer surrounding the Beaver Dam Mine Site and a 500 m buffer surrounding the Haul Road and Touquoy Mine Site components of the PA. The LAA boundaries were defined considering the expected extent of most direct and indirect impacts to terrestrial fauna. The LAA has been modified to reflect the changes to the PA.
  - The RAA (Section 6.11-1, Figure 6.11-1) encompasses NSL&F's Ecological Land Classification Ecodistrict 440 (Eastern Interior) within Halifax Regional Municipality (HRM), east and north of Lake Charlotte. Where the Ecodistrict boundary approached the northern extent of the Beaver Dam Mine Site, the RAA was enlarged to include a minimum 5 km buffer around the PA. This Ecodistrict spans an area broader than the expected Project impacts and considers other project boundaries as per cumulative effects methodology. Due to larger home ranges of terrestrial fauna, the RAA will be used to help identify the direct or indirect impacts to terrestrial fauna species and habitats that extend beyond the LAA.
- Avifauna:
  - The LAA (Section 6.12, Figure 6.12-1) consists of a 5 km buffer surrounding the Beaver Dam Mine Site and a 500 m buffer surrounding the Haul Road and Touquoy Mine Site components of the PA. The LAA boundaries were defined considering the maximum expected extent of direct and indirect impacts to avifauna. The LAA has been modified to reflect the changes to the PA.
  - The RAA (Section 6.12, Figure 6.12-1) encompasses NSL&F's Ecological Land Classification Ecodistrict 440 (Eastern Interior) within Halifax Regional Municipality (HRM), east and north of Lake Charlotte. Where the Ecodistrict boundary approached the northern extent of the Beaver Dam Mine Site, the RAA was enlarged to include a minimum 5 km buffer around the PA. This Ecodistrict spans an area broader than the expected Project impacts and considers other project boundaries as per cumulative effects methodology.

Assessment of SAR/SOCI will be completed in consideration of the LAA as the primary spatial boundary. All spatial boundaries will help to identify the direct or indirect impacts to priority species and the effects of the Project on distribution and abundance of these species.

6.13.6.1.2 Temporal Boundaries

The temporal boundaries used for the assessment of effects to SOCI and SAR are the construction phase, operations phase, active closure and post-closure.

6.13.6.1.3 Technical Boundaries

No technical boundaries were identified for the effects assessment of SOCI and SAR.

6.13.6.1.4 Administrative Boundaries

The primary administrative boundaries for SOCI and SAR are outlined in the federal SARA and provincial NSESA. Terrestrial fauna are provided protection under the provincial *Wildlife Act* and the federal *Canada Wildlife Act*. Fish species are further regulated under the federal *Fisheries Act*, while migratory bird species are regulated under the *Migratory Birds Convention Act*.

6.13.6.2 Thresholds for Determination of Significance

A significant adverse effect from the Project on SOCI and SAR is defined as an effect that is likely to cause a permanent, unmitigated, alteration to habitat that supports a species' distribution, or alteration of critical habitat. An adverse effect that does not cause a permanent alteration to habitat of SOCI and SAR species is not considered to be significant. Sedentary species such as vascular and non-vascular flora do not have the opportunity to move to avoid direct or indirect impact. For these species, the loss of an individual or individuals of a SAR species that is important in the context of the province, or that species' overall abundance or distribution, may be considered significant, if appropriate mitigation measures are not implemented. Mortality of a single SAR could, under some circumstances, be considered a significant effect. The loss of an individual SAR due to an accident or malfunction (i.e., wildlife collision) is not incorporated into the magnitude threshold or overall significance of Project activities.

Magnitude of effects has been defined separately for each VC and is dependent on loss of habitat. The same logic was applied to assess the magnitude of a predicted change in SOCI and SAR for each VC, in consideration of specific habitat use of the priority species and the loss of SAR as described above. Specific magnitude definitions are presented in the following sections.

The timing of residual effects for SOCI and SAR considers when the residual environmental effect is expected to occur, considering seasonal aspects. The duration of residual effects considers the time frame over which the effects are likely to last, ranging from short-term to permanent. Long term reflects the commencement of reclamation activities, relating to habitat, flora, fauna and avifauna. The frequency of residual effects considers the rate of recurrence of the effects, ranging from once to continuous. The reversibility of residual effects considers the time required for habitat to recover to naturalized conditions, or whether the changes to habitat, if identified, are permanent.

6.13.6.2.1 Priority Fish Species

The following logic was applied to assess the magnitude of a predicted direct change in SOCI and SAR fish and fish habitat and was determined by the habitat analysis results described in Section 6.9.6.2.

- **Negligible**: no measurable change in fish habitat quantity or quality for priority fish species described as one or more of the following (and/or):
  - less than one percent change in surface flow;
  - no direct loss of fish habitat; and
  - predicted change of surface water quality indicator is less than 10% of background conditions, (i.e., no measurable change of state of indicator from background conditions).
- **Low**: a measurable change in priority fish species habitat area or quality, but within the range of natural variation described as one or more of the following (and/or):
  - less than 10% flow reduction and not affecting the ability of documented fish species to use the habitat to carry out one or more life processes;
  - direct loss of to up to 20 m^2 of fish habitat in any individual fish-bearing wetland or watercourse; and
  - water quality in the receiving environment is predicted to be greater than guidelines and increase by greater than 10% over baseline levels but remains well within the observed range of natural variation (defined as 25th to 75th percentile baseline water quality).

- **Moderate**: a measurable change in priority fish habitat area or quality, above the range of natural variation, which partially limits the ability of fish to use the habitat to carry out one or more life processes described as one or more of the following (and/or):
  - less than 10% flow reduction but greater than a 10% net increase in the duration (number) of days below the 30% MAD (based on daily flows), which partially limits the ability of fish to use the habitat to carry out one or more life processes;
  - direct loss of fish habitat, greater than 20 m^2, up to 100 m^2 in any individual fish bearing wetland or watercourse; and
  - water quality in the receiving environment is predicted to be greater than guidelines and differ substantially from baseline levels and approaches upper observed limits of natural variation (defined as percentile baseline water quality).
- **High**: a measurable change in priority fish habitat area or quality to an extent which limits the ability of fish to use the habitat to carry out one or more life processes described as one or more of the following (and/or):
  - greater than a 10% flow reduction and a greater than 10% increase in number of days below the 30% MAD (based on daily flows), which limits the ability of fish to use the habitat to carry out one or more life processes;
  - direct loss of fish habitat greater than 100 m^2 in any individual fish-bearing wetland or watercourse; and
  - water quality in the receiving environment is predicted to be greater than guidelines and differ substantially from baseline water quality (outside of 75th to 95th baseline water quality), resulting in a detectable change beyond the range of natural variation.

6.13.6.2.2 Priority Flora Species

The following logic was applied to assess the magnitude of a predicted direct change in SOCI and SAR flora and habitat and was determined by the habitat analysis results described in Section 6.10.4.5.

- **Negligible** – the Project is predicted to result in less than 1% direct loss of habitat types within the LAA;
- **Low** – the Project is predicted to result in 1 to 5% direct loss of a habitat type within the LAA, and the loss of habitat is mitigated in the long term through reclamation planning and other mitigation measures as determined to be necessary based on flora species and communities present;
- **Moderate** – the Project is predicted to result in 5 to 25% direct loss of a habitat type within the LAA and the loss of habitat is mitigated in the long term through reclamation planning and other mitigation measures as determined to be necessary based on flora species and communities present; and,
- **High** – the Project is predicted to result in greater than 25% direct loss of a habitat type within the LAA and the loss of flora SAR. The loss of SAR and habitat is not mitigated in the long term through translocation, compensation or reclamation planning and other mitigation measures as determined to be necessary based on flora species and communities present.

6.13.6.2.3 Priority Terrestrial Fauna Species

The following logic was applied to assess the magnitude of a predicted change in observed priority terrestrial fauna, based on the habitat analysis results described in Section 6.11.6.2:

- **Negligible** – the Project is predicted to result in less than 1% direct loss of habitat types used by observed SAR fauna within the LAA.
- **Low** – the Project is predicted to result in 1 to 5% direct loss of habitat types used by observed SAR fauna within the LAA, and the loss of habitat is mitigated in the long term through reclamation planning and other mitigation measures as determined to be necessary based on flora species and communities present.
- **Moderate** – the Project is predicted to result in 5 to 25% direct loss of habitat types used by observed SAR fauna within the LAA and the loss of habitat is mitigated in the long term through reclamation planning and other mitigation measures as determined to be necessary based on flora species and communities present.
- **High** – the Project is predicted to result in greater than 25% direct loss of habitat types used by observed SAR fauna within the LAA and the loss of habitat is not mitigated in the long term through reclamation planning and other mitigation measures as determined to be necessary based on flora species and communities present.

The Habitat and Flora LAA was used to determine habitat type and area, and resultant habitat loss for species (Section 6.10.7.1).

6.13.6.2.4 Priority Avifauna Species

The following logic was applied to assess the magnitude of a predicted change in priority avifauna, based on the habitat analysis results described in Section 6.12.7.2:

- **Negligible** – the Project is predicted to result in less than 1% direct loss of habitat types used by observed SAR avifauna within the LAA.
- **Low** – the Project is predicted to result in 1 to 5% direct loss of habitat types used by observed SAR avifauna within the LAA, and the loss of habitat is mitigated in the long term through reclamation planning and other mitigation measures as determined to be necessary based on flora species and communities present.
- **Moderate** – the Project is predicted to result in 5 to 25% direct loss of habitat types used by observed SAR avifauna within the LAA and the loss of habitat is mitigated in the long term through reclamation planning and other mitigation measures as determined to be necessary based on flora species and communities present.
- **High** – the Project is predicted to result in greater than 25% direct loss of habitat types used by observed SAR avifauna within the LAA and the loss of habitat is not mitigated in the long term through reclamation planning and other mitigation measures as determined to be necessary based on flora species and communities present.

The Habitat and Flora LAA was used to determine habitat type and area, and resultant habitat loss for species (Section 6.10.7.1).

6.13.7 Project Activities/Interactions with Species of Conservation Interest and Species at Risk

Priority species identified within the PA represent a diversity of taxa, habitat preferences, and, therefore, represent a diversity of potential and confirmed Project interactions, effects, mitigation, and monitoring. As such, Project effects, mitigation, and monitoring are discussed in terms of each taxa, rather than individual species, with a focus on SAR, recognizing that mitigation measures for SAR will generally provide appropriate mitigation for identified SOCI in the same taxonomic group. Where this is not the case, it will be stated. Project interactions, mitigation, and monitoring for each broad taxonomic group are outlined in previous chapters as well, and these mitigation measures are appropriate and should be applied for all SOCI and SAR within the same taxonomic group.

6.13.7.1.1 Priority Fish Species

Three priority fish species have been identified to reside in watercourses within or in proximity to the PA (American eel, Atlantic salmon, and brook trout). American eel and Atlantic Salmon have been included in the effects assessment section of this EIS. Although these species are not listed under provincial or federal endangered species legislation, DFO has indicated that they are currently being reviewed for protection under SARA, and it would be prudent for the Project Team to plan for these species as if they were protected under this legislation. Atlantic salmon and brook trout are sensitive to changes in their aquatic ecosystem, and they have specific habitat requirements, while American eel are considered to be habitat generalists. As such, standard mitigation and monitoring for fish and fish habitat (Sections 6.9.8 and 6.9.10) will address direct and indirect effects to Atlantic salmon, brook trout and American eel.

Atlantic salmon was identified in the Killag River east of the Beaver Dam Mine Site in 2020 during electrofishing surveys. No Atlantic Salmon have been observed within the Beaver Dam Mine Site and Haul Road throughout extensive fishing surveys (2015-2020). The species has been extensively documented within the West River Sheet Harbour, the Killag River, and the Little River by the Nova Scotia Salmon Association and is presumed to be present in several tributaries to these watercourses. Within and in proximity to the Beaver Dam Mine Site, Atlantic salmon may travel into the most downstream extents of direct tributaries to the Killag River and Cameron Flowage based on documented presence within the Killag River, which includes WC13, WC25, WC27, and WC27. Though the species may access these systems, no quality Atlantic salmon habitat provisions are expected to be provided by these watercourses. Preferred Atlantic Salmon habitat within and in proximity to the Beaver Dam Mine Site is confined to the main bodies of the Killag River/Cameron Flowage. Two watercourses are likely to support habitat for Atlantic salmon within the Haul Road: the West River Sheet Harbour (WC-N) and Keef Brook (WC-H). The West River Sheet Harbour is considered to provide suitable habitat for all life stages of Atlantic salmon, while Keef Brook is considered to provide suitable habitat for older juveniles.

American eel were confirmed within WC13, the Killag River, Cameron Flowage, and Mud Lake/WC27 within the Beaver Dam Mine Site, and in WC-N, WC-V, and WC-AH within the Haul Road. Wetlands contiguous with watercourses and waterbodies which are confirmed to or potentially support American eel, may also support American eel. Suitable freshwater habitat for juvenile and adult American eel was also identified in Watercourses 5, 14, 25, and 26, and open water features associated with Wetlands 59 and 61 within the Beaver Dam Mine Site, and Watercourses A, B, C, D, E, F, G, J, M, N, O, Q, R, S, T, U, V, W, X, Y, Z, AA, AB, AC, AC, AD, AE, AF, AG, AH, and AI within the Haul Road. However, all hydrologically connected watercourses within the PA are believed to be potentially accessible to the American eel, even if habitat provision in those watercourses is low.

Based on the results of extensive fishing surveys and fish habitat assessments, no Atlantic salmon have been confirmed or are anticipated to frequent any of the fish-bearing aquatic features proposed for direct alteration to support Project development within the Beaver Dam Mine Site. No direct impacts to Atlantic salmon are anticipated as a result of the Project. In addition, none of the proposed direct effects to fish habitat along the Haul Road are expected to occur in suitable habitat for Atlantic salmon.

Direct loss of American eel habitat within the Beaver Dam Mine Site is anticipated based on confirmed or potential presence of the species in WC5, WC13, WC14, WC25, and open water areas of Wetland 59 and Wetland 61. Direct effects to potential American eel habitat along the Haul Road include WC-C, WC-D, WC-J, WC-M, WC-O, WC-X, WC-AC, WC-AF, and WC-AG. Eight wetlands that are expected or confirmed to support fish habitat, including potential American eel habitat, will also be partially altered within the Haul Road to support road upgrades, widening and re-alignment as required. Project interactions along the Haul Road are expected to be minimized with the implementation of standard mitigation practices for installation of culverts in fish bearing streams (Nova Scotia Environment, 2015b) and in many cases are expected to result in improved fish passage based on condition of current crossing along the existing logging road. Standard approvals and mitigation will be required for all watercourse crossings, including those in involving new road construction.

Additional information pertaining to the direct loss of fish habitat within the Beaver Dam Mine Site and Haul Road are presented in Sections 6.9.7.2 and 6.9.7.3. Through reconfiguring the Beaver Dam Mine Site layout, AMNS has been able to achieve avoidance of direct impacts in several tributaries to Crusher Lake and Mud Lake. The mitigation sequence (avoid, mitigate, offset) is presented in Section 6.9.8.

Expected and potential indirect fish and fish habitat impacts to surface water features (wetlands, watercourses, and waterbodies) in the immediate vicinity of the PA as a result of the Project construction and development within the Beaver Dam Mine Site and Haul Road are fully described and tabulated Sections 6.9.7.2.2., 6.9.7.2.3, and 6.9.7.2.4. These indirect effects of Project activities are expected to be similar in nature between priority fish species and all other fish species. Maintaining water quality and quantity downstream in the LAA is paramount for limiting broader fish and fish habitat impacts within each affected watershed associated with the Beaver Dam Mine, particularly those known to support priority fish species. Given the proximity of the Project to the Killag River, and the importance of the Killag River on Atlantic salmon, a thorough description of potential indirect effects of the Project on fish habitat quality in Cameron Flowage/Killag River is presented in Sections 6.9.7.2.2 and 6.9.7.2.4. All direct and indirect effects to fish and fish habitat, including water quantity (baseflow reduction, hydrological and hydraulic alteration) and water quality effects have been fully assessed and quantified in Section 6.9.7, and included in the draft Fish Habitat Offset Plan (Appendix J.3).

The Touquoy Mine Site is currently operational. Potential impacts to surface water quality and quantity as a result of the storage of Beaver Dam tailings in the exhausted Touquoy open pit mine were examined in Section 6.7.8.4. There are no direct or indirect effects to priority fish or fish habitat anticipated to be caused by the processing of ore and the management of tailings (exhausted pit) from the Beaver Dam Mine Project (Section 6.9.7.7).

6.13.7.1.2 Priority Vascular Flora and Lichen Species

Development of the Beaver Dam Mine Site and upgrading and construction of new sections of the Haul Road (Section 2, Figure 2.3-1) will result in direct impacts to vascular and non-vascular individuals and to flora communities at the full or partial forest stand level. The effects of the Project on flora encompass vascular and non-vascular priority flora species in aquatic, wetland, and upland habitats. As such, many of the effects described in Section 6.8 and Section 6.10, specific to wetland and flora habitat respectively, will directly relate to effects on priority flora species. The majority of direct impacts to flora will occur during site preparation and construction.

Micro-siting of infrastructure has been completed to avoid priority flora and lichen species, wherever practicable, and has reduced the direct impact of the Project on flora and lichens. The division and micro-siting of the waste rock stockpiles has relocated infrastructure out of two defined boreal felt lichen critical habitat areas that interact with the PA (NSLF, 2020), to the west of the NAG waste rock stockpile and south of the Beaver Dam Mine Site. The critical habitat area includes the lichen substrata, the wetland in which the substrata is found and the surrounding critical function zone, which maintains the necessary biophysical

functions (e.g., hydrology, microclimate) for the persistence of boreal felt lichen (NSLF, 2020). The boreal felt lichen critical habitat in relation to Project development is presented in Figure 6.13-2.

Micro-siting and PA modifications of the Beaver Dam Mine Site has allowed for avoidance of all eight of the known locations of frosted glass-whiskers and reduced the number of individuals of blue felt lichen directly impacted from three to two, which are proposed for translocation (Appendix P.6 Preliminary Lichen Mitigation and Monitoring Plan). These two occurrences are located within the proposed NAG waste rock stockpile and Crusher area. Ten SOOCI lichen will be directly impacted by Beaver Dam Mine Site infrastructure: six occurrences of salted shell lichen, three occurrences of slender monk's hood lichen and one eastern candlewax lichen. No priority vascular flora are anticipated to be directly impacted within the Beaver Dam Mine Site. The most recent Project design changes avoided two clusters of Wiegand's sedge by relocating the eastern waste rock stockpile.

Within the Haul Road, no priority lichen are anticipated to be directly impacted. One occurrence of southern twayblade within Wetland 161, is found withing the proposed alignment and is expected to be directly impacted. While detailed design of the Haul Road is not yet complete, it is not anticipated that other vascular or non-vascular flora priority species will be directly impacted by upgrading the existing road or by the construction of the new 4 km section of the Haul Road. As is possible, AMNS will work to avoid priority flora species during detailed Project design of the Haul Road upgrades.

Indirect effects to habitat and flora described in Section 6.10 are relevant to priority flora species as well. As such, Project activities may indirectly affect priority lichen species which have been avoided, but exist in close proximity to Project infrastructure. Project related traffic, crushing operations and raw material handling (e.g., loading, transport) during site preparation, operation, and maintenance can result in increased emissions and deposition of dust on vegetation within proximity of contributing Project activities (Appendix C.1 Air Emissions Assessment). Modeled air quality does not report a consequential increase or exceedance of assessment criteria for NO_2, SO_2 and volatile organic compounds (Appendix C.1). Deposition of dust on flora can temporarily reduce evapotranspiration, photosynthesis and can bioaccumulate within tissue, which may reduce overall growth rates, especially for non-vascular flora such as lichen (Degtjarenko, 2016; Naeth and Wilkinson 2008; Farmer, 1993).

Due to their non-vascular physiology, lichens are especially sensitive to changing environmental conditions, particularly air quality and edge effects (Boudreault et al. 2008; COSEWIC 2002). Studies, such as Neitlich et al. (2017), Naeth and Wilkinson (2008), Loppi and Frati (2005) and Farmer (1993), present the primary drivers of atmospheric contamination to lichen from mine operations: sulfur dioxide and nitrous oxide emissions, metal mobilization and dust generation. The Project is predicted to result in localized particulate and metal mobilization through dust generation during construction and operations (i.e., mining and hauling ore). Dust deposition may result in increased alkalinity in substrate pH composition (e.g., bark of host tree) and bioaccumulation in lichen tissue which can impact lichen health and species richness (Degtjarenko, 2016; Naeth and Wilkinson 2008; Farmer, 1993). Farmer (1993) present that bryophytes and lichens along a gravel road (traffic and distance unknown) were unaffected within 2 years of operation. Significant changes to the communities were noted at 10 years. Species decline was noted at dust deposition levels of 1.0-2.5 g/m^2/day. Effects to lichens were still observed at levels 0.07 g/m^2/day. Effects of fugitive dust, and resultant mobilized elements, on lichens have been observed up to 1 to 2 km from mine haul roads (Neitlich et al. 2017; ECCC, 2018). However, the emission rates and lifespan of the operations which resulted in these findings are substantially higher than those of the Project, when calculated at the most conservative rates. Other comparable mining operations (i.e., diamond mines) have reported that deposition rates reached background levels 100 m from haul roads (Dominion Diamonds 2018).

Along the Haul Road, the modeled particulate deposition rate at worst-case point of impingement drops below 0.07 g/m^2/day, the threshold where Farmer (1993) noted species decline or other impacts, within 500 m of the road. Therefore, effects of dust deception on lichen are not expected beyond 500 m of the Haul Road. The Haul Road is expected to the be largest source of particulate emissions within the PA.

Edge effects, which are a result of fragmented habitats, typically through conventional forestry practices, are viewed as a major factor for change in lichen diversity and health (Rheault et al. 2002). Microclimates of forested edges which adjoin clearcuts are different than those of interior forests. Edge effects include alteration of humidity, higher wind velocity, increase solar radiation often resulting in vegetation, and community structure changes (Rheault et al. 2002). Poikilohydric organisms (such as lichens) which have the inability to regulate and maintain their water content are often sensitive to these effects (Rheault et al. 2002).

The distance in which lichen individuals and populations are affected by edge effects (referred to as depth of edge-influence) have been well studied (Moen & Jonsson, 2002). Studies have shown that the depth of influence on pendent fruticose lichens (Esseen and Renhorn 1997) and diversity of cyanolichens (Haughian and Harper 2020) range from 60 to 80 m, respectively. However, studies by Gauslaa et al. (2018) recommend setbacks of greater than 240 m for three Lobaria species studied in temperate rainforests of British Columbia. These results show edge effects, and the depth of influence, is species and context-dependent (e.g., dependent on size of the clearings, substrate, type of climate etc.). Additionally, changes in vegetation communities that support lichen species could affect lichen community, health and abundance (Cornelission et al. 2001).

Potential indirect impacts to vascular plants and lichens surrounding Project infrastructure will be reduced through best management strategies and mitigation measures. The Preliminary Lichen Mitigation and Monitoring Plan (Appendix P.6) considers the impacts of edge effects and dust/particulate deposition and is further discussed in Section 6.13.9.

The Touquoy Mine Site is currently in operation. There are no direct or indirect effects to priority vascular flora and lichen species anticipated to be caused by the processing of ore and the management of tailings (exhausted pit) from the Beaver Dam Mine Project. Effects to habitat and flora related to the Project are described in Section 6.10.

6.13.7.1.3 Priority Terrestrial Fauna Species

The assessment of potential adverse interactions and effects of the Project on this VC takes into account the potential for the Project to result in changes to:

- permanent and temporary habitat alteration and fragmentation;
- disturbance and/or displacement;
- potential for direct and indirect mortality to individuals; and
- sensory disturbance.

Priority terrestrial fauna observed during field surveys within the PA includes the mainland moose and the snapping turtle. Each of these species has variable habitat preferences, depending on the time of year. Mainland moose are found in habitat mosaics of uneven age stands with abundant twigs and foliage for foraging. These uneven-aged mosaic forests that moose prefer can be formed from natural disturbance such as fire or wind throw, or anthropogenic disturbance such as timber harvesting. During the summer months, they are reliant upon aquatic systems (lakes, rivers, and wetlands) for submergent and emergent vegetation, and cover from thermal stress (NSDNR, 2007). Mainland moose are not particularly affected by habitat fragmentation based on habitat preference; however, increased access into a site (construction of new roads) may increase poaching levels. As such, low-level habitat fragmentation can indirectly affect mainland moose.

The snapping turtle can be found in a variety of freshwater ecosystems, such as slow-moving rivers, wetlands, lakes, streams, and ponds. Hibernation occurs in freshwater systems deep enough to prevent freezing through during the winter, with a mucky or muddy substrate. They are the most aquatic of freshwater turtles in Nova Scotia, but they do travel through upland habitat and use gravelly areas to nest. The preference for gravelly substrate during nesting is a threat to turtles, as gravid females are attracted to

the gravelly shoulders of roads for nesting. The potential for direct mortality of reproductive females is highest where roads intersect or are adjacent to aquatic ecosystems. This risk is highest in June when females are nesting, particularly given the proposed increase in traffic along the Haul Road.

Development of the Beaver Dam Mine Site and associated upgrades to the Haul Road will cause direct impacts to habitat used by terrestrial fauna, including wetlands with suitable hibernacula for snapping turtles, and those with abundant submergent and emergent vegetation for mainland moose. Moose tracks were observed adjacent to Wetland 56 which has habitat for foraging and thermal regulation (i.e., open water features). Wetland 56 will be directly impacted by the open pit. Wetlands 206 and 210 which contained, or were in proximity to, evidence of mainland moose will be avoided by Project development.

Wetlands 8, 10, 14, 17, 29, 44, 56, 59, 61, 64, 66, 68, 69, 159, 168, 171, and 207. are identified as potentially providing hibernacula for snapping turtles where open water is present. Wetland 10 is expected to be directly impacted by the western waste rock stockpile and Wetlands 59 and 61 are expected to be impacted by construction of the open pit. All other wetlands with hibernacula potential within the Beaver Dam Mine Site will be avoided. All other wetlands with potential to support snapping turtles within the Haul Road (Wetlands 66, 68, 69, 159, 168, and 171) will have minimal impact proposed, associated with upgrade or construction of the Haul Road. Either these wetlands will be avoided, or where interactions may occur with proposed alignment, impacts to snapping turtle habitat are expected to be minimal, with proper mitigation. Impacts to wetland habitats will occur mostly within the construction phase of the Project during clearing, grubbing, and development of the Beaver Dam Mine Site and its associated infrastructure, and upgrading of the Haul Road (widening). Habitat within the PA currently exhibits fragmented conditions based on historic mine operations and current and historic timber harvesting activity within and adjacent to the PA. Refer to the wetland cumulative effects modelling (Section 6.8.7.2) which determined the extent of predicted habitat loss for mainland moose and snapping turtle within the Beaver Dam Mine Site.

How wildlife species such as mainland moose and snapping turtle are affected by habitat availability, use, or fragmentation is determined by species habitat requirements (e.g., thermal, cover, security) and rates of movement through various habitats (With & Crist, 1995). Fragmentation of a particular species' habitat implies a loss of habitat, reduced patch size, and/or increasing distance between patches. However, fragmentation may also suggest an increase of new habitat (Andren, 1994). Therefore, the effect of habitat fragmentation on a species (population) would be primarily through not only habitat loss, but also habitat changes. Habitat patches are parts of the landscape mosaic and the presence of a species in a patch may be a function not only of patch size and isolation, but also of the neighboring habitat. In landscapes with more than 30% of suitable habitat, fragmentation is primarily habitat loss (With & Crist, 1995). Habitat generalists may survive in very small patches because they can also use resources in the surroundings. Furthermore, the total species diversity across habitats in a given landscape may increase when new patches of habitat are created within the continuous habitat, since new species may be found in these new habitats, even if they are human-made (Andren, 1994).

Habitat selection by wildlife is primarily a response to security, thermal comfort, and forage needs. Wildlife must balance these conflicting requirements. Habitat selection is species-specific and choices will depend on physiological constraints and social needs of the species. Literature in conservation biology indicates that maintenance of movement corridors of suitable habitat between population centers is fundamental to wildlife health (Bentz, Saxena, & O'Leary, 1994).

Although security and thermal cover are important, habitat selection is strongly influenced by relative foraging opportunities (Renecker and Hudson 1999). Requirements for security vary seasonally and are greatest when animals feel threatened. Wildlife is vulnerable at parturition and when accompanied by neonates, a condition that is exacerbated when the mother is in poor condition. To off-set this disadvantage, wildlife select habitats consistent with their physical attributes and cryptic coloration. For example, white-tailed deer escape cover in forests (Renecker & Hudson, 1999).

Ungulate species, such as mainland moose, use upland forests and shrub areas for cover and foraging, including early-successional and previously harvested stands. Dense conifer stands are preferred in the winter, which provide reduced snow depth and thermal protection (Timmermann and McNicol 1988). Moose also require aquatic and wetland habitat for summer thermoregulation, calving and foraging (Timmermann and McNicol 1988). Snapping turtle is generally more aquatic than other turtle species, and require shallow aquatic environments for overwintering/hibernations, breeding and cover. Snapping turtle can tolerate and utilize disturbed areas, such as systems with poor water quality and anthropogenic features for nesting (e.g., berms, roadsides; ECCC 2020). A habitat loss by observed fauna species (or species group) based on the habitat analysis described in Section 6.11.7.1 and presented in Table 6.11-7. Based on the definitions of magnitude of impact, it is anticipated that all impacts to habitat types used by observed SAR and SOCI terrestrial fauna (i.e., mainland moose and snapping turtle) will be low, in comparison to habitat availability within the LAA.

Sensory disturbance to terrestrial fauna would result from rock blasting, clearing and grubbing, infrastructure construction during the construction phase and, overall increased traffic, blasting, mining activities and trucking during operations within the PA. This would likely result in localized wildlife avoidance of the PA, including moose and snapping turtle. Increased human activity could result in increased usage of the PA by opportunistic species such as coyotes, raccoons, skunks, or black bears. Overall, Project activities could cause a change in usage of the PA by wildlife, with some species tending to avoid the area, while others may be attracted to the increased activity. Studies completed by Buckmaster et al. (1999) indicate that wildlife populations may be expected to disperse from the area during periods of construction. However, this displacement is generally of short temporal disturbance as most cases reveal that wildlife have returned rapidly after human activity has ceased (Shank, 1979).

Changes to ambient noise and light levels and the presence of periodic vibrations have the potential to adversely affect fauna by influencing circadian patterns, seasonal patterns, movement and distribution, and community interactions and composition (Pauwels, 2018). Refer to Section 6.11.7.4 for a discussion on predicted sensory disturbance impacts to terrestrial fauna as a result of the Project.

Mainland moose are likely to be less significantly affected by sensory disturbance, due to their ability to easily travel to avoid this disturbance. Hibernating snapping turtles, on the other hand, are unable to easily escape sensory disturbance easily during hibernation. As such, practices should be implemented to reduce blasting near wetlands with suitable snapping turtle hibernacula during hibernation. Hibernation generally occurs from October through March, depending on seasonal temperatures (i.e., hibernation can start later in a warm fall and end sooner in an early spring, and vice versa).

Direct mortality of priority fauna species could result from Project activities, particularly due to the increase in traffic during construction and operation of the facility. Increased traffic poses a risk to wildlife such as the mainland moose and snapping turtle along the entire length of the Haul Road between the Beaver Dam Mine Site and the Touquoy Mine Site. Indirect mortality to these species could also occur from exposure to contaminants or spills from unplanned incidents.

The Touquoy Mine Site is currently operational. There are no direct or indirect effects to priority fauna species anticipated to be caused by the processing of ore and the management of tailings (exhausted pit) from the Beaver Dam Mine Project. Effects to terrestrial fauna species related to the Project are described in Section 6.11.

6.13.7.1.4 Priority Avifauna Species

The assessment of potential adverse interactions and effects of the Project on this VC takes into account the potential for the Project to result in changes to:

- Permanent and temporary habitat alteration and fragmentation;
- Disturbance and/or displacement;
- Potential for direct and indirect mortality to individuals; and
- Sensory disturbance.

With appropriate mitigation and monitoring, no direct mortality of priority bird species is anticipated, with the exception of the low potential for a bird strike with a haul truck. Avian usage of the PA during construction and operation of the Beaver Dam Mine will largely be driven by changes to habitat, resulting in localized avoidance of the PA by some species. Noise and light generated during all Project phases also has the potential to affect avifauna. Artificial noise and light, especially at night, have been shown to influence avian migration and behavior pattens, which could affect individual fitness and reproductive success (Da Silva et al. 2014). Refer to Section 6.11.7.4 for a discussion on predicted sensory disturbance impacts to terrestrial fauna as a result of the Project.

A habitat loss by observed avifauna functional groups based on the group's preferred habitat type(s) present in Section 6.12.8.1 and the habitat analysis described in Section 6.12.8.1 is presented in Table 6.12-11. Consideration was given to the specific avifauna SAR habitat preferences as described in Section 6.13.5.5. Seven of the nine observed SAR are Passerines (i.e., chimney swift, olive-side flycatcher, Canada warbler, rusty blackbird, barn swallow, eastern wood-pewee and evening grosbeak). Generally, these species inhabit forested areas, of varying stand ages, with access to wetlands and water features. Based on the definitions of magnitude of impact, it is anticipated that all impacts to habitat types used by observed SAR avifauna will be low, in comparison to habitat availability within the LAA. Refer to the wetland cumulative effects modelling (Section 6.8.7.2) which determined the extent of predicted habitat loss for Canada warbler, olive-sided flycatcher, and rusty blackbird within the Beaver Dam Mine Site.

Some priority species may avoid the PA in favor of undisturbed habitat in the surrounding landscape. Other priority species are anticipated to be attracted to the mine infrastructure and newly created habitat. The common nighthawk, for instance, is a crepuscular insectivore which nests on exposed gravel and disturbed areas. Lighting of buildings at dawn and dusk can create a foraging opportunity where insects are attracted to the lights. Barn swallows commonly nest in the eaves of built structures and bank swallows can nest in vertical slopes in sandy or silty soil, even in areas with high activity levels. These species of swallows have similar feeding habits as the common nighthawk. As such, Project activities may increase habitat suitability for both these species.

The placement of the open pit cannot be micro-sited as its location is dependent on the ore location. A single greater yellowlegs was observed during breeding bird surveys within Wetland 59 (Beaver Dam Mine Site PC1). Single observations of greater yellowlegs were also made during breeding bird surveys within the Beaver Dam Mine Site at PC3 and PC10, located along a road that connects the eastern and the western stockpiles and north of the PA, respectively. The road where PC3 is located was micro-sited to minimize impact to wetlands.

Detailed designs of the Haul Road will minimize impact to wetlands which may offer suitable nesting habitat for greater yellowlegs (such as that observed at Haul Road PC3). Wetland 64, the area of highest evidence of possible nesting (Haul Road PC1) will be impacted by upgrades to Beaver Dam Mines Road and increased traffic. This will occur during the construction and operation phases. As a result of PA and infrastructure modifications, a waterline has been rerouted and will no longer discharge into Wetland

64, avoiding resultant changes in hydrology and greater yellowlegs habitat. Detailed design planning for these upgrades will take into consideration the location of Wetland 64, and others along the Haul Road to reduce the impact to these locations if possible (such as Haul Road PC 3, near Wetland 121) while maintaining safe road conditions for haul activities.

The current habitat in the Beaver Dam Mine Site displays a high level of disturbance and has been fragmented by historical mine operations, forestry operations, and roads. As a result, the Beaver Dam Mine Site does not offer high quality breeding habitat for the greater yellow legs. Suitable nesting habitat for greater yellowlegs is present within the LAA surrounding the Beaver Dam Mine Site and Haul Road, which will remain unaltered. Specific mitigation and monitoring commitments related to the greater yellowlegs are provided in Section 6.13.8.4.

The Touquoy Mine Site is currently in operation. There are no direct or indirect effects to priority avifauna species anticipated to be caused by the processing of ore and the management of tailings (exhausted pit) from the Beaver Dam Mine Project. Effects to avifauna species related to the Project are described in Section 6.12.

6.13.8 Mitigation

The potential effects related to species and that are associated with the different phases of the Beaver Dam Mine Project are outlined in Tables 6.13-14 to 6.13-17, for each taxonomic group of species. Specific mitigation measures related to priority species are outlined in the following sections. A comprehensive mitigation table for all VCs is provided in Section 9.

6.13.8.1 Priority Fish Species

Standard mitigation for fish and fish habitat is expected to appropriately mitigate effects on priority fish species. Watercourse alteration permitting will also be required, at which time detailed fish habitat quantification and potential effects on priority fish species will be addressed. The following mitigation efforts (Table 6.13-14) are considered in addition to those general fish and fish habitat mitigation measures outlined in Section 6.9.8.

- AMNS has achieved avoidance of direct impacts and reduction in indirect impacts to fish and fish habitat through redesigning the site layout, as described in Section 6.9.8.1.
- Direct and indirect effects to fish and fish habitat, including priority fish species, has been fully assessed, quantified and incorporated into the draft Fish Habitat Offset Plan (Appendix J.3).
- A Mine Water Management Plan has been developed and will be implemented. This Plan describes water collection and treatment plans within the Beaver Dam Mine Site, which will avoid and minimize direct or indirect effects to fish and fish habitat. Specific provisions to prevent impacts to important habitat in Cameron Flowage/Killag River includes discharging water from the North Settling Pond to supplement baseflow.
- Site specific terms and conditions for alteration of watercourses which support priority fish species will be communicated to all site personnel and strictly adhered to; fish rescue will be completed within the Beaver Dam Mine Site prior to commencement of mine development;
- Culverts to be installed will be done in accordance with the NSE Watercourse Standard (2015) or as updated at time of construction to ensure fish passage through new culverts, and improving access by upgrading or removing improperly installed culverts, where possible; and,
- The location of all watercourses known to support priority species will be communicated to site personnel along with recommended mitigation measures.

Table 6.13-14: Mitigation for Priority Fish

Species and Rank	Observations	Direct Impacts from Proposed Infrastructure	Potential Adverse Effects	Mitigation	Effectiveness of Mitigation
Atlantic salmon (Nova Scotia Southern Upland Population) COSEWIC – E ACCDC – S1	Atlantic Salmon were observed in the Killag River, beyond the PA. Atlantic salmon have been documented within the West River Sheet Harbour watershed, including the West River Sheet Harbour (WC-N), Killag River, and Little River. No Atlantic salmon were observed within the Beaver Dam Mine Site and Haul Road throughout extensive fishing surveys (2015-2020).	No direct impacts to Atlantic salmon or Atlantic salmon habitat are anticipated as a result of the Project.	Harmful alteration, destruction, or disruption to habitat as a result of indirect impacts to watercourses downgradient of the PA.	Implement Offsetting Plan Complete fish rescue and relocation within all fish habitat where direct impact is proposed Limit access to the PA and prohibit staff fishing within the PA to avoid increased fishing pressures Blasting activities will adhere to setback recommendations and other mitigation strategies advised by DFO for measures to avoid causing harm to fish and fish habitat Develop and follow a detailed explosive management plan as part of the permitting process Use an emulsion-type explosive that will minimize nitrogen release to surface water and groundwater Implement AEMP to monitor Project effects on fish and fish habitat Install groundwater pumps to supplement baseflow in Cameron Flowage, if necessary Implement the Mine Water Management Plan Collect and treat all contact water, as required Implement Erosion and Sediment Management Plan Replace crushed, hung, or improperly installed culverts along the Haul Road that are impeding fish passage Replacement of crushed, hung, or improperly installed culverts along the Haul Road that are impeding fish passage	Avoidance and mitigation results in no harmful alteration, destruction or disruption to Atlantic salmon or its habitat within the PA Potential indirect impacts to Atlantic salmon to be monitored as part of Aquatic Effects Monitoring Plan (AEMP) Include monitoring of mitigation effectiveness in development of AEMP
American eel COSEWIC – TH ACCDC – S2	American eel were confirmed in WC13, the KIllag River, Cameron Flowage, and Mud Lake/WC27 within the Beaver Dam Mine SIte. American eel were confirmed in Watercourse N, V and AH along the Haul Road Potential American eel habitat includes Watercourses 5, 14, 25, and 26, and open water features associated with Wetlands 59 and 61 within the Beaver Dam Mine Site, and Watercourses A, B, C, D, E, F, G, J, M, N, O, Q, R, S, T, U, V, W, X, Y, Z, AA, AB, AC, AC, AD, AE, AF, AG, AH, and AI within the Haul Road All hydrologically connected watercourses within the PA are believed to be potentially accessible to the American eel, even if habitat provision in those watercourses is low.	The development of the open pit is expected to impact confirmed and potential American eel habitat in Wetlands 59, 61 and WC12, WC13, WC14, and WC25. Potential American eel habitat in WC5 to be directly impacted by internal haul road. No change in impact along the Haul Road Direct impacts from the Haul Road to potential American eel habitat in WC-C, WC-D, WC-J, WC-L, WC-M, WC-O, WC-X, WC-AC, WC-AF, WC-AG, and potential fish habitat in WL64, WL66, WL73, WL77, WL76, WL146, WL154, WL159, and WL160.	Harmful alteration, destruction, or disruption to habitat as a result of direct and indirect impacts to watercourses within and downgradient of the PA		Avoidance and mitigation results in no harmful alteration, destruction or disruption to fish or fish habitat for the majority of the PA. Any Harmful Alteration, Disruption, or Destruction (HADD) of fish habitat through direct or indirect project impacts will require authorization under Section 35 of the Fisheries Act. A draft Fish Habitat Offset Plan (Appendix J.3) has been prepared to provide quantification of aquatic habitat both directly and indirectly affected by the Project and to outline the offset measures proposed to compensate for any HADD determination Potential indirect impacts to American eel to be monitored as part of Aquatic Effects Monitoring Plan (AEMP) Include monitoring of mitigation effectiveness in development of AEMP

Notes: No monitoring plan, action plan, or recovery strategy the species listed.

PA = Project Area; DFO = Department of Fisheries and Ocean; AEMP = Aquatic Effects Monitoring Plan; HADD = Harmful Alteration, Disruption, or Destruction.

6.13.8.2 Priority Vascular Flora and Lichen Species

No vascular flora SAR has been observed within the PA. Five priority species of vascular flora were identified across the Beaver Dam Mine Site and within the Haul Road. Two SAR lichens and seven SOCI lichens were identified within the PA. The following mitigation efforts for SAR lichen (Table 6.13-15) are considered in addition to standard mitigation measures outlined previously in Sections 6.10.8.

- Avoid SOCI wherever possible, particularly during micro-siting and detailed engineering of the Haul Road upgrades and new construction. Clearly identifying locations of SOCI where they will be avoided, and instruct personnel of their whereabouts.
- A map of all priority vascular and non-vascular flora will be provided to site personnel during site orientation, and the locations of all priority flora species that will be avoided during Project construction will be clearly flagged in the field.
- AMNS will transplant priority vascular species, where deemed reasonable and appropriate in consultation with regulators, that are located within the direct footprint of the Beaver Dam Mine Site infrastructure or Haul Road to nearby areas where suitable habitat is present. Where avoidance or transplanting is not possible, the Project Team will collect vascular flora SOCI form areas proposed for direct impact for herbarium records or for preservation of seeds in a seed bank through Acadia University.
- Wherever avoidance of lichen SAR is not possible, the Project Team will implement the Preliminary Lichen Mitigation and Monitoring Plan (Appendix P.6), developed in consultation with lichen specialists and regulators.
- Where avoidance and transplantation is not possible, the Project Team will collect specimens for submission to Frances Anderson or equivalent contact at time of construction (Lichen Specialist, Research Associate, and Nova Scotia Museum).
- Lichens are particularly sensitive to changing environmental conditions, particularly air quality and edge effects. The Project Team will implement the Preliminary Lichen Mitigation and Monitoring Plan (Appendix P.6) for those lichen SAR identified beyond the Project infrastructure footprint but in close proximity to the proposed development to determine the extent of indirect effects on those species.

Table 6.13-15: Mitigation for SAR Lichen

Species and Rank	Observations	Direct Impacts from Proposed Infrastructure and Micro-siting	Potential Adverse Effects	Monitoring Plan, Action Plan, or Recovery Strategy	Mitigation	Effectiveness of Mitigation
Blue felt lichen SARA - SC COSEWIC - SC NSESA – V ACCDC – S3	33 observed locations in the Beaver Dam Mine Site, Haul Road, and in the broader LSA Observations within the Beaver Dam Mine Site (17 individuals): Seven occurrences in Wetland 14 Three occurrences in Wetland 17 One occurrence in Wetland 4 One occurrence in Wetland 205 Occurrences adjacent to Wetlands 1, 2, 29, and 61. Observations along the Haul Road (four occurrences): One occurrence adjacent to Wetland 112 Two occurrences 350 and 170 m northwest of Wetland 126 (beyond PA) One occurrence 90 m south of Wetland 116 (beyond PA)	Two occurrences will be directly impacted (NAG waste rock stockpile and Crusher area) No direct impact along Haul Road, within 30 m buffer of centerline Water line north of the open pit has been micro-sited to avoid lichen occurrences. Infrastructure interacts with the 100 m buffer of five individuals within the Beaver Dam Mine Site and four individuals along the Haul Road.	Sensitive to changing environmental conditions, particularly air quality and edge effects. Edge effects – e.g.: increased light, wind, temp; decrease in moisture due to nearby disturbance. Accidental cutting of host tree or too close to host tree	NSLF At-Risk-Lichen SMP, 2018	Complete further detailed design of Haul Road and micro siting of mine infrastructure to avoid priority lichen species. Reduce disturbance through buffering of habitat - maintain 100m buffer, wherever practicable Implement air quality monitoring and dust suppression plans Flag host trees and setback areas Implement dust suppression plan Provide map of all priority vascular and non-vascular flora, and their setbacks, to site personnel during site orientation Implement the Preliminary Lichen Mitigation and Monitoring Plan (Appendix P.6), developed in consultation with lichen specialists and regulators, for observations within and in close proximity to the PA Wherever avoidance of SAR lichen species is not possible, the Project Team will implement the Preliminary Lichen Mitigation and Monitoring Plan (Appendix P.6), developed in consultation with lichen specialists and regulators. The two directly impacted blue felt lichen occurrences are proposed for translocation. Where avoidance and translocation are not possible, the Project Team will collect specimens for submission to Frances Anderson or equivalent contact at time of construction (Lichen Specialist, Research Associate, and Nova Scotia Museum)	Monitoring transplants and other monitoring sites, as per the Preliminary Lichen Mitigation and Monitoring Plan (Appendix P.6) Observed populations are of similar extent or exhibit similar abundance/distribution to baseline data (considering loss from external environmental factors) Implement mitigations and adaptive management proposed in the Preliminary Lichen Mitigation and Monitoring Plan (Appendix P.6)as required
Boreal felt lichen SARA - E COSEWIC - E NSESA – E ACCDC – S1	Habitat identified as potential Boreal Felt Lichen habitat by NSL&F was surveyed – BFL was identified in the LSA. Three thalli were found south of the PA. Follow up surveys conducted in the fall of 2016 determined that all three thalli were no longer present. Their absence was reconfirmed on December 4, 2017	No direct Project interaction with Boreal Felt Lichen Critical Habitat Areas Closest Project infrastructure to the three historic observations is 975 m, 1014 m, and 940 m, respectively. Micro-siting of Project infrastructure moved development from the Boreal Felt Lichen Critical Habitat Areas and increased distance from observations.	Sensitive to changing environmental conditions, particularly air quality and edge effects. Edge effects – e.g.: increased light, wind, temp; decrease in moisture due to nearby disturbance. Accidental cutting of host tree or too close to host tree Adverse effects are not anticipated due to Project distance from the occurrences and critical habitat.	Amended Recovery Strategy, 2018 NSLF At-Risk-Lichen SMP, 2018 NSLF Adopted Boreal Felt Lichen Recovery Plan, 2020	Micro-siting of Project infrastructure has been completed to avoid observations and Boreal Felt Lichen Critical Habitat Areas Continued detailed Project design to ensure no development occurs within the Boreal Felt Lichen Critical Habitat Areas Implement air quality monitoring and dust suppression plans Flag host tree and setback areas Implement dust suppression plan Provide map of all priority vascular and non-vascular flora, and their setbacks, to site personnel during site orientation Implement the Preliminary Lichen Mitigation and Monitoring Plan (Appendix P.6), developed in consultation with lichen specialists and regulators.	Monitoring transplants and other monitoring sites, as per Preliminary Lichen Mitigation and Monitoring Plan (Appendix P.6) Observed populations are of similar extent or exhibit similar abundance/distribution over the study area to baseline data (considering loss from external environmental factors) Implement mitigations and adaptive management proposed in the Preliminary Lichen Mitigation and Monitoring Plan (Appendix P.6) as required

Table 6.13-15: Mitigation for SAR Lichen (continued)

Species and Rank	Observations	Direct Impacts from Proposed Infrastructure and Micro-siting	Potential Adverse Effects	Monitoring Plan, Action Plan, or Recovery Strategy	Mitigation	Effectiveness of Mitigation
Frosted glass-whiskers SARA - SC COSEWIC – SC ACCDC – S1?	Observations within the Beaver Dam Mine Site (eight individuals): One occurrence east of Wetland 29 One occurrence on an upland island within Wetland 29 One occurrence west Wetland 2 Four occurrences on an upland island within Wetland 2 One individual north of the open pit No occurrences observed along the Haul Road	No occurrences are expected to be directly impacted within the Beaver Dam Mine Site or Haul Road Water line north of the open pit has been micro-sited to avoid lichen occurrences. Micro-siting of Project infrastructure avoided previous direct impact to three occurrences	Sensitive to changing environmental conditions, particularly air quality and edge effects. Edge effects – e.g.: increased light, wind, temp; decrease in moisture due to nearby disturbance. Accidental cutting of host tree or too close to host tree	Management Plan 2011 NSLF At-Risk-Lichen SMP, 2018	Complete further detailed design of Haul Road and micro siting of mine infrastructure to avoid priority lichen species Complete further detailed design of Haul Road and micro siting of mine infrastructure to avoid priority lichen species. Reduce disturbance through buffering of habitat - maintain 100m buffer, wherever practicable Implement air quality monitoring and dust suppression plans Flag host trees and setback areas Implement dust suppression plan Provide map of all priority vascular and non-vascular flora, and their setbacks, to site personnel during site orientation Implement the Preliminary Lichen Mitigation and Monitoring Plan (Appendix P.6), developed in consultation with lichen specialists and regulators, for observations within and in close proximity to the PA Wherever avoidance of SAR lichen species is not possible, the Project Team will implement the Preliminary Lichen Mitigation and Monitoring Plan (Appendix P.6), developed in consultation with lichen specialists and regulators. Where avoidance and transplantation are not possible, the Project Team will collect specimens for submission to Frances Anderson or equivalent contact at time of construction (Lichen Specialist, Research Associate, and Nova Scotia Museum)	Monitoring transplants and other monitoring sites, as per Preliminary Lichen Mitigation and Monitoring Plan (Appendix P.6) Observed populations are of similar extent or exhibit similar abundance/distribution over the study area to baseline data (considering loss from external environmental factors) Implement mitigations and adaptive management proposed in the Preliminary Lichen Mitigation and Monitoring Plan (Appendix P.6) as required

6.13.8.3 Priority Terrestrial Fauna Species

Standard mitigation for terrestrial fauna is expected to appropriately mitigate effects on priority fauna species. The following mitigation efforts (Table 6.13-16) are considered in addition to those outlined in Section 6.12.8.

- Wildlife observation reporting to appropriate site personnel during construction, operation and decommissioning of Project.
- AMNS encourages the public to report mainland moose sightings to the province at https://novascotia.ca/natr/wildlife/sustainable/msform.asp.
- Development and implementation of a draft Wildlife Management and Mitigation Plan (Appendix P.7).
- Limit use of lights to the amount necessary to ensure safe Project operations. Install lights facing downward and wherever practicable using motion-sensing lights.
- Impacts to snapping turtles will be reduced by implementing a 30 m buffer on aquatic habitat deemed suitable for snapping turtles, wherever practicable.
- Where avoidance of potential turtle hibernation habitat is not possible, construction in these habitats should be limited to the growing season when hibernating turtles are not likely to be impacted (October through April).
- Culverts will be installed in wetlands and watercourses under provincial permits as required. Culverts can encourage reptiles and amphibians to cross through those, rather than crossing roads, particularly if approach to the road prevents access. This can be especially important for turtles during nesting season (June) when they are more attracted to gravelly roadsides.
- Wetland and watercourse alterations will be completed under approval from NSE, with associated mitigation, monitoring and compensation measures employed.
- Implement signage on the Haul Road during operations adjacent to major stream crossings or waterbodies, preferably signage that is installed only seasonally during turtles' active period as drivers are more likely to pay attention to new signs when they are erected prior to nesting season, for example, than if signs remain all year.
- Increase dust suppression on roads to improve visibility during nesting season and hatchling emergence.

Table 3.16-16: Mitigation for Priority Terrestrial Fauna

Species and Ranks	Observations	Direct Impacts from Proposed Infrastructure and Micro-siting	Potential Adverse Effects	Monitoring Plan, Action Plan, or Recovery Strategy	Mitigation	Effectiveness of Mitigation
Snapping turtle SARA - SC COSEWIC - SC NSESA – V ACCDC – S3	One snapping turtle and nest was observed on the berm of WL59 One snapping turtle was observed within the Haul Road. Two snapping turtles were opportunistically observed adjacent the Touquoy Mine Site, within the LAA. Snapping turtles were frequently observed at the Touquoy Mine Site between June 19, 2017 and July 2, 2020. Suitable habitat for Snapping Turtles has been observed in Wetlands 8, 10, 14, 17, 29, 44, 56, 59, 61, 64, 66, 68, 69, 159, 168, 171, and 207.	Wetland 56 and 59 directly impacted by open pit The southern portion of Wetland 17 and western portions of Wetland 61 fall within the open pit Small portions of Wetlands 10 is directly impacted (in area away from water features) Potential use of Haul Road (e.g., nesting) Infrastructure was micro-sited out of Wetland 8 and 29, no direct impacts. The open water portions of Wetlands 8, 10, 11, and 29 within the Beaver Dam Mine Site are not proposed for direct impact Bypass roads have been micro-sited to avoid Wetland 64. A waterline has been rerouted and will no longer discharge into Wetland 64, avoiding resultant changes in hydrology.	Habitat alteration, fragmentation, or loss Unintentional destruction of nests, eggs, hatchlings or adults Accidental mortality from vehicle strike Potential chemical contamination Sensory disturbance (noise, light)	Draft Wildlife Mitigation and Monitoring Plan (Appendix P.7)	Include in the development and implementation of the Draft Wildlife Mitigation and Monitoring Plan (Appendix P.7) Implement wildlife observation reporting to appropriate site personnel during construction, operation, and decommissioning of Project Safety and Environment orientation and training will include information on turtles and nesting season awareness training, particularly along the Haul Road. If snapping turtle activity is occurring within and/or adjacent to the Beaver Dam Mine Site or Haul Road, additional turtle awareness and management program will be implemented to ensure all staff are well informed regarding the increased turtle activity, especially during breeding season Complete further detailed design of Haul Road and micro siting of Beaver Dam Mine Site infrastructure to avoid aquatic habitat Upgrade existing roads, wherever practicable, instead of building new roads Replace crushed, hung, or improperly installed culverts, wherever practicable, to improve habitat connectivity (while maintaining existing hydrological conditions) Reduce disturbance through buffering of habitat - a 30 m buffer on aquatic habitat deemed suitable for snapping turtles, wherever practicable Where avoidance of potential turtle hibernation habitat is not possible, construction in these habitats will be limited to the growing season when hibernating turtles are not likely to be impacted (Overwintering period - October through April), wherever practicable Implement surface water quality monitoring program Install turtle crossing signs near major watercourse crossings, or in areas where snapping turtles have been observed, in an effort to increase awareness and reduce vehicular collisions - preferably only seasonally when turtles are active Vehicles will yield to wildlife on roads Dust suppression to improve visibility during nesting and hatchling emergence Vehicles will adhere to safe speed limits, particularly around blind corners An un-vegetated buffer along roadsides will be maintained, where possible, to improve visibility along roadsides and reduce the potential for collisions with wildlife If a turtle is found, report immediately to site Environmental Technician; if found on road, move away provided not actively nesting using proper moving technique Use predator excluders on identified nests Install fencing, where practicable, to prevent wildlife from accessing areas with increased risk of injuries to wild species - appropriate dimensions to address and eliminate accidental falls of species of varying size including turtles into the open pit	No increase in mortalities due to mine related activities. If mortalities are occurring, AMNS will consult with regulatory agencies to determine the necessary action to be taken Assess findings from the Draft Wildlife Mitigation and Monitoring Plan (Appendix P.7), and implement adaptive management measure as needed
Mainland moose NSESA – E ACCDC – S1	PA is within a Mainland Moose Concentration Area Mainland moose tracks were observed within the Beaver Dam Mine Site north of Wetland 56, within Wetland 210, and observed incidentally outside of the PA north of Wetland 206 No signs of mainland moose were observed incidentally or during dedicated surveys within the Haul Road	Potential habitat within the Beaver Dam Mine Site and Haul Road – use of disturbed roadside habitat	Increased access into a site (construction of new roads) may increase poaching levels Lowered viability of individual populations of moose by direct mortality and reduction in range Habitat alteration, fragmentation, or loss Sensory disturbance (noise, light)	Recovery Plan for Mainland Moose in Nova Scotia (NSDNR, 2007)	Include in the development and implementation of the Draft Wildlife Mitigation and Monitoring Plan (Appendix P.7). Implement Moose Management and Monitoring Program - including activities such as repeated winter track surveys and pellet group inventories, and collaboration with the Mi'kmaq of Nova Scotia to study Mainland Moose in a broader context Implement wildlife observation reporting to appropriate site personnel during construction, operation, and decommissioning of Project Vehicles will yield to wildlife on roads Vehicles will adhere to safe speed limits, particularly around blind corners. An un-vegetated buffer along roadsides will be maintained, where possible, to improve visibility along roadsides and reduce the potential for collisions with wildlife Install fencing, where practicable, to prevent wildlife from accessing areas with increased risk of injuries to wild species - appropriate dimensions to address and eliminate accidental falls of species of varying size including deer and moose into the open pit	No increase in mortalities due to mine related activities. If mortalities are occurring, the Proponent will consult with regulatory agencies to determine the necessary action to be taken If monitoring of Mainland Moose to verify the efficacy of mitigation strategies show signs of disturbance due to mine related activities, the Proponent will consult with regulatory agencies to develop an adaptive management plan or other appropriate mitigation as deemed necessary by regulators Assess findings from the Draft Wildlife Mitigation and Monitoring Plan (Appendix P.7) and implement adaptive management measure as needed

6.13.8.4 Priority Avifauna Species

The potential effects related to migratory birds and the different phases of the Beaver Dam Mine Project are outlined in Section 6.12.7. Most direct and indirect impacts on birds, including SAR, are accounted for in general mitigation/monitoring for all birds, since many have legislated protection under the *Migratory Birds Convention Act* (primarily through avoiding clearing/grubbing during nesting season if possible, and conducting detailed pre-construction nest searches if clearing or grubbing must occur during nesting season). These pre-construction nest searches are particularly important in wetlands which provide suitable breeding habitat for the Olive-sided Flycatcher, Canada Warbler and Rusty Blackbird.

A draft Landbird Mitigation and Monitoring Plan (Appendix A of Appendix P.7 [draft Wildlife Mitigation and Monitoring Plan]) has been developed to verify the accuracy of the environmental assessment and the effectiveness of mitigation measures. Mitigations presented in this plan are described below and further outlined in Table 6.13-17:

- Avoiding clearing, grubbing and construction on native vegetation during the regional breeding season for migratory avifauna where practicable (beginning of April to end of August; ECCC 2015).
- Where this is not practicable, nesting bird surveys will be conducted Environmental personnel.
- Discourage ground- or burrow-nesting species (particularly common nighthawk and bank swallows, as directly requested by IR2 CEAA 2-24), by limiting the amount of exposed soil and stockpile slopes (less than 70°) during the breeding season, where practicable.
- Should any avifauna species initiate breeding or a nest be discovered in areas impacted by mine operations within the PA, the following actions will be taken:
  - The appropriate AMNS site personnel will be noticed immediately. Regulatory agencies (ECCC and NSL&F) will be contacted to review appropriate mitigation measures and buffer zones.
  - Spatial setbacks and temporal restrictions will be applied to the nest until chicks have fledged.
  - Monitoring will occur by qualified personnel (e.g., Environmental Technician) to determine if the chicks have fledged and if operations can re-commence.
- If a raptor nest is found within the forested areas to be cleared, a buffer zone appropriate to the species (as determined in consultation with NSL&F) would be placed around the nest.
- Monitor identified nests from a distance with a spotting scope or binoculars to verify the effectiveness of an identified buffer until the nests are inactive.
- Conduct routine inspections of the open pit area to remove any trapped or injured avifauna. If identified, determine a plan for removal in consultation with an avian specialist.
- Minimize on-site lighting while still allowing for safe operation and by installing downward-facing lights on site infrastructure and haul roads. Wherever practicable, install motion-sensing lights to ensure lights are not turned on when they are not necessary.
- Maintain speed limits on mine roads (max. 40 km/hr. within Beaver Dam Mine Site, 70 km/hr. along Haul Road) to minimize collisions with avifauna, implement dust suppression mitigations and conduct mobile refueling at least 30 m from any known breeding locations.

Table 6.13-17: Mitigations for Species at Risk Avifauna and Greater Yellowlegs (SOCI)

Species and Ranks	Observations	Direct Impacts from Proposed Infrastructure and Micro-siting	Potential Adverse Effects	Monitoring Plan, Action Plan, or Recovery Strategy	Mitigation	Effectiveness of Mitigation
Common nighthawk SARA - Th COSEWIC - SC NSESA – Th ACCDC – S2B	Observed along the Haul Road Four Common Nighthawks were observed during both breeding bird (n=1) and dedicated species surveys (n=3) in 2016	Possible breeding habitat within the PA - commonly associated with expansive gravelly areas adjacent to clear cuts or disturbed areas such as roadsides	Collisions with anthropogenic structures and vehicles Habitat alteration, fragmentation, or loss Sensory disturbance (noise, light) Unintentional destruction of nests, eggs, nestlings or adults Breeding disruption or functional habitat loss due to sensory disturbance (noise or light)	Recovery Strategy 2016	Avoid clearing/grubbing activities during nesting season If construction is required during the active nesting season, an avian specialist will monitor for nesting activity. If evidence of nesting is observed, the Proponent will consult with appropriate regulatory agencies to determine an appropriate spatial and temporal buffer, based on site and seasonal specific parameters at the time of the observation Discourage ground- or burrow-nesting species by limiting the amount of exposed soil Limit light use to direct and focused light when needed for worker safety Implement noise management including use of mufflers on equipment and regular maintenance Implement dust suppression plan Implement the draft Landbird Mitigation and Monitoring Plan (Appendix A of draft Wildlife Mitigation and Monitoring Plan) and Appendix P.7 draft Wildlife Mitigation and Monitoring Plan. All site workers shall comply with regulations outlined in the Migratory Bird Convention Act, which prohibits the disturbance of migratory birds, their nests and eggs. If any nest is identified, the Proponent Environmental Technician must be notified immediately, so steps can be taken to identify the species and determine appropriate mitigation or avoidance if required. Species identified of particular risk and several species of birds known to nest around active construction sites will be included in the Wildlife Sighting Report Card similar to those required at the Touquoy Mine Site	Assess findings from the Landbird SAR Mitigation and Monitoring Plan and Wildlife Management Plan, and implement adaptive management measure as needed If monitoring to verify the efficacy of mitigation strategies and any executed setbacks show signs of disturbance despite the setback, consultation with Environment and Climate Change Canada's Canadian Wildlife Service and other appropriate regulatory authorities will take place to develop a proposed adaptive management plan Monitor known nests around stockpiles and exposed areas from a distance with a spotting scope or binoculars to verify the effectiveness of the buffer until the nests are inactive Notify Environment and Climate Change Canada within 24 hours in the event of the mortality or injury of ten or more migratory birds in a single event or in the event of the mortality or injury of a migratory bird SAR
Canada warbler SARA - Th COSEWIC - Th NSESA – E ACCDC – S3B	Preferred habitat (moist mixed forests) was observed within the Beaver Dam Mine Site and Haul Road Eighteen Canada warblers were observed during the 2015, 2016 and 2019 breeding bird surveys within the Beaver Dam Mine Site and Haul Road.	Possible breeding habitat within the PA - moist mixed forests	Collisions with anthropogenic structures and vehicles Habitat alteration, fragmentation, or loss Sensory disturbance (noise, light) Unintentional destruction of nests, eggs, nestlings or adults Breeding disruption or functional habitat loss due to sensory disturbance (noise or light)	Recovery Strategy 2016	Avoid clearing/grubbing activities during nesting season If construction is required during the active nesting season, an avian specialist will monitor for nesting activity. If evidence of nesting is observed, the Proponent will consult with appropriate regulatory agencies to determine an appropriate spatial and temporal buffer, based on site and seasonal specific parameters at the time of the observation Limit light use to direct and focused light when needed for worker safety Implement noise management including use of mufflers on equipment and regular maintenance Implement dust suppression plan Implement the draft Landbird Mitigation and Monitoring Plan (Appendix A of Appendix P.7 [draft Wildlife Mitigation and Monitoring Plan]) All site workers shall comply with regulations outlined in the Migratory Bird Convention Act, which prohibits the disturbance of migratory birds, their nests and eggs. If any nest is identified, the Proponent Environmental Technician must be notified immediately, so steps can be taken to identify the species and determine appropriate mitigation or avoidance if required. Species identified of particular risk and several species of birds known to nest around active construction sites will be included in the Wildlife Sighting Report Card similar to those required at the Touquoy Mine Site	Assess findings from the draft Landbird Mitigation and Monitoring Plan (Appendix A of Appendix P.7 [draft Wildlife Mitigation and Monitoring Plan]), and implement adaptive management measure as needed If monitoring to verify the efficacy of mitigation strategies and any executed setbacks show signs of disturbance despite the setback, consultation with Environment and Climate Change Canada's Canadian Wildlife Service and other appropriate regulatory authorities will take place to develop a proposed adaptive management plan Notify Environment and Climate Change Canada within 24 hours in the event of the mortality or injury of ten or more migratory birds in a single event or in the event of the mortality or injury of a migratory bird SAR
Olive-sided flycatcher SARA - Th COSEWIC - SC NSESA – Th ACCDC – S2B	Observations were sparse, yet scattered across the Beaver Dam Mine Site (n=5) and Haul Road (n=5)	Possible breeding habitat within PA - commonly associated with edge habitat	Collisions with anthropogenic structures and vehicles Habitat alteration, fragmentation, or loss Sensory disturbance (noise, light) Unintentional destruction of nests, eggs, nestlings or adults Breeding disruption or functional habitat loss due to sensory disturbance (noise or light)	Recovery Strategy 2016	Avoid clearing/grubbing activities during nesting season If construction is required during the active nesting season, an avian specialist will monitor for nesting activity. If evidence of nesting is observed, the Proponent will consult with appropriate regulatory agencies to determine an appropriate spatial and temporal buffer, based on site and seasonal specific parameters at the time of the observation Limit light use to direct and focused light when needed for worker safety Implement noise management including use of mufflers on equipment and regular maintenance Implement dust suppression plan Implement surface water quality monitoring program Implement the draft Landbird Mitigation and Monitoring Plan (Appendix A of Appendix P.7 [draft Wildlife Mitigation and Monitoring Plan]) All site workers shall comply with regulations outlined in the Migratory Bird Convention Act, which prohibits the disturbance of migratory birds, their nests and eggs. If any nest is identified, the Proponent Environmental Technician must be notified immediately, so steps can be taken to identify the species and determine appropriate mitigation or avoidance if required. Species identified of particular risk and several species of birds known to nest around active construction sites will be included in the Wildlife Sighting Report Card similar to those required at the Touquoy Mine Site	Assess findings from the draft Landbird Mitigation and Monitoring Plan (Appendix A of Appendix P.7 [draft Wildlife Mitigation and Monitoring Plan]), and implement adaptive management measure as needed If monitoring to verify the efficacy of mitigation strategies and any executed setbacks show signs of disturbance despite the setback, consultation with Environment and Climate Change Canada's Canadian Wildlife Service and other appropriate regulatory authorities will take place to develop a proposed adaptive management plan Notify Environment and Climate Change Canada within 24 hours in the event of the mortality or injury of ten or more migratory birds in a single event or in the event of the mortality or injury of a migratory bird SAR

Table 6.13-17: Mitigations for SAR Avifauna and Greater Yellowlegs (SOCI) (continued)

Species and Ranks	Observations	Direct Impacts from Proposed Infrastructure and Micro-siting	Potential Adverse Effects	Monitoring Plan, Action Plan, or Recovery Strategy	Mitigation	Effectiveness of Mitigation
Eastern wood-pewee SARA - SC COSEWIC - SC NSESA – V ACCDC – S3S4B	Two observed: one identified at the outlet of Cameron Flowage, to the east of the Beaver Dam Mine Site, while the second was observed incidentally along the Haul Road, east of Wetland 114	Possible breeding habitat within PA – mature and intermediate mixed wood forest with open understory No expected direct impact to the two observation locations	Collisions with anthropogenic structures and vehicles Habitat alteration, fragmentation, or loss Sensory disturbance (noise, light) Unintentional destruction of nests, eggs, nestlings, or adults Breeding disruption or functional habitat loss due to sensory disturbance (noise or light) Impacts from dust along Haul Road	No current monitoring plan, action plan or recovery strategy for this species in this area	Avoid clearing/grubbing activities during nesting season If construction is required during the active nesting season, an avian specialist will monitor for nesting activity. If evidence of nesting is observed, the Proponent will consult with appropriate regulatory agencies to determine an appropriate spatial and temporal buffer, based on site and seasonal specific parameters at the time of the observation Limit light use to direct and focused light when needed for worker safety Implement noise management including use of mufflers on equipment and regular maintenance Implement dust suppression plan Implement draft Landbird Mitigation and Monitoring Plan (Appendix A of Appendix P.7 [draft Wildlife Mitigation and Monitoring Plan]) All site workers shall comply with regulations outlined in the Migratory Bird Convention Act, which prohibits the disturbance of migratory birds, their nests and eggs. If any nest is identified, the Proponent Environmental Technician must be notified immediately, so steps can be taken to identify the species and determine appropriate mitigation or avoidance if required. Species identified of particular risk and several species of birds known to nest around active construction sites will be included in the Wildlife Sighting Report Card similar to those required at the Touquoy Mine Site	Assess findings from the draft Landbird Mitigation and Monitoring Plan (Appendix A of Appendix P.7 [draft Wildlife Mitigation and Monitoring Plan]), and implement adaptive management measure as needed If monitoring to verify the efficacy of mitigation strategies and any executed setbacks show signs of disturbance despite the setback, consultation with Environment and Climate Change Canada's Canadian Wildlife Service and other appropriate regulatory authorities will take place to develop a proposed adaptive management plan Notify Environment and Climate Change Canada within 24 hours in the event of the mortality or injury of ten or more migratory birds in a single event or in the event of the mortality or injury of a migratory bird SAR
Peregrine falcon SARA - SC COSEWIC - NAR NSESA – V ACCDC – S1B	Two peregrine falcons were observed incidentally (n=1) and during the dedicated fall migration surveys (n=1) adjacent to the Beaver Dam Mine Site, in 2014. Both observations were documented immediately north of the Beaver Dam Mine Site, between Mud Lake and Cameron Flowage.	Suitable breeding habitat was not present within the Beaver Dam Mine Site or Haul Road No direct impact to two observation locations	Habitat alteration, fragmentation, or loss Sensory disturbance (noise, light) Unintentional destruction of nests, eggs, nestlings, or adults Breeding disruption or functional habitat loss due to sensory disturbance (noise or light)	Management Plan 2017	Avoid clearing/grubbing activities during nesting season If construction is required during the active nesting season, an avian specialist will monitor for nesting activity. If evidence of nesting is observed, the Proponent will consult with appropriate regulatory agencies to determine an appropriate spatial and temporal buffer, based on site and seasonal specific parameters at the time of the observation Limit light use to direct and focused light when needed for worker safety Implement dust suppression plan Implement noise management including use of mufflers on equipment and regular maintenance Implement the draft Landbird Mitigation and Monitoring Plan (Appendix A of Appendix P.7 [draft Wildlife Mitigation and Monitoring Plan]) All site workers shall comply with regulations outlined in the Migratory Bird Convention Act, which prohibits the disturbance of migratory birds, their nests and eggs. If any nest is identified, the Proponent Environmental Technician must be notified immediately, so steps can be taken to identify the species and determine appropriate mitigation or avoidance if required. Species identified of particular risk and several species of birds known to nest around active construction sites will be included in the Wildlife Sighting Report Card similar to those required at the Touquoy Mine Site	Assess findings from the draft Landbird Mitigation and Monitoring Plan (Appendix A of Appendix P.7 [draft Wildlife Mitigation and Monitoring Plan]), and implement adaptive management measure as needed If a raptor nest is found within the forested areas to be cleared, a buffer zone appropriate to the species (as determined in consultation with NSL&F) would be placed around the nest If monitoring to verify the efficacy of mitigation strategies and any executed setbacks show signs of disturbance despite the setback, consultation with Environment and Climate Change Canada's Canadian Wildlife Service and other appropriate regulatory authorities will take place to develop a proposed adaptive management plan Notify Environment and Climate Change Canada within 24 hours in the event of the mortality or injury of ten or more migratory birds in a single event or in the event of the mortality or injury of a migratory bird SAR
Chimney swift SARA - Th COSEWIC - Th NSESA – E ACCDC – S2B, S1M	Two chimney swifts were observed incidentally during the breeding season in 2015, within the Beaver Dam Mine Site. They were observed from Wetland 53, which is in the center of the Beaver Dam Mine Site, south of Crusher Lake There were no signs observed of chimney swift breeding	No suitable chimneys for roosting and nesting were observed within the PA; however, waterbodies used for foraging are present within the Beaver Dam Mine Site and Haul Road. Wetland 53 is no longer impacted by Project infrastructure.	Collisions with anthropogenic structures and vehicles Habitat alteration, fragmentation, or loss Sensory disturbance (noise, light) Unintentional destruction of nests, eggs, nestlings, or adults Breeding disruption or functional habitat loss due to sensory disturbance (noise or light)	No current monitoring plan, action plan or recovery strategy for this species in this area	Avoid clearing/grubbing activities during nesting season If construction is required during the active nesting season, an avian specialist will monitor for nesting activity. If evidence of nesting is observed, the Proponent will consult with appropriate regulatory agencies to determine an appropriate spatial and temporal buffer, based on site and seasonal specific parameters at the time of the observation Limit light use to direct and focused light when needed for worker safety Implement dust suppression plan Implement noise management including use of mufflers on equipment and regular maintenance Implement the draft Landbird Mitigation and Monitoring Plan (Appendix A of Appendix P.7 [draft Wildlife Mitigation and Monitoring Plan]. All site workers shall comply with regulations outlined in the Migratory Bird Convention Act, which prohibits the disturbance of migratory birds, their nests and eggs. If any nest is identified, the Proponent Environmental Technician must be notified immediately, so steps can be taken to identify the species and determine appropriate mitigation or avoidance if required. Species identified of particular risk and several species of birds known to nest around active construction sites will be included in the Wildlife Sighting Report Card similar to those required at the Touquoy Mine Site	Assess findings from the draft Landbird Mitigation and Monitoring Plan (Appendix A of Appendix P.7 [draft Wildlife Mitigation and Monitoring Plan]), and implement adaptive management measure as needed If monitoring to verify the efficacy of mitigation strategies and any executed setbacks show signs of disturbance despite the setback, consultation with Environment and Climate Change Canada's Canadian Wildlife Service and other appropriate regulatory authorities will take place to develop a proposed adaptive management plan Notify Environment and Climate Change Canada within 24 hours in the event of the mortality or injury of ten or more migratory birds in a single event or in the event of the mortality or injury of a migratory bird SAR

Table 6.13-17: Mitigations for SAR Avifauna and Greater Yellowlegs (SOCI) (continued)

Species and Ranks	Observations	Direct Impacts from Proposed Infrastructure and Micro-siting	Potential Adverse Effects	Monitoring Plan, Action Plan, or Recovery Strategy	Mitigation	Effectiveness of Mitigation
Rusty blackbird SARA - SC COSEWIC - SC NSESA - E	One rusty blackbird was observed incidentally during the 2014 fall migration survey in a large wetland complex to the north of the Beaver Dam Mine Site (PC15).	Breeding habitat, including forested wetlands, swamps, and peat bogs are present within the Beaver Dam Mine Site and Haul Road, however, no evidence of breeding was observed (no birds were observed within PA). No direct impact to observation location (beyond the PA)	Collisions with anthropogenic structures and vehicles Habitat alteration, fragmentation, or loss - particularly wetland loss Sensory disturbance (noise, light) Unintentional destruction of nests, eggs, nestlings, or adults Breeding disruption or functional habitat loss due to sensory disturbance (noise or light)	Management Plan 2015	Avoid clearing/grubbing activities during nesting season Complete further detailed design of Haul Road and micro siting of mine infrastructure to avoid major wetlands. Where wetlands cannot be avoided, total Project footprint within the wetland will be minimized to the extent practicable. Implement wetland monitoring programs If construction is required during the active nesting season, an avian specialist will monitor for nesting activity. If evidence of nesting is observed, the Proponent will consult with appropriate regulatory agencies to determine an appropriate spatial and temporal buffer, based on site and seasonal specific parameters at the time of the observation Limit light use to direct and focused light when needed for worker safety Implement dust suppression plans Implement noise management including use of mufflers on equipment and regular maintenance Implement the Landbird SAR Mitigation and Monitoring Plan and Wildlife Management Plan All site workers shall comply with regulations outlined in the Migratory Bird Convention Act, which prohibits the disturbance of migratory birds, their nests and eggs. If any nest is identified, the Proponent Environmental Technician must be notified immediately, so steps can be taken to identify the species and determine appropriate mitigation or avoidance if required. Species identified of particular risk and several species of birds known to nest around active construction sites will be included in the Wildlife Sighting Report Card similar to those required at the Touquoy Mine Site	Assess findings from the draft Landbird Mitigation and Monitoring Plan (Appendix A of Appendix P.7 [draft Wildlife Mitigation and Monitoring Plan]), and implement adaptive management measure as needed Assess impacts to habitat through Wetland Monitoring Program If monitoring to verify the efficacy of mitigation strategies and any executed setbacks show signs of disturbance despite the setback, consultation with Environment and Climate Change Canada's Canadian Wildlife Service and other appropriate regulatory authorities will take place to develop a proposed adaptive management plan Notify Environment and Climate Change Canada within 24 hours in the event of the mortality or injury of ten or more migratory birds in a single event or in the event of the mortality or injury of a migratory bird SAR
Barn swallow SARA - Th COSEWIC - Th NSESA - E	One barn swallow was observed along the Haul Road during the 2016 spring migration surveys, near Wetland 159. None were observed during the breeding bird surveys completed in the Beaver Dam Mine Site. Potential nesting habitat is available within the Beaver Dam Mine Site and Haul Road, particularly artificial structures including a cabin, bridges, and road culverts.	Possible breeding habitat within PA – artificial structures No expected direct impact to observation location along the Haul Road.	Habitat alteration, fragmentation, or loss Collisions with anthropogenic structures and vehicles Attraction to manmade structures for nesting Unintentional destruction of nests, eggs, nestlings or adults Breeding disruption or functional habitat loss due to sensory disturbance (noise or light)	No current monitoring plan, action plan or recovery strategy for this species in this area	Avoid clearing/grubbing activities during nesting season If construction is required during the active nesting season, an avian specialist will monitor for nesting activity. If evidence of nesting is observed, the Proponent will consult with appropriate regulatory agencies to determine an appropriate spatial and temporal buffer, based on site and seasonal specific parameters at the time of the observation Check abandoned structures on site for nests prior to any demolition Limit light use to direct and focused light when needed for worker safety Implement dust suppression plans Implement noise management including use of mufflers on equipment and regular maintenance Implement the Landbird SAR Mitigation and Monitoring Plan and Wildlife Management Plan All site workers shall comply with regulations outlined in the Migratory Bird Convention Act, which prohibits the disturbance of migratory birds, their nests and eggs. If any nest is identified, the Proponent Environmental Technician must be notified immediately, so steps can be taken to identify the species and determine appropriate mitigation or avoidance if required. Species identified of particular risk and several species of birds known to nest around active construction sites will be included in the Wildlife Sighting Report Card similar to those required at the Touquoy Mine Site	Assess findings from the draft Landbird Mitigation and Monitoring Plan (Appendix A of Appendix P.7 [draft Wildlife Mitigation and Monitoring Plan]), and implement adaptive management measure as needed If monitoring to verify the efficacy of mitigation strategies and any executed setbacks show signs of disturbance despite the setback, consultation with Environment and Climate Change Canada's Canadian Wildlife Service and other appropriate regulatory authorities will take place to develop a proposed adaptive management plan Notify Environment and Climate Change Canada within 24 hours in the event of the mortality or injury of ten or more migratory birds in a single event or in the event of the mortality or injury of a migratory bird SAR
Greater yellowlegs ACCDC – S3B,S3S4M	A total of 25 observations within the Beaver Dam Mine Site and eight observations along the Haul Road	Possible breeding habitat within the Beaver Dam Mine Site in close proximity or directly impacted by infrastructure Probable breeding habitat within Wetland 64 in close proximity to Haul Road upgrades. Bypass roads have been micro-sited to avoid Wetland 64. A waterline has been rerouted and will no longer discharge into Wetland 64, avoiding resultant changes in hydrology.	Collisions with anthropogenic structures and vehicles Habitat alteration, fragmentation, or loss Sensory disturbance (noise, light) Unintentional destruction of nests, eggs, nestlings or adults Breeding disruption or functional habitat loss due to sensory disturbance (noise or light) Impacts from dust along Haul Road	No current monitoring plan, action plan or recovery strategy for this species in this area	Avoid clearing/grubbing activities during nesting season Complete construction and upgrades of Haul Road within Wetland 64 outside of the active nesting season for Greater Yellowlegs, if practicable If construction is required during the active nesting season, an avian specialist will monitor for nesting activity within Wetland 64 and adjacent undisturbed habitat. If evidence of nesting is observed, AMNS will consult with appropriate regulatory agencies to determine an appropriate spatial and temporal buffer, based on site and seasonal specific parameters at the time of the observation. Implement dust suppression plans Limit light use to direct and focused light when needed for worker safety Implement noise management including use of mufflers on equipment and regular maintenance Implement the draft Landbird Mitigation and Monitoring Plan (Appendix A of Appendix P.7 [draft Wildlife Mitigation and Monitoring Plan]) All site workers shall comply with regulations outlined in the Migratory Bird Convention Act, which prohibits the disturbance of migratory birds, their nests and eggs. If any nest is identified, the Proponent Environmental Technician must be notified immediately, so steps can be taken to identify the species and determine appropriate mitigation or avoidance if required. Species identified of particular risk and several species of birds known to nest around active construction sites will be included in the Wildlife Sighting Report Card similar to those required at the Touquoy Mine Site	Assess findings from the draft Landbird Mitigation and Monitoring Plan (Appendix A of Appendix P.7 [draft Wildlife Mitigation and Monitoring Plan]), and implement adaptive management measure as needed If monitoring of Greater Yellowlegs to verify the efficacy of mitigation strategies and any executed setbacks show signs of disturbance despite the setback, consultation with Environment and Climate Change Canada's Canadian Wildlife Service and other appropriate regulatory authorities will take place to develop a proposed adaptive management plan Implement bird deterrents in Wetland 64 as necessary Notify Environment and Climate Change Canada within 24 hours in the event of the mortality or injury of ten or more migratory birds in a single event or in the event of the mortality or injury of a migratory bird SAR

Table 6.13-17: Mitigations for SAR Avifauna and Greater Yellowlegs (SOCI) (continued)

Species and Ranks	Observations	Direct Impacts from Proposed Infrastructure and Micro-siting	Potential Adverse Effects	Monitoring Plan, Action Plan, or Recovery Strategy	Mitigation	Effectiveness of Mitigation
Evening grosbeak SARA – SC COSEWIC – SC NSESA – Th ACCDC – S3S4B, S3N	Two individuals were observed during the breeding season in 2016, at PC7 along the Haul Road, in upland habitat. There were no signs observed of breeding	Possible breeding habitat within PA –open, mature mixedwood upland forests Observed location is directly adjacent to prosed Haul Road alignment.	Collisions with anthropogenic structures and vehicles Habitat alteration, fragmentation, or loss Sensory disturbance (noise, light) Unintentional destruction of nests, eggs, nestlings or adults Breeding disruption or functional habitat loss due to sensory disturbance (noise or light)	No current monitoring plan, action plan or recovery strategy for this species in this area	Avoid clearing/grubbing activities during nesting season If construction is required during the active nesting season, an avian specialist will monitor for nesting activity. If evidence of nesting is observed, the Proponent will consult with appropriate regulatory agencies to determine an appropriate spatial and temporal buffer, based on site and seasonal specific parameters at the time of the observation Limit light use to direct and focused light when needed for worker safety Implement dust suppression plans Implement noise management including use of mufflers on equipment and regular maintenance Implement the draft Landbird Mitigation and Monitoring Plan (Appendix A of Appendix P.7 [draft Wildlife Mitigation and Monitoring Plan]) All site workers shall comply with regulations outlined in the Migratory Bird Convention Act, which prohibits the disturbance of migratory birds, their nests and eggs. If any nest is identified, the Proponent Environmental Technician must be notified immediately, so steps can be taken to identify the species and determine appropriate mitigation or avoidance if required. Species identified of particular risk and several species of birds known to nest around active construction sites will be included in the Wildlife Sighting Report Card similar to those required at the Touquoy Mine Site	Assess findings from the draft Landbird Mitigation and Monitoring Plan (Appendix A of Appendix P.7 [draft Wildlife Mitigation and Monitoring Plan]), and implement adaptive management measure as needed If monitoring to verify the efficacy of mitigation strategies and any executed setbacks show signs of disturbance despite the setback, consultation with Environment and Climate Change Canada's Canadian Wildlife Service and other appropriate regulatory authorities will take place to develop a proposed adaptive management plan Notify Environment and Climate Change Canada within 24 hours in the event of the mortality or injury of ten or more migratory birds in a single event or in the event of the mortality or injury of a migratory bird SAR

- While no significant impacts are expected from the Project to mature and interior forests, overall and in the greater adjacent area, in instances where these habitat types cannot be avoided specific mitigations are proposed in Section 6.10 of the Updated 2021 EIS (AMNS 2021a).
- A draft Landbird Mitigation and Monitoring Plan (Appendix A of Appendix P.7 [draft Wildlife Mitigation and Monitoring Plan]), will be implemented during Project development.
- Wetland monitoring will occur within the PA, in wetland habitat that will be avoided by the Project, to ensure that wetland integrity is maintained, as these are the locations which have the highest potential to support landbird SAR.
- Implement surface water quality monitoring program, as many landbird SAR are reliant on wetlands and sources of open water for critical life functions.
- Communicate regulations related to nesting birds to all site personnel, particularly focused on those priority bird species which may be attracted to Project activities.
- Notify Environment and Climate Change Canada within 24 hours in the event of the mortality or injury of ten or more migratory birds in a single event or in the event of the mortality or injury of a bird SAR.

Additional mitigation measures specific to greater yellowlegs include:

- Wherever possible, clearing/grubbing and construction within and near wetland habitat will be limited during the nesting season;
- If construction is required within Wetland 64 during the active nesting season, an avian specialist will monitor for nesting activity within the wetland and adjacent undisturbed habitat. The proponent will consult with appropriate regulatory agencies to determine an appropriate spatial and temporal buffer, based on site and seasonal specific parameters at the time of the observation.
- An AMNS and contractor awareness program will be implemented to inform staff of greater yellowlegs identification and signs of nesting behavior. Contractors will be informed of their responsibility to remain inside approved work areas, and to report signs of nesting behavior of the greater yellowlegs to the Proponent's staff.
- To avoid nesting activity, bird deterrents will be implemented within Wetland 64, as this is the only location where probably breading was observed, following best-management-practices used in the mining industry.
- If new breeding evidence or nests are observed within 300 m of Project activities, a site mitigation plan will be developed in consultation with regulators. Nests will be monitored from a distance using binoculars or a spotting scope to avoid further human disturbance from monitoring. An acceptable setback (to be established in consultation with regulatory authorities) will be established.
- New bypass roads have been micro-sited to avoid Wetland 64 and, as a result of PA and infrastructure modifications, a waterline has been rerouted and will no longer discharge into Wetland 64, avoiding resultant changes in hydrology.

6.13.9 Residual Effects and Significance

Based on avoidance, mitigation and monitoring proposed for all priority species listed above, the following residual effects are anticipated. Project VC interactions of a priority taxa (e.g., priority fish species) that have the same residual environmental effects characteristic rankings of their related non-priority specific VC (e.g., fish and fish habitat) are not carried forward in the tables below. Rationales for differences in residual effect rankings are described following sections and tables.

The ecological and social context of each priority species taxa was included throughout the evaluation as was completed for all VCs. In general, the ecological and social context specific to priority species are more significant than non-listed species in each taxa. Ecological (species abundance, habitat, food source etc.) and social factors (recreational, commercial and Indigenous) for priority species are typically more specific and sensitive than for non-priority species. For example, rusty blackbirds have very specific ecological requirements for foraging and nesting and brook trout is of great social importance recreationally as one of Nova Scotia's most important sports fish and is also an important fish for the Mi'kmaq of Nova Scotia. SAR/SOCI species are less abundant than common species (e.g., mainland moose vs. snowshoe hare).

6.13.9.1 Priority Fish Species

Two VC interactions presented in Table 6.9-25 have been carried forward to Table 6.13-18 for priority fish species. In general, the residual effects to fish and fish habitat presented in Section 6.9.9 is consistent with the residual effects to priority fish species. No direct impacts are proposed in watercourses, waterbodies or wetlands known or expected to provide habitat for Atlantic salmon. Direct impacts are proposed in several habitats known to support brook trout and American eel; however, the residual effects to these species is reflected in Section 6.9.9. Given implementation of appropriate avoidance, mitigation and offsetting, significant adverse residual impacts to brook trout and American eel are not anticipated. Along the Haul Road, it is expected that fish habitat direct impact can be minimized through proper planning, micro-sighting of the upgraded road footprint, and installation of culverts in accordance with the Nova Scotia Watercourse Alteration Standard (2015). The two VC interactions which have been carried forward to the table below include indirect impacts during operations and post-closure, where the potential impact to sensitive Atlantic salmon habitat within the Killag River is the most elevated. The geographic extent, timing, duration, frequency, reversibility and magnitude of indirect impacts to Atlantic salmon remains the same as is with non-priority specific fish and fish habitat for these VC interactions. However, the scrutiny and analysis undertaken in determining the magnitude of each effect was substantially higher for priority species, particularly Atlantic salmon in Cameron Flowage/Killag River.

6.13.9.2 Priority Vascular Plant and Lichen Species

There are no differences between the residual environmental effects for non-priority specific flora and lichens compared to priority flora and lichens. Refer to Table 6.10-13 for residual environmental effects of habitat and flora.

No SAR vascular flora will be directly impacted by the Project. Mitigation of the two blue felt lichen occurrences that are expected to be directly impacted is proposed through the Preliminary Lichen Mitigation and Monitoring Plan (Appendix P.6).

6.13.9.3 Priority Terrestrial Fauna Species

All four VC interactions presented in Table 6.11-10 have been carried forward to Table 6.13-19 for priority terrestrial fauna species.

Project activities are expected to result in increased habitat fragmentation and a decrease in habitat quantity and quality for those species, including mainland moose, which rely especially on interior forest conditions. Clearing and grubbing during construction can reduce cover for priority turtle species (e.g., snapping turtle), indirectly affect water quality, and isolate populations (ECCC, 2016). For species relying on interior forest condition, the decrease in habitat quantity and quality is based on increased activity and sensory disturbance, along with increased physical habitat loss and fragmentation, which interferes with the long-term population viability and is a serious threat to the mainland moose in particular (NSDNR, 2007).

Table 6.13-18: Residual Effects for Priority Fish and Fish Habitat

Project VC Interactions	Parameter	Mitigation and Compensation Measures	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Operations –Beaver Dam Mine Site Indirect impacts including groundwater drawdown, groundwater seepage, altered surface water quality Cameron Flowage/Killag River Tent Lake Cope Brook	Indirect	Interceptor trench west of PAG stockpile Water treatment (as required) Discharge point location at northern end of Cameron Flowage Vegetative buffers to provide shade to on-site ponds Install groundwater pumps to supplement baseflow in Cameron Flowage Explosives Management Best Management Practices	L Interaction likely to cause indirect impacts to fish habitat	LAA Potential adverse effect to fish habitat outside of the PA	A Seasonal habitat provisions may affect VC	P Effect is expected to be permanent	R Effects occur at regular intervals throughout the Project	PR Groundwater drawdown effects will cease once the pit lake has filled. Surface water interactions are partially reversible	Habitat alteration	Not significant
Post Closure – Beaver Dam Mine Site and Touquoy Mine site Surface water quality Cameron Flowage/Killag River Moose River	Indirect	Water treatment (as required)	N VC interaction will remain below appropriate guidelines	LAA VC interaction will extend beyond PA	A Seasonal aspects will affect VC	P Effect is expected to be permanent	R Effects are expected to occur over a regular interval	PR VC will partially recover to baseline conditions	Change in water quality	Not significant

Notes: See Section 6.9Table 6.9-7 for definitions of the below characteristics.

Magnitude		Geographic Extent		Timing		Duration		Frequency		Reversibility	
N	Negligible	PA	Project Area	N/A	Not Applicable	ST	Short-Term	O	Once	R	Reversible
L	Low	LAA	Local Assessment Area	A	Applicable	MT	Medium-Term	I	Intermittent	IR	Irreversible
M	Moderate	RAA	Regional Assessment Area			LT	Long-Term	R	Regular	PR	Partially Reversible
H	High					P	Permanent	C	Continuous		

Table 6.13-19: Residual Effects for Priority Terrestrial Fauna

Project - VC Interactions	Mitigation and Compensation Measures	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction – Beaver Dam Mine Site and Haul Road (habitat loss and fragmentation from clearing and grubbing)	Limit habitat disturbance and minimize Project footprint during detailed design, implement speed limits, install fences where necessary, and minimize lighting.	L < 5% direct loss of habitat types used by observed SAR and SOCI within the LAA Partial mitigation through restoration.	RAA Potential adverse effect to fauna outside of the LAA (fragmentation)	A VC interaction may affect seasonal aspects of fauna.	MT (Beaver Dam Mine Site) Effects occur beyond 5 years when closure activities commence at Beaver Dam Mine Site. P (Haul Road) Closure of the Haul Road not expected.	O Effects occur once during the construction phase.	PR Mitigation and reclamation cannot guarantee a return to baseline conditions.	Habitat Loss	Not Significant
Construction – Beaver Dam Mine Site and Haul Road (sensory disturbance (noise, light, dust deposition) and wildlife vehicle collisions from construction activities)	Implement speed limits, install fences where necessary, and minimize lighting.	M	LAA Potential adverse effect to fauna outside of the PA	A VC interaction may affect seasonal aspects of fauna.	ST Effects are limited to occur from as little as 1 day to 12 months	R Effects occur at regular intervals during the construction phase	R VC will recover to baseline conditions	Disturbance	Not Significant
Operational – Beaver Dam Mine Site, Haul Road and Touquoy Mine Site (disturbance (noise, light, dust deposition and wildlife vehicle collisions) from haul trucks, heavy machinery and mine operations)	Implement speed limits, install fences where necessary, and minimize lighting.	M Moderate changes relative to baseline conditions in remaining and surrounding habitat.	LAA Potential adverse effect to fauna beyond the PA.	A VC interaction may affect seasonal aspects of fauna.	MT Effects may occur up to 5 years.	R Effects occur at regular intervals.	R VC will recover to baseline conditions	Disturbance	Not Significant
Closure (Active) – Beaver Dam Mine Site (re-establishment of habitat for fauna)	N/A	L Minor change from baseline conditions.	LAA Potential effect to fauna outside of the PA	A VC interaction may affect seasonal aspects of fauna.	LT Effects extend beyond active closure phase.	O Effects occur once during the closure phase.	PR Mitigation and reclamation cannot guarantee a return to baseline conditions.	Habitat Reclamation	Not Significant

Notes: See Section 5.11, Table 5.11-1 for definitions of the below characteristics.

Magnitude		Geographic Extent		Timing		Duration		Frequency		Reversibility	
N	Negligible	PA	Project Area	N/A	Not Applicable	ST	Short-Term	O	Once	R	Reversible
L	Low	LAA	Local Assessment Area	A	Applicable	MT	Medium-Term	S	Sporadic	IR	Irreversible
M	Moderate	RAA	Regional Assessment Area			LT	Long-Term	R	Regular	PR	Partially Reversible
H	High					P	Permanent	C	Continuous		

However, physical habitat loss for observed priority terrestrial fauna species is expected to be low, as presented in Section 6.11, in comparison to available habitat in the LAA. Based on the current high level of disturbed habitat and the limited Project edge effect impact to predicted interior forest patches, habitat fragmentation is also assessed to be low. Undisturbed, unfragmented habitat is present in the RAA, and the larger tracts are maintained around the PA, particularly on the north and southwest. Baseline conditions within the Beaver Dam Mine Site and the majority of the Haul Road (between logging roads and forestry activity) already demonstrate fragmentation as a result of a high level of forestry activity, especially within the Beaver Dam Mine Site where habitat loss will be greatest. The Beaver Dam Mine Site infrastructure footprint is situated primarily on an area of high existing disturbance and will only have fringe effects on the interior forest availability. There will be minimal isolation of habitat that is currently contiguous, limited to the portion of potential interior forest west of the NAG waste rock stockpile. However, broadly speaking, accessible routes to provide movement through and across the larger region at the LAA and RAA level still exist for wildlife and are un-impacted by the development of the Project. The RAA is generally remote, with a total of 72,663 ha of predicted interior forest. The maximum Project edge effect as discussed in Section 6.10.7.1, will affect 237 ha of interior forest habitat, which accounts for 0.3% of predicted interior forest in the RAA.

Vehicle and haul truck activity will occur throughout the PA during the construction, operations, and and closure phases. Vehicle and haul truck activity can cause impacts to priority fauna from wildlife vehicle collisions, dust, noise, and accidents (e.g., spills). Wildlife vehicle collisions can directly affect priority fauna and noise can indirectly affect priority fauna by encouraging avoidance behaviour.

Blasting and drilling of in-situ rock will occur at the Beaver Dam Mine Site during the operational phase of the Project. Blasting could negatively affect priority fauna from the noise associated with the activity. Although blasting is restricted to the PA the sound disturbance to terrestrial fauna has the potential to extend into the LAA. For example, a noise disturbance can cause flight behaviour in all terrestrial fauna but the impact to the energy balance of a mainland moose may have more severe consequences compared to a non-priority fauna species because stress on an already endangered (NSESA) population may impede its biological success in turn having a greater impact on the species.

6.13.9.4 Priority Avifauna Species

All four VC interactions presented in Table 6.12-15 have been carried forward to Table 6.13-20 for priority avifauna species.

Project activities (i.e., clearing and grubbing) are expected to result in increased habitat fragmentation and a decrease in habitat quantity and quality for those avifauna species, which rely especially on interior forest conditions. For species relying on interior forest condition, such as those presented in Table 6.12-11, the decrease in habitat quantity and quality is primarily based on increased activity and sensory disturbance, along with increased physical habitat loss and fragmentation.

However, physical habitat loss for observed SAR avifauna species is expected to be low, as presented in Section 6.12, in comparison to available habitat in the LAA. Based on the current high level of disturbed habitat and the limited Project edge effect impact to predicted interior forest patches, habitat fragmentation is also assessed to be low. Undisturbed, unfragmented habitat is present in the LAA and RAA, and the larger tracts are maintained around the PA, particularly on the north and southwest. Baseline conditions within the Beaver Dam Mine Site and the majority of the Haul Road (between logging roads and forestry activity) already demonstrate fragmentation as a result of a high level of forestry activity, especially within the Beaver Dam Mine Site where habitat loss will be greatest. The Beaver Dam Mine Site infrastructure footprint is situated primarily on an area of high existing disturbance and will only have fringe effects on the interior forest availability. The LAA is generally remote, with a total of 2,660 ha of predicted interior forest. The maximum Project edge effect as discussed in Section 6.10.7.1.2, will affect 237 ha of interior forest habitat, which accounts for which accounts for 9% of predicted interior forest in the LAA and 0.3% within the RAA.

Table 6.13-20: Residual Effects for Priority Avifauna

Project - VC Interactions	Mitigation and Compensation Measures	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction – Beaver Dam Mine Site and Haul Road (habitat loss from clearing and grubbing)	Limit habitat disturbance and minimize Project footprint during detailed design, implement speed limits and minimize lighting.	L < 5% direct loss of habitat types used by observed species within the LAA Partial mitigation through restoration.	LAA Potential adverse effect to avifauna outside of the PA	A Although clearing and grubbing will occur outside of the sensitive period for avifauna, other activities will not.	MT (Beaver Dam Mine Site) Effects occur beyond 5 years when closure activities commence at Beaver Dam Mine Site. P (Haul Road) Closure of the Haul Road not expected.	O Effects occur once during the construction phase.	PR Mitigation and reclamation cannot guarantee a return to baseline conditions.	Habitat Loss	Not Significant
Construction – Beaver Dam Mine Site and Haul Road (sensory disturbance (noise, light, dust deposition) and wildlife vehicle collisions from construction activities)	Implement speed limits and minimize lighting.	M	LAA Potential adverse effect to avifauna outside of the PA	A VC interaction may affect seasonal aspects of avifauna.	ST Effects are limited to occur from as little as 1 day to 12 months	R Effects occur at regular intervals during the construction phase	R VC will recover to baseline conditions	Disturbance	Not Significant
Operational – Beaver Dam Mine Site, Haul Road and Touquoy Mine Site (disturbance (noise, light, dust deposition and wildlife vehicle collisions) from haul trucks, heavy machinery and mine operations)	Implement speed limits, install fences where necessary, and minimize lighting.	M Moderate changes relative to baseline conditions in remaining and surrounding habitat.	LAA Potential adverse effect to avifauna outside of the PA	A VC interaction may affect seasonal aspects of fauna.	MT Effects may occur up to 5 years.	R Effects occur at regular intervals.	R VC will recover to baseline conditions	Disturbance	Not Significant
Operations – Touquoy Mine Site Tailings deposition	Best management practices, Bird Deterrent Program implementation	L Change in habitat for avifauna	PA VC interaction is confined to the PA.	A VC interaction may occur during sensitive period for avifauna.	LT Effects may extend beyond 5 years	R VC interaction will occur at regular intervals	PR Mitigation cannot guarantee a return to baseline conditions	Creation of potential open water habitat; decreased water quality	Not Significant
Closure (Active) – Beaver Dam Mine Site (re-establishment of habitat for fauna)	N/A	L Minor change from baseline conditions.	LAA Potential effect to avifauna outside of the PA	A VC interaction may affect seasonal aspects of fauna.	LT Effects extend beyond active closure phase.	O Effects occur once during the closure phase.	PR Mitigation and reclamation cannot guarantee a return to baseline conditions.	Habitat Reclamation	Not Significant

Notes: See Section 5.11, Table 5.11-1 for definitions of the below characteristics.

Magnitude		Geographic Extent		Timing		Duration		Frequency		Reversibility	
N	Negligible	PA	Project Area	N/A	Not Applicable	ST	Short-Term	O	Once	R	Reversible
L	Low	LAA	Local Assessment Area	A	Applicable	MT	Medium-Term	S	Sporadic	IR	Irreversible
M	Moderate	RAA	Regional Assessment Area			LT	Long-Term	R	Regular	PR	Partially Reversible
H	High					P	Permanent	C	Continuous		

There will be minimal isolation of habitat that is currently contiguous, limited to the patch of potential interior forest west of the NAG waste rock stockpile (Figure 6.10-6). However, broadly speaking, accessible routes to provide movement through and across the larger region at the LAA and RAA level still exist for wildlife and are un-impacted by the development of the Project.

Mitigation measures such as bird awareness and best management practices will be used. Best management practices include the avoidance of clearing and grubbing during the breeding season for migratory birds where practical (beginning of April to end of August for migratory birds; ECCC 2015).

Disturbances (e.g., wildlife vehicle collisions, light etc.) have the potential to pose a greater impact on priority bird species in comparison to non-priority specific bird species. This can be attributed to the rarity of priority bird species.

6.13.10 Proposed Compliance and Effects Monitoring Programs

Monitoring for specific priority species will be completed to verify the accuracy of the predicted environmental effects and the effectiveness of the mitigation measures outlined in Section 6.13.8. Preliminary monitoring programs have been prepared and will be established and adapted through the permitting process, as well as public and Mi'kmaw engagement. The following plans have been prepared or will be developed as part of the Project's commitments to monitoring and mitigating adverse effects to priority species:

- draft Mine Water Management Plan (Appendix P.4), describes surface water management mitigation measures and monitoring including sediment and erosion. Surface Water Monitoring Program is included in this Management Plan and may be updated based on regulatory review during the permitting phase (i.e., before submission of the Industrial Approval application);
- Fugitive Dust Control Plan (Appendix C.3);
- Preliminary Wetland Monitoring Program (Section 6.8.10);
- Preliminary Wetland Compensation Plan (Appendix H.3);
- draft Wildlife Mitigation and Monitoring Plan (Appendix P.7), including a specific Mainland Moose Management Plan for submission of the Industrial Approval submission for the Project;
- draft Lichen Mitigation and Monitoring Plan (Appendix P.6);
- draft Landbird SAR Mitigation and Monitoring Plan (included as Appendix A of the draft Wildlife Mitigation and Monitoring Plan [Appendix P.7]); and
- Conceptual Aquatic Effects Monitoring Program (AEMP) to be developed as part of the permitting process (i.e., included as part of the Industrial Approval application).

The monitoring of priority fish species will be captured under the conceptual AEMP, as well as general fish monitoring within the Surface Water Monitoring Plan. The AEMP is planned to be a comprehensive monitoring program designed to detect changes in the aquatic environment that may be mine-related. The AEMP includes study areas (watercourses and waterbodies) anticipated to be potentially influenced by predicted Project-related activities. The program will also include reference areas outside of the immediate zone of influence of the mine within the same or nearby watersheds. Monitoring components broadly include surface water quality and quantity, sediment quality, and fish and fish habitat.

The draft Wildlife Mitigation and Monitoring Plan has been developed to describe mitigation measures including protocols to minimize interactions between wildlife and Project activities. This Plan includes but is not limited to the following:

- Breeding birds and nesting protocols during construction and operations;
- Preliminary Landbird SAR Mitigation and Monitoring Plan, developed to address IR2 CEAA-2-24 (Appendix A of Appendix P.7); and
- Mainland Moose Monitoring and Management – will includes commitment for additional baseline data collection as well as monitoring potential for additional monitoring during construction and operations.

The draft Wildlife Management Plan will be finalized during the permitting process (i.e., final submitted as part of the Industrial Approval application) and will address regulatory, pubic and Mi'kmaq comments.

A draft Lichen Mitigation and Monitoring Plan has been prepared, as per IR2 CEAA-2-26, to evaluate the predicted Project related effects on lichen SAR and the success of the proposed translocation mitigations. The monitoring of vascular plants is encompassed within the Wetland Monitoring Plan may include priority vascular and non-vascular flora.

AMNS will look to support research opportunities to help inform priority species management and their protection. These initiatives may be incorporated into the above listed mitigation and monitoring plans.

6.14 Mi'kmaq of Nova Scotia

6.14.1 Introduction

6.14.1.1 Summary of Mi'kmaq of Nova Scotia Before the Updates

The Millbrook First Nation Traditional Land and Resource Use Study (TLRUS) was shared with AMNS just prior to submission of the Round 1, Information Request and revised EIS in February 2019 (AMNS 2019). As a result, detailed analysis of this TRLUS conclusions was not included in this 2019 submission package. The analysis of Project impacts and recommended mitigation measures was broad in nature.

6.14.1.2 Summary of Updates to Mi'kmaq of Nova Scotia

The EIS has been updated to reflect specific information provided by Millbrook First Nation regarding traditional land use and information received through on-going engagement efforts with the Mi'kmaq of Nova Scotia. Proposed mitigation measures have been updated to reflect changes in the Project Description (Section 2) and based on traditional land use within and surrounding the Project Area (PA). The TLRUS has been shared under confidential cover and as a result of this confidential arrangement with Millbrook First Nation, the TLRUS is not appended to this Updated EIS and information relating to Millbrook traditional land use has only been provided in a general format and not documented on supporting figures.

Residual impacts and significance thresholds have been refined. The human health risk assessment (HHRA) has been updated (Round 2, Information Request [IR2] response CEAA 2-38 and included in Appendix C.2) along with the visual zone of influence (IR2 response CEAA 2-01 and included in Appendix M.2).

Table 6.14-1: Updated Subsections from the 2019 Revised Environmental Impact Statement - Mi'kmaq of Nova Scotia

2019 Revised EIS Submission (February 28, 2019)	Updated in 2021	Corresponding 2021 EIS Update Section Number	Reason for Update
-	-	6.14.1 Introduction	• New
6.14.1 Rationale for Valued Component Selection	No	6.14.2 Rationale for Valued Component Selection	• N/A
6.14.2 Baseline Program Methodology	Yes	6.14.3 Baseline Program Methodology	• Minimal changes- updated to reflect continued Mi'kmaq engagement efforts since 2019.
6.14.3 Baseline Conditions	Yes	6.14.4 Baseline Conditions	• CEAA 2-54 baseline Mi'kmaq fisheries information detailed from TLRUS. Updated data available for each Mi'kmaq community provided including information on sub-populations within each community as is available. Additional descriptions of baseline conditions described from TLRUS.
6.14.4 Consideration of Consultation and Engagement Results	Yes	6.14.5 Consideration of Engagement Results	• Minimal changes- updated to reflect continued Mi'kmaq engagement efforts since 2019.
6.14.5 Effects Assessment Methodology – **Boundaries**	No	6.14.6 Effects Assessment Methodology – **Boundaries**	• N/A

Table 6.14-1: Updated Subsections from the 2019 Revised Environmental Impact Statement - Mi'kmaq of Nova Scotia (continued)

2019 Revised EIS Submission (February 28, 2019)	Updated in 2021	Corresponding 2021 EIS Update Section Number	Reason for Update
6.14.5 Effects Assessment Methodology – **Thresholds for Determination of Significance**	Yes	6.14.6 Effects Assessment Methodology – **Thresholds for Determination of Significance**	• Magnitude thresholds updated (CEAA 2-02 and CEAA 2-50, CEAA 2-53).
6.14.6 Project Activities and Mi'kmaq of Nova Scotia Interactions and Effects	Yes	6.14.7 Project Activities/Interaction with the Mi'kmaq of Nova Scotia	• CEAA 2-01 and 2-53 and updated to reflect continued Mi'kmaq engagement efforts and specific information relating to traditional use shared by Millbrook First Nation. HHRA also updated (CEAA 2-38).
6.14.7 Preferred Alternative Haul Road	Yes	-	• The Preferred Alternative Haul Road is no longer being considered and has been removed from the Project Description and EIS.
6.14.8 Mitigation	Yes	6.14.8 Mitigation	• Updated - project description and CEAA 2-48 and CEAA 2-49.
6.14.9 Residual Effects and Significance	Yes	6.14.9 Residual Effects and Significance	• CEAA 2-53 and updated to reflect continued Mi'kmaq engagement efforts and specific information relating to traditional use shared by Millbrook First Nation.
6.14.10 Proposed Compliance and Effects Monitoring Program	No	6.14.10 Proposed Compliance and Effects Monitoring Program	• N/A

Notes: - = no update; IR2 = Round 2, Information Requests; CEAA = Canadian Environmental Assessment Agency; TLURS = Traditional Land and Resources Use Study; HHRA = Human Health Risk Assessment; EIS = environmental impact statement; N/A = Not Applicable.

6.14.2 Rationale for Valued Component Selection

Assessment of the potential for the Project to interact with and affect the Mi'kmaq of Nova Scotia is included in consideration of its socio-economic, socio-cultural, and/or traditional importance; in recognition of potential or established Indigenous and Treaty rights; and due to the nature of potential Project-Valued Component (VC) interactions. The Impact Assessment Agency of Canada (formerly Canadian Environmental Assessment Agency [CEAA]) Environmental Impact Statement (EIS) Guidelines (CEAA 2016) for the Beaver Dam Mine Project (the Project) references *Canadian Environmental Assessment Act*, (2012) 5(1)(c) that states:

> *5 (1) For the purposes of this Act, the environmental effects that are to be taken into account in relation to an act or thing, a physical activity, a designated project or a project are*
>
> *(c) with respect to aboriginal peoples, an effect occurring in Canada of any change that may be caused to the environment on*
>
> *(i) health and socio-economic conditions,*
>
> *(ii) physical and cultural heritage,*
>
> *(iii) the current use of lands and resources for traditional purposes, or*
>
> *(iv) any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.*

As per Nova Scotia's Environmental Assessment Regulations, proponents are required to identify concerns of the Mi'kmaq of Nova Scotia regarding potential adverse effects and clarify the steps taken or proposed to be taken by Atlantic Mining NS Inc. (AMNS) to address concerns.

The Mi'kmaq in the provinces of Nova Scotia, New Brunswick, PEI, and the Gaspé Peninsula in Quebec are founded on land historically occupied by the ancestors of the Mi'kmaq. The earliest evidence of the Mi'kmaq of Nova Scotia in the Maritimes Region indicates that the ancestors of the Mi'kmaq have existed on the land for more than 11,000 years (NSOAA 2017). The Mi'kmaq generally lived in semi-permanent and permanent settlements at resource-rich locations (Appendix M.1). The lives of the Mi'kmaq of Nova Scotia, in what are today referred to as the Maritime Provinces, considered the seasonal cycles of the local vegetation, animals, and fish, living a traditional life as fishers, hunters, and gatherers throughout their territory (Appendix M.1). In the summer months, summer villages along the Eastern Shore provided fish, shellfish, fowl, and eggs, while during the colder months, the Mi'kmaq did most of their game hunting, moving inland from their summer camps (Hoffman 1955 in Appendix M.1).

The Mi'kmaq of Nova Scotia have established Aboriginal and Treaty rights, including the right to fish for a "moderate livelihood" which flows from the Peace and Friendship Treaties, and Aboriginal rights to hunt, fish and gather for food, social and ceremonial (FSC) purposes – more broadly referred to as "traditional" purposes. The EIS Guidelines (CEAA 2016) for the Project states:

> *The proponent is expected to engage with Aboriginal groups that may be affected by the project, beginning as early as possible in the project planning process. The proponent will provide Aboriginal groups with opportunities to learn about the project and its potential effects make their concerns known about the project's potential effects and discuss measures to mitigate those effects. The proponent is strongly encouraged to work with Aboriginal groups in establishing an engagement approach. The proponent will make reasonable efforts to integrate Aboriginal traditional knowledge into the assessment of environmental impacts.*

The Crown has a duty to consult with the Mi'kmaq of Nova Scotia, which is achieved in accordance with the Mi'kmaq-Canada-Nova Scotia Consultation TOR. As per Supreme Court of Canada instruction and subsequent guidance from governments, such as the Updated Guidelines for Federal Officials to Fulfill the Duty to Consult (Government of Canada, 2011) and the Proponents' Guide: Engagement with the Mi'kmaq of Nova Scotia (Province of Nova Scotia, 2012), the Crown may delegate procedural aspects of consultation to proponents. However, the duty to consult, and constitutional obligation remains with the Crown. As noted in the EIS Guidelines (CEAA 2016) the results of the AMNS's Mi'kmaq of Nova Scotia engagement program *"helps to contribute to the Crown's understanding of any potential adverse impacts of the project on potential or established Aboriginal or treaty rights, title and related interests, and the effectiveness of measures proposed to avoid or minimise those impacts"*.

For the purposes of consultation, 11 of the 13 Mi'kmaq communities are represented in consultation by the Kwilmu'k Maw-klusuaqn Negotiation Office (KMKNO), which reports to the Assembly of Nova Scotia Mi'kmaq Chiefs (ANSMC). Millbrook and Sipekne'katik First Nations represent their own communities in consultation through their elected Chiefs and Councils.

In summary, the historical presence of the Mi'kmaq in Nova Scotia, their proven Indigenous and treaty rights and title claim, the duty of the Crown to consult with the Mi'kmaq of Nova Scotia when contemplating decisions that could potentially adversely affect their rights form the rationale for the selection of the Mi'kmaq of Nova Scotia as a VC. The Mi'kmaq of Nova Scotia continue to rely on their traditional lands for cultural and economic survival. Broadly speaking, the Project has the potential to impact the Mi'kmaq's ability to access lands during the temporal life of the Project; and, to potentially alter the presence or availability of animals or plants that the Mi'kmaq rely on. Details relating to the specific nature of the potential impacts of the Project on the Mi'kmaq of Nova Scotia are described herein.

6.14.3 Baseline Program Methodology

6.14.3.1 Beaver Dam Mine Site and Haul Road Baseline Program Methodology

Five main components were used to define the baseline information for the Mi'kmaq of Nova Scotia:

- Information obtained during on-going engagement with the Mi'kmaq of Nova Scotia;
- Completion of a Mi'kmaq Ecological Knowledge Study (MEKS) (2016);
- Information shared with AMNS by Millbrook First Nation from a completed Traditional Land and Resource Use Study (TLRUS; MFC 2019) (Under Confidential Agreement);
- Publicly available Indigenous knowledge related to the Mi'kmaq of Nova Scotia; and
- Completion of archaeological screening and reconnaissance.

The on-going engagement activities and issues raised during the engagement are described in Section 4 of this EIS. The archaeological screening is described in Section 6.15 of this EIS, with findings relevant to the Mi'kmaq noted in this section. Issues raised during the Mi'kmaq engagement activities were considered in Project design and the overall development of this EIS, as described in Section 4.

6.14.3.1.1 Mi'kmaq Ecological Knowledge Study

The Confederacy of Mainland Mi'kmaq (CMM) was retained in 2009 by GHD Limited on behalf of the AMNS to complete an MEKS for the proposed Beaver Dam Mine Project at the Beaver Dam Mine Site. In 2015, CMM was retained to update the MEKS, due to changes in the Haul Road to include approximately 4 km of new construction. CMM was then retained again in 2016 to finalize the MEKS to include the revised PA and any additional information. This MEKS is attached as Appendix M.1.

The purpose of the MEKS is to foster the integration of Mi'kmaw traditional ecological knowledge into the environmental assessment process and development decisions. It also aims to identify and report any ecological concerns regarding the Project's impact on Mi'kmaw use of land, resources and special places within the Project Study Area.

The MEKS includes:

- a study of historic and current Mi'kmaq land and resource use;
- an evaluation of the potential impacts of the Project on Mi'kmaq use and occupation and constitutionally protected rights;
- an evaluation of the significance of the potential impacts of the Project on Mi'kmaq use and occupation; and
- recommendations to proponents and regulators that may include recommendations for mitigation measures, further study, or consultation with the Mi'kmaq of Nova Scotia.

The MEKS baseline information includes both historic and available current Mi'kmaq land and resource use. As defined in the MEKS, the MEKS Study Area for the evaluation of traditional practices is the Project Area with a 5-km radius while the historic use may include a wider surrounding area.

In addition, a MEKS was undertaken by Mi'kma'ki All Points Services for the Fifteen Mile Stream Gold Project at Fifteen Mile Stream, Nova Scotia. Aspects of this study, predominately the historical use sections and broad information, provides insight and relevance for the Beaver Dam Mine Project.

Figure 6.14-1 shows the Mi'kmaq LAA which is the equivalent to the MEKS Study Area. Relevant details from the MEKS relating to historical and available current Mi'kmaq land and resource use are included in this section and support the analysis of potential Project impacts to the Mi'kmaq of Nova Scotia. As the conclusions and recommendations as they are portrayed in the study are broad in nature, AMNS sought further refinement and detail of traditional and current Mi'kmaq land and resource use from CMM and other potential researchers. In 2018, Millbrook First Nation commenced a Traditional Land and Resource Use Study, described below, which supplements the conclusions of the MEKS.

6.14.3.1.2 Traditional Land and Resource Use Study

In addition to the MEKS cited above, in 2018, a Traditional Land and Resource Use Study (TLRUS; MFC 2019) was undertaken by Millbrook First Nation to document historical and current use of the Project Area and surrounding areas by the Millbrook First Nation. This document was shared with AMNS under a confidentiality agreement/confidential cover. AMNS has integrated information obtained from the TLRUS in a general format in appropriate sections of the EIS.

For the purposes of the TLRUS, a Local Study Area (LSA) and a Regional Study Area (RSA) were used. The RSA is based on the territorial boundaries of the Eskikewa'kik and captures some of the areas of greatest intensity of land and resource use by the Eskikewa'kik currently and within recent memory. The LSA includes the Beaver Dam Mine Site, Haul Road and the Touquoy Mine Site, plus a 5 km buffer. This TLRUS LSA is the same as the defined local assessment area (LAA) for the Mi'kmaq of Nova Scotia in this EIS (Section 6.14.6.1.1).

Direct engagement with the Mi'kmaq of Nova Scotia through the KMKNO, Sipekne'katik First Nation and the ANSMC for this Project in the past seven years has demonstrated that there is general agreement that Millbrook First Nation, with the Beaver Lake and Sheet Harbour Indian Reserves (IRS) in close proximity to the Project, are the Mi'kmaq community that will be most affected by the Project. Millbrook First Nation took the initiative to undertake the TLRUS which provides detail on historical and current use of their community in this local area that that supports the analysis of impacts, with additional valuable information also provided through the MEKS. As a result of the proximity of this community to the Project, and the data available through the TLRUS, the analysis of Project impacts is tailored to a discussion of impacts to the Millbrook First Nation specifically, acknowledging that conclusions formed relating to Project effects and mitigation measures proposed are relevant to all Mi'kmaq communities. This approach, and Project conclusions and mitigation measures have been reviewed and validated with both Millbrook First Nation, the KMKNO and the broader Mi'kmaq of Nova Scotia through direct engagement efforts.

Prepared For:

Atlantic Gold

FIGURE 6.14-1

Beaver Dam Mine Project

Spatial Boundaries: Mi'kmaq of Nova Scotia

Beaver Dam Mine Site

Touquoy Mine Site

Haul Road

Project Area

Mi'kmaq Local Assessment Area

Mi'kmaq Regional Assessment Area



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 5 10 20 km

1:740,000 Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed By: XX

Date: 2021-02-28

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

McCallum Environmental Ltd.

Document Name: BD_EIS_Figure6-14-XSpatialBound

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6.14.3.2 Touquoy Baseline Program Methodology

Four main components were used to define the baseline information for the Mi'kmaq of Nova Scotia:

- Information obtained during ongoing engagement with the Mi'kmaq of Nova Scotia since 2005;
- Completion of a Mi'kmaq Ecological Knowledge Study (MEKS) for the Touquoy Golf Project (CRA 2007a);
- Publicly-available Indigenous knowledge related to the Mi'kmaq of Nova Scotia;
- Information shared with AMNS by Millbrook First Nation from a completed Traditional Land and Resource Use Study (TLRUS; MFC 2019); and,
- Completion of archaeological screening and reconnaissance at the Touquoy Mine Site.

The MEKS was completed for the Touquoy Gold Project in December 2005 [prior to the development of the Mi'kmaq of Nova Scotia's MEKS Protocol (ANSMC 2007)]. Mi'kmaq involvement and the results of the MEKS for Touquoy Gold Project were documented in the EARD for this project that can be found on the NSE Environmental Assessment website. (http://novascotia.ca/nse/ea/MooseRiver.asp)

6.14.4 Baseline Conditions

6.14.4.1 Regional Baseline Conditions and General Information Relating to Mi'kmaq Communities

There are 13 Mi'kmaq communities in Nova Scotia, with two First Nation (Mi'kmaq) reserves in the vicinity of the Project: Beaver Lake IR 17 (49.4 ha) is located approximately 5 km southwest from the Beaver Dam Mine Site, and Sheet Harbour IR 36 (32.7 ha) is located 20 km south of the Project. Both these reserves belong to the Millbrook First Nation which is located in Truro, Nova Scotia, 54 km northwest of the Beaver Dam Mine Site. The 2017 Census reports 21 and 25 Mi'kmaw residents at Beaver Lake and Sheet Harbour, respectively (Statistics Canada 2017, 2017a).

- Beaver Lake: established in 1867 and approximately 49.4 ha in size is situated along Hwy 224. The estimated population on reserve is 21 with a total of five homes and four small cottages/camps.
- Sheet Harbour: set aside under Millbrook administration in 1960 and approximately 32.7 ha along Hwy 7, the estimated population on reserve is 25 with a total of nine homes, two trailers, a community hall and a convenience/gas bar.

The Sipekne'katik First Nation, located in Indian Brook, Nova Scotia, is located approximately 61 km west of the Project. The Pictou Landing First Nation (PLFN), located north of the town of New Glasgow, is located 66 km north of the Project.

Mi'kmaq rights are communal rights and therefore shared amongst all members of the Mi'kmaq Nation in Nova Scotia. Community profiles of the 13 Mi'kmaw First Nations in Nova Scotia have been included in Table 6.14-2 (Stantec 2018c, CBU 2020).

The locations of First Nations reserve lands in Nova Scotia are also depicted below on Figure 6.14-2.

Figure 6.14-2: First nations Reserve Lands in Nova Scotia

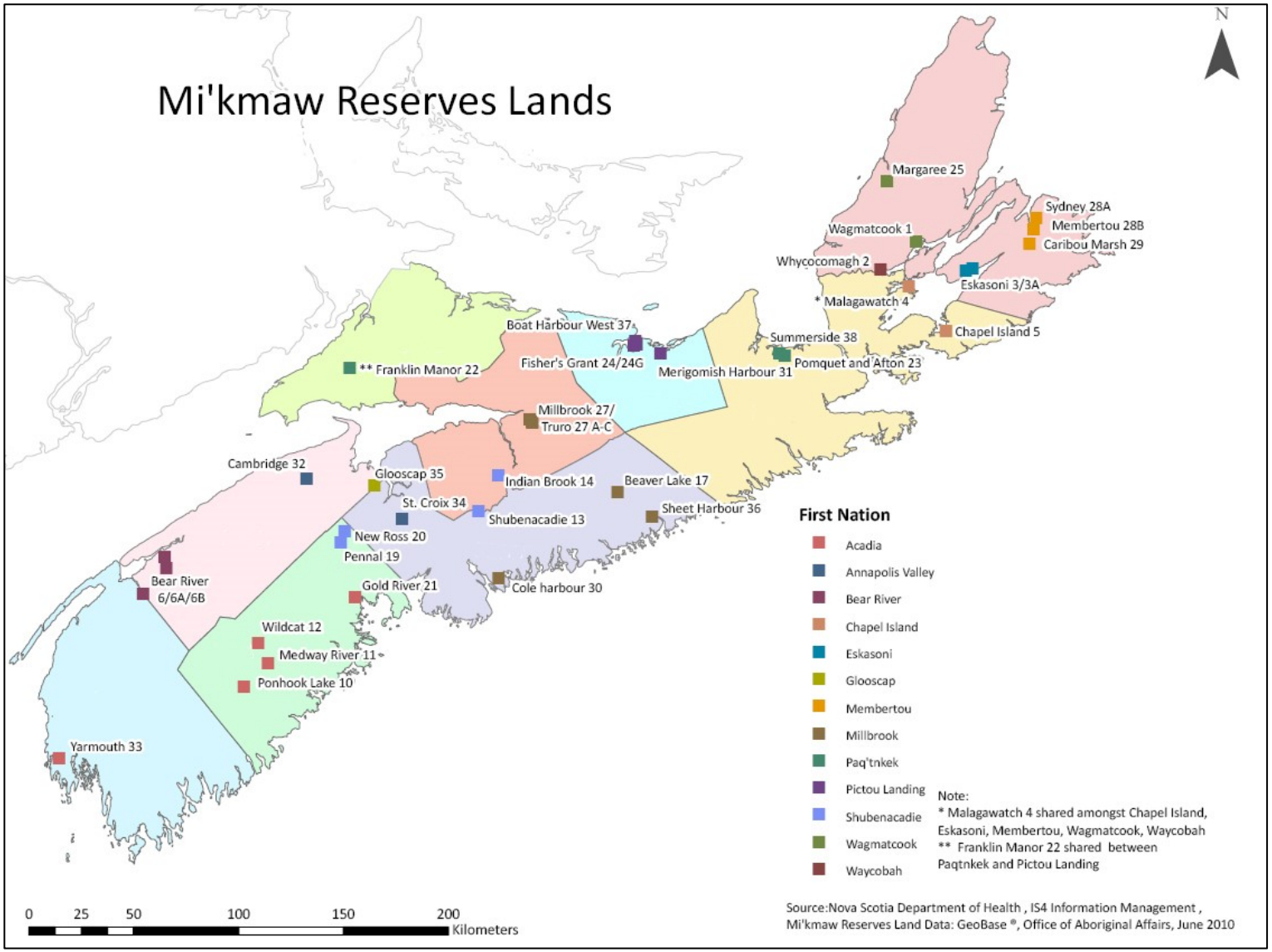


Table 6.14-2: Community profiles of the 13 Mi'kmaw First Nations in Nova Scotia

Mi'kmaw First Nation	Description
Acadia First Nation	
Location	Acadia First Nation in southwestern Nova Scotia is comprised of five reserves, in five counties from Yarmouth to Halifax.
Reserves	Gold River IR 21; Medway River IR 11; Ponhook Lake IR 10; Wildcat IR 12; Yarmouth IR 33
General Overview	Acadia First Nation encompasses five reserves: Yarmouth 33 (3.2 km east of Yarmouth with an area of 27.7 ha), Ponhook Lake 10 (115.2 km southwest of Halifax with an area of 101.8 ha), Medway River 11 (108.8 km southwest of Halifax with an area of 4.7 ha), Wildcat 12 (11 km southwest of Halifax with an area of 465.4 ha) and Gold River 21 (60.8 km west of Halifax with an area of 270.2 ha) (INAC undated, as citied in Stantec 2018c). Acadia First Nation also has separate land holdings in Gardner's Mill and Hammonds Plains. Acadia First Nation is represented by the ANSMC. According to 2017 census data, the registered population was 1,519 (approx. 230 on and 1,289 off reserve). As of February 2020 the total population was 1,664: Registered Males on Own Reserve – 112 Registered Females on Own Reserve – 127 Registered Males on Other Reserves – 2 Registered Females on Other Reserves – 0 Registered Males on No Band Crown Land – 1 Registered Females on No Band Crown Land – 2 Registered Males Living Off-Reserve – 697 Registered Females Living Off-Reserve – 723 (CBU, 2020) No data was available related to age of population.
Health and Socio-economic Conditions	The availability of infrastructure within each community varies, however Acadia First Nation has experienced infrastructure growth over the past decade, including the development of housing and roads (Acadia First Nation undated, as citied in Stantec 2018c). An after-school program exists within Yarmouth for children ages 5-12 attending elementary school. Health centers are in Yarmouth and Gold River. The Yarmouth Health Centre includes a dentist, Victorian Order of Nurses (VON), clinic nursing, foot care clinics and wellness and health promotion clinics (Acadia First Nation undated, as citied in Stantec 2018c). The Gold River Health Centre provides a VON, clinic nursing, wellness and health-promotion clinics, afterschool program and parent and tot groups (Acadia First Nation undated, as citied in Stantec 2018c). In Wildcat, a VON is available once a month (Acadia First Nation undated, as citied in Stantec 2018c). Recent economic developments for the Nation include administrative buildings, gaming facilities, and offices in Halifax and Milton to serve the off-reserve population.
Physical and Cultural Heritage (including archaeological, paleontological, historical or architectural sites)	The Acadia First Nation were once based in what is today's Queen's County with artifacts found along the Mersey River (KMKNO undated, as citied in Stantec 2018c). Proposed PA does not overlap with any known physical and cultural heritage sites related specifically to Acadia First Nation.
Historical and Current Use of Lands and Waters	All Mi'kmaq in Nova Scotia would have a right to trap, hunt and harvest fish, animals and plants in the PA, as part of their Aboriginal and Treaty rights to hunt, fish, and gather. In particular, Mi'kmaq community members likely use the area within and surrounding the PA to hunt deer, bear, porcupine and foul; trap rabbits, fox and other small fur-bearing animals; fish for trout and other freshwater species; gather berries and plants for food and medicinal purposes; harvest plants, birchbark and fallen wood for handicrafts and cultural items. Mi'kmaq families also enjoy camps in the area for recreational purposes. All Nova Scotia Mi'kmaq communities hold FSC and commercial communal fishing licenses to harvest a variety of marine and freshwater species in tidal and non-tidal waters of Nova Scotia. Specific details and information relating to how subpopulations within a Mi'kmaq community (women, youth, elders, families) engage in traditional practices, other than the general information provided above, has not been shared with AMNS through direct engagement and the MEKS, but AMNS understands additional information may be available during the EIS review process from Mi'kmaq communities, and will continue to work with communities to integrate that information into project planning.
Asserted or Established Aboriginal and / or Treaty Rights	The Mi'kmaq of Nova Scotia have established Aboriginal and Treaty rights. This includes traditional rights to hunt, gather and fish, as well as treaty-protected rights to hunt and gather, and to fish for a "moderate livelihood". Those activities are related to sustenance, cultural and socio-economic practice.
Annapolis Valley First Nation	
Location	Annapolis Valley First Nation is comprised of two reserves within Kings County in southwestern Nova Scotia.
General Overview	Annapolis Valley First Nation encompasses two reserve lands: Annapolis Valley (Cambridge) (88 km northwest of Halifax with an area of 59 ha) and St. Croix 34 (46.6 km northwest of Halifax with an area of 126.2 ha) (INAC undated, as citied in Stantec 2018c). Annapolis Valley First Nation is represented by the ANSMC. According to 2017 census data, the registered population was 290 (approx. 117 on and 173 off reserve). As of February 2020, the population was 302: Registered Males on Own Reserve – 68 Registered Females on Own Reserve – 55 Registered Males Living Off-Reserve – 73 Registered Females Living Off-Reserve – 106 (CBU, 2020) No data was available related to age of population.
Health and Socio-economic Conditions	Established in 1998, the Three Wishes Learning Centre provides a nursery school program, after school program, and culture programs (Annapolis Valley First Nation undated). The Annapolis Valley First Nation Health Centre has a registered community health nurse, access to prevention and weight control programs, foot care clinics, prenatal programs, massage therapy, physical activity programs, drug and alcohol abuse prevention, suicide prevention, injury / illness prevention and health and wellness promotion (Annapolis Valley First Nation undated). A dental hygienist is available twice a month at the health center. Annapolis Valley First Nation's economic initiatives include Annapolis Valley First Nation Gaming, Annapolis Valley First Nation Smoke Shop, and Annapolis Valley First Nation Gas Bar (Annapolis Valley First Nation undated, as citied in Stantec 2018c).

Table 6.14-2: Community profiles of the 13 Mi'kmaw First Nations in Nova Scotia (continued)

Mi'kmaw First Nation	Description
Physical and Cultural Heritage (including archaeological, paleontological, historical or architectural sites)	There is a long history of Mi'kmaq presence in Annapolis Royal and the surrounding areas; archeologists have identified several settlement patterns (Statoil 2017, as citied in Stantec 2018c). The Mi'kmaq lived in Annapolis Valley when the Europeans arrived in the area, with lifestyles heavily influenced by the land and ecosystems and a strong tradition of innovation connected to the homelands. Proposed PA does not overlap with any known physical and cultural heritage sites related specifically to Annapolis First Nation.
Historical and Current Use of Lands and Waters	All Mi'kmaq in Nova Scotia would have a right to trap, hunt and harvest fish, animals and plants in the PA, as part of their Aboriginal and Treaty rights to hunt, fish, and gather. In particular, Mi'kmaq community members use the area within and surrounding the PA to hunt deer, bear, porcupine and foul; trap rabbits, fox and other small fur-bearing animals; fish for trout and other freshwater species; gather berries and plants for food and medicinal purposes; harvest plants, birchbark and fallen wood for handicrafts and cultural items. Mi'kmaq families also enjoy camps in the area for recreational purposes. All Nova Scotia Mi'kmaq communities hold FSC and commercial communal fishing licenses to harvest a variety of marine and freshwater species in tidal and non-tidal waters of Nova Scotia. Specific details and information relating to how subpopulations within a Mi'kmaq community (women, youth, elders, families) engage in traditional practices, other than the general information provided above, has not been shared with AMNS through direct engagement and the MEKS, but AMNS understands additional information may be available during the EIS review process from Mi'kmaq communities, and will continue to work with communities to integrate that information into project planning.
Asserted or Established Aboriginal and / or Treaty Rights	The Mi'kmaq of Nova Scotia have established Aboriginal and Treaty rights. This includes traditional rights to hunt, gather and fish, as well as treaty-protected rights to hunt and gather, and to fish for a "moderate livelihood". Those activities are related to sustenance, cultural and socio-economic practice.
Bear River First Nation	
Location	Bear River First Nation is comprised of three reserves, within the Annapolis Valley between the towns of Annapolis Royal and Digby (KMKNO undated).
General Overview	Bear River First Nation encompasses three reserve lands: Bear River 6 (17.7 km southeast of Digby with an area of 633.8 ha), Bear River 6A (9.6 km southeast of Annapolis Valley with an area of 31.2 ha), and Bear River 6B (6.4 km southeast of Annapolis Valley with an area of 24.3 ha) (INAC undated). Bear River First Nation is represented by the ANSMC. According to 2017 census data, the registered population was 338 (approx. 110 on and 228 off reserve). As of February 2020, the population was 357: Registered Males on Own Reserve – 50 Registered Females on Own Reserve – 63 Registered Males on Other Reserves – 0 Registered Females on Other Reserves – 1 Registered Males Living Off-Reserve – 119 registered Females Living Off-Reserve – 124 (CBU, 2020) No data was available related to age of population.
Health and Socio-economic Conditions	The majority of community members live on the Bear River 6, also known as L'sitkuk Mainland (Mainland Mi'kmaq Development Inc. 2016, as citied in Stantec 2018c). In Bear River, a learning center provides space for educational activities. There is a health center in Bear River, offering healing services and workshops (Bear River First Nation 2016, as citied in Stantec 2018c). A doctor visits the health center monthly (Bear River First Nation 2016, as citied in Stantec 2018c). Recently, an RCMP satellite office opened in the community. Bear River First Nation enterprises include a Treaty Gas bar, L'sitkuk Gas Bar Limited, and a seasonal Heritage and Cultural Centre.
Physical and Cultural Heritage (including archaeological, paleontological, historical or architectural sites)	There is a long history of Bear River Mi'kmaq presence in Digby and Annapolis Counties (Mainland Mi'kmaq Development Inc. 2016, as citied in Stantec 2018c). As early as 1612, the Mi'kmaq have been recorded as harvesting resources in the Annapolis River and French Bay (Bay of Fundy) (Mainland Mi'kmaq Development Inc. 2016, as citied in Stantec 2018c). Traditionally, during the fall and winter, families would travel to hunt big game such as moose, deer, caribou and bear, and smaller game such as beaver, bird species, and rabbit. In the spring, families typically settled along the coast and in the summer, they harvested shellfish such as clam, mussels, and scallops as well as several fish species including cod, salmon, trout, eel, herring, and bass (Mainland Mi'kmaq Development Inc. 2016, as citied in Stantec 2018c). Seals, walrus, porpoises and berries and plants were also harvested. Bear River First Nation was traditionally, and continues to be, well known for their artwork, specializing in embroidering porcupine quills on birchbark, leatherwork, and basketry (Mainland Mi'kmaq Development Inc. 2016, as citied in Stantec 2018c). Proposed PA does not overlap with any known physical and cultural heritage sites related specifically to Bear River First Nation.
Historical and Current Use of Lands and Waters	All Mi'kmaq in Nova Scotia would have a right to trap, hunt and harvest fish, animals and plants in the PA, as part of their Aboriginal and Treaty rights to hunt, fish, and gather. In particular Mi'kmaq community members use the area within and surrounding the PA to hunt deer, bear, porcupine and foul; trap rabbits, fox and other small fur-bearing animals; fish for trout and other freshwater species; gather berries and plants for food and medicinal purposes; harvest plants, birchbark and fallen wood for handicrafts and cultural items. Mi'kmaq families also enjoy camps in the area for recreational purposes. All Nova Scotia Mi'kmaq communities hold FSC and commercial communal fishing licenses to harvest a variety of marine and freshwater species in tidal and non-tidal waters of Nova Scotia. Specific details and information relating to how subpopulations within a Mi'kmaq community (women, youth, elders, families) engage in traditional practices, other than the general information provided above, has not been shared with AMNS through direct engagement and the MEKS, but AMNS understands additional information may be available during the EIS review process from Mi'kmaq communities, and will continue to work with communities to integrate that information into project planning.
Asserted or Established Aboriginal and / or Treaty Rights	The Mi'kmaq of Nova Scotia have established Aboriginal and Treaty rights. This includes traditional rights to hunt, gather and fish, as well as treaty-protected rights to hunt and gather, and to fish for a "moderate livelihood". Those activities are related to sustenance, cultural and socio-economic practice.

Table 6.14-2: Community profiles of the 13 Mi'kmaw First Nations in Nova Scotia (continued)

Mi'kmaw First Nation	Description
Eskasoni First Nation	
Location	Eskasoni First Nation is comprised of three reserves, along the shore of the Bras d'Or Lakes.
General Overview	Eskasoni First Nation encompasses three reserves: Eskasoni 3 (40 km southwest of Sydney with an area of 3,504.6 ha), Eskasoni 3A (40 km southwest of Sydney with an area of 28.5 ha), and Malagawatch 4 (62 km southwest of Sydney with an area of 661.3 ha) (INAC undated, as citied in Stantec 2018c). Eskasoni First Nation is the largest Indigenous community in Atlantic Canada (KMKNO undated, as citied in Stantec 2018c). According to 2017 census data, the registered population was 4,443 (approx. 3,780 on and 631 off reserve). As of February 2020, the population was 4,642: Registered Males on Own Reserve – 1,953 Registered Females on Own Reserve – 1,998 Registered Males on Other Reserves – 16 Registered Females on Other Reserves – 18 Registered Males on Other Band Crown Land – 1 Registered Females on Other Band Crown Land – 0 Registered Males Living Off-Reserve – 303 Registered Females Living Off-Reserve – 353 (CBU, 2020) No data was available related to age of population.
Health and Socio-economic Conditions	Eskasoni First Nation has community-owned infrastructure such as a community-operated school, accommodating students from kindergarten to grade 12, a supermarket, a community rink and a cultural center. The Eskasoni Community Health Centre provides a wide range of primary care services as well as several health programs and services such as blood collection, community health nursing, maternal child health, medical transportation, and diabetic services (Eskasoni Community Health Centre 2004, as citied in Stantec 2018c). The Eskasoni Pharmacy is in the Health Centre. The pharmacy provides information to the community on drug use, Native Alcohol and Drug Addiction Counseling Association, and Mi'kmaq Family and Children's Services. The Health Centre is staffed with a nurse, medical transcriptionist, and several physicians (Eskasoni Community Health Centre 2004, as citied in Stantec 2018c). Community Health Representatives are also on-site and act as a liaison between health care providers and community members, assisting with translation and administration of health care services and programs (Eskasoni Community Health Centre 2004, as citied in Stantec 2018c). Within the community there is also a fire department, with four career firefighters and 20 volunteer firefighters (Eskasoni First Nation undated, as citied in Stantec 2018c). As described in more detail below, Eskasoni First Nation hold several commercial communal licenses for a variety of fish and marine species. The community operates Crane Cove Seafoods. Crane Cove Seafoods owns 13 vessels ranging from 30 – 65 feet and employs over 100 community members, with an additional 35 community members employed at the associated processing plant (Eskasoni First Nation undated, as citied in Stantec 2018c). Fish harvesting takes place throughout Nova Scotia from Ingonish to Yarmouth.
Physical and Cultural Heritage (including archaeological, paleontological, historical or architectural sites)	Chartered in 1832, Eskasoni First Nation became an official reserve in 1834. From 1845 to 1851, much of Cape Breton suffered from famine (MGS 2012, as citied in Stantec 2018c). During this time, the Mi'kmaq transitioned into a more stationary lifestyle and found opportunities to provide labour, typically traveling to Sydney to work and sell wares (MGS 2012, as citied in Stantec 2018c). The population of Eskasoni grew in the 1940s as the Department of Indian Affairs implemented a new policy to centralize Indigenous peoples (Eskasoni First Nation undated, as citied in Stantec 2018c). In the 1950s, Eskasoni First Nation began controlling their own affairs and a Band Council was established in 1958 (Eskasoni First Nation undated, as citied in Stantec 2018c). Proposed PA does not overlap with any known physical and cultural heritage sites related specifically to Eskasoni First Nation.
Historical and Current Use of Lands and Waters	All Mi'kmaq in Nova Scotia would have a right to trap, hunt and harvest fish, animals and plants in the PA, as part of their Aboriginal and Treaty rights to hunt, fish, and gather. In particular, Mi'kmaq community members use the area within and surrounding the PA to hunt deer, bear, porcupine and foul; trap rabbits, fox and other small fur-bearing animals; fish for trout and other freshwater species; gather berries and plants for food and medicinal purposes; harvest plants, birchbark and fallen wood for handicrafts and cultural items. Mi'kmaq families also enjoy camps in the area for recreational purposes. All Nova Scotia Mi'kmaq communities hold FSC and commercial communal fishing licenses to harvest a variety of marine and freshwater species in tidal and non-tidal waters of Nova Scotia. Specific details and information relating to how subpopulations within a Mi'kmaq community (women, youth, elders, families) engage in traditional practices, other than the general information provided above, has not been shared with AMNS through direct engagement and the MEKS, but AMNS understands additional information may be available during the EIS review process from Mi'kmaq communities, and will continue to work with communities to integrate that information into project planning.
Asserted or Established Aboriginal and / or Treaty Rights	The Mi'kmaq of Nova Scotia have established Aboriginal and Treaty rights. This includes traditional rights to hunt, gather and fish, as well as treaty-protected rights to hunt and gather, and to fish for a "moderate livelihood". Those activities are related to sustenance, cultural and socio-economic practice.
Glooscap First Nation	
Location	Glooscap First Nation is comprised of one reserve (Glooscap 35), northwest of Halifax.
General Overview	Glooscap 35 is 68.8 km northwest of Halifax with an area of 171.1 ha (INAC undated). Glooscap First Nation is represented by the ANSMC. According to 2017 census data, the registered population was 374 (approx. 94 on and 280 off reserve). As of February 2020, the population was 393: Registered Males on Own Reserve – 32 Registered Females on Own Reserve – 65 Registered Females on Other Reserves – 1 Registered Males Living Off-Reserve – 143 Registered Females Living Off-Reserve – 152 (CBU, 2020) No data was available related to age of population.
Health and Socio-economic Conditions	Glooscap First Nation does not have any schools within the community; however, the Nation has an appointed education director who oversees primary and secondary education for on-reserve members (Glooscap First Nation 2018, as citied in Stantec 2018c). There is a Health Centre in the community, offering health and healing services that focus on six components: education, health promotion, culture and language, nutrition, social support, and parent / family involvement (Glooscap First Nation 2018, as citied in Stantec 2018c). Established in 2014, Glooscap Ventures was created as the economic department for the community and is owned and operated by Glooscap First Nation. Glooscap Ventures manages on-reserve businesses including the variety store / gas bar, gaming facility, and commercial fisheries. Currently, Glooscap Ventures is developing a 27-acre parcel of land, Glooscap Landing, along Highway 101 for retail purposes (Glooscap First Nation 2018, as citied in Stantec 2018c). Other initiatives include the expansion of the commercial fisheries and pursuing opportunities in renewable energy (Glooscap First Nation 2018, as citied in Stantec 2018c).

Table 6.14-2: Community profiles of the 13 Mi'kmaw First Nations in Nova Scotia (continued)

Mi'kmaw First Nation	Description
Physical and Cultural Heritage (including archaeological, paleontological, historical or architectural sites)	Established in 1984, Glooscap First Nation became the thirteenth Mi'kmaq band in NS (KMKNO undated). Originally, Glooscap First Nation was created following the separation of two communities, Annapolis Valley and Glooscap, that were 30 km apart (KMKNO undated, as citied in Stantec 2018c). Glooscap First Nation was originally known as Horton but was renamed in 2001 (KMKNO undated, as citied in Stantec 2018c). Proposed PA does not overlap with any known physical and cultural heritage sites related specifically to Glooscap First Nation.
Historical and Current Use of Lands and Waters	All Mi'kmaq in Nova Scotia would have a right to trap, hunt and harvest fish, animals and plants in the PA, as part of their Aboriginal and Treaty rights to hunt, fish, and gather. In particular, Mi'kmaq community members use the area within and surrounding the PA to hunt deer, bear, porcupine and foul; trap rabbits, fox and other small fur-bearing animals; fish for trout and other freshwater species; gather berries and plants for food and medicinal purposes; harvest plants, birchbark and fallen wood for handicrafts and cultural items. Mi'kmaq families also enjoy camps in the area for recreational purposes. All Nova Scotia Mi'kmaq communities hold FSC and commercial communal fishing licenses to harvest a variety of marine and freshwater species in tidal and non-tidal waters of Nova Scotia. Specific details and information relating to how subpopulations within a Mi'kmaq community (women, youth, elders, families) engage in traditional practices, other than the general information provided above, has not been shared with AMNS through direct engagement and the MEKS, but AMNS understands additional information may be available during the EIS review process from Mi'kmaq communities, and will continue to work with communities to integrate that information into project planning.
Asserted or Established Aboriginal and / or Treaty Rights	The Mi'kmaq of Nova Scotia have established Aboriginal and Treaty rights. This includes traditional rights to hunt, gather and fish, as well as treaty-protected rights to hunt and gather, and to fish for a "moderate livelihood". Those activities are related to sustenance, cultural and socio-economic practice.
Membertou First Nation	
Location	Membertou First Nation is comprised of four reserves, in northeastern and southwestern Sydney.
General Overview	Membertou First Nation encompasses four reserves: Membertou 28B (1.6 km south of Sydney with an area of 100.1 ha), Sydney 28A (1.6 km northeast of Sydney with an area of 5.1 ha), Caribou Marsh 29 (8 km southwest of Sydney with an area of 219 ha) and Malagawatch 4 (62 km southwest of Sydney with an area of 661.3 ha) (INAC undated, as citied in Stantec 2018c). Membertou First Nation is represented by the ANSMC. According to 2017 census data, the registered population was 1,500 (approx. 904 on and 552 off reserve). As of February 2020, the population was 1,573: Registered Males on Own Reserve – 482 Registered Females on Own Reserve – 454 Registered Males on Other Reserves – 19 Registered Females on Other Reserves – 25 Registered Males on No Band Crown Land – 1 Registered Females on No Band Crown Land – 2 Registered Males Living Off-Reserve – 299 Registered Females Living Off-Reserve – 291 (CBU, 2020) No data was available related to age of population.
Health and Socio-economic Conditions	Membertou First Nation has one school, Maupeltuewey Kina'matno'kuom, accommodating students from kindergarten to grade 6 (Membertou First Nation undated). A local Cape Breton Regional Police detachment is in Membertou. The Membertou Wellness Centre delivers programs to the community that address prominent health issues such as smoking cessation, crisis prevention / intervention, addictions services, and home and community care (Membertou First Nation undated, as citied in Stantec 2018c). The Membertou Wellness Centre also provides a family practice medical clinic with a doctor available Monday through Friday (Membertou First Nation undated, as citied in Stantec 2018c). Membertou First Nation has made considerable investments in infrastructure and providing services to community members over the last decade such as a gas station, church, community center, band office and boxing gym. Membertou First Nation also recently built the Membertou Sports and Wellness Centre, with two ice surfaces, an indoor walking track, a YMCA gym and multi-purpose meeting and event rooms (Membertou Sports and Wellness Centre undated, as citied in Stantec 2018c). Within Membertou, there is a business park including the Membertou Trade and Convention Centre, Membertou Heritage Park and Petroglyphs Gift Shop, a hotel, Kiju's Restaurant, Membertou Entertainment Centre, and private businesses. In 2002, Membertou First Nation became the first Indigenous government in the world to be ISO-certified (CANDO 2018, as citied in Stantec 2018c). The Nation owns and operates a seafood company, First Fishermen Seafoods. The company has six fleet vessels and harvests a variety of groundfish, shellfish, tuna, and swordfish (Membertou First Nation undated, as citied in Stantec 2018c). Membertou First Nation is part of a Mi'kmaq coalition that, in Fall 2020, acquired Clearwater Seafoods. This coalition includes a business partner, Premium Brands. Clearwater is one of the largest fully integrated seafood companies in North America, and is as of Fall 2020, owned by the Mi'kmaq. The details of this commercial acquisition include Membertou and a coalition of participating Mi'kmaq communities from across Nova Scotia and Newfoundland, owning 50% of Clearwater Seafoods, and 100% of all Canadian Clearwater licenses.
Physical and Cultural Heritage (including archaeological, paleontological, historical or architectural sites)	Once known as Kings Road, Membertou was situated along the banks of Sydney Harbour. In 1926, Membertou was officially moved to its present location (Membertou First Nation undated). As an urban Indigenous community, few members relied solely on traditional hunting, fishing, and gathering to earn their living; instead, both men and women worked in various industries (Membertou First Nation undated, as citied in Stantec 2018c). Proposed PA does not overlap with any known physical and cultural heritage sites related specifically to Membertou First Nation.
Historical and Current Use of Lands and Waters	All Mi'kmaq in Nova Scotia would have a right to trap, hunt and harvest fish, animals and plants in the PA, as part of their Aboriginal and Treaty rights to hunt, fish, and gather. In particular, Mi'kmaq community members use the area within and surrounding the PA to hunt deer, bear, porcupine and foul; trap rabbits, fox and other small fur-bearing animals; fish for trout and other freshwater species; gather berries and plants for food and medicinal purposes; harvest plants, birchbark and fallen wood for handicrafts and cultural items. Mi'kmaq families also enjoy camps in the area for recreational purposes. All Nova Scotia Mi'kmaq communities hold FSC and commercial communal fishing licenses to harvest a variety of marine and freshwater species in tidal and non-tidal waters of Nova Scotia. Specific details and information relating to how subpopulations within a Mi'kmaq community (women, youth, elders, families) engage in traditional practices, other than the general information provided above, has not been shared with AMNS through direct engagement and the MEKS, but AMNS understands additional information may be available during the EIS review process from Mi'kmaq communities, and will continue to work with communities to integrate that information into project planning.
Asserted or Established Aboriginal and / or Treaty Rights	The Mi'kmaq of Nova Scotia have established Aboriginal and Treaty rights. This includes traditional rights to hunt, gather and fish, as well as treaty-protected rights to hunt and gather, and to fish for a "moderate livelihood". Those activities are related to sustenance, cultural and socio-economic practice.

Table 6.14-2: Community profiles of the 13 Mi'kmaw First Nations in Nova Scotia (continued)

Mi'kmaw First Nation	Description
Paq'tnkek Mi'kmaw Nation	
Location	Paq'tnkek Mi'kmaw Nation is comprised of three reserves, southeast of Amherst and east of Antigonish.
General Overview	Paq'tnkek Mi'kmaw Nation encompasses three reserves: Franklin Manor 22 (32 km southeast of Amherst with an area of 212.5 ha), Paq'tnkek-Niktuek 23 (24 km east of Antigonish with an area of 218.1 ha), and Welnek 38 (18 km east of Antigonish with an area of 43.4 ha) (INAC undated, as citied in Stantec 2018c). Paq'tnkek is represented by the ANSMC. According to 2017 census data, the registered population was 573 (approx. 404 on and 141 off reserve). As of February 2020, the population was 599: Registered Males on Own Reserve – 197 Registered Females on Own Reserve – 229 Registered Males on Other Reserves – 10 Registered Females on Other Reserves – 20 Registered Males Living Off-Reserve – 62 Registered Females Living Off-Reserve – 81 (CBU, 2020) No data was available related to age of population.
Health and Socio-economic Conditions	Since 1980, the Paq'tnkek Pre-School has been in operation in Afton, NS. The nearest RCMP detachment is in Antigonish. The Paq'tnkek Health Centre provides a variety of programs and services to community members, including community health promotion, education, and prevention programming (Paq'tnkek Mi'kmaw Nation 2018, as citied in Stantec 2018c). Paq'tnkek Mi'kmaw Nation has an Economic Development Department which manages all development projects within the community, including recent infrastructure development projects related to highway development and commercial opportunities. The First Nation also operates the Paq'tnkek Entertainment Centre, Gas Bar, and Smoke Shop (Paq'tnkek Mi'kmaw Nation 2018, as citied in Stantec 2018c). The First Nation owns and operates the Paq'tnkek Fisheries Enterprise, employing 20 community members. The enterprise has a fleet of five communal vessels and harvests lobster, snow crab, and herring (Paq'tnkek Mi'kmaw Nation 2018, as citied in Stantec 2018c).
Physical and Cultural Heritage (including archaeological, paleontological, historical or architectural sites)	Established in 1820, Paq'tnkek, meaning "by the bay", has been a traditional stopping point for Mi'kmaq travelling to and from Unama'ki, and a central meeting point for Chiefs across the province. Cultural and traditional practices such as spearing eel and salmon and snaring rabbits are still practiced within the community (Paq'tnkek Mi'kmaw Nation 2018, as citied in Stantec 2018c). Proposed PA does not overlap with any known physical and cultural heritage sites related specifically to Paq'tnkek First Nation.
Historical and Current Use of Lands and Waters	All Mi'kmaq in Nova Scotia would have a right to trap, hunt and harvest fish, animals and plants in the PA, as part of their Aboriginal and Treaty rights to hunt, fish, and gather. In particular, Mi'kmaq community members use the area within and surrounding the PA to hunt deer, bear, porcupine and foul; trap rabbits, fox and other small fur-bearing animals; fish for trout and other freshwater species; gather berries and plants for food and medicinal purposes; harvest plants, birchbark and fallen wood for handicrafts and cultural items. Mi'kmaq families also enjoy camps in the area for recreational purposes. All Nova Scotia Mi'kmaq communities hold FSC and commercial communal fishing licenses to harvest a variety of marine and freshwater species in tidal and non-tidal waters of Nova Scotia. Specific details and information relating to how subpopulations within a Mi'kmaq community (women, youth, elders, families) engage in traditional practices, other than the general information provided above, has not been shared with AMNS through direct engagement and the MEKS, but AMNS understands additional information may be available during the EIS review process from Mi'kmaq communities, and will continue to work with communities to integrate that information into project planning.
Asserted or Established Aboriginal and / or Treaty Right	The Mi'kmaq of Nova Scotia have established Aboriginal and Treaty rights. This includes traditional rights to hunt, gather and fish, as well as treaty-protected rights to hunt and gather, and to fish for a "moderate livelihood". Those activities are related to sustenance, cultural and socio-economic practice.
Pictou Landing First Nation	
Location	Pictou Landing First Nation is comprised of five reserves on the south shore of the Northumberland Strait in Pictou County.
General Overview	Pictou Landing First Nation encompasses five reserves: Franklin Manor 22 (32 km southeast of Amherst with an area of 212.5 ha), Fisher's Grant (10 km north of New Glasgow with an area of 142.7 ha), Boat Harbour West 37 (8 km north of New Glasgow with an area of 98.2 ha), Fisher's Grant 24G (3.2 km southeast of Pictou Landing with an area of 60.0 ha) and Merigomish Harbour 31 (12.8 km east of New Glasgow with an area of 14.2 ha) (INAC undated). Pictou Landing First Nation is represented by the ANSMC. According to 2017 census data, the registered population was 663 (approx. 483 on and 157 off reserve). As of February 2020, the population was 672: Registered Males on Own Reserve – 241 Registered Females on Own Reserve – 250 Registered Males on Other Reserves – 10 Registered Females on Other Reserves – 12 Registered Males Living Off-Reserve – 83 Registered Females Living Off-Reserve – 76 (CBU, 2020) No data was available related to age of population.
Health and Socio-economic Conditions	Pictou Landing First Nation School accommodates students from primary to grade 6. There are no police detachments or fire halls within the community. The Nation has a church, gas bar, and health center (KMKNO undated, as citied in Stantec 2018c). As described in more detail below Pictou Landing First Nation holds several commercial communal licenses for a variety of fish and marine species. The Pictou Landing First Nation fishery is the Nation's main industry, with a fleet of 12 vessels and employing approximately 100 people (full and part time) a year (KMKNO undated, as citied in Stantec 2018c).
Physical and Cultural Heritage (including archaeological, paleontological, historical or architectural sites)	Pictou Landing First Nation have lived on a seasonal basis in and around a small tidal estuary connected by a narrow channel to the Northumberland Strait (Statoil 2017, as citied in Stantec 2018c). The area provided an abundance of resources such as fish, eel, crustaceans, and shellfish as well as hunting and trapping near shore (Statoil 2017, as citied in Stantec 2018c). Proposed PA does not overlap with any known physical and cultural heritage sites related specifically to Pictou Landing First Nation.

Table 6.14-2: Community profiles of the 13 Mi'kmaw First Nations in Nova Scotia (continued)

Mi'kmaw First Nation	Description
Historical and Current Use of Lands and Waters	All Mi'kmaq in Nova Scotia would have a right to trap, hunt and harvest fish, animals and plants in the PA, as part of their Aboriginal and Treaty rights to hunt, fish, and gather. In particular, Mi'kmaq community members use the area within and surrounding the PA to hunt deer, bear, porcupine and foul; trap rabbits, fox and other small fur-bearing animals; fish for trout and other freshwater species; gather berries and plants for food and medicinal purposes; harvest plants, birchbark and fallen wood for handicrafts and cultural items. Mi'kmaq families also enjoy camps in the area for recreational purposes. All Nova Scotia Mi'kmaq communities hold FSC and commercial communal fishing licenses to harvest a variety of marine and freshwater species in tidal and non-tidal waters of Nova Scotia. Specific details and information relating to how subpopulations within a Mi'kmaq community (women, youth, elders, families) engage in traditional practices, other than the general information provided above, has not been shared with AMNS through direct engagement and the MEKS, but AMNS understands additional information may be available during the EIS review process from Mi'kmaq communities, and will continue to work with communities to integrate that information into project planning.
Asserted or Established Aboriginal and / or Treaty Rights	The Mi'kmaq of Nova Scotia have established Aboriginal and Treaty rights. This includes traditional rights to hunt, gather and fish, as well as treaty-protected rights to hunt and gather, and to fish for a "moderate livelihood". Those activities are related to sustenance, cultural and socio-economic practice.
Potlotek First Nation	
Location	Potlotek First Nation is comprised of two reserves, southwest of Sydney.
General Overview	Potlotek First Nation encompasses two reserves: Chapel Island 5 (69 km southwest of Sydney with an area of 595.5 ha) and Malagawatch 4 (62 km southwest of Sydney with an area of 661.3 ha (INAC undated, as citied in Stantec 2018c). Potlotek First Nation is represented by the ANSMC. According to 2017 census data, the registered population was 727 (approx. 552 on and 140 off reserve). As of February 2020, the population was 773: Registered Males on Own Reserve – 297 Registered Females on Own Reserve – 290 Registered Males on Other Reserves – 19 Registered Females on Other Reserves – 19 Registered Males Living Off-Reserve – 66 Registered Females Living Off-Reserve – 82 (CBU, 2020) No data was available related to age of population.
Health and Socio-economic Conditions	Within the community, there is a day care and elementary school, the Mi'kmawey School. Established in 1998, it accommodates students from primary to grade 6 (Potlotek First Nation 2016, as citied in Stantec 2018c). An RCMP building and fire hall exist within the community. The Potlotek Volunteer Fire Department has 14 active members (KMKNO undated, as citied in Stantec 2018c). A Health Centre is in the community, providing a variety of services and programs such as addiction services, maternal care, home care, advanced and diabetic foot care, healing programs and wellness programs (Potlotek First Nation 2016, as citied in Stantec 2018c). A doctor visits the Health Centre on a weekly basis (Potlotek First Nation 2016, as citied in Stantec 2018c). Additional infrastructure within the community includes the Chapel Island Community Hall / Kateri Chapel and a Youth Centre. Recently, economic developments such as the construction of a store-gas bar which includes Robins Donuts, a Rite Stop, Esso and video lottery terminals have provided employment opportunities for community members (KMKNO undated). The fisheries industry plays a dominant role in the First Nation's economy, particularly in oyster cultivation. Formed in 1995, the Apaqtukewaq Fisheries Co-op includes four members and employs seven people during peak season (May to September) (Potlotek First Nation 2016, as citied in Stantec 2018c). An oyster plant operates within the community and the Co-op operates two fishing vessels used for harvesting of lobster and snow crab (Potlotek First Nation 2016, as citied in Stantec 2018c).
Physical and Cultural Heritage (including archaeological, paleontological, historical or architectural sites)	Established in 1834, Potlotek First Nation, also known as Chapel Island, is the home of the Saint Anne's Mission where each year Mi'kmaw people gather to celebrate the Feast of Saint Anne (Potlotek First Nation 2016, as citied in Stantec 2018c). Chapel Island is considered a sacred ground to the Mi'kmaq (Potlotek First Nation 2016, as citied in Stantec 2018c). Proposed PA does not overlap with any known physical and cultural heritage sites related specifically to Potletek First Nation.
Historical and Current Use of Lands and Waters	All Mi'kmaq in Nova Scotia would have a right to trap, hunt and harvest fish, animals and plants in the PA, as part of their Aboriginal and Treaty rights to hunt, fish, and gather. In particular, Mi'kmaq community members use the area within and surrounding the PA to hunt deer, bear, porcupine and foul; trap rabbits, fox and other small fur-bearing animals; fish for trout and other freshwater species; gather berries and plants for food and medicinal purposes; harvest plants, birchbark and fallen wood for handicrafts and cultural items. Mi'kmaq families also enjoy camps in the area for recreational purposes. All Nova Scotia Mi'kmaq communities hold FSC and commercial communal fishing licenses to harvest a variety of marine and freshwater species in tidal and non-tidal waters of Nova Scotia. Specific details and information relating to how subpopulations within a Mi'kmaq community (women, youth, elders, families) engage in traditional practices, other than the general information provided above, has not been shared with AMNS through direct engagement and the MEKS, but AMNS understands additional information may be available during the EIS review process from Mi'kmaq communities, and will continue to work with communities to integrate that information into project planning.
Asserted or Established Aboriginal and / or Treaty Rights	The Mi'kmaq of Nova Scotia have established Aboriginal and Treaty rights. This includes traditional rights to hunt, gather and fish, as well as treaty-protected rights to hunt and gather, and to fish for a "moderate livelihood". Those activities are related to sustenance, cultural and socio-economic practice.
Wagmatcook First Nation	
Location	Wagmatcook First Nation is comprised of three reserves, within the Bras d'Or Lakes region of Cape Breton.

Table 6.14-2: Community profiles of the 13 Mi'kmaw First Nations in Nova Scotia (continued)

Mi'kmaw First Nation	Description
General Overview	Wagmatcook encompasses three reserves: Malagawatch 4 (62 km southwest of Sydney with an area of 661.3 ha), Margaree 25 (68.8 km northwest of Sydney with an area of 0.8 ha), and Wagmatcook 1 (51 km west of Sydney with an area of 385.0 ha) (INAC undated). Wagmatcook First Nation is represented by the ANSMC. According to 2017 census data, the registered population was 852 (approx. 626 on and 184 off reserve). As of February 2020 the population was 900: Registered Males on Own Reserve – 334 Registered Females on Own Reserve – 328 Registered Males on Other Reserves – 19 Registered Females on Other Reserves – 25 Registered Males Living Off-Reserve – 83 Registered Females Living Off-Reserve – 111 (CBU, 2020) No data was available related to age of population.
Health and Socio-economic Conditions	In 1986, Wagmatcook First Nation initiated the first Indigenous secondary school in the Atlantic Region and established the first Nova Scotia Mi'kmaq Day Care Centre (Statoil 2017, as citied in Stantec 2018c). A new elementary-secondary education school, Wamgatcookewey School, is the first kindergarten to grade 12 Mi'kmaq First Nation school in Nova Scotia (Wagmatcook First Nation 2016, as citied in Stantec 2018c). There is no police detachment within the community, but there is a fire hall. The cultural center, the Wagmatcook Enterprise and Cultural Centre, provides a variety of services to community members including an Alternate School for Youth, cultural demonstration projects, and a Fitness Centre (Wagmatcook First Nation 2016, as citied in Stantec 2018c). The cultural center also houses the TD Canada Trust Agency bank, a Canada Post office, and the Clean Wave Restaurant (Wagmatcook First Nation 2016, as citied in Stantec 2018c). The band also operates a gas bar, grocery store, wharf, and warehouse. The Wagmatcook commercial fishery has been in operation since 1990 and is communally owned by registered members of Wagmatcook First Nation (Wagmatcook First Nation 2016). The Wagmatcook Commercial Fishery employs 35 fishers and one shore-based manager (Wagmatcook First Nation 2016). It utilizes a total of eleven fishing vessels and primarily harvests groundfish, palegics, shellfish and is a producer / wholesaler of shell ice products (Wagmatcook First Nation 2016). The fishery has six Cape Islander-style lobster vessels, one groundfish vessel, two storage facilities and an ice processing facility (Wagmatcook First Nation 2016, as citied in Stantec 2018c). The fishery generates the highest projected returns to the community (Wagmatcook First Nation 2016, as citied in Stantec 2018c).
Physical and Cultural Heritage (including archaeological, paleontological, historical or architectural sites)	Proposed PA does not overlap with any known physical and cultural heritage sites related specifically to Wagmatcook First Nation.
Historical and Current Use of Lands and Waters	All Mi'kmaq in Nova Scotia would have a right to trap, hunt and harvest fish, animals and plants in the PA, as part of their Aboriginal and Treaty rights to hunt, fish, and gather. In particular, Mi'kmaq community members use the area within and surrounding the PA to hunt deer, bear, porcupine and foul; trap rabbits, fox and other small fur-bearing animals; fish for trout and other freshwater species; gather berries and plants for food and medicinal purposes; harvest plants, birchbark and fallen wood for handicrafts and cultural items. Mi'kmaq families also enjoy camps in the area for recreational purposes. All Nova Scotia Mi'kmaq communities hold FSC and commercial communal fishing licenses to harvest a variety of marine and freshwater species in tidal and non-tidal waters of Nova Scotia. Specific details and information relating to how subpopulations within a Mi'kmaq community (women, youth, elders, families) engage in traditional practices, other than the general information provided above, has not been shared with AMNS through direct engagement and the MEKS, but AMNS understands additional information may be available during the EIS review process from Mi'kmaq communities, and will continue to work with communities to integrate that information into project planning.
Asserted or Established Aboriginal and / or Treaty Rights	The Mi'kmaq of Nova Scotia have established Aboriginal and Treaty rights. This includes traditional rights to hunt, gather and fish, as well as treaty-protected rights to hunt and gather, and to fish for a "moderate livelihood". Those activities are related to sustenance, cultural and socio-economic practice.
We'koqma'q First Nation	
Location	We'ko'kmaq (Waycobah) First Nation is comprised of two reserves within the village of Whycocomagh in Cape Breton.
General Overview	Waycobah First Nation encompasses two reserves: Malagawatch 4 (62 km southwest of Sydney with an area of 661.3 ha) and Whycocomagh 2 (70 km west of Sydney with an area of 908 ha) (INAC undated, as citied in Stantec 2018c). Waycobah First Nation is represented by the ANSMC. According to 2017 census data, the registered population was 999 (approx. 883 on and 81 off reserve). As of February 2020 the population was 1031: Registered Males on Own Reserve – 454 Registered Females on Own Reserve – 458 Registered Males on Other Reserves – 15 Registered Females on Other Reserves – 18 Registered Males on Own Band Crown Land – 1 Registered Females on Own Band Crown Land – 1 Registered Males Living Off-Reserve – 36 Registered Females Living Off-Reserve – 48 (CBU, 2020) No data was available related to age of population.
Health and Socio-economic Conditions	In 2008, a new elementary-secondary school was opened within the community (Waycobah First Nation undated). A daycare facility also exists within the community as well as a RCMP station and volunteer fire department. In 2010, the Theresa Cremo Memorial Health Centre was opened, offering a variety of programs and services such as a full time Nurse Practitioner, full time clinical therapist, prenatal classes, lab collection, Reiki treatments, an Alcohol and Drug counselor, midwifery clinics, well women and men clinics, a dietician, teen health clinic and a variety of activities for members of the community of all ages (Waycobah First Nation undated). A doctor is available at the Health Centre twice a week. The Nation also owns and operates a convenience store and gas bar and a gaming center (Waycobah First Nation undated, as citied in Stantec 2018c). The First Nation has two lobster licenses, shrimp trap and trawl licenses, groundfish quotas and an active elver fishery (Waycobah First Nation undated). The Waycobah Fisheries employs approximately 35 community members (Waycobah First Nation undated, as citied in Stantec 2018c). In 2011, a trout fish farm was re-established within the community. Although owned by Cold Water Fisheries, employees are largely Waycobah community members (Waycobah First Nation undated, as citied in Stantec 2018c).

Table 6.14-2: Community profiles of the 13 Mi'kmaw First Nations in Nova Scotia (continued)

Mi'kmaw First Nation	Description
Physical and Cultural Heritage (including archaeological, paleontological, historical or architectural sites)	Established in the early 1800s, Waycobah First Nation was originally known as We'ko'kmaq. In the 1940s, the community experienced a decline in population because of the federal government's centralization policy, where many individuals were relocated to the community of Eskasoni (Waycobah First Nation undated, as citied in Stantec 2018c). Proposed PA does not overlap with any known physical and cultural heritage sites related specifically to We'ko'kmaq First Nation.
Historical and Current Use of Lands and Waters	All Mi'kmaq in Nova Scotia would have a right to trap, hunt and harvest fish, animals and plants in the PA, as part of their Aboriginal and Treaty rights to hunt, fish, and gather. In particular, Mi'kmaq community members use the area within and surrounding the PA to hunt deer, bear, porcupine and foul; trap rabbits, fox and other small fur-bearing animals; fish for trout and other freshwater species; gather berries and plants for food and medicinal purposes; harvest plants, birchbark and fallen wood for handicrafts and cultural items. Mi'kmaq families also enjoy camps in the area for recreational purposes. All Nova Scotia Mi'kmaq communities hold FSC and commercial communal fishing licenses to harvest a variety of marine and freshwater species in tidal and non-tidal waters of Nova Scotia. Specific details and information relating to how subpopulations within a Mi'kmaq community (women, youth, elders, families) engage in traditional practices, other than the general information provided above, has not been shared with AMNS through direct engagement and the MEKS, but AMNS understands additional information may be available during the EIS review process from Mi'kmaq communities, and will continue to work with communities to integrate that information into project planning.
Asserted or Established Aboriginal and / or Treaty Rights	The Mi'kmaq of Nova Scotia have established Aboriginal and Treaty rights. This includes traditional rights to hunt, gather and fish, as well as treaty-protected rights to hunt and gather, and to fish for a "moderate livelihood". Those activities are related to sustenance, cultural and socio-economic practice.
Millbrook First Nation	
Location	Millbrook First Nation is comprised of seven reserves, near the communities of Truro and Halifax. It is the Mi'kmaq First Nation that is located in closest geographic proximity to the proposed Project.
General Overview	Millbrook First Nation encompasses seven reserves. Four reserve lands: Truro 27A, Truro 27B, Truro 27C and Millbrook 27, are near the town of Truro with a total area of 344.9 ha (INAC undated, as citied in Stantec 2018c). The remaining three are: Beaver Lake 17 (78.4 km southeast of Halifax with an area of 49.4 ha), Sheet Harbour 36 (91.2 km northeast of Halifax with an area of 32.7 ha), and Cole Harbour 30 (9.6 km east of Halifax with an area of 18.6 ha (INAC undated). The Beaver Lake and Sheet Harbour reserves are the two Millbrook communities in closest geographic proximity to the proposed Project. Millbrook First Nation is currently not represented in consultation by the ANSMC. According to 2017 census data, the registered population was 1,831 (approx. 872 on and 916 off reserve). As of February 2020, the population was 1,995: Registered Males on Own Reserve – 452 Registered Females on Own Reserve – 460 Registered Males on Other Reserves – 22 Registered Females on Other Reserves – 15 Registered Females on Own Crown Land – 1 Registered Males on Other Band Crown Land – 1 Registered Females on Other Band Crown Land – 1 Registered Males on No Band Crown Land – 1 Registered Males Living Off-Reserve – 507 Registered Females Living Off-Reserve – 535 (CBU, 2020) No data was available related to age of population.
Health and Socio-economic Conditions	Infrastructure and services available in the community of Millbrook are the Millbrook Band Office, Millbrook Community Hall, Millbrook Ballfield, Millbrook Gym, Millbrook Early Education Centre, Millbrook Senior's Centre, and Sacred Heart Mission Church (Millbrook First Nation 2018, as citied in Stantec 2018c). The Millbrook Health Centre is also in the community, providing a variety of programs and services such as home and community care and assisted living programs, youth support, addiction services, wellness programs and community support and family enrichment programs. Millbrook First Nation owns, develops, and manages the retail park, Millbrook Power Centre, in Truro, NS. This park encompasses 68 acres of commercial land on the most traveled stretch of highway in Nova Scotia, outside of Halifax (Millbrook First Nation 2018, as citied in Stantec 2018c). Since opening in 2001, the Millbrook Power Centre has approximately a dozen tenants including a multiplex theatre, several restaurants, two hotels, a recreational vehicle retailer, a service station, an aquaculture facility, a furniture store, and the Glooscap Heritage Centre (Millbrook First Nation 2018, as citied in Stantec 2018c). There have also been recent developments in the Cole Harbour community, including apartment buildings, General Dynamics Building, and a gaming center. Millbrook Fisheries is an important part of the local economy, controlling eight vessels and employing over 40 staff members throughout the year. In recent years, Millbrook First Nation has opened several cannabis dispensaries in the community of Millbrook.
Physical and Cultural Heritage (including archaeological, paleontological, historical or architectural sites)	From the late 1700s to the early 1800s, the Mi'kmaq near Truro were settled along the banks of the Salmon River. The Mi'kmaq then relocated to their current community at Millbrook (Millbrook First Nation 2018, as citied in Stantec 2018c). Both the MEKS and the Archaeological studies completed for the Touquoy Gold Project and the Fifteen Mile Stream Gold Project were considered in this EIS, and archaeological studies appended to this EIS. The proposed PA does not overlap with any known physical and cultural heritage sites related specifically to Millbrook First Nation.
Historical and Current Use of Lands and Waters	All Mi'kmaq in Nova Scotia would have a right to trap, hunt and harvest fish, animals and plants in the PA, as part of their Aboriginal and Treaty rights to hunt, fish, and gather. As described in the TLRUS, the LSA is a significant area for Millbrook occupancy including permament residences at the Beaver Dam IR, as well as camps within and directly adjacent to the LSA used to support harvesting activities and that provide restorative peace and solitude to Millbrook citizens. The LSA is also a significant harvesting location for many species such as big game (deer and bear), small game (rabbits and grouse), furbearers (beaver and coyotes), fish (trout), berries, wood and medicine. All Nova Scotia Mi'kmaq communities hold FSC and commercial communal fishing licenses to harvest a variety of marine and freshwater species in tidal and non-tidal waters of Nova Scotia. Specific details and information relating to how subpopulations within a Mi'kmaq community (women, youth, elders, families) engage in traditional practices, has been shared with AMNS through direct engagement and through the generation of the TLRUS. Overall, the TLRUS concludes that all subpopulations of the Millbrook First Nation engage in traditional practices throughout the LSA. A detailed description of historical and current use of lands and waters is provided in Section 1.1.2.2.
Asserted or Established Aboriginal and / or Treaty Rights	The Mi'kmaq of Nova Scotia have established Aboriginal and Treaty rights. This includes traditional rights to hunt, gather and fish, as well as treaty-protected rights to hunt and gather, and to fish for a "moderate livelihood". Those activities are related to sustenance, cultural and socio-economic practice

Table 6.14-2: Community profiles of the 13 Mi'kmaw First Nations in Nova Scotia (continued)

Mi'kmaw First Nation	Description
Sipekne'katik First Nation	
Location	Sipekne'katik First Nation (also known as Indian Brook or Shubenacadie) is comprised of five reserves in Hants County, near the town of Shubenacadie. It is the second most proximate Mi'kmaw community to the proposed Project.
General Overview	Sipekne'katik First Nation encompasses five reserves: Indian Brook 14 (29 km southwest of Truro with an area of 1,234.2 ha), Wallace Hills 14A (with an area of 54.8 ha), Shubenacadie 13 (32 km north of Halifax with an area of 412.0 ha), Pennal 19 (67.2 km northwest of Halifax with an area of 43.5 ha) and New Ross 20 (64 km northwest of Halifax with an area of 408.3 ha) (INAC undated, as citied in Stantec 2018c).The Indian Brook and Shubenacadie reserves would be the two most proximate Sipekne'katik communities to the proposed Project. Sipekne'katik First Nation is currently not represented by the ANSMC. According to 2017 census data, the registered population was 2,645 (approx. 1,268 on and 1,298 off reserve). As of February 2020, the population was 2,771: Registered Males on Own Reserve – 617 Registered Females on Own Reserve – 699 Registered Males on Other Reserves – 34 Registered Females on Other Reserves – 31 Registered Males on Other Band Crown Land – 2 Registered Females on Other Band Crown Land – 1 Registered Males on No Band Crown Land – 8 Registered Females on No Band Crown Land – 7 Registered Males Living Off-Reserve – 655 Registered Females Living Off-Reserve – 717 (CBU, 2020) No data was available related to age of population.
Health and Socio-economic Conditions	In 2008, the L'nu Sipuk Kina'muokum (LSK) school opened in the community, accommodating students from primary to grade 12. The school specializes in Mi'kmaq studies and Mi'kmaq language courses (Sipekne'katik First Nation 2016, as citied in Stantec 2018c). Little Eagles Daycare Centre provides care to children ages 1-4 years old (Sipekne'katik First Nation 2016, as citied in Stantec 2018c). The community also has the Sipekne'katik Multipurpose Centre, used for community meetings, events, and social gatherings. Local businesses within the community include a community gas-bar, tobacco shop, gaming room and convenience store. The Sipekne'katik First Nation Fisheries Department is an economic enterprise, managing 33 fishing licenses for various species including lobster, crab, and groundfish (BP 2017, as citied in Stantec 2018c).
Physical and Cultural Heritage (including archaeological, paleontological, historical or architectural sites)	Established in 1820, Sipekne'katik was originally named "Indian Brook". The area was traditionally used as a sacred site to prepare for ceremonies and hunting and fishing trips (Sipekn'katik First Nation undated). In 1752, one of the most significant Peace and Friendship Treaties was signed at Shubenacadie District (Sipekn'katik First Nation 2016, as citied in Stantec 2018c). This treaty dealt with lands, hunting, fishing, trapping, gathering, and trading. In 2002, a memorial was erected in honor of Chief Jean Baptiste Cope and the Treaty of 1752 (Sipekn'katik First Nation 2016, as citied in Stantec 2018c). Proposed PA does not overlap with any known physical and cultural heritage sites related specifically to Sipekne'katik First Nation.
Historical and Current Use of Lands and Waters	All Mi'kmaq in Nova Scotia would have a right to trap, hunt and harvest fish, animals and plants in the PA, as part of their Aboriginal and Treaty rights to hunt, fish, and gather. In particular, Mi'kmaq community members use the area within and surrounding the PA to hunt deer, bear, porcupine and foul; trap rabbits, fox and other small fur-bearing animals; fish for trout and other freshwater species; gather berries and plants for food and medicinal purposes; harvest plants, birchbark and fallen wood for handicrafts and cultural items. Mi'kmaq families also enjoy camps in the area for recreational purposes. All Nova Scotia Mi'kmaq communities hold FSC and commercial communal fishing licenses to harvest a variety of marine and freshwater species in tidal and non-tidal waters of Nova Scotia. Specific details and information relating to how subpopulations within a Mi'kmaq community (women, youth, elders, families) engage in traditional practices, other than the general information provided above, has not been shared with AMNS through direct engagement and the MEKS, but AMNS understands additional information may be available during the EIS review process from Mi'kmaq communities, and will continue to work with communities to integrate that information into project planning.
Asserted or Established Aboriginal and / or Treaty Rights	The Mi'kmaq of Nova Scotia have established Aboriginal and Treaty rights. This includes traditional rights to hunt, gather and fish, as well as treaty-protected rights to hunt and gather, and to fish for a "moderate livelihood". Those activities are related to sustenance, cultural and socio-economic practice.

6.14.4.2 Beaver Dam Mine Site and Haul Road Baseline Conditions

This section describes the historical and current traditional Mi'kmaq use of the PA, LAA and RAA (Section 6.14.6.1), as described through regional research, direct engagement, the TLRUS (MFC 2019), and the conclusions from the MEKS (Appendix M.1). The Project LAA is consistent with the Local Study Area (LSA) defined in the TLRUS (MFC 2019) and for ease of review, the term LAA is used in this section. Historical use has been informed by the MEKS, and the TLRUS also relies on the MEKS for the description of Mi'kmaq historical use of the area and describes this description as robust (MFC 2019). As a result, the historical Mi'kmaq land and resource use section is written in consideration of the collective Mi'kmaq of Nova Scotia and is directly referenced from the MEKS.

AMNS acknowledges the collective rights for all Mi'kmaq of Nova Scotia. Given the proximity of the Project to the Millbrook First Nation Beaver Lake IR and Sheet Harbour IR and, given the documented Millbrook First Nation traditional and current use presented in the TLRUS (MFC 2019), the EIS has tailored the description and analysis of the Project and current Mi'kmaq land and resource use, health and socio-economic conditions, physical and cultural heritage to the Millbrook First Nation community and its members. This approach has been validated through engagement with Millbrook First Nation, the KMKNO, and the broader Mi'kmaq of Nova Scotia community.

6.14.4.2.1 Historic Mi'kmaq Land and Resource Use

Historical Mi'kmaq Land and Resource Use is described in detail in the MEKS and is summarized within this section. For the detailed description, please reference the MEKS (CMM 2016) in Appendix M.1.

Pre-Contact

Mi'kmaq traditional use of the land in Nova Scotia involved semi-permanent and permanent settlements. Summer villages of the Mi'kmaq were usually located on the banks of streams or rivers. The most important factor in the choice of a site was the proximity of the site to a navigable body of water. Sites around the mouths of rivers with heavy spawning runs were highly favourable for use, as well as smaller rivers running back into a system of lakes (Appendix M.1).

Beaver Dam lies within Eskikewa'kik or the "skin dressing territory". This particular district spans from Halifax County across to Guysborough County. Various authors and historians have differed in their description of how far this territory expands, but all have agreed that Beaver Dam lies within this district (Appendix M.1).

Although little historical information has been written about Mi'kmaq inhabiting these areas in large numbers, there is some documentation that suggests that they mainly inhabited Halifax and Port Mulgrave. Bernard Hoffman has noted that there were seven main sites within Eskikewa'kik; including sites at Ship Harbour, Spry Bay Harbour and Liscomb Harbour near the study area (Appendix M.1).

Mi'kmaq cultures hunted land and marine mammals and fish for sustenance and some trading until the late sixteenth century, when traditional activities began to change in response to contact with the Europeans. Settlements, although not permanent, were located near major waterways and harbours, providing accessibility to trade with the Europeans. The Mi'kmaq traveled inland through minor streams and rivers, either by canoe or on foot (Appendix M.1).

Post-Contact

Nicholas Denys gives a brief description of the area "Bay de Toutes Isles" which would cover the area along the Eastern Shore known as the Bay of Islands running from Ship Harbour along the coast to Liscomb Harbour. "This bay has nearly four leagues of depth, and there are several rivers which discharge into it. These are small and are only, as it were, large brooks, [though] by them the Indians come and go." He stated that there *seems to be a large number of Indians living in that area in order to hunt the moose* (Appendix M.1).

Mi'kmaq at Beaver Dam

The Mi'kmaq referred to this area as Kopitewey Kwimuti literally meaning Beaver Harbour. In 1852, 100 acres had been set-aside for Simon Francis on the Sheet Harbour Road at the head of Beaver Lake. There is little written prior to the setting aside of this reserve under Samuel Fairbanks' Return of Land report in 1866 (Appendix M.1).

The reference plan from Natural Resources Canada shows a parcel of ten acres adjacent to the Beaver Dam reserve as being allotted to Peter Paul in 1930. The original letters patent and grant was not located, but Peter Paul's name again comes up in lands held by himself and his brother adjacent to the Sheet Harbour Reserve (Appendix M.1).

In the Old Man Told Us by Ruth Holmes Whitehead, reference is made to John Cope killing 18 moose at Beaver Dam and selling them to the men at Fifteen Mile Stream Goldmine in 1918 (Appendix M.1).

In 1973, John Covert conducted another survey at Beaver Lake and found that the reserve contained 122 acres instead of the initial one hundred acres granted to Simon. The reserve was formally set-aside to Millbrook Band in 1960 (Appendix M.1).

Mi'kmaq at Sheet Harbour

Around the seventeen hundreds, the Mi'kmaq lived along the eastern coast, at Spry Bay Harbour, Ship Harbour and Sheet Harbour. In 1762, Jonathan Belcher issued a proclamation protecting the traditional hunting and fishing territories of the Indians. This area included all that portion of Canso and running westerly as far as Musquodoboit (Appendix M.1).

Following the American Revolution in 1776, an influx of loyalists induced on settling in Nova Scotia, were given gratuitous land grants and most of the land laid out for the Indians was encroached upon. In 1783 a license of occupation was issued to the Indians for 11,520 acres in order to protect their fishing and hunting rights. James E. Rutledge mentioned in his book History of Sheet Harbour that when a number of soldiers had moved to the area in 1784, "there was an encampment of Indians in the maple grove now the property of the heirs of Robert Rutledge at Watt Section".8 This in all likelihood was the section of land included within the license of occupation (Appendix M.1).

A large portion of the areas given under these licenses, were encroached upon by European settlers but Mi'kmaq occupation continued at Sheet Harbour prior to the establishment of the formal reserve in 1915. The white settlers, angered by Belcher's proclamation for protecting Mi'kmaq hunting territories, ignored his rule, and continued to settle there. The lands set aside for the Indians were eventually abandoned, but some continued to return there to hunt and fish (Appendix M.1).

In Frank Speck's work, Beothuk and Micmacs, he describes the hunting territories. "The Micmac, like the rest of the northern and eastern Algonkian, whose subsistence was gained by hunting and fishing, had their country subdivided into more or less well recognized districts in which certain individual proprietors or families enjoyed the inherited privileges of hunting" (Appendix M.1).

Contained within Speck's list of territories, predominantly Cope surnames continued to hunt and fish at Ship Harbour, Jeddore, Ten and Fifteen Mile Lake, Sheet Harbour and Liscomb (Appendix M.1).

Mi'kmaq at Ship Harbour

The Mi'kmaq referred to the area at Ship Harbour as Tetmnipukwek10 meaning "where Indian men are bludgeoned to death". In 1813, a petition came from Francis Coop for land at Ship Harbour for himself, his wife and seven children as outlined in document RG 20 A – Coop Francis. The petition stated that 200 acres of land be laid out for him, as he was sober and industrious, on the provison that it could only be passed on to his children at the head of the Ship Harbour River (CMM 2016).

In 1848, John Spry Morris laid out 500 acres of land in 100-acre lots, with a small lot measuring 47 acres being reserved for fishing. The five lots were laid off to Francis Paul, Joseph Paul, Lewis Paul, Lewis Newal and Lewis Brooks. Two additional lots were allotted to Francis Paul's sons, James Paul and Joseph Paul. A survey of the area in 1853 had referred to 700 acres of land but did not mention the 47 acres reserved for fishing (CMM 2016).

After 1855 little correspondence is written about the Mi'kmaq living at Ship Harbour. There are a few bills for provisions and aid given to them in 1856 (MG 15 Volume 6 no. 14). Various requests for blankets had dropped from 1861 onward, as they believed that an outbreak of smallpox had serious effect on the numbers living at Musquodoboit, Sheet Harbour and Ship Harbour. Joseph Browner had requested that four dollars worth of blankets be sent to him for Indians living at Tangier, but no mention of Ship Harbour. (Journal of Assembly: 1863, No. 16, p.5.) (CMM 2016).

In 1893, J. Lewis & Sons inquired into the possibility of purchasing land at Ship Harbour Reserve in order to locate a factory and use the timber on the land. The Superintendent General then wrote to the Indian agent to inquire any Indians lived there, and would be willing to surrender the reserve. Joseph Cope's letter to the Superintendent General stated: "the said or supposed Reserve has been abandoned by the Indians thirty or forty years ago. Although a good number of us are there every summer for the [?] work pur- poses..." (CMM 2016).

In 1919, the government wanted to centralize the Mi'kmaq on two main reserves at Shubenacadie and Indian Brook. They had made several attempts with the Halifax County Indians to either settle permanently on Ship Harbour, or to dispose of the land. The property was eventually surrendered along with Sambro and Ingram River, but the Mi'kmaq continued to use that area as shown in Frank Speck's Beothuks and Micmac. He pointed out that Andrew Francis was allotted hunting territory #29 in 1922, which covered land at the Great Ship Harbour: whether or not that fell into the lands originally set aside as an Indian Reserve is unknown (CMM 2016).

Historic land loss and displacement of the Mi'kmaq as a result of the taking up of lands by settlers and their industries has had a profound impact on current land use patterns. Although there was continuous Mi'kmaq resistance and resilience in the face of this, this process has immensely shaped what Mi'kmaq land use looks like today (MFC 2019).

The 1876 Indian Act was another major factor in the alternation of Mi'kmaq land use patterns. Under this Act was the failed Centralization Policy of 1942 that attempted to cut Indian administration costs by forcing Mi'kmaq families onto two central reserves - Eskasoni and Shubencadie. Further to this, assimilation was the ultimate goal of the residential school system and from 1930 to 1966 one thousand Mi'kmaq children attended the Shubencadie Indian Residential School. Attendance at residential school led to a loss of language, culture, and identity and disrupted intergenerational knowledge transfer of Mi'kmaq cultural values and norms (MFC 2019).

Beginning in the late 1970s a series of legal milestones occurred that led to a recognition of Mi'kmaq Aboriginal and treaty rights in the courts. This again began to re-shape Mi'kmaq land use patterns through greater access to traditional resources. However, by this time multi-generational alienation from lands had already led to a significant loss of place-based traditional knowledge that was irreplaceable (MFC 2019).

6.14.4.2.2 Known Mi'kmaq Archaeological Sites near the Beaver Dam Mine Site and Haul Road

The vast majority of archaeological discoveries in Nova Scotia have been incidental rather than the result of targeted archaeological surveys. More often than not they have been made in the context of some sort of development – agricultural development or residential, industrial or infrastructural construction. The Beaver Dam Mine Site and Haul Road have to date not had significant development activities. The archaeological record for most of Eskikewa'kik is very sparse and consists mostly of sporadic surface finds.

It is obvious therefore, and important to note, that the relative lack of archaeological evidence in the Beaver Dam Mine Site and the Haul Road cannot be construed as proof of a lack of pre-contact Mi'kmaw occupancy. Nova Scotia Museum records did not contain any archaeological sites within the MEKS Study Area. The adjoining areas have had some activity recorded in the Maritime Archaeological Resource Inventory. The information collected from that research has shown that Mi'kmaq presence is documented surrounding the study area (Appendix M.1).

AMNS has shared the archaeological reports directly with KMKNO (October 5, 2020).

6.14.4.2.3 Current Mi'kmaq Land and Resource Use

Drawing from information provided through the MEKS, the TLRUS (MFC 2019), direct information gathered from engagement activities between AMNS and the Millbrook First Nation and Sipekne'katik First Nation, and the KMKNO, and the Project team's knowledge of the Beaver Dam Mine Site and the Haul Road, the following summary of current Mi'kmaq land and resource use has been prepared as a basis from which to understand and evaluate Project interactions and potential effects of the Project on the Mi'kmaq of Nova Scotia. As described in Section 1.1.2.2, the description and analysis in this section has been tailored to Millbrook First Nation, unless specific mention of information relating to a different Mi'kmaq community is noted. Information was requested from all Mi'kmaq communities in Nova Scotia through the MEKS and direct engagement with KMKNO and Sipekne'katik First Nation; however, the TLRUS (MFC 2019) prepared for Millbrook First Nation and information received directly from the Millbrook First Nation community informs AMNS's specific understanding of traditional and current use. Some generalized information, especially relating to traditional use, was available through the MEKS and is presented herein. The baseline information provided in the MEKS is generally consistent with that baseline data collected by the Millbrook First Nation through the TLRUS (MFC 2019).

The following key aspects were considered and requested from the Mi'kmaw communities during collection of baseline data (either through direct engagement or the completion of the MEKS and TLRUS):

- General information about Mi'kmaq of Nova Scotia populations;
- General description of baseline conditions within the Beaver Dam Mine Site and Haul Road and surrounding landscape to support an understanding of the current experience of the traditional practice for the Mi'kmaq of Nova Scotia;
- Sites or areas that are used by the Mi'kmaq of Nova Scotia either for permanent residences or on a seasonal/temporary basis and the number of people that use each site/area identified;
- Drinking water sources (permanent, seasonal, periodic, or occasional);

- Consumption of country foods (also known as traditional foods) including food that is trapped, fished, hunted, harvested, or grown for subsistence or medicinal purposes, outside of the commercial food chain;
- Which country foods are consumed by which groups, how frequently, and where these country foods are harvested;
- How are different subpopulations of the Mi'kmaq communities using the land;
- How often is the right practiced or exercised and timing/seasonality of the practice; the context in which the right is practiced;
- Commercial activities (e.g. fishing, trapping, hunting, forestry, outfitting) and the frequency, duration and timing of these activities including maps and data sets; and
- Recreational uses and the frequency, duration and timing of these activities.

Baseline information that was shared and available for the Project is described in this section. This summary of current use is specific to the Millbrook First Nation, through the completion of the TLRUS (MFC 2019), supported by conclusion of the MEKS. This report describes Millbrook traditional land and resource use in the regional and local study areas through careful documentation of harvesting and occupancy locations, as well as the presentation of qualitative information relating to participants' relationships with these locations (MFC 2019).

It is important to note that some limitations relating to baseline information are present and thus, evaluation of Project interactions and potential effects to the Millbrook First Nation and more broadly the Mi'kmaq of Nova Scotia, are provided with some limitations on specific analysis:

- **Drinking Water Sources:** No surface drinking water sources were identified through the MEKS or TLRUS, and direct engagement activities with the communities. As a result, no analysis of specific surface water drinking water sources is completed. However, a discussion of impact to drinking water at the Cameron Flowage/Killag River (the discharge location from the Project) is included as it is considered the reasonable worst case predicted water quality conditions stemming from the Project.
- **Residences (Permanent or Seasonal):** No specific detail relating to location of seasonal or temporary camps/cottages/residences were provided to AMNS. The MEKS did not provide any information relating to seasonal or permanent residences, with the exception of the Beaver Lake IR 17. The TLRUS identified several Millbrook camp locations, but no specific locations were provided. Thus, no analysis of specific Millbrook residential receptors has been included in this Project EIS. Conclusions relating to Project impacts at the Beaver Dam Mine Site and Haul Road property boundaries have been provided for each VC in Table 6.14-5 and these conclusions can support analysis of camps/cottages that have been identified in a more generalized way surrounding, and in close proximity to, the Beaver Dam Mine Site and Haul Road.
- **Ceremonial/Spiritual Activities and Sites:** General or specific information about sacred sites was not provided in the MEKS or TLRUS.

Additional information relating to strengthening AMNS understanding of current Millbrook and more broadly, Mi'kmaq, land use was requested as documented in detail in Section 4 and summarized herein. AMNS will continue to work with the Millbrook First Nation and the Mi'kmaq of Nova Scotia to identify any outstanding traditional and current use information related to the Project.

Baseline Current Millbrook First Nation Land Use

Cultural continuity through practice is of great importance to the Mi'kmaq – and the connection of that continued practice for their cultural survival.

The TLRUS describes current primary impacts on Millbrook traditional land and resource use (harvesting and occupancy) in the RAA and then provides a high-level description of current harvesting and occupancy values within the RAA. Then, the TLRUS provides a detailed description of harvesting and occupancy within the LAA. This description at the LAA level, along with supplemental information documented in the MEKS and through direct engagement with Millbrook First Nation, the KMKNO, and the Mi'kmaq of Nova Scotia forms the basis of the baseline current Mi'kmaq use for the purposes of evaluation of impacts to the Millbrook First Nation, and, by extension, the Mi'kmaq of Nova Scotia, from the Project.

Current Primary Impacts and Harvesting and Occupancy Values within the RAA

Within the RAA, the primary impacts can be described in four main impact categories: direct physical disturbance; sensory disturbance; access considerations; and the quality and quantity of resources (MFC 2019).

The RAA has experienced direct physical disturbance and changes in access for baseline Millbrook First Nation and Mi'kmaq practices. The main disturbances in close proximity to the Beaver Dam Mine Site and the Haul Road stem from forestry activities (cut blocks, logging roads and mills), the existing operating Touquoy mine, the tourism industry, and the Port of Sheet Harbour (MFC 2019). Sensory disturbance in the RAA is linked largely to forestry activities (noise and lights from logging and haul trucks and noise, light and odours from mill sites). The Touquoy Gold Project and the Port of Sheet Harbour also contribute to baseline noise and light levels. The TLRUS estimates that only one third of the RAA is available for the Mi'kmaq for harvesting and occupancy (MFC 2019), which is then further limited by designated protected areas (provincial) which don't allow hunting and camping within their boundaries. Finally, there has been a documented decline in the quantity and quality of the traditional resources as demonstrated by designated species at risk and reduction in baseline water quality throughout the RAA as a result of herbicides and insecticides used by forestry and agricultural industries (MFC 2019).

The TLRUS describes a high-level description of harvesting and occupancy in the RAA. Occupancy is defined by the presence of indicators - camps, cabins and overnight sites, place names and burial sites. Although specific locations were not shared with the AMNS, this occupancy is documented within the TLRUS and includes a detailed list of Mi'kmaq place names, and is described in general ways for the purposes of AMNS evaluation of Project impacts. Harvesting locations are also described in a general format within the RAA (MFC 2019) and can be summarized by documenting that many Millbrook members, particularly local members of the Beaver Lake and Sheet Harbour IRS, are sustenance harvesters, with hunting, fishing, and trapping practices as important contributions to their household income (MFC 2019). Harvesting includes big game, fish and shellfish and medicinal and ceremonial plant and tree species. The MEKS also documents Mi'kmaq place names, demonstrating occupancy within the RAA.

Current Primary Impacts within the LAA

The majority of documented primary impacts within the LAA relating to physical disturbance is as a result of forestry activities including cut blocks and associated forestry roads (MFC 2019). Millbrook members also provided comment on the changed landscape at the Touquoy Gold Project, at the western extent of the LAA. Sensory disturbance is also documented at the western extent of the LAA from the Touquoy Gold Project, and from forestry activities throughout the LAA which are described as limited and primarily short term in nature (MFC 2019). The forestry industry also resulted in changed access within the eastern portions of the LAA, and the Touquoy Gold Project has changed access to the adjacent areas for Milbrook hunters, as they are concerned about discharging their firearms in close proximity to the mine and possibly hurting someone. Overall, the TLRUS describes a

general reduction in quantity of resources such as deer, trout, medicines and berries within the LAA, and describes a reduction in water quality as a result of logging activities in close proximity to streams and resulting reduction in riparian zones causing an increase in water temperatures.

Harvesting and Occupancy Values with the LAA

The Mi'kmaq of Nova Scotia have established Aboriginal and Treaty rights. This includes traditional rights to hunt, gather and fish, as well as treaty-protected rights to hunt and gather, and to fish for a "moderate livelihood", which may take place throughout the year. According to the TLRUS (MFC 2019), the LAA is used by the Millbrook First Nation for the following purposes:

- Hunting deer, bear, rabbit and grouse for sustenance;
- Trapping rabbits, bobcat, beaver, coyotes, musrat, mink, otter, weasel and other small fur bearing animals for pelts and food;
- Gathering/harvesting various plants for medicinal and sustenance purposes;
- Gathering/harvesting fallen wood and birchbark for handicrafts and cultural items;
- Fishing for trout and other freshwater species; and
- Modern-day camps for recreational purposes.

The TLRUS (MFC 2019) states that local residents of the Beaver Dam, Sheet Harbour and Millbrook IRs frequently use the area (range of use from weekly to yearly, depending on availability of species) for hunting (deer, bear, rabbit, grouse, porcupine) and rely on the wild harvest as an important food and dietary source. Equally, community members harvest berries when in season, and a number of plants that are also used for sustenance, as well as traditional medicines. The seasonal and recreational use of animals and plants important to the Millbrook community members supports the continuity of traditional practices and is very important to the maintenance of their culture and the practice of their rights. Millbrook harvesting activities and practices are culturally important as they ensure the sharing and maintenance of cultural values and their practice. Millbrook First Nation community members use plants and animals harvested in the area for traditional sustenance purposes, health-related medicinal purposes, and spiritual and cultural purposes.

Additionally, the MEKS (CCM 2016) provided the following information related to current Mi'kmaq land and resource use sites, species of significance to Mi'kmaq, and Mi'kmaw communities, with the current Mi'kmaq land and resource uses categorized and identified as:

- Kill/hunting: trout, eel, bear, rabbit, deer, porcupine, partridge, coyote, mink, muskrat, weasels, raccoon, fox, otter and beaver;
- Burial/birth: potential burial sites recorded within the MEKS study area on the western side of the Beaver Dam Mine Road but not within the PA;
- Ceremonial: none identified;
- Gathering: wild fruit, berries, water, food plant, specialty wood, logs, feathers, quills; and
- Habitation: anchored boat, travel route, overnight site.

Species of significance to the Mi'kmaq are associated with three categories; these are listed below with the number of occurrences in the study area based on field work completed by CMM in summer 2016:

- Medicinal: 49 species present;
- Food/beverage: 27 species present; and
- Craft/art: 11 species present.

An overview of the Millbrook First Nation local fisheries activity within the identified LAA was provided in the TLRUS (MFC 2019). Additional information relating to the local Mi'kmaq fisheries was also reported in the MEKS and through direct engagement with the Mi'kmaq of Nova Scotia which supports the conclusions presented in the TLRUS (MFC 2019).

As requested by Round 2, Information Request (IR2) CEAA 2-54, fishing is traditional practice (historical and current) in the LAA. Fishing is generally for sustenance/subsistence, as well as for recreational purposes. Trout is the key fish species described in the TLRUS (MFC 2019) with additional species including brook and rainbow trout, sea trout, American eel, Atlantic salmon, herring, mackerel, gaspereau, various groundfish species, smelt, striped bass and sucker. Shellfish harvesting within the LAA include clams, lobster, mussels, snowcrab, and scallop (MFC 2019). Fishing is practiced across the LAA in most major rivers and lakes, as documented in the TLRUS and MEKS. Within the Beaver Dam Mine Site, there is documentation of trout fishing within Cameron Flowage/Killag River and possibly Mud Lake and Crusher Lake (MFC 2019). Within the 4km footprint of new construction for the Haul Road, there are no documented rivers or lakes that support the Mi'kmaq fisheries. However, adjacent to this new construction corridor and along the road footprint proposed for upgrades to construct the Haul Road, fishing locations are common, and Millbrook First Nation use of these lakes (and rivers) is well documented from the Beaver Dam Mine Site to the Mooseland Road (MFC 2019). AMNS acknowledges documented fish harvesting by Millbrook First Nation within the area directly surrounding the Project and the broader LAA.

There are a number of activities associated with the harvest and use of plants, animals and fish within the PA and in the LAA that relate to historical traditions and customs of the Mi'kmaq that are still practiced today. As described, the TLRUS (MFC 2019), the MEKS and residents of the Beaver Lake IR identify trapping and hunting activities, plant and berry gathering, and fishing in, near and surrounding the PA for purposes of sustenance, spiritual and cultural practice. The TLRUS (MFC 2019) described the frequency of use within the LAA which can be summarized as regular: weekly to annually across all seasons. This means the area was, and still is, an important resource area for the Millbrook First Nation community members and by extension, all Mi'kmaq of Nova Scotia, and any Project activities may have potential impacts on the ability of the Mi'kmaq of Nova Scotia to access certain areas to practice their rights where species with important cultural relevance may be found. Wild meat was traditionally a staple of the Millbrook First Nation diet, and a few of the harvesters interviewed for the TLRUS (MFC 2019) indicated they rely mainly on this food source and they share their food with other community members, rather than purchase their meat at a local supermarket.

Some Mi'kmaq community members have camps on Crown land where they go to enjoy peaceful recreational and traditional activities with family and community members. There are five camps documented within 1 km of the Haul Road and multiple other camp locations throughout the LAA (MFC 2019). The Millbrook community is concerned that noise and activity from the Beaver Dam Mine Site and the Haul Road will negatively impact their ability to enjoy the remoteness and quiet of the area, as well as impact wildlife patterns and their hunting practices.

The evidence presented above shows Mi'kmaw occupancy and land/resource use in the PA, LAA and wider region of Eskikewa'kik – are changing, and more limited but uninterrupted use from pre-contact times to today.

In summary, both those aspects, the economic and cultural motivations for traditional land and resource uses, feed into a third impetus: the need to express, affirm and exercise their Aboriginal rights to live their cultural heritage within Mi'kma'ki, and their Treaty rights to continue harvesting the resources of their traditional territory.

6.14.4.3 Touquoy Mine Site Baseline Conditions

The processing of Beaver Dam ore at the Touquoy Mine Site will not result in any additional impact to the Mi'kmaq of Nova Scotia, other than those effects already addressed and evaluated in the Touquoy EARD (CRA 2007a). Therefore, the effects assessment portion of this section will address only the Project in the context of the Beaver Dam Mine Site and Haul Road. The cumulative effect of the Touquoy Gold Project and the Project is considered in Section 8.

6.14.5 Consideration of Engagement Results

Key issues raised during Mi'kmaq engagement include concerns related to pathways of adverse effects from Project activities during construction and operation, including direct physical disturbance and habitat loss, sensory disturbance from elevated noise and light from the Beaver Dam Mine Site and haul trucks along the Haul Road, loss of access to the PA, and potential impact to the quality and quantity of flora and fauna used in traditional hunting, fishing, gathering and trapping activities. AMNS acknowledges there will be a loss of access to the land required to support the mine development for up to eight years (one year construction; five years operations; and two years for active closure). AMNS will continue to engage in discussions with the Millbrook First Nation, and the Mi'kmaq more broadly, regarding appropriate avoidance, access, and mitigation options as required.

Specific questions were noted on potential effects of accidents and malfunctions on current use of traditional lands and associated contingency planning for an unplanned release and the potential effects of climate change on the Project. These items are discussed further in Section 6.18 and Section 7. AMNS has developed an emergency response protocol with the Mi'kmaq to ensure their interests are protected in the unlikely case of an accident or malfunction, and to ensure appropriate communication if an emergency were to occur. Specific questions have also been raised relating to potential sensory disturbance from noise and light and their potential effect on traditional practices on the land surrounding the Beaver Dam Mine Site and Haul Road. Specific questions have also been asked about potential dust deposition into the adjacent forest and risk to human health. These project interactions are described and analyzed herein.

Concerns were expressed regarding the original Haul Road routing as it was planned to pass Beaver Lake IR 17 along Hwy 224. These were primarily concerns related to noise, air quality and health and safety. AMNS has addressed these concerns by revising the Project design to include construction of 4 km of new Haul Road to avoid travel along Hwy 224 past the Beaver Lake IR 17. This change from the Project Description (October 2015) is documented in Section 2.

The results of Mi'kmaq engagement have been considered and incorporated in the environmental effects assessment and are reflected in AMNS's commitments to involve the Mi'kmaq in the development and implementation of mitigation and monitoring measures and proposed compliance and effects monitoring programs. The specific engagement record describing the engagement efforts and how comments raised have been incorporated into the EIS is provided in Section 4 and Appendix A.5.

6.14.6 Effects Assessment Methodology

6.14.6.1 Boundaries

6.14.6.1.1 Spatial Boundaries

The spatial boundaries for the assessment of effects to Mi'kmaq of Nova Scotia are defined below.

- Project Area (PA): The PA is the most basic and immediate area of the Project and consists of the area of physical disturbance associated with the Construction and Operation of the Project, including the Beaver Dam Mine Site, the Haul Road and the Touquoy Mine Site, as described in Section 2. The PA encompasses three primary components from Marinette to Moose River Gold Mines, Halifax County, NS. The Beaver Dam Mine Site will be located at the end of the Beaver Dam Mines Road and the Haul Road will span from the Beaver Dam Mine Site to the Touquoy Mine [processing and exhausted pit (to be used to dispose Beaver Dam tailings)].
- Local Assessment Area (LAA): The LAA encompasses a 5 km radius from the PA. The LAA includes the maximum extent of physical disturbance from project and interactions with expected Mi'kmaq current use of lands and resources, and physical and cultural heritage (Figure 6.14-1). The LAA is the maximum area within which Project-related effects can be predicted or measured with a reasonable degree of accuracy and confidence.
- Regional Assessment Area (RAA): The RAA for the assessment of Indigenous Peoples is defined as the territorial boundaries of the *Eskikewa'kik* (meaning 'skin dressers territory'; Figure 6.14-1). The extent to which cumulative effects on the Mi'kmaq of Nova Scotia may occur depends on physical and biological conditions and the type and location of other past, present, or reasonably foreseeable future projects or activities that have been or will be carried out, as defined within the RAA.

Effects from the Project on Mi'kmaq of Nova Scotia may potentially occur within and immediately adjacent to the Project Area, therefore, the LAA has been selected as the appropriate boundary for the evaluation of this VC.

6.14.6.1.2 Temporal Boundaries

The temporal boundary for the assessment of effects to the Mi'kmaq of Nova Scotia extends through the Project, including construction (one year), Operation (five years) and Active Closure (two years) phases.

6.14.6.1.3 Technical Boundaries

The assessment of potential Project-related effects is limited by the availability of information, which has been obtained primarily through a balance of ongoing engagement, the TLRUS (MFC 2019) and MEKS (CMM 2016) conducted for this and related projects, and Mi'kmaq groups' reviews and submissions to IAAC regarding the EIS Guidelines and EIS. AMNS stived to achieve a good balance between first-hand knowledge shared through engagement and the various Indigenous use studies completed to date, and secondary sources, although the limited amount of published information regarding historical and current use does present a technical limitation as to the comprehensiveness and verification of the information provided.

6.14.6.1.4 Administrative Boundaries

Provincially, the Nova Scotia Environmental Assessment Regulations include a requirement to identify concerns of the Mi'kmaq of Nova Scotia about potential adverse effects and steps taken or proposed to be taken by AMNS to address concerns, as well as the steps taken to identify these concerns.

Federally, subparagraph 5(1)(c) of *CEAA 2012* requires the assessment of effects of changes to the environment on Aboriginal peoples, including: health and socio-economic conditions; physical and cultural heritage, including any structure, site or thing that is of historical, archaeological, paleontological or architectural significance; and current use of lands and resources for traditional purposes.

The governments of Nova Scotia and Canada, and the Mi'kmaq follow a TOR that lays out a process for Crown consultation with the Mi'kmaq. Procedural aspects of the Crown's duty to consult are delegated to AMNS.

6.14.6.2 Thresholds for Determination of Significance

To support analysis of Project effects, and to respond to Round 2 Information Requests (IR2s) CEAA 2-02, 2-39 and 2-53, a significant adverse residual effect on the Mi'kmaq of Nova Scotia is defined as a Project-related environmental effect that results in one or more of the following outcomes:

- Long-term (greater than 20 years) or permanent loss of the availability of, or access to, land and resources currently relied on for traditional use practices; or if long-term or permanent loss is expected, no allowance for agreed-upon compensation with the affected Mi'kmaq community(s). A twenty-year temporal scale was chosen to represent a generational loss of access to an area.
- Human health risk assessments are inherently conservative, and hence, development of a threshold of significance for human health is complicated, since risk estimates tend to be biased high, based on the degree of conservatism included in any given risk assessment. The threshold for a significant residual effect has been defined as a potential adverse effect to health, identified through the conclusions presented in the HHRA.
- An unmitigated loss of a physical or cultural structure, site or thing that is of historical, archaeological, paleontological or architectural significance to the Mi'kmaq.
- Short-term (less than 20 years) loss of availability of land and resources caused by displacement due to Project activities are not considered to be significant.

The significance of potential effects on potential or established Aboriginal or treaty rights is a matter of consideration by the Crown and Mi'kmaq representatives (Assembly of Nova Scotia Chiefs and the Governments of Canada and Nova Scotia).

For the Mi'kmaq of Nova Scotia, the following was applied to assess the magnitude of a predicted change (one or more of these aspects):

- Negligible
  - no loss of a structure, site or thing that is of historical, archaeological, paleontological or architectural significance to the Mi'kmaq of Nova Scotia as a result of Project development;
  - no observable change in the availability and baseline condition of lands and resources for traditional purposes; and
  - no change in baseline socio-economic condition of the affected Mi'kmaq communities from Project activities.
- Low
  - loss of a structure, site or thing that is of historical, archaeological, paleontological or architectural significance to the Mi'kmaq of Nova Scotia as a result of Project development, but only after a comprehensive evaluation by Mi'kmaq archaeological teams determines the loss is considered appropriate and mitigation measures are employed;

  - an observable change in the availability and baseline condition of the lands and resources for traditional purposes for a short temporal window (greater than 20 years) and with commitment to appropriate and negotiated accommodation and compensation with the affected Mi'kmaq community(s);
  - elevated risk of non-carcinogenic or carcinogenic health risk that do not exceed Risk Quotients and where Incremental Lifetime Cancer Risks (ILCR) related to the Project were not predicted to exceed the benchmark cancer risk level of 1 in 100,000; and
  - a positive potential change in baseline socio-economic condition of the affected Mi'kmaq communities from Project activities.
- Moderate
  - loss of a structure, site or thing that is of historical, archaeological, paleontological or architectural significance to the Mi'kmaq of Nova Scotia as a result of Project development, with mitigation measures;
  - an observable change in the availability and baseline condition of the lands and resources for traditional purposes for a short temporal window (less than 20 years) with no consideration of appropriate and negotiated accommodation and compensation with the affected Mi'kmaq community(s); and
  - elevated risk of non-carcinogenic or carcinogenic health risk that do not exceed Risk Quotients and where Incremental Lifetime Cancer Risks (ILCR) related to the Project were not predicted to exceed the benchmark cancer risk level of 1 in 100,000.
- High
  - loss of a structure, site or thing that is of historical, archaeological, paleontological or architectural significance to the Mi'kmaq of Nova Scotia as a result of Project development, without mitigation measures;
  - an observable change in the availability and baseline condition of the lands and resources for traditional purposes for a long term temporal window (>20 years);
  - elevated risk of non-carcinogenic or carcinogenic health risk that exceed Risk Quotients and/or where Incremental Lifetime Cancer Risks (ILCR) related to the Project were predicted to exceed the benchmark cancer risk level of 1 in 100,000; and
  - a negative potential change in baseline socio-economic condition of the affected Mi'kmaq communities from Project activities.

6.14.7 Project Activities/Interactions with Mi'kmaq of Nova Scotia

The assessment of potential effects on Indigenous Peoples includes consideration of changes in health and socio-economic conditions; physical and cultural heritage, including any structure, site or thing that is historical, archaeological, paleontological or architectural significance; and current use of lands and resources for traditional purposes.

Potential interactions between Project activities and the Mi'kmaq of Nova Scotia are outlined in Table 6.14-3 and Table 6.14-4 below.

Table 6.14-3: Potential Project Activities/Interactions with Mi'kmaq of Nova Scotia at Beaver Dam Mine Site

Project Phase	Duration	Relevant Project Activity
Construction	1 year	• Clearing, grubbing, and grading in preparation of construction • Rock blasting in preparation of construction (e.g., pre-stripping) • Till, Organic and waste rock from site preparation including transport and storage • Watercourse and wetland alteration in preparation of construction, including open pit dewatering • Surface infrastructure installation and construction • Collection ditches and settling pond construction • Local traffic bypass road construction • Mine Site road construction and lighting • Culvert and bridge upgrades and construction • General noise and lighting from construction activities • Wildlife vehicle interactions/collisions
Operations and Maintenance	5 years	• Drilling and rock blasting to access and extract ore • Management of waste rock • Management of till and organic stockpiles • Open pit dewatering • Site maintenance • Treatment of site surface water runoff and surface mine pumped water • General management of domestic wastes derived from operation and maintenance activities • Petroleum products management • Dust management • Culvert and bridge maintenance • General noise and lighting from operational activities • Wildlife vehicle interactions/collisions
Active Closure	2 years	• Site reclamation activities • Water treatment and management • Noise and lighting from active closure activities • Wildlife vehicle interactions/collisions
Post-closure	10+ years (monitoring)	• Water treatment and management

Table 6.14-4: Potential Project Activities/Interactions with Mi'kmaq of Nova Scotia along the Haul Road

Project Phase	Duration	Relevant Project Activity
Construction	1 year	• Clearing, grubbing, and grading in preparation of construction • Rock blasting in preparation of construction • Watercourse and wetland alteration in preparation of construction • Auxiliary infrastructure installation and construction • Local traffic bypass road construction • Culvert and bridge upgrades and construction • General noise and light from construction activities • Wildlife vehicle interactions/collisions
Operations and Maintenance	5 years	• Transport of ore form Beaver Dam Mine Site to Touquoy Mine Site • Haul Road maintenance and repairs, including snow removal and deposition of sand for traction control • Petroleum products management • Dust management • Noise and light from Haul Road activity • Wildlife vehicle interactions/collisions
Active Closure	2 years	• N/A[(a)]
Post-closure	10+ years (monitoring)	• N/A

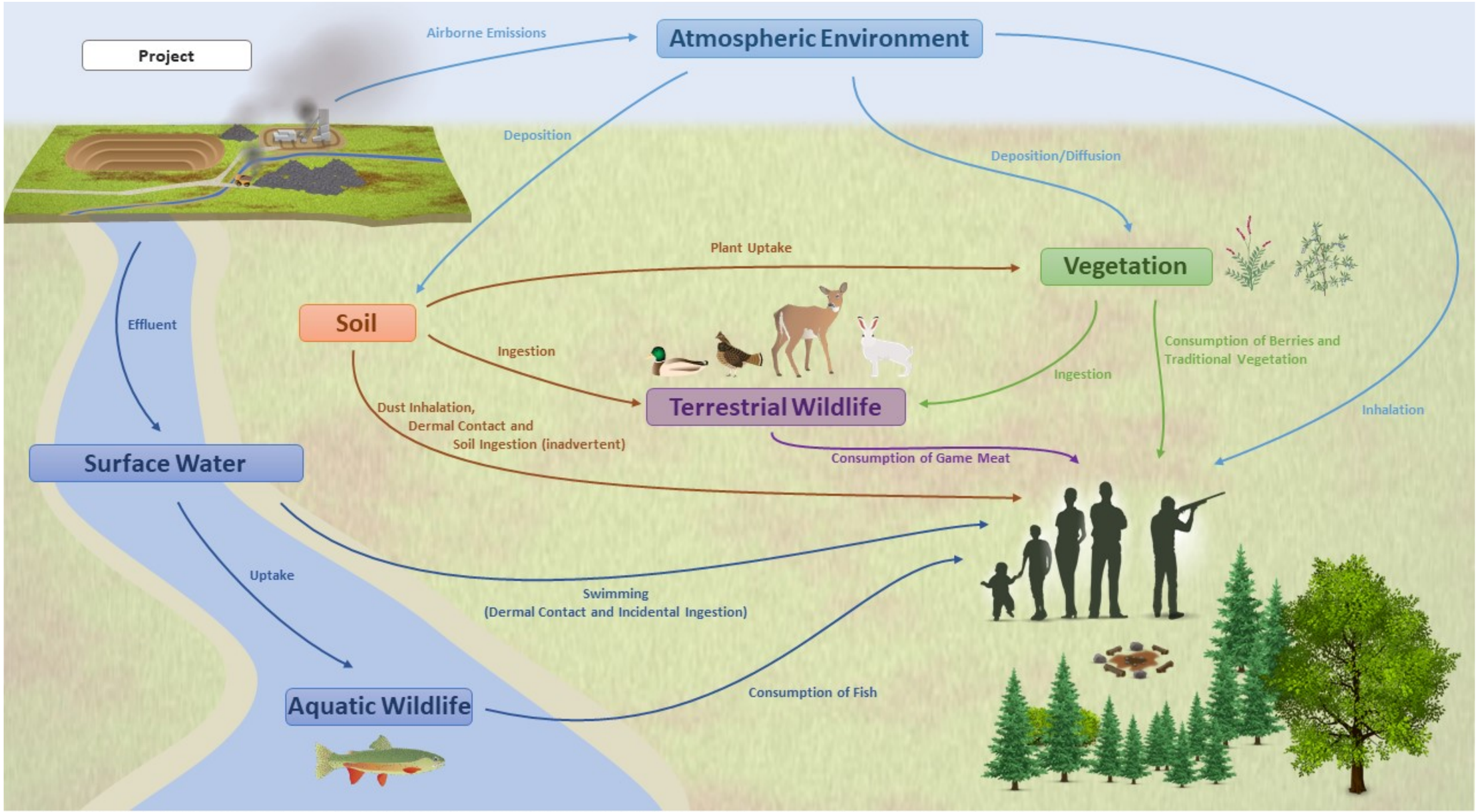
Note: [(a)] Decommissioning and Reclamation of the Haul Road is not expected. The Haul Road will be returned to owner for forestry Industry. N/A = not applicable.

The temporal scale of effects to the Millbrook First Nation and the Mi'kmaq of Nova Scotia more broadly will begin with initiation of site preparation activities, as the land and resources within the proposed site property boundaries at the Beaver Dam Mine Site and Haul Road will no longer be available for use and will continue throughout all Project phases until completion of the active closure phase. During the post-closure phase, the pit at the Beaver Dam Mine Site will be re-filling with water, and water treatment as required and monitoring is predicted to continue, but no other site activities would affect the site area usage for the Mi'kmaq, as active reclamation activities will be completed.

Many of the potential Project effects to the Mi'kmaq of Nova Scotia health and socio-economic conditions, and current use of lands and resources for traditional purposes, are via effects to VCs assessed as part of this EIS (including potential adverse effects to noise, air, light, geology/soil/sediment, surface water, groundwater, wetlands, fish and fish habitat, habitat and flora, birds, fauna, and SAR/SOCI). A summary of each of these relevant VC predicted residual effects (post mitigation) are described below in Table 6.14-5, and then are evaluated for potential interaction with the Mi'kmaq of Nova Scotia.

Where appropriate, individual VCs were included in a human health risk assessment (HHRA) completed by Intrinsik (2021), included in Appendix C.2, to evaluate potential risk to human health from the Project. This report assesses the potential for emissions from the Beaver Dam Mine Site and the Haul Road, released via Project activities, to change the chemistry of air, water and soils in the area, and whether the predicted changes have the potential to result in metals accumulation in, or on, vegetation, or other selected country foods that may be consumed by humans. In addition, this report also provides an assessment of other exposure pathways, such as recreational swimming (Cameron Flowage/Killag River), and inhalation and incidental ingestion of metals on dusts in air and soil. The focus of this assessment is on the Beaver Dam Mine Site and Haul Road, in areas outside of the proposed property boundary which could be accessed by the general public, including the Millbrook First Nation community members and the Mi'kmaq of Nova Scotia more broadly, during various activities. The Moose River was not evaluated due to demonstrated low water levels and limited opportunity for swimming in this receiving environment. Figure 6.14-3 documents the human health conceptual site visual model and Figure 6.14-4 documents exposure pathways considered in the HHRA. The complete HHRA is included in Appendix C.2 and is described in Section 6.14.7.2.

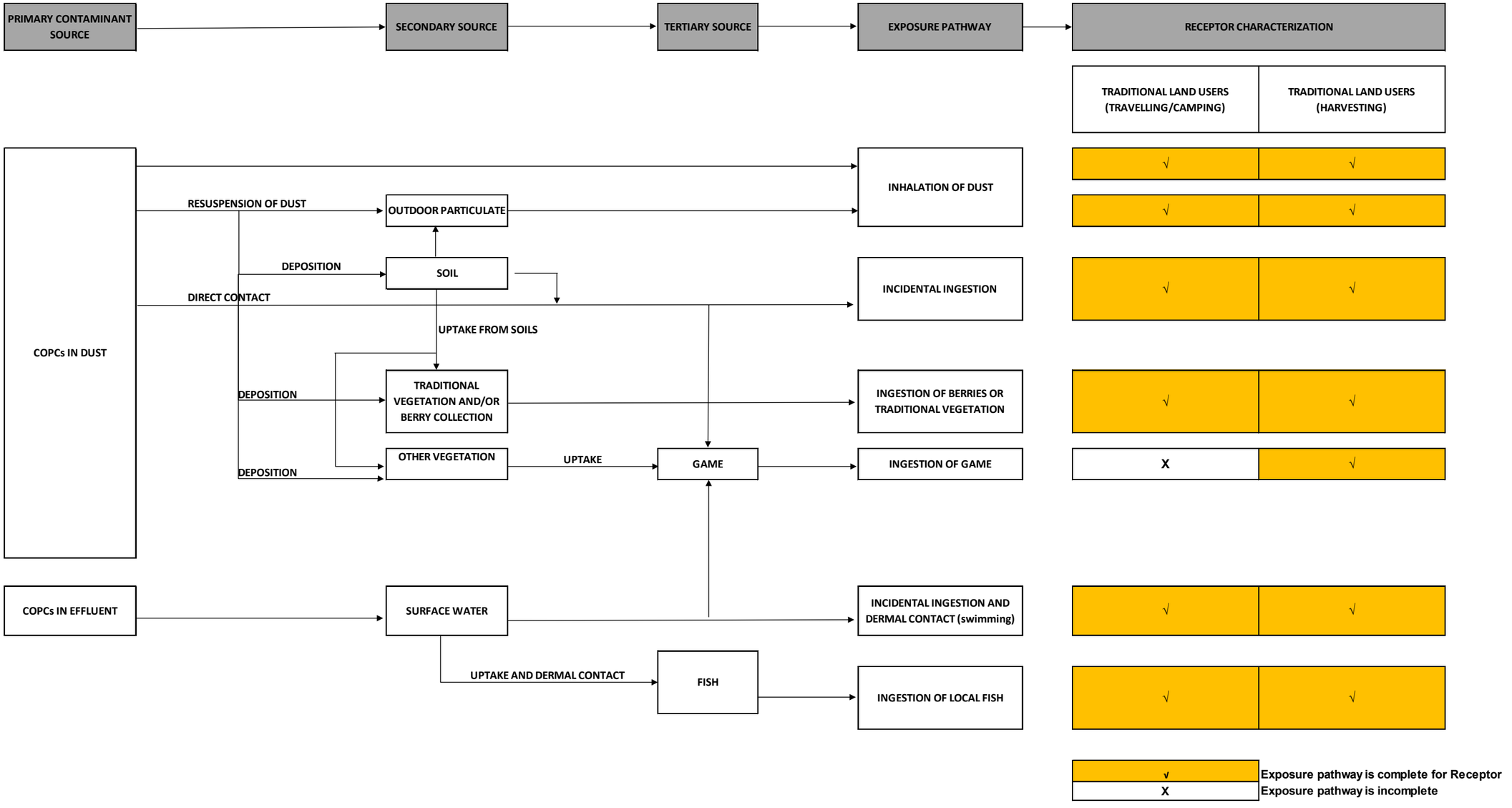
Figure 6.14-3: Human Health Conceptual Site Visual Model



Graphics courtesy of the Integration and Application Network, University of Maryland Center for Environmental Science (ian.umces.edu/imagelibrary/) and the Health Canada conceptual site model builder tool.

Source: Intrinsik 2021 included as Appendix C.2.

Figure 6.14-4: Human Health Conceptual Site Model



Source: Intrinsik 2021 included as Appendix C.2.

Note: COPC = Contaminants of Potential Concern.

Table 6.14-5: Project Interactions and Summaries for each Valued Components and Potential Effect to Mi'kmaq of Nova Scotia

Valued Component	Summary of Residual Effect	Potential Interaction with, and Effect to the Mi'kmaq of Nova Scotia (health and socio-economic conditions, current use, physical and cultural heritage)	Consideration in HHRA
Noise	Beaver Dam Mine Site will be in compliance with the nighttime Pit and Quarry Guidelines (55 dBa).The Haul Road will operate from 7am-11pm and will be in compliance with the evening Pit and Quarry Guidelines (60 dBa). Predicted blasting noise will meet the Nova Scotia Pit and Quarry Guidelines (NSEL 1999) criteria of 128 dBA at approximately 100+ m from the blast location.	Noise levels are predicted to meet the Pit and Quarry Guidelines (NSEL 1999) at the proposed property boundary at the Beaver Dam Mine Site and Haul Road and thus, there is limited noise exposure to the Mi'kmaq of Nova Scotia outside of the Project property boundaries. Elevated noise above background concentrations near the Beaver Dam Mine Site and Haul Road may affect wildlife patterns and as a result, affect traditional hunting practices by the Mi'kmaq of Nova Scotia within 400m (S, W, E) to 1,000m (N) of the Beaver Dam Mine Site and approximately 500m on either side of the Haul Road, based on the most conservative guideline (nighttime value of 45 dBA) identified for potential broad wildlife effects (Environmental Code of Practice for Metals Mines EC 2012c). Elevated noise is not expected to affect plant gathering or fishing activities or other recreational/commercial uses of the area directly surrounding the Project. Summary effects of noise on fauna are described below.	No
Air	Maximum predicted concentrations of parameters (i.e., TSP, PM_{10}, and $PM_{2.5}$) meet the assessment criteria for ambient air quality standards (NSAQA 2017 and CAAQS 2020) at the proposed Beaver Dam Mine Site and the Haul Road property boundaries. At the Haul Road property boundaries, these assessment criteria are met with applied mitigation of 80% chemical dust suppressants.	Elevated particulate levels above background concentrations outside of the Beaver Dam Mine Site and Haul Road property boundaries could be present on vegetation and berries and as a result, affect traditional gathering and food consumption practices and human health by the Mi'kmaq of Nova Scotia.	Yes
Light	Direct line of sight is possible up to 5 km from the Beaver Dam Mine Site property boundary where topography favors light propagation. Light intrusion into the forested habitat along the Haul Road up to 279m from the Haul Road property boundary.	Increased light levels above background levels near the Beaver Dam Mine Site could affect wildlife patterns and as a result, affect traditional hunting practices by the Mi'kmaq of Nova Scotia. While effects of light on wildlife are documented, it is still an emerging area of research. This is discussed in Fauna section below. Increased light levels are not expected to affect plant gathering or fishing activities or other recreational/commercial uses of the area directly surrounding the Project. There is no pathway for effect to human health from light.	No
Geology, Soils and Sediment	There is a potential for acid rock drainage based on 70 static tests and 5 humidity cell tests of mine rock materials Based on a number of conservative assumptions, the results indicate that there is very low potential for acidic conditions to occur during operations. During closure phase, there is potential for acidic conditions to occur (i.e., 50% of PAG is predicted to be acidic within 10 years); however, through mitigations (e.g., engineered cover and water management) these conditions can be mitigated. Monitoring will be undertaken during operations and closure to validate the geochemical source terms and impact predictions. If necessary additional mitigations will be applied.	Acidic conditions in predicted surface water quality from the Project could affect fishing practices in Cameron Flowage (Killag River) (receiving environment for mine discharge). This potential pathway for exposure is considered in the Surface Water VC. Mine rock will be tested during construction and operations as described in Metal Leaching/Acid Rock Drainage Plan (Appendix E.5). Material considered to have the potential for acid rock drainage will be stored in a designated area (i.e., PAG stockpile) located adjacent to the pit. Although water quality models indicate that there is a very low potential for acid conditions to occur during operations diversion ditches will be constructed around the PAG Stockpile so that water can be directed to the North Settling Pond for treatment, as necessary, prior to discharge. At closure, an engineered cover will be placed over the PAG to reduce infiltration of water into the pile. The area will be covered with soil and revegetated. Water from the PAG stockpile will be directed towards the pit. Monitoring will be undertaken throughout construction and operations to confirm impact predictions (i.e. geochemical characterization and water quality) and to adaptively manage PAG mitigations prior to closure. Monitoring will continue during active and post closure.	No* * Human exposure to soils outside the proposed property boundaries, which could be potentially influenced by atmospheric deposition from mining activities is described in the air VC and is included in the HHRA (dust deposition onto soils)
	Historical tailings present at Beaver Dam Mine Site will be fully delineated, tested and managed during construction. Disposal of historic tailings will be off-site at the Touquoy tailings management facility.	The applied monitoring and mitigation will limit potential impacts to Mi'kmaq human health, harvesting/gathering practices and/or recreation and other cultural pursuits. Release of sediment and contaminants associated with historical tailings could also affect downstream water quality in surface water systems (Cameron Flowage (Killag River), Mud Lake, Crusher Lake, Tent Lake watershed). An assessment was undertaken in 2019 and 2020 (Appendix E.9) to identify historical tailings within the Beaver Dam Mine Site. AMNS is committed to managing historic tailings encountered during construction and operations. Historic tailings will be stored in a designated area until it can either be shipped off-site to the Touquoy Tailings Management Facility (TMS) or in the exhausted pit. .Water originating from historic tailings will be directed to the North Settling Pond for treatment prior to release to the environment. Water treatment is designed to meet water quality objectives. and compliance as described in Surface Water VC. Human exposure to historic tailings will be limited because they are either going to be removed and managed/disposed of, to enable mining to occur, or left in their current stable condition (Appendix E.9). Furthermore, there will be no access for general public in the active mining area.	

Table 6.14-5: Project Interactions and Summaries for each Valued Components and Potential Effect to Mi'kmaq of Nova Scotia (continued)

Valued Component	Summary of Residual Effect	Potential Interaction with, and Effect to the Mi'kmaq of Nova Scotia (health and socio-economic conditions, current use, physical and cultural heritage)	Consideration in HHRA
	There is the potential for release of sediment from the road surface to be released to water bodies, especially at stream crossings.	Lessons learned from Touquoy sediment release incidents will be incorporated into the engineered designs of roads near water bodies and during road maintenance and snow clearing activities. These lessons include careful control of road height and drainage gradients near water bodies, as well as specialized sediment control measures near stream crossings that incorporate filter cloth into the road base design and application of specialized surface stabilizers on the road surface near water bodies. In addition, specialized ditching, check dams and sumps will be utilized as required. A monitoring plan for sediment in water bodies near the road will be implemented during and after construction to ensure control measures are and continue to be effective.	
Groundwater	Maximum radius of influence (groundwater drawdown) is predicted at a maximum of 1000 m (to the south) from the pit during operations, and less that this during closure, when the pit is re-filling with water. The nearest potable well is 5 km south of the Beaver Dam Mine Site (drilled well Beaver Lake IR 17). Groundwater seepage has been predicted through modelling efforts and these seepage rates have been included in operational and closure surface water modelling efforts to understand potential effect of groundwater seepage on surrounding surface water features.	At the end of mine operations, there is no significant impact to the reasonable use of groundwater at the Beaver Dam Mine Site property boundary. No impacts to groundwater quality and quantity are predicted approaching the regional assessment area, or at key receptors including Beaver Lake IR 17 or the nearest domestic well located along Hwy 224. Groundwater seepage was considered as part of the surface water quality modelling efforts. Due to the distance of Mi'kmaq communities and residences, and proposed surface water treatment, if required, during Closure Phase of the Project, predicted groundwater changes and groundwater seepage are not expected to affect the traditional practices or residences of the Mi'kmaq of Nova Scotia.	No
Surface Water	During construction, water will be directed to the North Settling Pond and treated (i.e., modular effluent treatment plant), as necessary, for elevated metals, originating from historic tailings, as well as sediments. Water will be monitored and tested prior to discharge to confirm it meets discharge criteria. The modular effluent treatment plant will remain as contingency during operations. During operations, mine contact water will be directed to the North Settling Pond where it will be tested and, if necessary, treated before release. Water from the topsoil and organic stockpiles will be directed to the East and South Settling Ponds where it will be treated for TSS before release. There is contingency to direct water from the East Settling Pond to the North Settling Pond if additional water treatment is necessary. Water quality modelling predicts elevated nitrite originating from the WRSA will require treatment in aeration ponds before release. Water quality monitoring will be undertaken a compliance points to confirm impact predictions and inform adaptive management as necessary. Water at the 100 m mixing zone in the Cameron Flowage/Killag River will be monitored to ensure meets water quality objectives. At closure, an engineered cover will be installed to encapsulate the PAG stockpile and reduce infiltration. Water from the site include the PAG stockpile will be directed to the pit to facilitate refilling. Water quality modeling predicts elevated levels of zinc and cobalt for the upper case only (i.e., most conservative case) for two months. Water will be treated at closure, as necessary, to ensure it meets discharge criteria. Geochemical characterization of waste rock and water quality monitoring will be undertaken throughout construction and operations to confirm impact predictions and inform adaptive management.	Due to the distance of Mi'kmaq communities and residences, and proposed surface water treatment, as/if required, during operations and during Closure Phase of the Project, surface water quality and quantity predictions are not expected to affect the traditional practices or residences of the Mi'kmaq of Nova Scotia outside of the Beaver Dam Mine Site property boundary during operations and closure phases of the Project. No known locations where Mi'kmaq residents draw directly from lakes or rivers for potable purposes (permanent or seasonal/temporary) have been identified, through direct engagement with Mi'kmaq communities or through the TLRUS and MEKS, in close proximity to the Beaver Dam Mine Site. In the absence of such locations being identified to AMNS, no evaluation of surface potable water sources was considered in the HHRA. However, evaluation of the predicted concentrations at the North Settling Pond and East Pond discharge (Cameron Flowage) have been compared to Canadian Drinking Water Guidelines within the HHRA. These locations are considered the worst-case scenario and these predictions demonstrate there is no concern associated with occasional consumption of surface water surrounding the Beaver Dam Mine Site. The potential for adverse health effects from recreational water use (i.e. swimming) in Cameron Flowage/Killag River have been considered in the HHRA. Swimming in the Moose River has been excluded from HHRA consideration due to low water levels in this river.	Yes
Wetlands	Of the 236 wetlands identified within the FMS Study Area, 128 (54%) will be avoided by Project design. A total of 108 wetlands are proposed for alteration, 74 of which will require only partial alteration. Indirect wetland impacts are expected from changes to local catchment areas and groundwater drawdown (open pit dewatering). Wetland compensation will be required to off-set the loss of wetland habitat from the Project. A preliminary Wetland Compensation Plan is attached as Appendix H.3.	Loss of wetland habitat is limited to the area directly surrounding the pit and associated infrastructure development for the proposed mine. Management of historical tailings will improve wetland quality in the local area and improve water quality, and overall watershed health. Wetland restoration opportunities will be identified in consultation with the Mi'kmaq of Nova Scotia with the goal to identify projects that would benefit the Mi'kmaq and local watersheds where wetland restoration would benefit traditional Mi'kmaq practices.	No
Fish and Fish Habitat	Spawning habitat for species known or expected is limited in the Beaver Dam Mine Site and Haul Road. Development of the Beaver Dam pit and associated mine infrastructure will require the alteration of Wetland 59 (open water marsh habitat with fish and fish habitat) and several smaller tributaries. Indirect impacts to fish and fish habitat have also been described. A draft Fish Habitat Offset Plan (Appendix J.3) has been developed to compensate for loss of fish habitat required for Project development. Site infrastructure has been micro-sited for fish habitat avoidance wherever practicable. A Fisheries Authorization will be required for the Project, and a Preliminary Fish Habitat Offset Plan for fish habitat offsetting is included in the EIS	The development of the pit will manage the containment/disposal of historical tailings. Areas where Mi'kmaq fishing activities are known or expected to take place surrounding the Beaver Dam Mine Site and Haul Road will not be affected by Project development. Access will be maintained to fishing locations throughout the LAA through a constructed bypass access road for Mi'kmaq and local people who want continued access to fish in the LAA. Evaluation of the potential exposure pathway of uptake of metals from surface water into fish and subsequent consumption by humans was considered in the HHRA.	Yes

Table 6.14-5: Project Interactions and Summaries for each Valued Components and Potential Effect to Mi'kmaq of Nova Scotia (continued)

Valued Component	Summary of Residual Effect	Potential Interaction with, and Effect to the Mi'kmaq of Nova Scotia (health and socio-economic conditions, current use, physical and cultural heritage)	Consideration in HHRA
Flora and Habitat	Ecosites are predominantly poor to medium nutrient regimes with acidic soils and dominated by mixedwood and conifer forest stands. Historical mining and impacts from timber harvesting have historically affected the habitat and flora communities with the Beaver Dam Mine Site and Haul Road. A total of 295 species of vascular plants were observed. Of these, six a SOCI. No SAR vascular plant species were observed. Twenty-three species of lichens were observed within the FMS Study Area. One of these, eight are SOCI and three are SAR.	A total of 14 occurrences of lichen and/or vascular plant SAR and SOCI will are expected to be directly impacted by the Project. The loss of these individual plants and lichens is not expected to have a significant impact on the Mi'kmaq of Nova Scotia and their traditional practices. New habitat loss to support Project development is minimized by active historical timber harvesting activities in this area and historical mining activities. Reclamation will involve revegetation of the disturbed areas with an approved mix of native seeds and potentially shrubs/seedlings. This Reclamation Plan will be developed in consultation with Mi'kmaq of Nova Scotia.	No
Fauna	A common assemblage of fauna was observed within the Beaver Dam Mine Site and Haul Road. The Beaver Dam Mine Site and Haul Road were evaluated for bat hibernacula potential through both desktop and field evaluations. No evidence of bat usage or suitable hibernacula habitat were observed. Three set of mainland moose (ACCDC S1; NSESA E) tracks were observed incidentally and during targeted moose surveys within, or in proximity to, the Beaver Dam Mine Site. Snapping turtle (SAR) uses portions of the Beaver Dam Mine Site, with documented turtle sightings adjacent to Wetland 59 and along roadsides near the Touquoy Mine Site, including the Haul Road. The Project will result in a loss of habitat for Fauna, increased habitat fragmentation, and potential sensory disturbance (noise and light) to wildlife in close proximity to the Beaver Dam Mine Site and Haul Road property boundaries.	Project activities are likely to result in localized avoidance of the Beaver Dam Mine Site and Haul Road and directly surrounding areas by some species. This potential avoidance would be due to changes in ambient noise levels and light levels in close proximity to the property boundaries, direct habitat loss, potential indirect habitat loss, and increased fragmentation. This potential change in wildlife patterns may affect the traditional practices of the Mi'kmaq of Nova Scotia in close proximity to the Beaver Dam Mine Site and Haul Road. This disturbance is limited spatially, and temporary in nature, with construction, operation and active reclamation of the Project resulting in up to eight years of potential local disruption to wildlife patterns. Evaluation of the potential exposure pathway of uptake of metals from soil or vegetation, uptake of metals in game species, and subsequent consumption by humans was considered in the HHRA.	Yes
Avifauna	Abundance and diversity of avian species observed was moderate to high based on observer experience in the geographic area. A common species assemblage of forest birds was observed, along with many priority species. Nine SAR and 23 SOCI avifauna species were observed in the Beaver Dam Mine Site and Haul Road. The Project will result in a loss of habitat for Fauna, increased habitat fragmentation, and potential sensory disturbance (noise and light) to avifauna in close proximity to the Beaver Dam Mine Site and Haul Road property boundaries.	Project activities are likely to result in localized avoidance of the Beaver Dam Mine Site and Haul Road and directly surrounding areas by some bird species. This potential avoidance would be due to changes in ambient noise levels, light levels, direct and indirect habitat loss and increased fragmentation. This potential change in bird usage patterns may affect the traditional practices of the Mi'kmaq of Nova Scotia in close proximity to the Beaver Dam Mine Site and Haul Road. This disturbance is temporary in nature, with construction, operation and active reclamation of the Mine resulting in up to eight years of potential local disruption to bird usage patterns.	No
Species at Risk	Mainland moose (ACCDC S1; NSESA E) tracks were observed surveys within, or in proximity to, the Beaver Dam Mine Site. Snapping turtle (SAR) was observed within the Beaver Dam Mine Site, the Touquoy Mine Site, and the Haul Road. Six SOCI vascular plant species were observed. Three SAR and eight SOCI lichen species were observed. Eight SAR and 17 SOCI avifauna species were observe. Three SOCI fish species were observed. Direct habitat loss is expected as a result of the Project. SOCI vascular plant loss includes one occurrence of southern twayblade. SOCI and SAR lichen loss includes blue felt lichen, salted shell lichen, eastern candlewax lichen, and slender monk's hood lichen.	Mobile species (birds, fish, moose) are expected to occupy adjacent suitable habitat for the eight years that the Project is being developed, operated and completion of active reclamation. The Beaver Dam Mine Site and Haul Road is located in a rural area, with limited development pressures in close proximity to the Beaver Dam Mine Site and Haul Road. This potential change in wildlife patterns, including SAR, may affect the traditional practices of the Mi'kmaq of Nova Scotia in close proximity to the Beaver Dam Mine Site and Haul Road.	No
Physical and Cultural Heritage	Thirteen sites/areas with elevated archaeological potential were identified with the Beaver Dam Mine Site. Most sites are associated with historical mining activities and Euro-Canadian archaeological resources. Three sites (Areas 1, 2 and 3) were identified as having elevated potential for historic Mi'kmaw archeological resources based on their proximity to a water source and terrain suitable for settlement/encampment. Three sites will be impacted by the Project.: Site 6 is located in an area identified as "Forge Hill". The features are identified as having moderate to high potential for historic Euro-Canadian archaeological resources related to historical mining activities. Areas 2 and 3 are located along the western shore of Cameron Flowage. Area 2 will be impacted by a topsoil stockpile north of the pit, and Area 3 will be impacted by the pit and an adjacent access road. Additional shovel tests were completed within Site 6, Area 2 and Area 3 in fall 2020. No Pre-contact Mi'kmaq archaeological resources were encountered.	Identified archaeological sites that will be affected by the Project are not Mi'kmaq resources. Identified areas of Mi'kmaq elevated potential within the Beaver Dam Mine Site for archaeological resources will be avoided. Identified and known Mi'kmaq archaeological features are outside of the proposed development footprint of the Project and thus will not be affected by Project development. No Pre-contact Mi'kmaq archaeological resources were encountered during the fall 2020 shovel tests of Areas 2 and 3 and Site 6.CRM Group recommends these areas be cleared of requirements for further investigation. In the event that archaeological deposits or human remains are encountered during construction/operation activities associated with the Beaver Dam Mine Project, all work in the associated area(s) should be halted and immediate contact made with the Nova Scotia Special Places Program, and with the KMKNO Archaeological Division.	No

Stemming from the technical conclusions presented in Table 6.14-5, a discussion of potential Project interactions with Millbrook First Nation traditional use of the land, and Project Interactions with Health and Socioeconomic Conditions is provided in the following sections, followed by proposed mitigation measures to minimize impact to the Millbrook First Nation and the Mi'kmaq of Nova Scotia more broadly. Throughout these subsections, feedback received from Millbrook and other Mi'kmaq communities relating to Project interactions, mitigation and accommodation conclusions are presented, where feedback has been provided.

AMNS is committed to on-going engagement with Millbrook First Nation, and the other Mi'kmaq of Nova Scotia communities throughout the environmental assessment, and the entire life cycle of the Project. Ongoing feedback and input from the community will allow for adaptive management of, in proposed mitigation measures, and monitoring plans. AMNS is committed to pursuing a process of meaningful engagement to ensure that:

- Engagement activities are inclusive, flexible and respect Indigenous decision-making and processes that are in place;
- Indigenous knowledge is included and considered in the EIS and further Project development; and
- Avoidance, mitigation, and other measures are developed with impacted Indigenous communities.

6.14.7.1 Project Interactions with Mi'kmaq Traditional Use/Rights

This section provides a discussion of Project interactions with Mi'kmaq traditional use and rights as described in Section 6.14.2 and 6.14.4, and provides Round 2 Information Requests (IR2s) responses to CEAA 2-49 and CEAA 2-54 (AMNS 2021a).

There will be a reduction in area available for hunting, trapping, gathering, fishing, spiritual ceremonies and other Millbrook and broader Mi'kmaq traditional activities within the Beaver Dam Mine Site and Haul Road. The infrastructure footprint (mine site and haul road) will result in direct habitat loss and the Project will restrict access within a proposed property boundary/compliance boundary for a period of eight years. This infrastructure footprint and property boundary are shown on Figure 6.14-5.

Plant species of significance to Millbrook First Nation, and the Mi'kmaq more broadly, were identified within the Beaver Dam Mine Site and Haul Road portions of the PA, and the surrounding LAA (Figure 6.14-1). Habitat adjacent to and surrounding the Project has the potential to support plant species of significance based on information presented in MEKS and TLRUS as well as engagement undertaken to date with the First Nations. These adjacent plant communities, not impacted by historic tailings, are expected to remain accessible to Millbrook community members. Access to these areas will remain with the construction of, proposed bypass road, which will be adjacent and parallel to the Haul Road and around the Beaver Dam Mine Site. AMNS does acknowledge that there will be loss of habitat resulting from the construction and operations of the mine and therefore altering the habitat and area available to the Millbrook First Nation and the broader Mi'kmaq community for their use. However, the loss of habitat that supports traditional plants does not pose a significant threat to Mi'kmaq use of the species, given their abundance and availability within close proximity, and the rural nature of the landscape surrounding the Beaver Dam Mine Site and Haul Road.

Prepared For:

Atlantic Gold

FIGURE 6.14-5

Review of Direct/Indirect Impacts to Millbrook First Nation

Beaver Dam Mine Site

Beaver Lake IR

Haul Road

Touquoy Mine Site

HWY 224

Mooseland Road

- Collector Road
- Local Road
- Seasonal Road
- Diveways (>300 m)
- Track
- Trail
- Streams
- Haul Road Centerline
- Beaver Lake IR
- Wildlife Indirect Environmental Effects Zone
- Limited Firearms Zone
- Proposed Infrastructure
- Touquoy Infrastructure Layout
- Proposed Property Boundary
- Lakes
- Corporate Lands
- Crown Lands
- Private Lands
- Unknown
- Roads



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 0.75 1.5 3 Kilometers

1:75,000 Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed By: XX

Date: 2021-04-28

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

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Document Name: BD_EIS_Figure6-14-4Direct_Indirect Impacts

Additionally, due to the proximity of the Beaver Dam Mine Site and Haul Road to traditional harvesting areas as demonstrated in Section 6.14.3 and 6.14.4 through the TLRUS (MFC 2019) and MEKS, there will potentially be an area outside of the Beaver Dam Mine Site and Haul Road where Millbrook community members and other Mi'kmaq hunters may observe a changed pattern of wildlife movement. This area has been identified as a potential wildlife environmental effects zone. Within close proximity to the proposed property boundaries of the Beaver Dam Mine Site and Haul Road, there is the potential for sensory disturbance to wildlife and birds from noise and light above background conditions resulting in potential changes to wildlife patterns and by extension, hunting practices for the Mi'kmaq of Nova Scotia. There are limited Project effects expected to hunting, gathering and trapping activities beyond the potential Wildlife Environmental Effects Zone. This potential wildlife environmental effects zone is shown on Figure 6.14-5.

The Mi'kmaq may experience hunting limitations near the Beaver Dam Mine Site and Haul Road for the use of firearms. Participants in the TLRUS described how they might be displaced along the Haul Road and in proximity to the Beaver Dam Mine Site where they "may feel uncomfortable using their firearms for safety reasons" (MFC 2019, p. 54). This limited firearms zone is shown on Figure 6.14-5 and demonstrates the maximum potential "loss of harvesting area for those individuals who do not feel comfortable shooting towards an active mine or haul road" (MFC 2019).

These direct and indirect impact areas are described in Table 6.14-6.

Table 6.14-6: Beaver Dam Mine Project Direct and Indirect Impact Areas for Mi'kmaq Traditional Use

Direct or Indirect Impact Areas	Area (Hectares (ha))*
Direct Infrastructure Footprint – associated habitat loss	243 (34 ha of which is Crown land)
Direct Access Loss – compliance boundary	727 (123 ha of which is Crown land)
Indirect Wildlife Environmental Effects Zone	3261 (1108 ha of which is Crown land)
Indirect Limited Firearms Zone	4358 (1411 ha of which is Crown land)

*Area calculations were completed using available property boundaries from Government of Nova Scotia Geomatics Centre (not survey plans).

Details relating to Millbrook First Nation and Mi'kmaq of Nova Scotia traditional and current fish harvesting locations are described within the TLRUS and MEKS. In summary, fishing practice has been documented across the LAA and adjacent to the proposed Beaver Dam Mine Site and Haul Road. No fishing lakes or rivers are documented within the proposed 4km of new construction for the Haul Road, however, fishing has been documented within the Beaver Dam Mine Site (trout fishing) within the Killag River and possibly also within Mud and Crusher Lakes. These fishing locations have, in part, informed proposed mitigation measures, as described in Section 6.14.8 and detailed in CEAA 2-48 and proposed suitable alternative areas for traditional practices, as described in CEAA 2-49. Access to the lakes and rivers surrounding the Beaver Dam Mine Site and Haul Road will be maintained (Section 6.14.8 (mitigation)), however, direct access to Crusher and Mud Lakes will be limited during the temporal scale of the Project (i.e., eight years).

Fishing practices for Millbrook First Nation community members and other Mi'kmaq of Nova Scotia within lakes and rivers surrounding the Project will be maintained during Project construction and operations. All site water will be collected, managed and discharged to the receiving environment (Cameron Flowage/Killag River) in accordance with all regulatory requirements and in a manner which ensures protection of aquatic life. Monitoring programs will be designed and implemented to confirm these conclusions for the temporal life of the Project. Details relating to Project effects on fish can be found in Section 6.9.

Engagement with Millbrook First Nation on January 31, 2019 provided information that there is a potential for a housing development (69 lots) on the existing lands of the Beaver Lake IR 17. A review of the modelling results and a qualitative impact analysis on this potential development was completed. As the geography of the potential development is contained within the

existing Beaver Lake IR, the modelling efforts and impact assessment conclusions are valid and consistent for the entire lands of the Beaver Lake IR. A review of the key VCs for the residents and lands at Beaver Lake IR such as light, air quality, noise, surface water, groundwater, socio-economic and cultural resources was completed. All the predicted levels of impact for those VCs remain valid for the potential development. AMNS commits to maintaining an ongoing relationship with Millbrook First Nation and will continue engage on this potential development and the Beaver Dam Mine Project throughout all stages of permitting, construction, operation and closure.

Identified archaeological sites that will be affected by the Project are not Mi'kmaq resources. Identified areas of Mi'kmaq elevated potential within the Beaver Dam Mine Site and Haul Road for archaeological resources will be avoided. Identified or potential Mi'kmaq archaeological features (potential burial site west of Beaver Dam Mines Road) are outside of the proposed Beaver Dam Mine Site property boundaries and thus will not be affected by Project development. Discussions and review of the Project by the KMKNO archaeological division have occurred (Section 4 and Appendix A.5 for details on engagement and dialogue efforts with the KMKNO teams). To date, no additional archaeological sites have been identified within the Beaver Dam Mine Site.

Nortek Resource Solutions Inc. (Nortek) has completed a viewshed analysis of the Project to support a visual representative of where the Project will be visible from surrounding vantage points (Appendix M.2). This was completed to respond, in part, to CEAA Round 2 information request (IR2) CEAA 2-01.

The Zone of Visual Influence (ZVI) provides a spatial overview of where the proposed Project stockpiles will be visible across a 20 km radius. The Beaver Dam Mine Site is predominantly forested and therefore the existing forest stand data was included in the analysis. The analysis consisted of preparing a Digital Surface Model (DSM) which included the proposed stockpiles. Once the model was prepared, a visibility analysis was completed to determine all areas on the DSM in which the stockpiles are visible. This analysis focused on stockpile locations as they are the highest infrastructure proposed at the Beaver Dam Mine Site.

The ZVI was generated for the region within a 20 km radius of the Beaver Dam Mine Site. The Nova Scotia Provincial Digital Terrain Model (DTM) at 20 m resolution was used as a base layer for the analysis. The proposed stockpiles were rasterized and added to the base DTM so that they were included in the model. A visibility analysis was run using the upper rims of the stockpiles as targets and receptor heights of 1.7 m. The resulting raster was clipped with forest stand polygons that have an average height of 2 m or less which excluded areas were the forest is higher than eye height. The final results show where the proposed stockpiles will be visible assuming summer, leaf on forest conditions.

The Visual Zone of Influence (ZVI) (Appendix M.2) identifies where stockpiles (highest elevation features on the Beaver Dam Mine Site) are visible from the surrounding landscape. The NAG pile, which will be present during operations and closure, is 185m asl. The LGO and till stockpiles are 180m asl, which will both only be present only during operations. These are the highest infrastructure features associated with the Project. On the ZVI, these areas where stockpile(s) are predicted to be visible are shown in green. This ZVI was prepared to provide a general overview of where the Project will be visible from, and also to demonstrate a visual representation of what the visual influence will look like from specific locations. As shown in Appendix M.2 the Project stockpile(s) will be visible from the east and west of the Beaver Dam Mine Site including from West Lake, from the north of the Beaver Dam Mine Site in Como Lake, directly south of the Beaver Dam Mine Site, and also to the west of Beaver Lake IR along the north and south side of Highway 224. Commercial and recreational activities (boating, fishing, swimming) along Cameron Flowage will observe an adjusted viewplane with visible stockpile(s). The ZVI also demonstrates as a user moves farther away from the Beaver Dam Mine Site, the mine infrastructure will be visible from higher elevation points on the landscape, including several high points northwest of the Beaver Dam Mine Site and south of the mine including near Lake Alma. The user will not observe the infrastructure from the majority of lakes surrounding the Beaver Dam Mine Site, with the exception of those described above.

To support Project development, there will be a local bypass road constructed to allow for continued access around the Beaver Dam Mine Site and the lands to the north of the Beaver Dam Mine Site. Based on a review of the ZVI, the Project stockpiles will be visible from the bypass road directly south of the mine site and around the organic stockpile.

Through a review of the ZVI results, several photos were then taken from various vantage points to attempt to demonstrate specific locations where visual influence of the Project would be greatest. Visual Simulations 1 to 4 in Appendix M.2 show these four vantage points and what will be visual during operations and closure phases of the Project.

Visual Simulation 1 illustrates the view from the north side of the Beaver Dam Mine Site just north of Cameron Flowage, looking southwest towards the Project. The NAG stockpile will be visible during operations and closure phases, as shown on Figure 6.14-5. Visual Simulation 2 illustrates a similar view from the north side of the Beaver Dam Mine Site but looking farther southwest/west. The full extent of the NAG stockpile will be visible during operations and closure phases from this location, as shown on Visual Simulation 2. Visual Simulation 3 illustrates the view from west of the Beaver Lake IR on Highway 224 where the ZVI also predicted a visual change from the Project. The PAG, NAG and LGO stockpiles will be visible from this vantage point during the operation phase, as shown on Visual Simulation 3. During reclamation, only the PAG and NAG piles will remain. Finally, Visual Simulation 4 illustrates the view from a forestry road near Cope Brook, south of the NAG pile. From this location, the NAG stockpile will be visible during both the operations and closure phases. These four vantage points were selected to be representative of expected maximum change in viewscape and the locations where anticipated human activities is likely to occur (e.g., near access trails, lakes and other access points).

Once the construction, operation, and active closure phases are complete (i.e., eight years), access will be re-established within the Beaver Dam Mine Site for Millbrook First Nation and the broader Mi'kmaq of Nova Scotia community members. At this time, the site infrastructure will be dismantled and removed, the waste rock piles will be covered and revegetated, and drainage will be re-established. Drainage immediately adjacent to the pit will be directed to towards the exhausted pit to facilitate pit filling, which is expected to take approximately 13 years. With the exception of the pit area, where filling will be on-going and water monitoring will be occurring, traditional practices within the Beaver Dam Mine Site can resume. The landscape will be altered, with more limited forested cover for an extended period of time. This will likely affect the specific nature of traditional practices that will resume within the Beaver Dam Mine Site until the forest re-establishes. The majority of identified historical tailings and waste rock will have been managed and/or removed from the site thereby potentially improving the quality of the habitat. This is considered a positive impact of this Project on future traditional practices with the Beaver Dam Mine Site.

AMNS commits to ongoing engagement to assess any additional sites that have not been previously identified. The predicted impacts of the Project to the Mi'kmaq traditional use of the land are summarized below. These impacts are predicted to be low magnitude, as defined in Section 6.14.6.2 and in consideration of mitigation and accommodation. A low magnitude change is defined (in part) by an observable change in the availability and baseline condition of the lands and resources for traditional purposes for a short temporal window (<20 years) and with commitment to appropriate and negotiated accommodation and compensation with the affected Mi'kmaq community(s). AMNS is committed to appropriate and negotiated accommodation and compensation, as described in Section 6.14.8.

- It is the conclusion of AMNS that the permanent loss of habitat/plant species does not pose a significant threat to Mi'kmaq use of the species as a whole, given their abundance and availability within close proximity, and the rural location of the Beaver Dam Mine Site and Haul Road.
- The Beaver Dam Mine Site and Haul Road will be restricted for access. The Beaver Dam Mine Site area includes 123 ha of Crown land, with limited open water/lakes/recreational swimming or known fishing areas. Crusher Lake and Mud Lake are present within the Beaver Dam Mine Site, located on private land, and these two lakes, which may be used for fishing purposes (trout), will have limited access for the temporal scale of the Project (i.e., eight years).

- Access to the landscape surrounding the Beaver Dam Mine Site and Haul Road will be maintained. A local multi-use bypass road will be constructed parallel to the Haul Road and around the Beaver Dam Mine Site to allow for continued access to the lands to the north of the mine. This mitigation measure is described in detail in Section 6.14.8.
- Change in noise and light levels will meet compliance with guidelines at the Beaver Dam Mine Site and Haul Road property boundary. Elevated noise and light levels above background conditions are expected, but only in close proximity to the Beaver Dam Mine Site and Haul Road.
- Within close proximity to the proposed property boundaries of the Beaver Dam Mine Site and Haul Road, there is the potential for sensory disturbance to wildlife and birds from noise and light above background conditions resulting in potential changes to wildlife patterns and by extension, hunting practices. This area is documented as the Indirect Wildlife Environmental Effects Zone and includes approximately 1,108 ha of Crown land.
- Within close proximity to the proposed property boundaries of the Beaver Dam Mine Site and Haul Road, there is the potential for Mi'kmaq hunters to experience hunting restrictions. This area is documented as the Indirect Limited Firearms Zone and includes approximately 1,411 ha of Crown land.
- Access limitations within the Project property boundaries are for a temporal scale of eight years (construction, operations and the active closure).
- The assessment concludes that traditional practices within the Beaver Dam Mine Site can resume during the post-closure phase. The landscape will be altered, with more limited forested cover for an extended period of time until forest re-establishes. This will likely affect the specific nature of traditional practices that will resume within the Beaver Dam Mine Site.
- There will be a change in surrounding viewscape of the Project. Project stockpiles will be visible from several local vantage points around the Beaver Dam Mine Site including Como Lake and Cameron Flowage.
- No known physical and cultural sites of Mi'kmaq importance will be affected by Project development. A chance find protocols for archaeological resources will be implemented as part of the Project Environmental Protection Plan (EPP). Personnel will receive the appropriate level of EPP training to properly implement the chance find protocol.

These conclusions relating to Project impacts and the magnitude of these impacts have been shared with Millbrook First Nation through face to face meetings and discussions that included the preparation and delivery of a Summary of Effects document and a Plain Language Summary (Appendix A.1) on September 1, 2020. AMNS reviewed these conclusions in the draft Summary of Effects document in a face to face meeting with the Millbrook community engagement officer in late fall 2020. The Plain Language Summary was also shared with the KMKNO on November 2, 2020 and Sipekne'katik First Nation on May 7, 2021.

Subsequently, AMNS prepared IR2 responses for CEAA 2-48 and CEAA 2-49 for Millbrook First Nation which was shared with the community engagement officer on February 16, 2021 to support planned internal meetings with Millbrook community members. This IR response includes figures that show the proposed bypass roads/mitigation measures to allow continued access to the lands surrounding the Beaver Dam Mine Site and Haul Road, as well as the Project property boundaries (direct loss of access) and indirect potential zones of interactions (Wildlife Environmental Effects Zone and the Limited Firearms Zone). AMNS reviewed these figures with the Millbrook First Nation community engagement officer in a virtual meeting on February 3, 2021, in advance of sharing them on February 16, 2021, to request initial feedback from the Millbrook community engagement officer.

On April 1, 2021, this Mi'kmaq of Nova Scotia draft section of the EIS was shared with the Millbrook First Nation for review and feedback. The purpose of this review was twofold:

- A request to validate and provide feedback of impact conclusions and proposed mitigation; and

- To provide feedback on the level of specificity regarding the referencing of data in the TLRUS and to ensure the presentation is acceptable in consideration that the TLRUS is considered restricted and confidential.

The purpose of planned community meetings, as described by the Millbrook community engagement officer, is to receive feedback from specific families who have expressed an interest in the Project, relating to Project summary of impacts and proposed mitigation measures. This feedback is intended to supplement general feedback received from Millbrook First Nation through regular and on-going engagement efforts to date, as described in Section 4 and Appendix A.5.

At the time of submission of this updated EIS, no specific feedback has been received from the Millbrook First Nation. AMNS understands that community meetings have taken place and that a report summarizing these meetings is drafted. Regular and consistent communications to receive this feedback has been ongoing with Millbrook First Nation through April and May 2021. Although the feedback has not been received, AMNS will continue to reach out and find opportunities to address feedback in the Projects development plans.

It is anticipated that engagement will continue throughout and beyond the current environmental assessment process. This will require ongoing dialogue regarding potential impacts on Mi'kmaq communities, and AMNS is committed to continuing those discussions. AMNS looks forward to receiving feedback and commits to discussing with Millbrook First Nation how best to address their feed back into Project design, mitigation and monitoring measures and potentially additional monitoring and mitigation measures. Subject to any confidentiality concerns expressed by the Millbrook First Nation, AMNS will provide this information to the appropriate regulators.

6.14.7.2 Project Interactions and Mi'kmaq Health and Socio-economic Condition

Potential health impacts on Mi'kmaq communities are linked to the interconnected nature of the ability to access traditional territory to continue cultural practices, such as hunting, gathering and fishing – not only for their consumptive human health value, but also for mental and human health associated with cultural survival and continuity. While issues impacting Indigenous health are complex, the Mi'kmaq of Nova Scotia would view a loss of access to territory and the ability to exercise Aboriginal and Treaty rights in that area to extend to potential impacts to human health outcomes, based on the review of conclusions relating to gathering of berries and vegetation for human consumption, and hunting for sustenance purposes in the TLRUS (MFC 2019).

The Health Canada document "Useful Information for Environment Assessments" (HC 2015) was reviewed to determine the appropriate baseline information that should be included relevant to human health of First Nations. Table 6.14-7 presents the relevant information related to effects on human health of the Mi'kmaq of Nova Scotia based on the review of the Health Canada document.

As with the analysis of Project impacts to traditional use, some specificity relating to Mi'kmaq land use and baseline health and socio-economic condition is not fully understood, and as a result, some analyses relating to health and socio-economic conditions have been completed utilizing a series of assumptions. Assumptions relating to the Human Health Risk Assessment (HHRA), described in Section 6.14.7.2.1, are provided in the technical report in Appendix C.2. The assumptions in the HHRA have been reviewed against the information provided in the TLRUS (MFC 2019). The specificity of consumption rates required to utilize as inputs into the HHRA were not presented in the TLRUS (MFC 2019). As a result, the HHRA has been completed with assumed consumption rates Chan et al. (2017) and as described in Section 6.14.7.2.1.

AMNS has attempted to collect information through multiple methods, as described in Section 4 and Appendix A.5. Information has been received through direct engagement, the MEKS and most informatively, through the TLRUS, which supports and complements the analysis of Project impacts relating to health and socio-economic conditions. The TLRUS (MFC 2019) describes, with some specificity, the harvesting patterns of the Millbrook First Nation and specificity of country food consumption. AMNS understands that harvesting/hunting practices are regular (weekly and span across all four seasons). The TLRUS (MFC 2019) also documents that many Millbrook members, particularly local members of the Beaver Lake and Sheet Harbour IRS, are sustenance

harvesters, with hunting, fishing, and trapping practices as important contributions to their household income (MFC 2019). Harvesting includes big game, fish and shellfish and medicinal and ceremonial plant and tree species.

The TLRUS (MFC 2019) states that local residents of the Beaver Dam, Sheet Harbour and Millbrook IR's frequently use the area (i.e., range of use from weekly to yearly, and depending on availability of species) for hunting (i.e., deer, bear, rabbit, grouse, and porcupine) and rely on the wild harvest as an important food and dietary source. Equally, community members harvest berries when in season, and a number of plants that are also used for sustenance, as well as traditional medicines. The seasonal and recreational use of animals and plants important to the Millbrook community members supports the continuity of traditional practices and is important to the maintenance of their culture and the practice of their rights. Millbrook harvesting activities and practices are culturally important as they ensure the sharing and maintenance of cultural values and their practice. Millbrook First Nation community members use plants and animals harvested in the area for traditional sustenance purposes, health-related medicinal purposes, and spiritual and cultural purposes.

Table 6.14-7: Baseline Information Relevant to Human Health of the Mi'kmaq of Nova Scotia

Elements to Consider	Anticipated Effect
Location of First Nations in relation to the Project	The nearest First Nation (Mi'kmaq) reserves are the Beaver Lake IR 17, located approximately 5 km from the Project, and the Sheet Harbour IR, located approximately 25 km from the Project. The EIS has concluded that there are likely occasional use and modern day camps used by the Mi'kmaq in closer proximity to the proposed Project, based on conclusions relating to traditional practices in close proximity to the Project (MFC 2019). The locations of these camps are unknown, and as a result, have not been evaluated as specific receptors in any VCs.
Size of the Population Potentially Affected	An estimated total of 21 people are living at Beaver Lake and 15 people are living at Sheet Harbour IR. However, extended familial and broader community relationships exist at other Millbrook communities and also with other Mi'kmaq communities including, but not limited to, Pictou Landing First Nation, Sipekne'katik First Nation and Paqtnkek First Nation, and would indicate a larger potentially-affected population.
Presence of Drinking Water Intakes	The nearest domestic well is approximately 5 km south from the Project at the Beaver Lake IR 17. No other seasonal/temporary or permanent water usage has been documented in closer proximity to the Project through research completed for this EIS. As a result, no surface water withdrawal locations have been evaluated, although as mentioned in Table 6.14-4, an analysis of surface water concentrations at discharge locations within Cameron Flowage (presumed reasonable worst case surface water location from Project) has been completed against the Canadian Drinking Water Quality Guidelines.
Timing/Duration of Project	The Project will take place in stages – first construction, followed by operations, and reclamation. It is anticipated that the period from construction through active reclamation is eight years. The mine will limit access to specific areas for hunting, fishing and harvesting purposes for that period. After this period, during post-closure, monitoring and water treatment (if/as required) in the pit will be on-going, but access to the areas surrounding the pit will be re-established for the Mi'kmaq.
Recreational Use of Surface Water	The Project, as planned with constructed bypass roads, allows for continued access to areas of documented use, with the exception of Mud Lake and Crusher Lake. Swimming may occur within Cameron Flowage during high flows (Spring and Fall). The HHRA evaluated risk to recreational swimming and also accidental ingestion of surface water during swimming.
Country Food Harvesting	Based on the information compiled through the TLRUS and MEKS, historical information and secondary sources, and findings during site visits, it is concluded that there is a documented Mi'kmaq use of the Project site and surrounding areas for subsistence harvesting of food and medical plants, fish and furbearing animals. Historical and current information indicates that the Mi'kmaq would have and continue to conduct these activities in the Beaver Dam Mine Site and Haul Road and surrounding areas.
Location of Traditional Resource Use	

Fishing is traditional practice (historical and current) in the LAA. Fishing is generally for sustenance/subsistence, as well as for recreational purposes. Trout is the key fish species described in the TLRUS (MFC 2019) with additional species including brook and rainbow trout, sea trout, American eel, Atlantic salmon, herring, mackerel, gaspereau, various groundfish species, smelt, striped bass and sucker. Shellfish harvesting within the LAA include clams, lobster, mussels, snowcrab, and scallop (MFC 2019).

Fishing is practiced across the LAA in most major rivers and lakes, as documented in the TLRUS and MEKS. Within the Beaver Dam Mine Site, there is documentation of trout fishing within Cameron Flowage/Killag River and possibly Mud Lake and Crusher Lake (MFC 2019). Within the 4km footprint of new construction for the Haul Road, there are no documented rivers or lakes that support the Mi'kmaq fisheries. However, adjacent to this new construction corridor and along the road footprint proposed for upgrades to construct the Haul Road, fishing locations are common, and Millbrook First Nation use of these lakes (and rivers) is well documented from the Beaver Dam Mine Site to the Mooseland Road (MFC 2019).

Some Mi'kmaq community members have camps on Crown land where they go to enjoy peaceful recreational and traditional activities with family and community members. There are five camps located within 1 km of the Haul Road and multiple other camp locations throughout the LAA. These camp locations in close proximity to the Haul Road (within 1 km) may experience indirect Project impacts due to wildlife pattern adjustment or adjustments in hunting patterns where hunters may feel uncomfortable using their firearms for safety reasons.

The TLRUS (MFC 2019) asked participants specific questions relating to the annual percentage of harvesting completed within the LAA and what the impact might be from displacement from the area (socio-economic impacts). AMNS understands that the TLRUS (MFC 2019) concludes that Millbrook First Nation community members may need to assume the cost to purchase additional meat at a local grocery store, and/or they may choose to hunt elsewhere. Detailed analysis of the potential effects of this change in pattern is not fully understood. No information was provided documented Mi'kmaq commercial forestry or logging operations but there is documented trapping of furbearers for cash sale of the furs.

The following sections describe the human health risk assessment and potential impact to the socio-economic, mental, and social well-being of the Millbrook First Nation community and more broadly, the Mi'kmaq of Nova Scotia.

6.14.7.2.1 Human Health Risk Assessment Summary of Methods and Results

The HHRA was completed by Intrinsik Corp. to support the EIS and also to respond to Round 2 Information Requests (IR2s) CEAA 2-38, CEAA 2-52 and CEAA 2-53. The HHRA evaluated the following VCs to support the analysis of Project impact to the Mi'kmaq of Nova Scotia: Air, Surface Water, Fish and Fish Habitat, and Fauna. Table 6.14-4 outlines the technical conclusions for each VC and the justification for inclusion in the HHRA. Activities in the area could include traditional hunting and plant gathering, fishing, swimming, hiking, use of ATVs, and camping. The HHRA identified possible exposure pathways such as:

- inhalation of air containing dusts;
- incidental soil and dust ingestion;
- ingestion of berries and/or traditional vegetation, game meats and fish; and
- incidental consumption and dermal contact to surface waters through recreational activities (swimming).

These exposure pathways were included in the assessment for the Project. The HHRA followed a standard screening level risk assessment approach using methods outlined by Health Canada (2012; 2016a; 2016b; 2018 as cited in Appendix C.2). The steps of a HHRA involve conducting a Problem Formulation, which involves identifying the ways by which people could be exposed to chemicals released from mining activities (which are known as exposure pathways), the identification of Chemicals of Potential Concern (known as COPCs), and identifying the characteristics of people who could be exposed (known as receptors), based on the types of activities that could occur in the area of the mine. This stage was followed by an Exposure Assessment (to estimate the potential rate of exposure to COPCs) and Toxicity Assessment (which estimates exposure rates which are considered to be without risk of adverse health effects, or of negligible risk) and a Risk Characterization step. Activities in the area could include traditional hunting and plant gathering, fishing, hiking, use of ATVs, and camping. The HHRA identified possible exposure pathways

such as inhalation of air containing dusts; incidental soil and dust ingestion; ingestion of berries and/or traditional vegetation, game meats and fish; incidental consumption and dermal contact to surface waters through recreational activities (swimming), which were all included in the assessment.

Since most of the dust generated from the Beaver Dam Mine Project is expected to be related to the transportation along haul roads, the chemical composition of the dust considered in the HHRA is specifically associated with source of metals in road construction, which is proposed to be waste rock related to mining activities at the Beaver Dam Mine Site. The waste rock will be used to construct interior mine roads. Screening of these sources resulted in several metals/metalloids meriting further assessment in the HHRA (aluminum; antimony; arsenic; barium; beryllium; boron; cadmium; chromium; cobalt; copper; lead; manganese; mercury; molybdenum; nickel; strontium; vanadium and zinc).

With regard to other potential substances released by mining activities, the following can be stated:

- Criteria air contaminants (TSP; PM_{10}; $PM_{2.5}$, NO_x; SO_2) are assessed in the air quality assessment (Appendix C.1), relative to provincial and federal air quality standards and objectives. These substances were also re-evaluated in a supplemental modelling effort by GHD (2021a), due to infrastructure changes. These are not evaluated further in this report, and results of comparisons to air quality guidelines are provided Appendix C.1.
- Metals in dusts ($PM_{2.5}$ and PM_{10}) merit further evaluation. The specific COPCs identified above (based on the relevant geochemistry of the dust sources) are assessed further in response to Provincial IR NSE 2-129. No metals on particulate matter exceeded their respective short term (24 hour) air quality guidelines or long term (chronic) inhalation toxicity reference values. A copy of this IR response is located as Appendix B of the HHRA (Appendix C.2).
- VOCs were concluded to be insignificant at this site, and hence are not evaluated further (predictions are provided in Appendix C.1).

For metals from water release of effluent into Killag River at Cameron Flowage, predicted future concentrations in the receiving environment (Appendix D of Appendix P.4 [Mine Water Management Plan] and Appendix C.2) were screened against Canadian Drinking Water Quality Guidelines (CDWQG) to identify potential COPCs related to recreational water usage.

Dust deposition from mine site activities was predicted by GHD (Appendix C.1), based on proposed operations and activities at the mine site, using standard methods. Predicted deposition rates were provided for the maximum point of impingement (MPOI) associated with mine site activities, as well as the receptor location with the highest dust deposition rate [e.g., Deepwood Estates (R7)]. These predictions were used to estimate potential future soil, vegetation and game meat concentrations in the Study area, using standard risk assessment equations provided by Health Canada and US EPA (e.g., US EPA OSW, 2005; US EPA, 1993a). Effluent release into the nearby receiving environment (i.e., Cameron Flowage on the Killag River) during construction, operation and post-closure are predicted by GHD (Appendix P.4). These data are used to evaluate potential exposures related to recreational swimming, and fish consumption.

Potential exposures to releases of the COPCs from the proposed Beaver Dam Mine Project for people who could spend time in areas near the Beaver Dam Mine Site or Haul Road were estimated using standardized equations by Health Canada (2012) and US EPA (2003; 2004a). Consumption rates for various foods which could be harvested from the area near the proposed mine, such as leafy vegetation, berries, fish and game meats (e.g., deer; grouse; hare and duck), were identified from the First Nations Food, Nutrition and Environment Study (FNFNES) for the Atlantic region (Chan et al, 2017), and are consistent with traditional knowledge report (Millbrook First Nation and Moccasin Flower Consulting, 2019) and ongoing engagement with Millbrook First Nations. Soil ingestion and dust inhalation exposure rates were identified from Health Canada (2012). Exposure rates from swimming and incidental water ingestion were identified from both Health Canada (2012) and US EPA (2003; 2004a). Chronic

Toxicity Reference Values (TRVs), which are exposure levels of COPCs for a life-time below which adverse effects are not anticipated, or which are associated with negligible risk levels, were identified from Health Canada (2010), World Health Organization (2010), US EPA (1996; 1993a) and other notable regulatory agencies. Potential risks were characterized by comparing the predicted exposure levels from all exposure pathways to the TRV, to predict a Risk Quotient (RQ) for non-carcinogens. An RQ less than 0.2 for the Project scenario, or less than 1.0 for the Baseline + Project scenario, are considered to indicate that risks associated with the Project are negligible. For carcinogenic chemicals, an Incremental Lifetime Cancer Risk (ILCR) for all life stages is calculated. A benchmark cancer risk level of 1 in 100,000 (i.e., 1×10^{-5}) is used to assess risk, and cancer risks are deemed negligible when the estimated ILCR is less than the benchmark value of 1 in 100,000 (i.e., ILCR ≤ 1.0).

The non-carcinogenic risks from soil and dust exposures, the consumption of country foods harvested from the vicinity of the Mine Site, and recreational water use (i.e., swimming), as well as soil ingestion, are considered to be negligible based on the assessment. The predicted ILCRs for arsenic are below the benchmark ILCR of 1 in 100,000 in all scenarios and assessment cases. Therefore, the potential for adverse health effects from arsenic exposure are considered negligible. The risk assessment results indicate that risks to people consuming country foods from the area, or spending time in the area, will not increase appreciably following mine development.

Based on the assessment conducted, the following can be concluded:

- Metals are naturally occurring in the environment and are present within existing soils and vegetation in the region. Mine activities will result in increased deposition of dust in the vicinity of the Mine Site outside the PDA, particularly related to Haul Road activities;
- Dustfall predictions indicate that the areas outside the PDA that will potentially receive higher dustfall rates are generally located near the Haul Road. Based on the estimated future soil concentrations of all metals considered, some accumulation within vegetation is anticipated to occur, but that accumulation would likely be localized to areas most affected by dust loadings which are generally limited in size and closer to the Beaver Dam Mine Site and Haul Road boundaries;
- It is considered unlikely that ore dust deposition and effluent releases from the Beaver Dam Mine Project at the rates considered in this assessment would result in levels of metals in country foods, soils and dust, and surface water (*via* recreational water use) that would be harmful to human health. Predicted risks associated with consumption of country foods are considered to be negligible

6.14.7.2.2 Socio-Economic, Mental, and Social Well-Being

The Project is planned for an eight-year timeframe within the proposed Beaver Dam Mine Site and Haul Road property boundaries. As described above, the HHRA has determined that there is a low risk of direct human health effects from this Project within and surrounding the Beaver Dam Mine Site and Haul Road. However, AMNS understands that this Project may result in an impact to the socio-economic, mental and social well-being of the Mi'kmaq of Nova Scotia.

The Project may impact the economic condition of the Mi'kmaq communities. This impact could be felt in either a positive or negative way. Some of these potential changes, related to the economic condition of Mi'kmaq individuals, families and at the community level, include changes in income, population, housing conditions, employment, cost of living and food security.

With loss of access to the Beaver Dam Mine Site, AMNS acknowledges that patterns of traditional use (hunting; trapping; medicinal, food or cultural-use plants; and recreational use of water) may change for the Millbrook First Nation and other Mi'kmaq community members. This may result in a shift to other areas to practice traditional use, or a reduction or stoppage of the use of traditional resources in the local area, and potentially the need to purchase of goods to replace these traditional resources. These shifts could

increase the cost of living for Millbrook First Nation and other Mi'kmaq families who rely on traditional resources. There are also possible positive effects on the economic condition for both the Millbrook community members and the broader Mi'kmaq community with provision of potential new job opportunities and improved socio-economic conditions through increased income. However, it is also possible that the Project may cause worker shortages in other businesses if people are recruited away from their current jobs in the community, and it is also possible that loss of access to the land and resources may have a direct effect on an individual's income.

AMNS anticipates that the Project will have limited effect on Mi'kmaq use of navigable waters. Inside the property boundary of the proposed Beaver Dam Mine Site, there are only two small lakes (Mud Lake and Crusher Lake) and no major riverways. The watercourse draining from Crusher Lake to Mud Lake to Cameron Flowage/Killag River is not navigable by canoe, and as a result, the effect on navigable waters from Project development is predicted to be low.

As previously discussed in this section, there is an impact on traditional practices for Millbrook First Nation and more broadly, the Mi'kmaq of Nova Scotia, due to a loss of access, which potentially includes Mi'kmaq forestry and logging operations and traditional practices in the context of moderate livelihood. Forestry activities have been documented historically. Insight into Millbrook and the Mi'kmaq of Nova Scotia forestry and logging activities has been documented. The TLRUS (MFC 2019) and MEKS describe the harvesting of wood and wood products as a general aspect of Mi'kmaq traditional practice to support carvings and specialty wood items. As a result, lack of access to this area of Crown land (123 ha) could impact the Mi'kmaq of Nova Scotia ability to harvest wood and wood products and may affect Mi'kmaq forestry and logging activities that may be present within this area. Limited information has been provided relating to specific use of the Beaver Dam Mine Site and Haul Road for commercial trapping and hunting, but the TLRUS (MFC 2019) and MEKS both report trapping and hunting efforts within and surrounding the Beaver Dam Mine Site and Haul Road and TLRUS participants describe that they sell furs for cash.

It is acknowledged that the Millbrook First Nation and other Mi'kmaq communities use the Beaver Dam Mine Site and surrounding area for traditional and recreational purposes and possibly for non-commercial/trade economy purposes. These activities will be limited during Project construction, operation and active closure to areas surrounding the Beaver Dam Mine Site, which will have an effect on the Millbrook First Nation and broader Mi'kmaq community members who carry out these activities. The TLRUS (MFC 2019) indicates that Millbrook individuals currently use the Beaver Dam Mine Site specifically to gather food for sustenance for themselves and/or their family members and thus, for these people, the loss of access into the Beaver Dam Mine Site and Haul Road for the eight-year period may affect their food security and require an adjustment to either hunt and gather in other areas adjacent to their traditional area (refer to mitigation measures in Section 6.14.8), or purchase food instead.

The Project will provide employment opportunities for individuals from the Mi'kmaq communities, including the youth. There may be an increase in public and community services in the area once the Project is developed, resulting from increased population and economic activity in the local area around the Beaver Dam Mine Site. This may also raise the cost of living in close proximity to the mine. The mine will provide added employment and economic opportunities to the area, and the Mi'kmaq are anticipated to benefit from this increased economic activity.

The development of the mine will change the baseline conditions in the local area. There will be an increase in background noise, dust, and light in close proximity to the mine. This may affect the spiritual and cultural experience and sense of well-being for the Millbrook First Nation community members and the Mi'kmaq of Nova Scotia more broadly on the landscape adjacent to the Beaver Dam Mine Site and Haul Road.

Once the construction phase, operation phase, and active closure are complete (eight years), access will be re-established within the Beaver Dam Mine Site for all Mi'kmaq of Nova Scotia. With the exception of the pit area, where filling will be on-going and

water monitoring will be occurring, commercial and traditional practices within the Beaver Dam Mine Site can resume. The landscape will be altered, with more limited forested cover for an extended period of time until forest cover re-establishes. This will likely affect the specific nature of traditional practices that can resume within the Beaver Dam Mine Site.

Collectively these potential changes as a result of the proposed mine development are expected to have an impact on the economic, mental and social well-being of Millbrook First Nation and the Mi'kmaq of Nova Scotia. Mitigation measures have been developed through engagement with Millbrook to reduce the impacts of the Project for their community and their individual community members. Although there may be specific individual examples of negative economic impact as a result of changed traditional practices (for example), generally, the overall conclusion is that this Project will have a net positive impact on the Mi'kmaq of Nova Scotia through an increase in job opportunities and economic prosperity in the local region around the Project. Moreover, mitigation measures proposed to allow continued access to lands surrounding the Beaver Dam Mine Site and Haul Road, and the availability of Crown land adjacent to the Project. The development of the Project is also expected to have an impact on the mental and social well-being of the Mi'kmaq of Nova Scotia. Similar to economic condition changes, the Project may have a negative localized impact on Millbrook First Nation and other Mi'kmaq individuals partaking in traditional practices within close proximity to the mine. AMNS acknowledges this localized effect and has committed to mitigation measures to maintain access to lands surrounding the Project and has reviewed available Crown land surrounding the property that can continue to be used by Millbrook First Nation and the Mi'kmaq of Nova Scotia. The temporal scale of the Project is short (i.e., eight years), and impacts are localized in nature, so impacts are not considered significant once mitigation measures are applied, as described in Section 6.14.8 (residual effects).

From a socio-economic perspective, interest has been expressed by the Mi'kmaq of Nova Scotia to work toward benefit agreement(s). These discussions and negotiations are ongoing and are privileged and confidential discussions between AMNS and the Mi'kmaq of Nova Scotia. While not required by the Crown or legislation, such agreements are considered a best practice. AMNS had a Memorandum of Understanding (MOU) with the ANSMC through the KMKNO from 2014-2016. A renewed MOU was proposed in 2018 and is pending approval by ANSMC in January 2021. Once the MOU is approved, it is expected that AMNS will develop an Impacts Benefits Agreement (IBA) with the ANSMC through the KMKNO Benefits Office. In addition, AMNS will seek to develop a Benefits and Compensation Agreement with Millbrook First Nation related to the Project. These discussions are separate to those referred to above, however, and AMNS will work to coordinate the two agreements to avoid duplication and overlap.

A Plain Language Summary (PLS) and a Summary of Effects is provided in Appendix A.1. Both documents have been shared with Millbrook First Nation on September 1, 2020. The PLS was also shared with KMKNO on November 2, 2020 and Sipekne'katik First Nation on May 7, 2021. This dialogue, as described above and in Section 4, is expected to be strengthened and on-going throughout the life of the environmental assessment process, and the Project in general.

6.14.8 Mitigation

Mitigation measures and monitoring associated with related VCs are key to avoiding effects on the Mi'kmaq of Nova Scotia, as detailed in each VC section. The Project has been planned to minimize footprint disturbance and impacts to Millbrook First Nation and the Mi'kmaq of Nova Scotia wherever possible and practicable. There are limited expected indirect effects on the Mi'kmaq of Nova Scotia based on the assessment of effects for related VCs (Table 6.14-5). This evaluation is based on the implementation of the proposed mitigation measures and associated monitoring as a result of direct and indirect effects as outlined in the VC sections. These mitigation measures are not repeated in detail in this section but generally including dust mitigation and monitoring, treatment of discharge water if/as needed prior to discharge into Cameron Flowage/Killag River during both the operations and closure phases of the Project, surface and groundwater monitoring programs, implementation of erosion and sediment control measures

throughout the life of the Project, management and disposal of historical tailings when they are required to be disturbed, fisheries offsetting, wetland compensation, and wetland, lichen and moose monitoring programs.

There are also direct proposed mitigation measures to reduce impact on traditional practices, Mi'kmaq archaeological features (if identified) and the socio-economic, mental and social well-being of the Mi'kmaq of Nova Scotia. These mitigations are described in detail below and in Table 6.14-8 and in response to Round 2 Information Requests (IR2s) CEAA 2-48 and 2-49.

Table 6.14-8: Description of Potential Suitable Alternative Areas for Mi'kmaq Traditional Use

Suitable Alternative Area (named by major lake and shown on Figure 6.14-7)	Description of Known Characteristics(a)	Limitations
1: Otter Lake	Crown land Ease of access – no implication to access to this area from Project from Hwy 224, and accessible with mitigations (CEAA 2-48) from Haul Road/ATV Route 320 Close to camp locations Resource quality (outside of indirect areas of potential impact) Quietness/seclusion Based on review of TLRUS, long-term familial connection to the area and suitability for inter-generational knowledge transfer	
2: Kent Lake	Crown land Ease of access (through mitigation measures described in CEAA 2-48) Close to camp locations Resource quality (outside of indirect areas of potential impact) Based on review of TLRUS, long-term familial connection to the area and suitability for inter-generational knowledge transfer	There will be elevated noise and dust levels above background during the temporal scale of the Project. Expected sky glow from the Mine Site.
3: West Lake	Crown land Ease of access – no implication to access to this area from Project Resource quality (outside of indirect areas of potential impact)	There will be elevated noise and dust levels above background during the temporal scale of the Project. Expected sky glow from the Mine Site.
4: Como Lake	Crown land Ease of access (through mitigation measures described in CEAA 2-48) Close to camp locations Resource quality (outside of indirect areas of potential impact) Based on review of TLRUS, long-term familial connection to the area and suitability for inter-generational knowledge transfer	There will be elevated noise and dust levels above background during the temporal scale of the Project. Expected sky glow from the Mine Site.
5: Lake Mulgrave	Crown land Ease of access (through mitigation measures described in CEAA 2-48) Close to camp locations Quietness/seclusion Resource quality (outside of indirect areas of potential impact) Based on review of TLRUS, long-term familial connection to the area and suitability for inter-generational knowledge transfer	

Note: (a) Crown land, similar size to area of lost access from Project development, ease of access, close to a camp, quietness/seclusion, long-term familial connection to the area, resource quality, and suitability for inter-generational knowledge transfer.

The Beaver Dam Mine Site and Haul Road will limit access to Millbrook First Nation and other Mi'kmaq of Nova Scotia for a period of eight years. The proposed property extents of the Beaver Dam Mine Site and Haul Road encompasses a 727-ha area, of which

123 ha is Crown land (Figure 6.14-5). Figure 6.14-5 shows the proposed property boundary of the Beaver Dam Mine Site, and the proposed 30m property boundary on either side of the centre line of the proposed Haul Road. There will be restricted access to this area for eight years to allow for construction, operation and active reclamation of the Project. Outside of this area of restricted access, mitigation measures are proposed to allow continued access to the Millbrook First Nation community members and other Mi'kmaq of Nova Scotia communities to lands surrounding the Beaver Dam Mine Project to continue traditional practices on the landscape.

As a key proposed mitigation measure, a multi-use bypass road is planned to support Project development (Figure 6.14-6A). This multi-use bypass road is designed to allow pick-up truck/vehicle traffic and ATV traffic to transverse the length of the upgraded Haul Road without having to interact directly with the haul trucks (Figure 6.14-6A). This bypass road will allow continued access for the Mi'kmaq of Nova Scotia and specifically, Millbrook First Nation community members, to lands and lakes used for traditional purposes to the south and north of the Beaver Dam Haul Road between Highway 224 and the Mooseland Road, to the east and west of the Beaver Dam Haul Road between Highway 224 and the Beaver Dam Mine Site, as well as access to the lands north of the Beaver Dam Mine Site. The TLRUS (MFC 2019) describes traditional practices near the Beaver Dam Haul Road including areas around Lake Alma, Ferry Lake, Southwest Lake, Lower and Middle Beaver Lake, Otter Lake, Rocky Lake, Como Lake, and Lake Mulgrave including fishing, trapping, collection of specialty wood and medicinal plants, berry gathering, and hunting. This proposed mitigation measure (i.e., the construction of a parallel bypass road), will allow continued access to these areas for traditional practices during the eight years when the Project is active.

This bypass road to support continued traditional practices in the lands surrounding the Project are described in more detail below and shown in detail on Figures 6.14-6B to 6.14-6F.

Access from Hwy 224 west along the original portion of the Northern Timber haul road will still be available for the Millbrook First Nation and the Mi'kmaq of Nova Scotia. Where the existing Northern Timber haul road joins with the proposed Beaver Dam Haul Road (Figure 6.14-6B), there will be a stop sign/crossing location. Haul truck drivers will be trained on locations of crossings/stop signs and will proceed with caution at these crossing locations.

Two crossing locations (with stop signs) are planned where ATV trail Route 320 and ATV trail Route 367 currently join the existing Northern Timber haul road, which is proposed to be upgraded for the Project (Figure 6.14-6C). The haul trucks will have the right-of-way at these locations. However, as described, truck drivers will slow down to allow crossings when vehicles are visually observed, will be trained on locations of crossings/stop signs and will proceed with caution at these locations. These two crossing locations will allow community members to exit from the proposed bypass road, cross the Beaver Dam Haul Road, and continue north on ATV trail Route 320 or south on Route 367. These two ATV Routes accesses lands and lakes to the north and south of the Beaver Dam Haul Road where documented traditional practices occur.

The Beaver Dam Mines Road from Hwy 224 to the Beaver Dam Mines Site will be upgraded as part of the proposed Haul Road. Where Route 323 joins with the proposed Haul Road (Figure 6.14-6D) there will be another stop sign/crossing location. Specifically, this will allow access for Millbrook First Nation and other Mi'kmaq of Nova Scotia communities to the ATV trail Route 323 to the east and west of the Beaver Dam Mines Road. Smaller trails are also present to the west of the Beaver Dam Mines Road and access across the Beaver Dam Haul Road will be possible for ATVs and trucks to reach these trails and areas west of the Beaver Dam Mines Road to continue their traditional practices. The TLRUS (MFC 2019) describes traditional practices in close proximity to the Beaver Dam Haul Road from Hwy 224 to the Beaver Dam Mine Site including areas around Kent and Tent Lake, River Lake/West River Sheet Harbour, and areas to the east of the Beaver Dam Mines Road as far east as Lake Mulgrave, including fishing, trapping, collection of specialty wood and medicinal plants, berry gathering, and hunting.

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FIGURE 6.14-6A

Primary Mitigation Measure Proposed Bypass Roads

- Secondary Access Point
- Stop Sign and Crossing Location
- Proposed Trail End
- Haul Road Centerline
- ATVANS Active Trail
- Collector Road
- Local Road
- Seasonal Road
- Diveways (>300 m)
- Track
- Trail
- Streams
- Beaver Lake IR
- Proposed Multi-use Bypass
- Proposed Property Boundary
- Proposed Infrastructure
- Touquoy Infrastructure Layout
- Lakes



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 0.75 1.5 3 Kilometers

1:78,600 Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed By: LP

Date: 2021-04-28

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FIGURE 6.14-6B

Primary Mitigation Measure Proposed Bypass Roads

- Secondary Access Point
- Stop Sign and Crossing Location
- Haul Road Centerline
- ATVANS Active Trail
- Collector Road
- Local Road
- Seasonal Road
- Diveways (>300 m)
- Track
- Trail
- Streams
- Beaver Lake IR
- Wildlife Indirect Environmental Effects Zone
- Limited Firearms Zone
- Proposed Multi-use Bypass
- Proposed Property Boundary
- Lakes



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 0.375 0.75 1.5 Kilometers

1:40,000 Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed By: LP

Date: 2021-03-08

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
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Document Name: BD_EIS_Figure6-14-5Primary Mitigation Proposed Bypass1a

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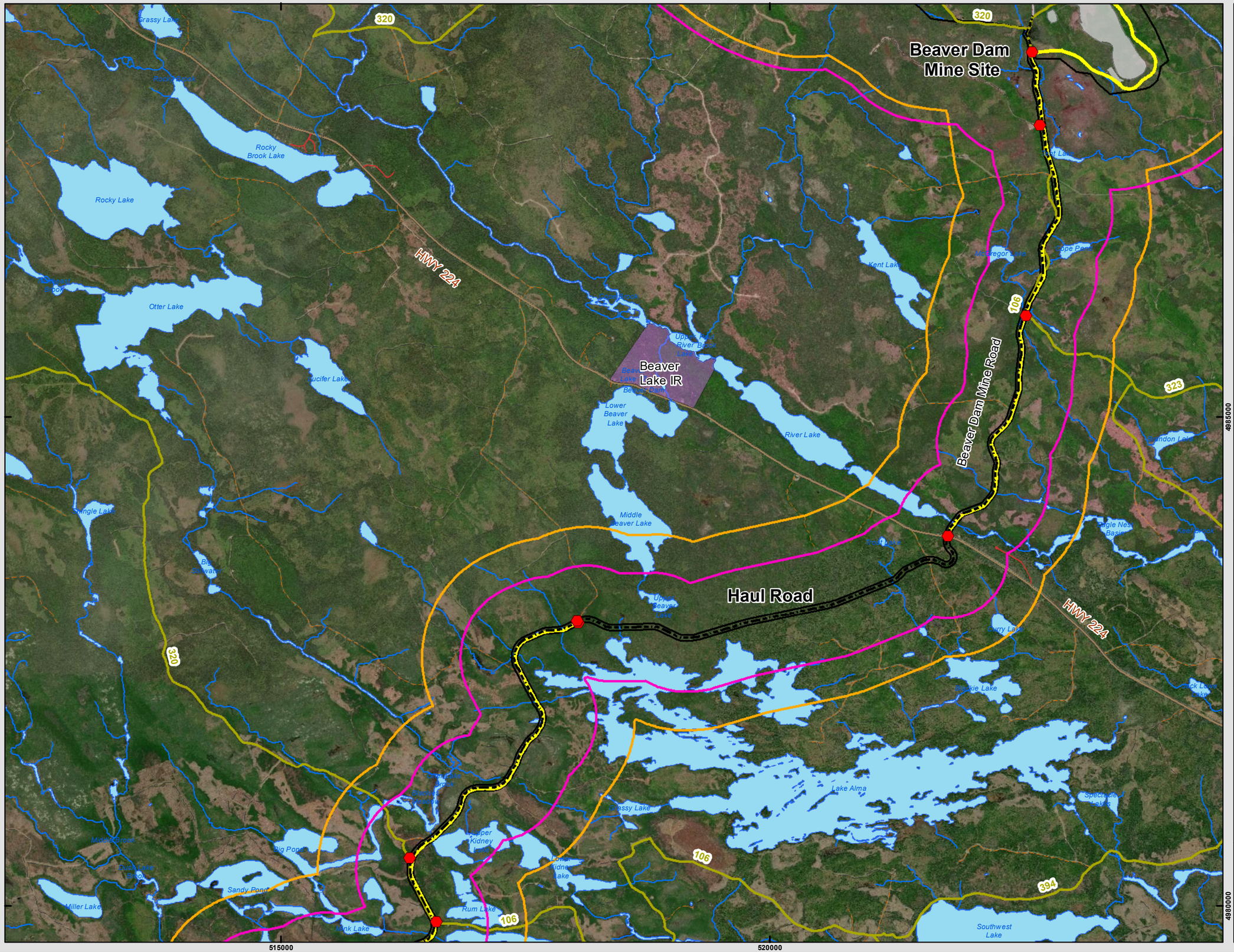

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FIGURE 6.14-6C

Primary Mitigation Measure Proposed Bypass Roads

- Stop Sign and Crossing Location
- Haul Road Centerline
- ATVANS Active Trail
- Collector Road
- Local Road
- Seasonal Road
- Diveways (>300 m)
- Track
- Trail
- Streams
- Beaver Lake IR
- Proposed Multi-use Bypass
- Wildlife Indirect Environmental Effects Zone
- Limited Firearms Zone
- Proposed Property Boundary
- Proposed Infrastructure
- Lakes



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

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1:36,000 Scale when printed @ 11" x 17"

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Document Name: BD_EIS_Figure6-14-5Primary Mitigation Proposed Bypass

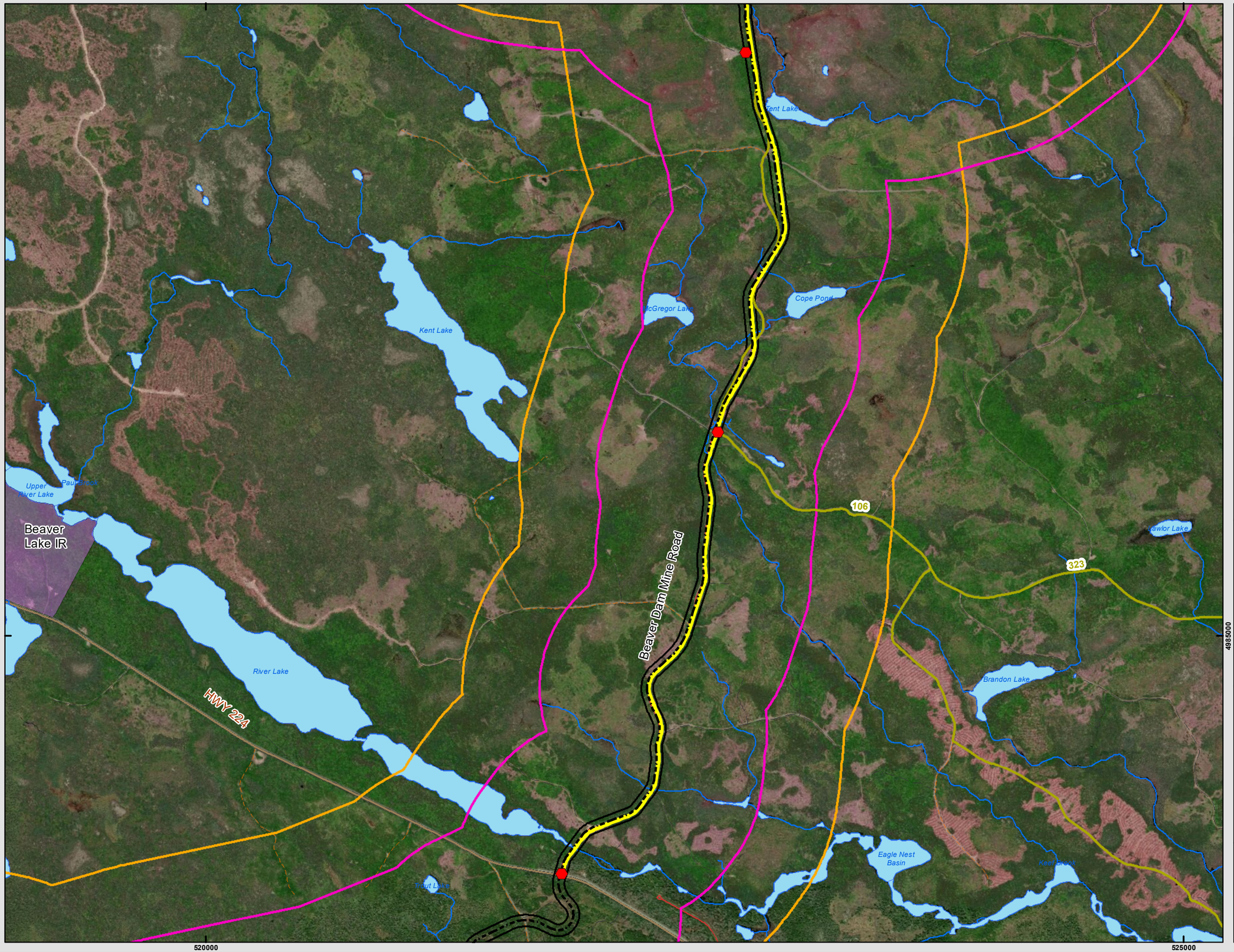

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FIGURE 6.14-6D

Primary Mitigation Measure Proposed Bypass Roads

- Secondary Access Point
- Stop Sign and Crossing Location
- Proposed Trail End
- Haul Road Centerline
- Proposed Multi-use Bypass
- Beaver Lake IR
- ATVANS Active Trail
- Wildlife Indirect Environmental Effects Zone
- Limited Firearms Zone
- Proposed Infrastructure
- Touquoy Infrastructure Layout
- Proposed Property Boundary
- Lakes
- Streams
- Collector Road
- Local Road
- Seasonal Road
- Diveways (>300 m)
- Track
- Trail



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 0.175 0.35 0.7 Kilometers

1:18,000 Scale when printed @ 11" x 17"

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Document Name: BD_EIS_Figure6-14-5Primary Mitigation Proposed Bypass1c

Prepared For:

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FIGURE 6.14-6E

Primary Mitigation Measure Proposed Bypass Roads

- Secondary Access Point
- Stop Sign and Crossing Location
- Proposed Trail End
- Haul Road Centerline
- ATVANS Active Trail
- Collector Road
- Local Road
- Seasonal Road
- Diveways (>300 m)
- Track
- Streams
- Proposed Multi-use Bypass
- Beaver Lake IR
- Wildlife Indirect Environmental Effects Zone
- Limited Firearms Zone
- Proposed Infrastructure
- Proposed Property Boundary
- Lakes



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 0.375 0.75 1.5 Kilometers

1:40,000 Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed By: LP

Date: 2021-05-24

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri

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Document Name: BD_EIS_Figure6-14-5Primary Mitigation Proposed Bypass1d

515000 520000 525000

4990000 4985000

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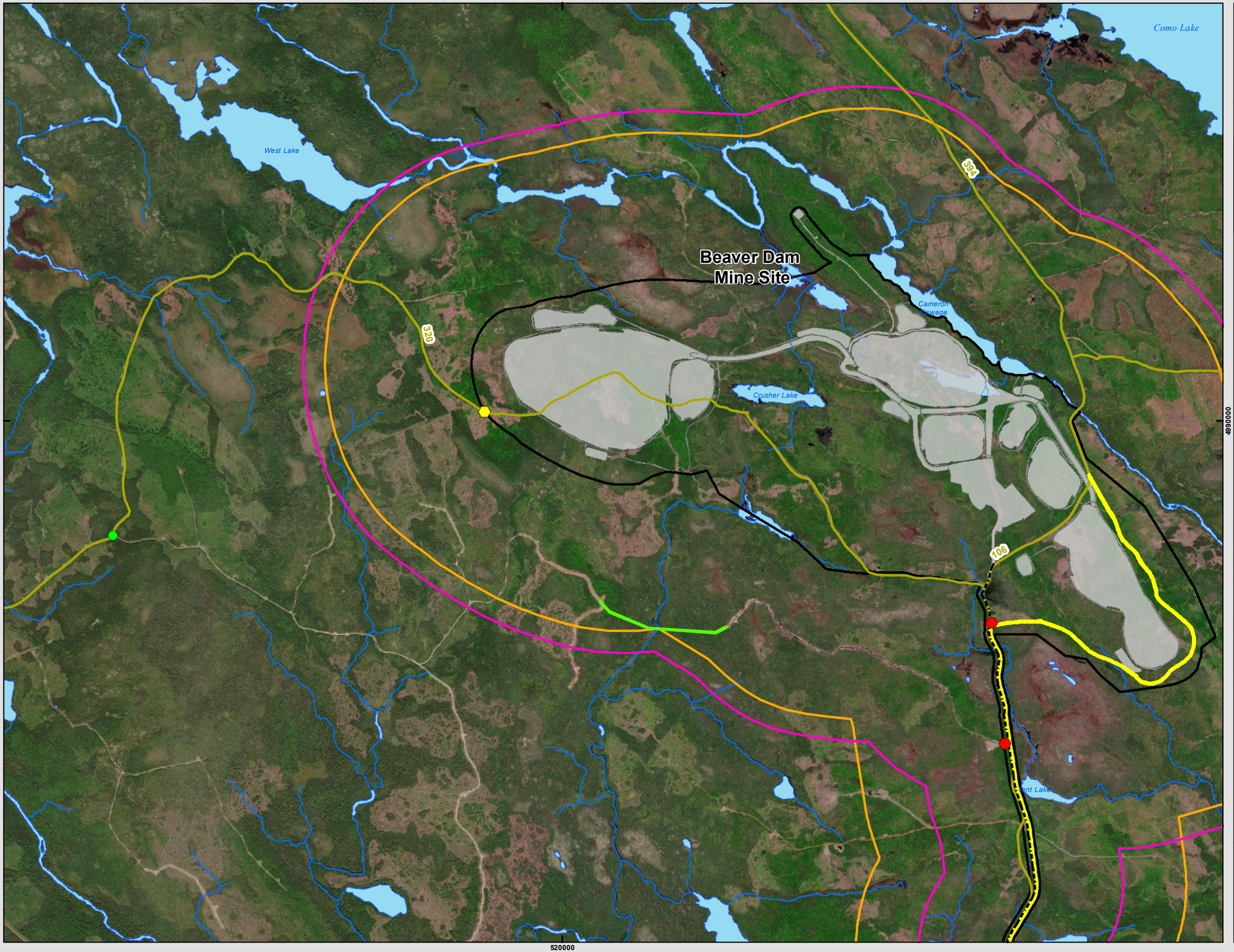
FIGURE 6.14-6F

Primary Mitigation Measure Proposed Bypass Roads



- Secondary Access Point
- Stop Sign and Crossing Location
- Proposed Trail End
- Haul Road Centerline
- ATVANS Active Trail
- Collector Road
- Local Road
- Seasonal Road
- Track
- Streams
- Proposed ATV connection
- Proposed Multi-use Bypass
- Wildlife Indirect Environmental Effects Zone
- Limited Firearms Zone
- Proposed Property Boundary
- Proposed Infrastructure
- Lakes



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 0.25 0.5 1 Kilometers

1:22,000 Scale when printed @ 11" x 17"

Drawn By: EP Date: 2021-05-24
Reviewed By: LP

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri

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Document Name: BD_EIS_Figure6-14-5Primary Mitigation Proposed Bypass1e

The proposed bypass road will continue around, and to the east of, the Beaver Dam Mine Site to allow access for Millbrook First Nation and other Mi'kmaq of Nova Scotia community members to the north of the mine to join with ATV Route 394, including areas around Como Lake and areas east and west of this lake (Figure 6.14-6E). This bypass road will allow access to lands and lakes north of the Beaver Dam Mine Site to continue traditional practices. The TLRUS (MFC 2019) describes traditional practices north of the Beaver Dam Mine Site around Como Lake and Lake Mulgrave, including fishing, extensive trapping, and hunting.

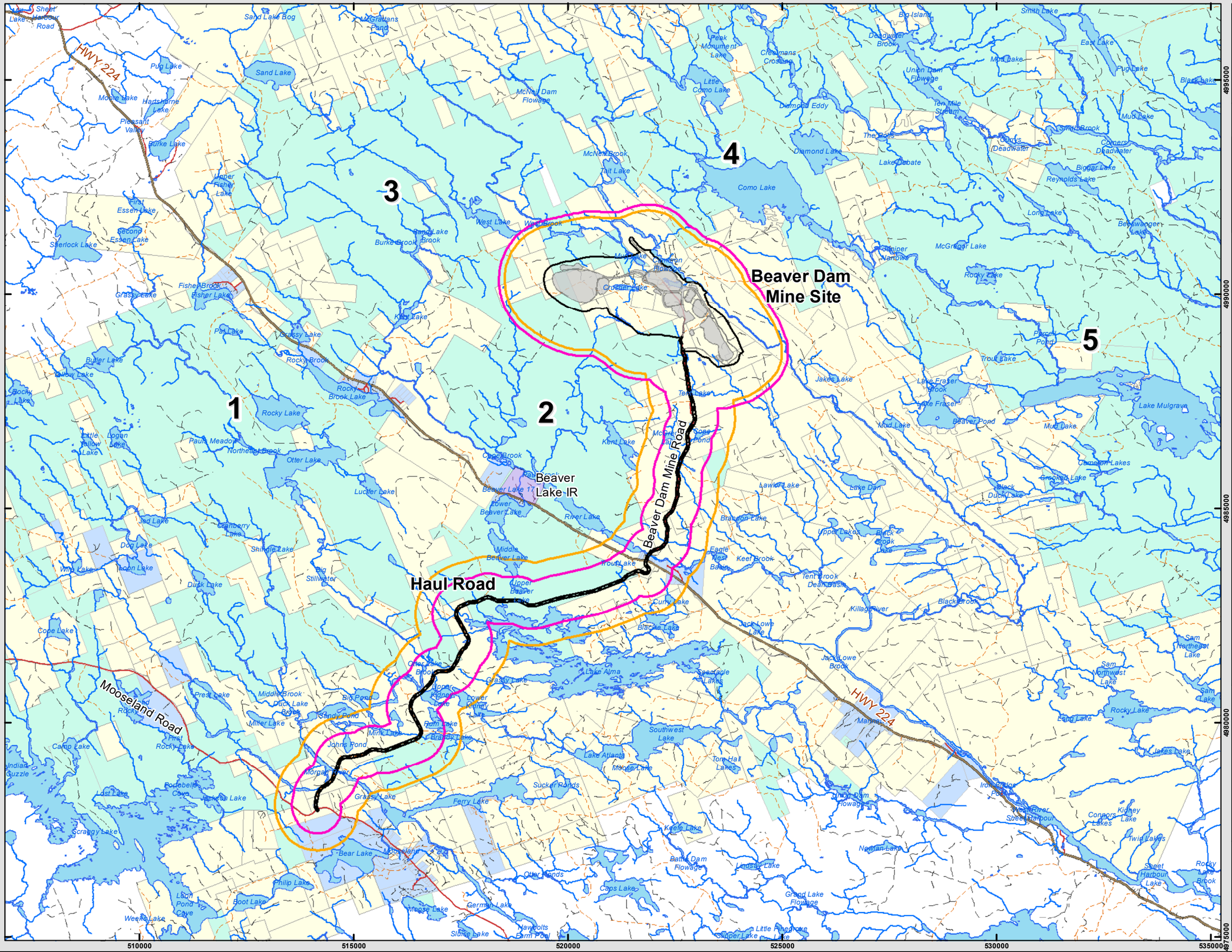
ATV Route 320 allows access from Hwy 224 to the lands to the west of the Beaver Dam Mine Site (Figure 6.14-6). In order to allow Project development, Route 320 will end at the western end of the Beaver Dam Mine Site, where the WRSA is proposed. There is a proposed ATV trail connection to the south of the WRSA to allow access from the western side of the Beaver Dam Mine Site east to the Beaver Dam Mine Road bypass road (Figure 6.14-6F). AMNS plans to provide permitting and financial support to the local ATV club(s) for this ATV trail. This mitigation measure will allow continued transport from Route 320 west of the Beaver Dam Mine Site to the lands south, east and north of the Beaver Dam Mine Site, to allow Millbrook First Nation and other Mi'kmaq of Nova Scotia community members to continue to access lands around the mine to practice their traditional practices.

Through direct engagement with Millbrook community members and conclusions provided within the TLRUS and MEKS, AMNS has been able to confirm areas of Mi'kmaq traditional use surrounding the Beaver Dam Mine Site and Haul Road. Mitigation measures described in CEAA 2-48 will allow on-going access to the lands surrounding the Project where traditional use has been documented, during the eight years where direct access to the mine will be limited. However, after consideration of these mitigation measures, the Project is expected to limit traditional practices within the direct areas, and potentially affect traditional practices within the indirect areas described in Table 6.14-8. As a result, alternative areas have been described, where traditional practices may continue during the life of the Project.

Tracts of crown land are present in close proximity to the Project (Figure 6.14-7). These tracts of land are adjacent to the Project Area and, in most cases, overlap with areas with documented traditional use (MFC 2019). These areas of land are publicly owned, not limited by provincial or federal parks and protected areas, are all accessible and available with consideration of the mitigation measures described in CEAA 2-48. These areas are presented as potential suitable alternative areas for traditional practices to continue, during the eight-year temporal scale of the Project.

The TLRUS (MFC 2019) confirms a definition of traditional use areas, and what uses these areas provide for community members of the Millbrook First Nation. This documentation of traditional land use areas extends beyond a physical description of quality of the land to support hunting, fishing, trapping and other traditional practices. Traditional areas are also described as "remote", places where community members can experience "solitude and peace while conducting their TLRU activities", and where there is a generational connection to the specific locations where traditional practices take place (MFC 2019, p. 26). Community members describe their temporal connection to specific locations where they complete their traditional practices, with over 40 years returning to the same locations to fish and hunt (MFC 2019). Also, Millbrook community members describe their generational connection to camp locations throughout the TLRUS (MFC 2019), with their own memories of visiting a camp location as a youth in the 1950 to 1970's, and then introducing these same camp locations to their grandchildren. These camp locations are "special because of the long history of use" and they bring back memories of their own childhood and uncles/father's use of the same locations (MFC 2019, p. 36). Millbrook First Nation community members document their hunting and fishing practices in the same locations within the LAA over the last 50 years (MFC 2019).

As part of the TLRUS (MFC 2019), community members were asked about potentially having to go elsewhere to practice their traditional activities. One community member described that generational connectivity to the land. They said, "I would definitely be missing out on places… where my father fished, and my grandparents fished" (MFC 2019, p.40).


Beaver Dam Mine Site
Haul Road
Beaver Dam Mine Road
Beaver Lake IR
1
2
3
4
5
HWY 224
Mooseland Road
Sand Lake Bog
McGrattans Pond
Peak Monument Lake
Cleamans Crossing
Big Island
Smith Lake
East Lake
Deadwater Brook
Union Dam Flowage
Mud Lake
Pug Lake
Black Lake
Ten Mile Stream
Smith Brook
Mud Lake
Corners Deadwater
Bigger Lake
Reynolds Lake
Long Lake
Bergwanger Lake
McGregor Lake
Rocky Lake
Pincock Pond
Trout Lake
Lake Fraser Brook
Lake Fraser
Beaver Pond
Mud Lake
Lake Mulgrave
Jakes Lake
Cameron Lakes
Crooked Lake
Black Duck Lake
Lawlor Lake
Lake Dan
Braddon Lake
Upper Lakes
Black Duck Lake
Eagle Nest Basin
Keel Brook
Tent Brook Deadwater
Killag River
Black Brook
Jack Lowe Lake
Jack Lowe Brook
Spectacle Lakes
Sam Northeast Lake
Sam Northwest Lake
Sam Lake
Long Lake
Rocky Lake
Lakes Lake
Iron Bridge Pond
West River Sheet Harbour
Connors Lakes
Kidney Lake
Twid Lakes
Sheet Harbour Lake
Rocky Lake Brook
Neptune Lake
Keele Lake
Lindsey Lake
Grand Lake Flowage
Caps Lake
Otter Ponds
Battle Dam Flowage
Sucker Ponds
Ferry Lake
Grassy Lake
Morgan River
Johns Pond
Mink Lake
Brandy Lake
Pam Lake
Sandy Pond
Big Pond
Middle Brook
Duck Lake Brook
Miller Lake
Prest Lake
First Rocky Lake
Camp Lake
Indian Guzzle
Rocky Lake
Lost Lake
Jackson Lake
Scraggy Lake
Bear Lake
Philip Lake
Boot Lake
Weeks Lake
Loon Pond Cove
Moose Lake
German Lake
Hawbolts Farm Pond
Slimy Lake
Upper Lake
Southwest Lake
Lake Atlanta
Moose Lake
Tom Hall Lakes
Lower Kidney Lake
Upper Kidney Lake
Lake Alma
Grassy Lake
Curry Lake
Blacke Lake
Otter Lake Brook
Tait Lake
McNeil Brook
McNeil Dam Flowage
Little Como Lake
Diamond Eddy
Diamond Lake
Lake Debate
Como Lake
The Rolls
Cooks Deadwater
Juniper Narrows
Crusher Lake
Mud Lake
Pleasant Valley
Burke Lake
Upper Fisher Lake
First Essen Lake
Second Essen Lake
Sherlock Lake
Fisher Brook
Fisher Lake
Grassy Lake
Butler Lake
Yellow Lake
Rocky Brook
Rocky Brook Lake
Little Yellow Lake
Logan Lake
Paulls Meadow
Northeast Brook
Otter Lake
Lucier Lake
Jed Lake
Cranberry Lake
Dog Lake
Shingle Lake
Wild Lake
Loon Lake
Duck Lake
Big Stillwater
Cope Lake
Middle Beaver Lake
Upper Beaver Lake
Beaver Lake 17
Lower Beaver Lake
River Lake
Trout Lake
Sand Lake
Moore Lake
Hartshorne Lake
Pug Lake
Sand Lake
Burke Brook
West Lake
West Brook
Sandy Lake Brook
Kent Lake
Kent Lake
Tent Lake
Mud Lake
Mud Lake
Mud

The TLRUS (MFC 2019) offers a description of the conditions that support Millbrook First Nation traditional practices at a specific location: **"Ease of access, close to a camp, quietness/seclusion, long-term familial connection to the area, resource quality, and suitability for inter-generational knowledge transfer"** (MFC 2019, p 46).

By extension, a "suitable alternative area" to practice, as documented in CEAA 2-49, will have similar characteristics to current traditional practice areas that are used by the Millbrook First Nation and other Mi'kmaq of Nova Scotia community members within and surrounding the proposed Project and that are described above (bolded) and in the TLRUS (MFC 2019). Suitable alternative areas shown on Figure 6.14-7. These areas are described below in Table 6.14-8 in the context of provision of similar characteristics to those described by the TLRUS (MFC 2019). These areas are recommended as potential suitable alternative areas based on AMNS review of the TLRUS (MFC 2019), a review of available crown land surrounding the Project, and on-going engagement with Millbrook First Nation and the Mi'kmaq of Nova Scotia, given the limited access to 123 ha of Crown land within the Beaver Dam Mine Site and Haul Road property boundaries, and given the potential for indirect impact to traditional practices with the Indirect Wildlife Environmental Effects Zone (1,108 ha of Crown Land) and the Limited Firearms Zone (1,411 ha of Crown land), as described in Table 6.14-6. These proposed suitable alternative areas have been shared with Millbrook First Nation. The Millbrook First Nation community engagement officer is coordinating community meetings with specific families who are interested in providing feedback on Project impacts, mitigation measures proposed, and potentially suitable alternative areas for continuation of traditional practices, to, in part, mitigation for loss access associated with the Project for the eight year mine life.

The purpose of these community meetings, as described by the Millbrook community engagement officer, is to receive feedback from specific families who have expressed an interest in the Project, relating to Project summary of impacts and proposed mitigation measures. This feedback is intended to supplement general feedback received from Millbrook First Nation through regular and on-going engagement efforts to date.

At the time of submission of this updated EIS, no specific feedback has been received from the Millbrook First Nation. AMNS understands that community meetings have taken place and that a report summarizing these meetings is drafted. Regular and consistent communications to receive this feedback has been ongoing with Millbrook First Nation through April and May 2021. Although the feedback has not been received, AMNS will continue to reach out and find opportunities to address feedback in the Projects development plans.

It is anticipated that engagement will continue throughout and beyond the current environmental assessment process. This will require ongoing dialogue regarding potential impacts on Mi'kmaq communities, and AMNS is committed to continuing those discussions. AMNS looks forward to receiving feedback and commits to discussing with Millbrook First Nation how best to address their feed back into Project design, mitigation and monitoring measures and potentially additional monitoring and mitigation measures. Subject to any confidentiality concerns expressed by the Millbrook First Nation, AMNS will provide this information to the appropriate regulators.

These areas are shown on Figure 6.14-7. The description of suitable alternative areas was shared with Millbrook First Nation on February 3, 2021, and the proposed locations of these areas has also been shared with Millbrook First Nation on February 16, 2021. AMNS looks forward to receiving Millbrook First Nation feedback.

In the event that archaeological deposits or human remains are encountered during construction activities associated with the Beaver Dam Mine Project, all work in the associated area(s) will be halted and immediate contact made with the Nova Scotia Special Places Program and with the KMKNO Archaeological Division.

Feedback from Millbrook First Nation and the Mi'kmaq of Nova Scotia has been requested relating to these specific proposed mitigation measures. These requests have been made during face to face meetings, through direct engagement efforts (emails

and phone calls), and through the sharing of the draft Mi'kmaq of Nova Scotia Effects Assessment (Section 6.14) and draft Round 2, Information Responses (IR2s) to CEAA 2-48 and CESS 2-49 (summary of Project impacts, mitigation measures and suitable alternative areas) specifically with Millbrook First Nation on February 16, 2021.

The mitigation measures as described in detail above, and in Table 6.14-9 have been developed through ongoing discussions with Millbrook First Nation and the Mi'kmaq of Nova Scotia. Environmental monitoring and follow-up monitoring, as described in Section 6.14.10 will be include the opportunity for Mi'kmaq participation, including in planning and executing wetland compensation, wildlife monitoring, and fisheries productivity offsetting projects.

Table 6.14-9: Mitigation for Potential Effects on the Mi'kmaq of Nova Scotia

Project Phase	Mitigation Measures
EIS Review	Support Mi'kmaq third party review of AMNS's EIS, including mitigation and monitoring programs.
EIS Review	Continuing to provide the opportunity for Mi'kmaq to delineate the specificity of Mi'kmaq traditional use, and meet with the Mi'kmaq to receive feedback on EIS conclusions and impacts.
Pre-construction	Provide Mi'kmaq land users the opportunity to walk the Beaver Dam Mine Site and Haul Road with Proponent representatives to identify and document sensitive sites prior to construction
Pre-construction	Provide a tour of the Beaver Dam Mine Site and Haul Road and information on Project operations to interested Mi'kmaq peoples.
Pre-construction	Develop a Mi'kmaq Communication Plan with the Mi'kmaq of Nova Scotia that outlines an ongoing two-way communication process throughout the lifecycle of the Project.
Pre-construction	As part of the existing communications process, AMNS will build upon and strengthen a Complaints Management and Action Program for Mi'kmaq input in advance of Project commencement, as an opportunity for having grievances heard and addressed, and development of an communication protocol.
Pre-construction	Possible establishment of an environmental protection committee to review proposed and develop additional environmental mitigation protocols, oversee monitoring procedures and review/evaluate results. This committee should have representation from Proponent environmental experts, as well as Mi'kmaw representatives from Millbrook First Nation, Unama'ki Institute of Natural Resources, the Mi'kmaq Conservation Group, and NSE.
Construction	Design and construct bypass roads allow for travel routes to by-pass the Beaver Dam Mine Site and Haul Road and allow access to areas surrounding the Project.
Construction	In the event that Mi'kmaw archaeological features are encountered during construction or operation of the Project, all work in the area will be halted and immediate notification made to the Special Places Coordinator, Nova Scotia Museum, the KMKNO and the communities of Sipekne'katik and Millbrook As part of the EMS, AMNS will ensure mitigation measures are undertaken to prevent irreversible damage to Mi'kmaq archaeological resources and known burial site(s), including ensuring all Project activities are within the defined Project property boundaries only.
On-going	AMNS will provide various opportunities for Mi'kmaq participation in the Project, including opportunities to participate in environmental monitoring and implementation of Mi'kmaq projects such as fish habitat offsetting, wetland compensation, and others. AMNS will continue to engage with the Mi'kmaq on various Project benefits.
On-going	Engage in open dialogue with affected communities relating to issues of limited Mi'kmaq access to the Beaver Dam Mine Site and Haul Road for the eight year project window and continue to review and discuss mitigation options including suitable alternative crown land access in close proximity to the Beaver Dam Mine Site and Haul Road.
On-going	Continue to engage with the Mi'kmaq of Nova Scotia to determine how they would like to participate and integrate traditional knowledge into the Reclamation and Closure Plan for the Project. AMNS will also provide the opportunity for the Mi'kmaq to provide input on species end land uses, revegetation, reclamation techniques, and for Mi'kmaq members to join the reclamation team to execute this Project phase.
On-going	Commitment to developing and conducting a Mi'kmaq Cultural Awareness Program for staff and contractors. Scope to be determined based on further discussions.

Millbrook First Nation and the Mi'kmaq of Nova Scotia will be provided with the opportunity to engage on the verification of the nature and extent of the effects on current use of lands and resources for traditional purposes, to determine the effectiveness of mitigation measures, and to ensure ongoing and adaptive management of any unanticipated outcomes. A Draft pilot Emergency Response Mi'kmaq Communications Plan has been developed and is being implemented with Indigenous groups to ensure the Mi'kmaq of Nova Scotia are kept informed and are able to provide feedback on key issues related to the Project; and, to implement an emergency response protocol, in the unlikely event of an incident.

6.14.9 Residual Effects and Significance

The predicted residual environmental effects of the Project on the Mi'kmaq of Nova Scotia are assessed to be adverse, but not significant following implementation of applicable mitigation measures (Table 6.14-10). Potential residual effects to the Mi'kmaq of Nova Scotia's physical health from Project-related changes to the environment (e.g., changes to country foods, water, and soils) are anticipated to be not significant. Potential pathways of effects on human health associated with consumption of or contact with country foods, water and soils will be minimized by implementing mitigation measures such as dust control, water management infrastructure and processes and water treatment (if required). Mitigation measures to reduce atmospheric emissions will be implemented to minimize potential related effects on human health, and the residual risk to human health from inhalation of Project-related dust and airborne contaminants is considered low.

Mitigation measures and conclusions relating to impacts to traditional practices and socio-economic, mental and social well-being will continue to be evaluated directly with Millbrook First Nation and the Mi'kmaq of Nova Scotia throughout the environmental assessment process, and throughout the lifecycle of the Project. AMNS has reviewed with Millbrook First Nation and the Mi'kmaq of Nova Scotia the proposed mitigation measure of a multi-use bypass road to access to lands surrounding the Haul Road and north of the Beaver Dam Mine Site, as well as the availability and proposed suitability of nearby Crown land as partial mitigation for loss of access during the eight years that the mine will be limiting access to the Beaver Dam Mine Site and Haul Road.

Table 6.14-10: Residual Effects of the Project on Mi'kmaq of Nova Scotia

Project - VC Interactions	Mitigation and Compensation Measures	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction – Beaver Dam Mine Site and Haul Road Direct effect on archaeological resources and burial site	Ensure no Project activities occur outside of PA, education and procedures in place as part of the EPP to halt work and notify the Mi'kmaq if archaeological deposits are encountered.	N No interactions with known archaeological Mi'kmaq resources and burial sites are expected. Identified resources will be avoided	PA VC confined to the mine site	N/A This project interaction is not expected to be affected by timing	ST VC interaction will occur during construction phase	O VC interaction will occur once	IR VC remains at the end of the activity	None	Not Significant
Construction – Beaver Dam Mine Site and Haul Road Direct habitat loss, including wetlands, and loss of plants of significance to the Mi'kmaq	Minimize footprint as per Project design, implementation of mitigation and monitoring as per other VCs to minimize indirect effects, engagement and involvement of the Mi'kmaq throughout Project (including monitoring and compensation)	L Mitigation strategies and best management practices reduce the magnitude of impact	PA VC confined to the mine site	A timing is applicable and clearing and grubbing will be completed outside of the growing season wherever practicable	ST VC interaction will occur during construction phase	O VC interaction will occur once	PR VC remains at the end of the activity	Loss of plant specimens, habitat loss. Reclamation will restore some native plant species but not expected to return to baseline	Not Significant
Construction and Operations – Beaver Dam Mine Site and Haul Road Direct and indirect impacts to fish and fish habitat	Minimize footprint as per Project Design, erosion and sediment control to minimize impact, and water quality treatment, if required. Fisheries Act Authorization and Fish Habitat Offset Plan	L Mitigation strategies and best management practices reduce the magnitude of impact	PA/LAA Direct effect within PA, indirect effect within LAA	A Seasonality (spawning) windows applicable	MT VC interaction will occur during construction, operations and active reclamation	O/S Effects will be once from direct impacts, effects will be sporadic from indirect impacts	IR VC interactions are permanent	Habitat loss, change in water quality/quantity. Positive change in water quality due to historical tailings management	Not Significant
Construction and Operations – Beaver Dam Mine Site and Haul Road Indirect impacts to fauna- loss of habitat; noise and fragmentation	Minimize footprint as per Project Design, utilize existing roads wherever practicable, provision of bypass roads to maintain access.	L Mitigation and best management strategies reduce magnitude of impact	PA/LAA Direct effect within PA, indirect effect within LAA	A Seasonality (breeding windows) applicable	MT VC interaction will occur during construction, operations and active reclamation	R effects will be regular from indirect impacts	PR Traffic will reduce on roads once operations cease	Habitat loss, potential changes in species movement patterns	Not Significant
Construction and Operations – Beaver Dam Mine Site and Haul Road Predicted noise and air potential interaction with traditional practices surrounding the Project	Utilize berms and other mitigation where required to reduce noise levels to minimize indirect impact to Mi'kmaq; share noise study results and involve Mi'kmaq in data collection. Use of chemical dust suppressants on Haul Road to ensure 80% dust control.	L noise and dust levels predicted to be elevated above background but in compliance at the property boundaries,	LAA Noise will potentially affect wildlife patterns in close proximity to the Mine (LAA)	N/A This project interaction is not expected to be affected by timing	MT VC interaction will occur during construction, operations and active reclamation (2-3 yrs) phases of the Project	R VC interaction will occur at regular intervals throughout the Project	R VC interaction will recover to baseline after Project activities are completed	Sensory Disturbance	Not Significant

Table 6.14-10: Residual Effects of the Project on Mi'kmaq of Nova Scotia (continued)

Project - VC Interactions	Mitigation and Compensation Measures	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction and Operations – Beaver Dam Mine Site and Haul Road Predicted Light levels and potential interaction with traditional practices surrounding the Project	Maintenance of forested canopy wherever practicable within the Project property boundaries. Limit unnecessary lighting at Beaver Dam Mine Site; utilization of potential green energy options	L Light levels are predicted to meet guidelines at residences. Elevated light levels above background will be present up to 2 km from the Mine	LAA light from the Beaver Dam Mine Site is predicted to extend into the LAA	A Timing is applicable as visual effect is adjusted based on foliage on trees	MT VC interaction will occur during construction, operations and active reclamation (2-3 yrs) phases of the Project	R VC interaction will occur at regular intervals throughout the Project	R VC interaction will recover to baseline after Project activities are completed	Sensory Disturbance	Not Significant
Construction, Operations and Closure, Beaver Dam Mine Site and Haul Road Potential impact to human health from the Project	Implement mitigation and monitoring measures identified for each VC for the life of the Project as required	L Adverse health effects from dust exposure, the consumption of country foods harvested from the vicinity of the Mine Site, and recreational water use are not anticipated.	LAA This project interactions resulting in potential health effects extend into the LAA	N/A This project interaction is not expected to be affected by timing	MT VC interaction will occur during construction, operations and active reclamation (2-3 yrs) phases of the Project	R VC interaction will occur at regular intervals throughout the Project	R VC interaction will recover to baseline after Project activities are completed	Human Health	Not Significant
Construction, Operations and Closure, Beaver Dam Mine Site and Haul Road Potential impact to the economic, social and mental well being of the Mi'kmaq of Nova Scotia from the Project	Continue discussions with the Mi'kmaq to determine appropriate mitigation and compensation requirements, where appropriate. Proposed multi-use bypass road. Potentially suitable alternative tracts of Crown land are available surrounding the Beaver Dam Mine Site and Haul Road. Mi'kmaq participation in monitoring programs and development of Reclamation and Closure Plan for the Project.	L	LAA	A	MT VC interaction will occur during construction, operations and active reclamation (2-3 yrs) phases of the Project	C	PR	Change in economic, social and mental well being of the Mi'kmaq of Nova Scotia	Not Significant
Construction, Operations and Closure – Beaver Dam Mine Site and Haul Road Restriction and loss of access for traditional practice during construction, operations and active reclamation of the Mine	Continue discussions with the Mi'kmaq to determine appropriate mitigation and compensation requirements, where appropriate. Proposed multi-use bypass road. Potentially suitable alternative tracts of crown land are available surrounding the Beaver Dam Mine Site and Haul Road	L Mitigation strategies and best management practices reduce the magnitude of impact	LAA Access restriction is confined to PA; hunting effects may be felt within LAA due to sensory disturbance and/or firearm restrictions	N/A This project interaction is not expected to be affected by timing	MT VC interaction will occur during construction, operations and active reclamation (2-3 yrs) phases of the Project	R VC interaction will occur regularly	R VC returns to baseline conditions at the end of the activity	Loss of Access	Not Significant

Table 6.14-10: Residual Effects of the Project on Mi'kmaq of Nova Scotia (continued)

Project - VC Interactions	Mitigation and Compensation Measures	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction, Operations and Closure – Beaver Dam Mine Site and Haul Road Development of Project	Continue confidential discussions with the Mi'kmaq of Nova Scotia (parallel to the federal environmental assessment) to identify employment, community and economic benefits.	L Considerable and tangible opportunities for Mi'kmaq communities	RAA Opportunities can be considered across the RAA	N/A This project interaction is not expected to be affected by timing	MT to LT Opportunities will extend past operational period into reclamation and post closure.	C There are continuous opportunities throughout all project phases.	R VC returns to baseline conditions at the end of the activity	Benefits to the Mi'kmaq of Nova Scotia	Not Significant

Notes: See Section 5.11, Table 5.11-1 for definitions of the below characteristics.

Magnitude		Geographic Extent			Timing		Duration		Frequency		Reversibility	
N	Negligible	PA	Project Area		N/A	Not Applicable	ST	Short-Term	O	Once	R	Reversible
L	Low	LAA	Local Assessment	Area	A	Applicable	MT	Medium-Term	S	Sporadic	IR	Irreversible
M	Moderate	RAA	Regional Assessment	Area			LT	Long-Term	R	Regular	PR	Partially Reversible
H	High						P	Permanent	C	Continuous		

A significant adverse environmental effect for the Mi'kmaq of Nova Scotia has not been predicted for the Project for the following reasons, with consideration of the ecological and social context of the LAA surrounding the Project:

During Construction:

- Direct impacts to terrestrial habitat, flora and fish habitat will be minimized through on-going Project design and micro-sighting of infrastructure footprints, where practicable.
- Construction work and methods will be considerate of fish spawning timing windows and the breeding bird season.
- Construction noise and light will be limited and temporary in nature with an approximate 12 month duration.
- Changes to access for the Mi'kmaq of Nova Scotia to the Beaver Dam Mine Site and Haul Road will be evaluated through on-going dialogue between individual Mi'kmaq communities and AMNS as part of broader impact benefits and compensation discussions. A multi-use bypass access route has been planned to allow access to areas surrounding the Haul Road and north of the Beaver Dam Mine Site. There are available possible alternative suitable areas with the potential to support for the continuation of traditional practices (equivalent sized tracts of crown land).

During Operations:

- Noise and air concentrations will be elevated above regulatory criteria only within the proposed property boundaries, and elevated above background near the Beaver Dam Mine Site and Haul Road during this period. The likelihood of mobile receptors being regularly in close proximity to noise generation sites is low. A potential Indirect Wildlife Environmental Effects Zone and an Indirect Limited Firearms Zone has been described, and mitigation measures for the effect to Mi'kmaq hunters with a potential change in hunting patterns within these zones have been proposed through the construction of a multi-use bypass road and potential suitable alternative areas with the potential for the continuation of traditional practices.
- It is considered unlikely that ore dust deposition from the Beaver Dam Mine Site and Haul Road at the rates considered in this assessment would result in levels of metals in country foods, soils and dust that would be harmful to human health, based on the risk assessment conducted. Adverse health effects from soil and dust exposure, the consumption of country foods harvested from the vicinity of the Beaver Dam Mine Site and Haul Road, and recreational water use (i.e., swimming) are not anticipated.
- Changes to access for the Mi'kmaq of Nova Scotia will be evaluated through on-going dialogue between individual Mi'kmaq communities and AMNS as part of broader impact benefits and compensation discussions. There are available possible alternative suitable areas for the continuation of traditional practices (equivalent sized tracts of Crown land).

During Active Closure:

- Noise will be elevated above baseline during active closure (i.e., 2 years) involving mobile equipment and then lower to baseline levels during the post-closure period. During post-closure, pit refilling, water treatment, if required, and associated monitoring will be on-going. However, Mi'kmaq access to the site is anticipated to be restored during post closure.
- Changes to access for the Mi'kmaq of Nova Scotia will be evaluated through on-going engagement between individual Mi'kmaq communities and AMNS as part of broader impact benefits and compensation discussions. There are available possible alternative suitable areas with the potential to support of the continuation of traditional practices (equivalent sized tracts of crown land).

6.14.10 Proposed Compliance and Effects Monitoring Program

AMNS commits to providing the opportunity for Mi'kmaq participation in community-based monitoring programs and development of the Reclamation and Closure Plan. As the Project moves forward, discussions will continue with the Mi'kmaq of Nova Scotia regarding participation opportunity in the development, implementation and evaluation of proposed compliance and effects monitoring programs. These could include monitoring programs such as:

- Wetland Monitoring;
- Wildlife Monitoring, including Moose; and
- Other monitoring programs such for air, surface water, groundwater, and noise.

In addition, AMNS will hold periodic meetings with the Mi'kmaq of Nova Scotia, including Millbrook and Sipekne'katik First Nations, to review overall environmental compliance and effects monitoring programs associated with other VCs, and provide data and results of monitoring programs. On-going dialogue will continue with the Mi'kmaq of Nova Scotia regarding participation in, and implementation of, monitoring programs for the Project.

The effects monitoring program will verify the effectiveness of mitigation measures associated with minimizing any potential effects to human health from consumption of or contact with country foods, water and soils, and results will be shared with local Indigenous groups.

6.15 Physical and Cultural Heritage

6.15.1 Introduction

6.15.1.1 Summary of Physical and Cultural Heritage Before the Updates

Baseline archaeological screening and reconnaissance confirmed presence of eight Sites and five Areas with elevated potential for encountering archaeological resources, including historic Euro-Canadian and Mi'kmaq resources. Many Euro-Canadian resource were identified as twentieth century artifacts from historic mining and industrial activities in the area. The Haul Road, as specified at the time of 2015 site reconnaissance and including the proposed new section of road, was cleared of any requirement for further archaeological investigation.

The previous infrastructure footprint of the Beaver Dam Mine Site impacted archaeological Site 6, as a result of mine road construction. Site 6 exhibits elevated potential for encountering historic Euro-Canadian archaeological resources from the early 1900s. The features at this site were noted to be twentieth century historical mining features only. Mitigations for the potentially impacted sites/areas were recommended by the CRM Group and accepted by Nova Scotia Communities, Culture and Heritage. As a result of mitigations and detailed design planning, the predicted residual environmental effects of Project development and production on physical and cultural heritage are assessed to be adverse (low), but not significant.

6.15.1.2 Summary of Updates to Physical and Cultural Heritage

As a result of PA modifications and continued infrastructure micro-siting since the 2019 EIS submission, additional archaeological screening and reconnaissance were conducted in 2019 in the western and southeastern Beaver Dam Mine Site expansions. Two areas, Areas 4 and 5, were identified that had elevated potential for encountering Mi'kmaw archaeological resources. Neither will be impacted by Project development. Previously identified Areas 2 and 3 will be impacted by a topsoil stockpile and open pit. These areas are noted to exhibit elevated potential for encountering Pre-contact and/or early historic Mi'kmaq archaeological resources.

The current infrastructure footprint of the Beaver Dam Mine Site will impact archaeological Site 6, Area 2 and Area 3. Additional shovel testing was completed within these locations in fall 2020 to assess the presence of historic and Mi'kmaq archaeological resources prior to development. Eleven positive shovel test was encountered, one within Area 2 and 10 within Site 6, all with material recovered dating from the late 19th to early 20th centuries associated with historic structures, geotechnical testing, and the continued development of road infrastructure. Additionally, field reconnaissance of a newly proposed topsoil storage pile (TSSP) location, immediately southeast of Site 6, within 100 m of the north side of Crusher Lake, was also conducted in fall 2020.

Site 6, Area 2, Area 3 and the remainder of the Beaver Dam Mine Site and Haul Road is recommended to be cleared for any further archaeological investigation. As a result, Project effects remain not significant.

Table 6.15-1: Updated Subsections from the 2019 Revised Environmental Impact Statement – Physical and Cultural Heritage

2019 Revised EIS Submission (February 28, 2019)	Updated in 2021	Corresponding 2021 EIS Update Section Number	Reason for Update
-	-	6.15.1 Introduction	• new
6.15.1 Rationale for Valued Component Selection	No	6.15.2 Rationale for Valued Component Selection	-
6.15.2 Baseline Program Methodology	Yes	6.15.3 Baseline Program Methodology	• Addition of 2019 field surveys. • Additional survey areas as a result of PA modification for infrastructure micro-sitting.
6.15.3 Baseline Conditions	Yes	6.15.4 Baseline Conditions	• Present results from 2019 archaeological assessment. Addition of Table 6.15-2 summarizing archaeological sites/areas. • Additional survey areas as a result of PA modification for infrastructure micro-sitting.
6.15.4 Consideration of Consultation and Engagement Results	No	6.15.5 Consideration of Engagement Results	-
6.15.5 Effects Assessment Methodology – **Boundaries**	Yes	6.15.6 Effects Assessment Methodology – **Boundaries**	• Adjusted PA description. • PA modification for infrastructure micro-sitting.
6.15.5 Effects Assessment Methodology – **Thresholds for Determination of Significance**	Yes	6.15.6 Effects Assessment Methodology – **Thresholds for Determination of Significance**	• Updated significance threshold and magnitude assessment. • Reflect changes in VC baseline conditions and improve significance assessment criteria. • Response to IR2 CEAA 2-02.
6.15.6 Project Activities and Physical and Cultural Heritage Interactions and Effects	Yes	6.15.7 Project Activities/Interactions with Physical and Cultural Heritage	• Updated based on archaeological assessment results and changes to baseline conditions. Changes to project timelines. • Reflect changes in VC baseline conditions and updates to project infrastructure and operations.
6.15.7 Preferred Alternative Haul Road	Yes	Section removed	• The Preferred Alternative Haul Road is no longer being considered and has been removed from the Project Description.
6.15.8 Mitigation and Monitoring	Yes	6.15.8 Mitigation	• Updated based on archaeological assessment results and changes to baseline conditions. • Reflect changes in VC baseline conditions and updates to project infrastructure and operations.
6.15.9 Residual Effects and Significance	Yes	6.15.9 Residual Effects and Significance	• Updated based on field survey results and changes to significance threshold determination. • Change to magnitude determination • Reflect changes to significance threshold and magnitude assessment.
6.15.10 Proposed Compliance and Effects Monitoring Program	No	6.15.10 Proposed Compliance and Effects Monitoring Program	• Updates to reporting and Mi'kmaq engagement commitments. • Bolster Mi'kmaq engagement.

Notes: PA = Project Area; LAA = Local Assessment Area; RAA = Regional Assessment Area- = no update; IR2 = Round 2, Information Requests; CEAA = Canadian Environmental Assessment Agency; EIS = environmental impact statement.

6.15.2 Rationale for Valued Component Selection

Physical and cultural heritage are provincially regulated through the *Special Places Act*, which supports the preservation, regulation, and study of archaeological, historical, and paleontological sites and artifacts remains deemed to be important parts of Nova Scotia's natural or cultural heritage. The areas historical importance for post-Contact land use and recreational value are important considerations for the mine development.

6.15.3 Baseline Program Methodology

In 2008, Cultural Resource Management Group (CRM Group), undertook an archaeological screening and reconnaissance program at the Beaver Dam Mine Site on behalf of Acadian Mining. At that time, a surface mine was in early-stage planning as well as associated mine features including a crusher, a settling pond, stockpiles of overburden and product, and service roads.

In 2014, CRM Group was retained on behalf of AMNS to conduct archaeological screening and reconnaissance at the Beaver Dam Mine Site using the current site development plan. Building upon the research and reconnaissance undertaken on the property in 2008, CRM Group revisited several of the sites previously noted, as well as identified other features related to previous site activities (sawmill and possible cookhouse sites). The 2014 archaeological screening and reconnaissance consisted of a visual inspection of the ground surface and did not involve sub-surface testing. As part of the 2014 archaeological assessment, an archaeological screening was completed prior to site reconnaissance. CRM Group reviewed documents available through the Nova Scotia Archives, the Department of Natural Resources and Crown Land Information Management Centre. The screening included a review of land grant records, legal survey, historical maps, local and regional histories, topographic maps, and aerial photos.

In 2015, CRM Group was retained on behalf of AMNS to conduct additional archaeological reconnaissance. Changes to the layout of the proposed facility led to additional archaeological reconnaissance being undertaken in the summer of 2015. Previously investigated mine features that were proposed, such as the WRSP and the crusher site had been reconfigured. Two till piles, two ore piles, two settling ponds, and the ROM/crusher/service pad site were added to the Project. The reconnaissance was focused within the pit, the waste rock stockpile, the till piles, the ore piles, the settling ponds, and the ROM/crusher/service pad site.

CRM Group was also retained in 2015 to complete archaeological reconnaissance of the proposed Haul Road where upgrades to the existing road will be conducted. The focus of the reconnaissance was on Beaver Dam Mines Road and Moose River Cross Road (so-called), which are portions of the proposed Haul Road that require upgrades to allow for truck travel. The water crossings exhibited the highest potential in the background research and were the focus of the reconnaissance. In 2016, CRM Group completed archaeological reconnaissance of a proposed 4.0 km new section of the Haul Road, located west of Hwy 224 (Section 2, Figure 2.3-2).

In 2018, the PA was modified to allow for the micro-siting of infrastructure. CRM Group was retained to conduct an additional archaeological screening and reconnaissance of the western waste rock stockpile (western extent of the Beaver Dam Mine Site), which was to be located on the west side of Crusher Lake.

In 2019, the PA was again modified, as described in Section 2. As a result, CRM Group was retained to undertake additional archaeological screening and reconnaissance of the Beaver Dam Mine Site within the western NAG waste rock stockpile expansion and the southeastern organic materials stockpile expansion.

The 2015, 2016, 2018, and 2019 archaeological reconnaissance for the Beaver Dam Mine Site and Haul Road consisted of a visual inspection of the ground surface and did not involve sub-surface testing. Although the initial ground search did not involve

sub-surface testing, the investigators were watchful for topographic or vegetative anomalies that might indicate the presence of buried archaeological resources. Subsequent shovel tests were completed in fall 2020 in noted archeological areas where development is proposed: Site 6, Area 2 and Area 3. A total of 310 shovel tests were excavated. Additionally, field reconnaissance of a newly proposed topsoil storage pile (TSSP) location, immediately southeast of Site 6, within 100 m of the north side of Crusher Lake, was also conducted in fall 2020.

The Touquoy Mine Site was previously subjected to archaeological reconnaissance in November 2006. No additional disturbances are anticipated at the Touquoy Mine Site as a result of the Beaver Dam Mine Project and therefore no additional work was completed.

The archaeological reports are included in Appendix N.1 to N.7.

6.15.4 Baseline Conditions

Updates to physical and cultural heritage baseline conditions reflected within this section are as a result of additional surveys required by changes to the PA in order to incorporate the micro-siting of Project infrastructure.

6.15.4.1 Beaver Dam Mine Site

Site reconnaissance in 2008, completed as part of the archaeological assessment, noted 6 features, of which Sites 1 to 5 were within close proximity to Crusher Lake. Site 6 was located northwest of the lake. Two areas along the Cameron Flowage were identified as being high potential for pre-European contact resources (Areas 2 and 3 as presented in Appendix N.6). In addition to these features and high potential areas, numerous industrial features were identified along the northern shore of Crusher Lake. CRM Group recommended that the features and the high potential areas be subject to shovel testing and the industrial features subject to detailed documentation if any of them fell within areas of future development.

An archaeological screening was undertaken at the Beaver Dam Mine Site in 2014 that identified that the land within the study area was historically part of the greater Mi'kmaq territory known as *Eskikewa'kik,* meaning 'skin dressers territory'. The Maritime Archaeological Resource Inventory does not identify any registered archaeological sites within the study area. However, the lack of archaeological data may represent a lack of archaeological investigation and not an absence of archaeological sites. The Beaver Dam Mine Site property was historically developed for industrial use since the late-1800s. Aerial photographs from 1982 and 1992 indicate that the mine underwent a significant amount of development during this time period. This development likely destroyed any features that may have been present in the area.

Archaeological screening conducted in 2014 identified that, based on the environmental setting and Indigenous Peoples land use, as well as the Property's long history of industrial use, the Beaver Dam Mine Site exhibits high potential for encountering Pre-contact and historic Indigenous Peoples archaeological resources and high potential for encountering historic Euro-Canadian archaeological resources.

Based on the field reconnaissance completed as part of the 2014 archaeological assessment, historic features that had been identified in the Beaver Dam Mine Site footprint were determined to have been destroyed, likely by mining activities previously undertaken on the site during the 1980s.

CRM Group recommended that any development around the features identified during the 2008 or 2014 reconnaissance would require shovel testing and intensified historical research. In addition, any development around Crusher Lake should be subjected

to intensified reconnaissance (i.e., shovel testing). The pit and waste rock stockpile study areas, as they were oriented at the time of reconnaissance in 2014, were cleared of any requirement for further archaeological investigation.

The additional archaeological screening and reconnaissance within the Beaver Dam Mine Site in 2015 determined that one historic feature (Feature 5, Cookhouse) was identified within the then proposed Till Pile 2 study area and Feature 4 (Mill) were in proximity to the mine activities. Subsequent adjustments of the mine layout put these features within an access road to the western waste rock stockpile. No archaeological features or areas of archaeological potential were identified within any of the other study areas, either during the background or field reconnaissance. It was recommended that either a program of shovel testing be conducted around the possible cookhouse (Feature 5) prior to disturbance or a buffer of 20 m be put in place around the feature to protect it from any mining activities. No further archaeological work is required for the rest of the Till Pile 2 study area. CRM Group recommended that any development around the features identified in 2008 and/or 2014 would require shovel testing and intensified historical research in advance of disturbance. Other areas, as they were oriented at the time of reconnaissance in 2015, were cleared of any requirement for further archaeological investigation.

Further archaeological screening and reconnaissance in 2018 of the western waste rock stockpile concluded that there were two sites/areas that had elevated potential for encountering archaeological resources: Site 6, a historic cabin as described in the 2008 archaeological assessment, located on the eastern side of a logging road that runs through the western portion of the study area, exhibited elevated potential for encountering archaeological resources related to the historic Beaver Dam Gold District, and Area 1, located approximately 25 m north of Crusher Lake, ascribed elevated potential for encountering Mi'kmaw archaeological resources. Site 6 was revisited and investigated further in 2018. This site has the potential to be impacted by construction of the access road leading to the western waste rock stockpile. CRM Group recommended that an intensified reconnaissance be conducted if any development is set to occur within 100 m of Crusher Lake. It was also recommended that shovel testing be conducted in advance of any disturbance in the proximity of Site 6 or Area 1, or if development is set to occur around any historic feature identified in the 2008 and 2014 reconnaissance. The remainder of the western waste rock stockpile study area, as it was oriented at the time of reconnaissance in 2018, is recommended to be cleared for any further archaeological investigation.

Additional archaeological screening and reconnaissance in 2019 of the western and southeastern Beaver Dam Mine Site expansions identified two areas, Areas 4 and 5, that had elevated potential for encountering Mi'kmaw archaeological resources. Both areas are within the southeastern expansion study area and exhibit elevated potential for Pre-contact and/or early historic Mi'kmaw archeological resources. Areas 4 and 5 are located on level, elevated plateaus on the western side of the Killag River, measuring approximately 20 x 10 m and 20 x 20 m, respectively. No sites/areas of elevated archaeological resource potential were identified within the western expansion study area. If any development is to occur within Areas 4 or 5, CRM Group recommends that shovel testing be conducted in advance of any disturbance. These areas are currently outside the PA and will therefore be avoided. As such, it is recommended that the western and southeastern expansion areas be cleared of any requirements for further archaeological investigation.

Additional archaeological investigations and shovel testing was completed within Site 6, Area 2 and Area 3 in fall 2020. Eleven positive shovel test was encountered, one within Area 2 and 10 within Site 6, all with material recovered dating from the late 19th to early 20th centuries associated with historic structures, geotechnical testing, and the continued development of road infrastructure. No positive shovel tests were encountered in Area 3. No Pre-contact Mi'kmaq archaeological resources were encountered during shovel tests. In conjunction with the 2020 shovel testing program, the newly proposed TSSP impact area, southeast of Site 6, was subject to field reconnaissance. Given the rocky, wet, and sloped nature of the terrain encountered during field reconnaissance, as well as disturbance resulting from forestry and mining activities, the proposed TSSP impact area is ascribed low potential for encountering Pre-contact and early historic Mi'kmaw archaeological resources and historic Euro-Canadian archaeological resources.

A summary of all archaeological sites/areas identified within Beaver Dam Mine Site, during all assessment years, is presented in Table 6.15-2.

Table 6.15-2: Details of Archeological Resources Identified during Field Reconnaissance at the Beaver Dam Mine Site

Site ID	Site Description
Site 1	A collapsed wooden structure revealed the remains of a log cabin, 40 m north of Crusher Lake. Based on the observed artifacts, it is possible that Site 1 represents the remains of a twentieth century structure.
Site 2	Potential remains of a partially in-filled cellar, 20 m southeast of Site 1. No visible structural remains.
Site 3	Depression features of potentially in-filled cellar, 30 m east of Site 2.
Site 4	A small, partially collapsed wooden structure, 70 m southeast of Site 3. Visual examination suggests the feature may represent the remains of a twentieth century outhouse.
Site 5	Potential remains of a moss-covered foundation, 10 m north of Crusher Lake. The feature may be related to mineral exploration and/or extraction activities.
Site 6	Two depressions east of a logging road that runs west of Crusher Lake. The features are identified as having moderate to high potential for historic Euro-Canadian archaeological resources. The area is identified as "Forge Hill". Additional shovel tests completed Fall 2020. Ten positive shovel tests encountered late 19th to early 20th century materials.
Site 7	Remains of a mill, 14 m east of an unnamed stream and north of the mine road north of Crusher Lake. The mill Is identified on a historic map (1928) and is estimated to have been built in 1904.
Site 8	A possible cookhouse is indicated on a historic map (1928), on the north side of the mine road north of Crusher Lake. No structural remains were encountered, but a sight depression and iron pot were observed.
Area 1	A level, elevated plateau north of Crusher Lake identified as having elevated potential for historic Mi'kmaw archeological resources.
Areas 2 & 3	Level, elevated plateaus on the western side of the Cameron Flowage identified as having elevated potential for historic Mi'kmaw archeological resources. Additional shovel tests completed Fall 2020. One positive shovel test in Area 2 encountered late 19th to early 20th century materials.
Areas 4 & 5	Level, elevated plateaus on the western side of the Killag River identified as having elevated potential for historic Mi'kmaw archeological resources.

6.15.4.2 Haul Road

An archaeological screening and reconnaissance conducted for the Haul Road in 2015 and 2016 identified that water crossings along the Haul Road, in particular the West River Sheet Harbour, would have been important transportation corridors for the Mi'kmaq and their ancestors prior to the arrival of European settlers. Faribault (1898) depicts several features in the vicinity of the Haul Road. This includes a camp within three kilometres of the alignment of the Haul Road and several dams located in the vicinity of Moose River Cross Road. Although no other features were depicted, dams would suggest further activity not noted on the Faribault map. Several houses and a Mi'kmaq community (Beaver Lake IR 17) are located adjacent to what is now Hwy 224. The section of the Haul Road along Mooseland Road passes two camps, several structures noted as "Icelanders huts", and a dam at the south end of Cope Lake. The review of Faribault indicates there was heavy activity in the area and that many of the modern road alignments follow closely to the historic alignments. The Maritime Archaeological Resource Inventory does not identify any registered archaeological sites within the study area. However, the lack of archaeological data may represent a lack of archaeological investigation and not an absence of archaeological sites.

During the 2015 and 2016 field reconnaissance, water crossings exhibited the highest potential in the background research and were the focus of the field investigations. The field reconnaissance did not identify any areas along the Haul Road that were ascribed high archaeological potential.

Based on the recommendations of the 2015 and 2016 archaeological reconnaissance, the alignment of the Haul Road, as specified at the time of 2015 site reconnaissance and including the proposed new section of road (Section 2, Figure 2.3-2), was cleared of any requirement for further archaeological investigation.

The current Haul Road alignment has been captured under the existing archaeological screening and reconnaissance programs.

6.15.4.3 Touquoy Mine Site

The entire Touquoy Mine Site was previously subjected to archaeological reconnaissance in November 2006. An archaeological screening was conducted by CRM Group to evaluate the archaeological potential within the proposed Touquoy development limits. The results of the study indicated that there is a low archaeological potential ascribed to the area. No additional disturbances are anticipated at the Touquoy site as a result of the Beaver Dam Mine Project.

6.15.5 Consideration of Engagement Results

Issues raised during public and Mi'kmaq engagement relating to physical and cultural heritage include potential disturbance of pre- and post-European contact archaeological resources.

The results of the public and Mi'kmaq engagement have been considered in the environmental effects assessment, including the AMNS's commitments on mitigation and monitoring measures and proposed compliance and effects monitoring programs, as well as the AMNS's broader commitment to ongoing public and Mi'kmaq engagement. Specific to evaluating the effect on physical and cultural heritage, these are found within the following environmental effects assessment.

6.15.6 Effects Assessment Methodology

6.15.6.1 Boundaries

6.15.6.1.1 Spatial Boundaries

The spatial boundaries used for the assessment of Project effects to physical and cultural heritage is the PA, as defined below.

The PA encompasses three primary components from Marinette to Moose River Gold Mines, Halifax County, NS. The Beaver Dam Mine Site will be located at the end of the Beaver Dam Mines Road and the Haul Road will span from the Beaver Dam Mine Site to Moose River Gold Mines, where the Touquoy Mine Site [processing and exhausted pit (to be used to dispose Beaver Dam tailings)] is located. The PA was modified in 2019 as a result of the expansion of the Beaver Dam Mine Site and ongoing modifications to the Haul Road design, as described in Section 2. These changes have been captured under the existing and additional archaeological screening and reconnaissance programs.

There is no LAA or RAA for physical and cultural heritage, as the loss or destruction of heritage or archaeological resources could occur only within the disturbed footprint of the Project (Section 5.5, Figure 5.5-1).

6.15.6.1.2 Temporal Boundaries

The temporal boundaries used for the assessment of effects to physical and cultural heritage are limited to the construction phase of the Project. Construction is estimated to take approximately one year.

6.15.6.1.3 Technical Boundaries

No technical boundaries were identified for the effects assessment of physical and cultural heritage.

6.15.6.1.4 Administrative Boundaries

Physical and cultural heritage are provincially regulated through the *Special Places Act*. In order to conduct any archaeological work, a Heritage Research Permit must be issued by the Minister of the Department of Communities, Culture, and Heritage.

6.15.6.2 Thresholds for Determination of Significance

A significant adverse effect is an uncontrolled (without appropriate study, analysis and mitigation measures in conjunction with the Province and Mi'kmaq archaeologists as required) disturbance to, or destruction of, any unassessed historical or cultural resource of importance in context of the *Special Places Act*. The assessment of historical or cultural features is considered complete when the feature has undergone intensified historical research involving archeological shovel testing, where required, surveyed plans, photography and videography.

For physical and cultural heritage, the following logic was applied to assess the magnitude of a predicted change in baseline documented conditions at the Beaver Dam Mine Site and Haul Road:

- Negligible – no direct or indirect impacts are expected to identified archaeological features
- Low – impacts are expected to historical mining feature(s) only, with consideration of all mitigation and in consultation with appropriate regulatory and Mi'kmaq agencies. No direct or indirect impacts to Mi'kmaq archaeological features are expected.
- Moderate – direct impacts to Mi'kmaq and/or other archaeological features are expected, with consideration of all mitigation and in consultation with appropriate regulatory and Mi'kmaq agencies.
- High – direct impacts to Mi'kmaq and other archaeological features are expected, without consideration of all mitigation and without consultation with appropriate regulatory and Mi'kmaq agencies.

6.15.7 Project Activities/Interactions with Physical and Cultural Heritage

Potential interactions between Project activities and physical and cultural heritage resources are outlined in Table 6.15-3 and 6.15-4 below.

Table 6.15-3: Potential Project Activities/Interactions with Physical and Cultural Heritage at Beaver Dam Mine Site

Project Phase	Duration	Project Interaction
Construction	1 year	• Clearing, grubbing, and grading in preparation of construction • Drilling and rock blasting in preparation of construction • Topsoil, till and waste rock transport and storage from site preparation • Watercourse and wetland alteration • Mine Site road construction and maintenance • Site infrastructure installation and construction • Settling pond construction
Operation	5 years	• Adjustment of site infrastructure • Continued potential interaction with areas of elevated archaeological resource potential
Active Closure	2 years	• N/A
Post-closure	10+ years (monitoring)	• N/A

Note: N/A = not applicable.

Table 6.15-4: Potential Project Activities/Interactions with Physical and Cultural Heritage along Haul Road

Project Phase	Duration	Project Interaction
Construction	1 year	• Clearing, grubbing, and grading in preparation of construction • Rock blasting in preparation of construction • Till and waste rock from site preparation transport and storage • Watercourse and wetland alteration in preparation of construction • Haul road construction and upgrades
Operation	5 years	• Adjustment of site infrastructure • Continued potential interaction with areas of elevated archaeological resource potential
Active Closure	2 years	• N/A[(a)]
Post-closure	10+ years (monitoring)	• N/A[(a)]

Note: [(a)] Decommissioning and Reclamation of the Haul Road is not expected. The Haul Road will be returned to owner for forestry Industry. N/A = not applicable.

There is low potential for the Project to interact with identified heritage resources that have been associated with historic mining at or near the Project site. The Project will endeavor to avoid the areas identified above.

The current infrastructure footprint of the Beaver Dam Mine Site will impact archaeological Site 6, Area 2 and Area 3, originally identified in 2008 and presented in subsequent archeological reports (Appendix N.1 to N.7). The identified archaeological features around Crusher Lake (Site 1-5, Site 7, Site 8 and Area 1, as presented in Appendix N.6 are not anticipated to be impacted by the current infrastructure footprint. A ditch is planned within 100 m of the western side of Crusher Lake. While no archeological features were found in this area, intensified reconnaissance (shovel testing) will be undertaken if the ditch cannot be micro-sited further away from Crusher Lake. As planned, Site 6 will be impacted by the access road to the western NAG waste rock stockpile, Area 2 will be impacted by a topsoil stockpile north of the pit, and Area 3 will be impacted by the pit and an adjacent access road. The CRM Group assessments indicate that Site 6 exhibits elevated potential for encountering historic Euro-Canadian archaeological resources from the early 1900s. Areas 2 and 3 are noted to exhibit elevated potential for encountering Pre-contact and/or early historic Mi'kmaq archaeological resources, however, the original shoreline has been altered by the created of Cameron Flowage and no resources were discovered during the assessments to date. Additional shovel tests were completed in these areas in Fall 2020 to assess for presence of Mi'kmaq archaeological resources prior to development. Of the 11 positive shovel tests were

encountered, one within Area 2 and 10 within Site 6, all material recovered dates from the late 19th to early 20th centuries, associated with historic structures, geotechnical testing, and the continued development of road infrastructure. No Pre-contact Mi'kmaq archaeological resources were encountered during shovel tests.

Mitigations for the potentially impacted sites/areas are presented in Section 6.15.8 and were recommended by the CRM Group and accepted by Nova Scotia Communities, Culture and Heritage.

There have been no identified archaeological sites/areas along the current Haul Road alignment.

If areas of known heritage resources are to be impacted, further work will be undertaken to document these resources. If heritage resources are identified during construction of the mine, then all work will stop in the immediate vicinity until said resources can be further studied. The potential for heritage resources to be impacted exists primarily during the construction phase of the Project.

There is no potential for the disturbance of cultural or physical heritage resources during the operational and reclamation phases of the Project based on studies to date.

There are no known federal decisions that could affect physical and cultural heritage in the PA, or that could affect structures, sites, or items of historical, archaeological, paleontological, or architectural significance of non-Indigenous peoples.

6.15.7.1 Touquoy Mine Site

The Touquoy Mine Site is currently operational. There are no effects to physical and cultural heritage anticipated to be caused by the processing of ore and the management of tailings (exhausted pit) from the Beaver Dam Mine Site. Effects to physical and cultural heritage at the Touquoy Mine Site were only anticipated to potentially occur during the initial construction phase, which is complete. No additional cultural resources were encountered during the Touquoy Mine Site development and all activities related to continued ore processing and tailings management will occur within the existing disturbed footprint.

6.15.8 Mitigation

Mitigation for physical and cultural heritage at the Beaver Dam Mine Site and the Haul Road are described below. Mitigation measures and monitoring programs at the Touquoy Mine Site are anticipated to be completed during the construction and site preparation phase and will not be applicable for the Beaver Dam Mine Project.

Based on the current Beaver Dam Mine Site infrastructure footprint and Haul Road alignment, archaeological Site 6, Area 2 and Area 3 are the only identified sites/areas anticipated to be impacted by the Project. All materials encountered date from the late 19th to early 20th centuries. No Pre-contact Mi'kmaq archaeological resources were encountered during shovel tests.

The 2014, 2015, 2016, 2018, 2019 and 2021 archaeological reports recommend that the Project, as it is currently orientated, be cleared of any requirement for further archaeological investigation. Based on these archaeological assessments, the mitigation measures presented in Table 6.15-5 were recommended by CRM Group and accepted by Nova Scotia Communities, Culture and Heritage. The archaeological investigations included a background study with Mi'kmaw engagement.

A comprehensive mitigation table for all VCs is provided in Section 9.

Table 6.15-5: Mitigation for Physical and Cultural Heritage

Project Phase	Mitigation Measures
Construction	A program of archaeological shovel testing was conducted in fall 2020, in advance of any disturbance to Site 6, Areas 2 and 3. CRM Group cleared these areas of any requirement for further archaeological investigation
	If any development is to occur within 100 metres of Crusher Lake, intensified reconnaissance (i.e., shovel testing) should be conducted to identify any additional features.
	If any development is to occur specifically around the historic features identified during the 2014, 2015, 2016, 2018 and 2019 reconnaissance, intensified historical research and archaeological shovel testing should be conducted in advance of disturbance.
	Any further changes in the layout of the mine and associated facilities be evaluated as to potential impacts to archaeological resources.
	In the event that archaeological resources or human remains are encountered during ground disturbance activities, it is required that all activity stop, and the Coordinator of Special Places, Nova Scotia Communities, Culture, & Heritage Department be contacted.
Operation	In the event that archaeological resources or human remains are encountered during ground disturbance activities, it is required that all activity stop, and the Coordinator of Special Places, Nova Scotia Communities, Culture, & Heritage Department be contacted.
Active Closure	N/A
Post-Closure	N/A

6.15.9 Residual Effects and Significance

The predicted residual environmental effects of Project development and production on physical or cultural heritage resources are assessed to be adverse, but not significant. The overall residual effect of the Project on physical or cultural heritage resources is assessed as not significant after mitigation measures have been implemented and are summarized in Table 6.15-6.

A significant adverse environmental effect for physical and cultural heritage has not been predicted for the Project for the following reasons, with consideration of the ecological and social context of the PA of the Project:

- During Construction.

Although the loss of Site 6 is anticipated, appropriate mitigation and evaluation will be completed prior to construction at this location. The features at this site were noted to be twentieth century historical mining features only. Additional shovel tests were completed in these areas in fall 2020 and CRM Group recommends the area be cleared of any requirement for further archaeological investigation.

Although disturbance to Areas 2 and 3 is anticipated, appropriate mitigation and evaluation will be completed prior to construction at these locations. Additional shovel tests were completed in these areas in Fall 2020 and No Pre-contact Mi'kmaq archaeological resources were encountered. CRM Group recommends the area be cleared of any requirement for further archaeological investigation.

No impacts to any other archaeological sites/areas are predicted based on the proposed development of the Project.

The Project will work to micro-site water management infrastructure beyond 100 m from Crusher Lake as is practicable, but if not possible, intensified reconnaissance (shovel testing) will be undertaken in this area.

- Operations: No impacts are predicted based on the studies completed to date.
- During Closure: No impacts are predicted based on the studies completed to date.

Table 6.15-6: Residual Effects for Physical and Cultural Heritage

Project - VC Interactions	Mitigation and Compensation Measures	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction – Beaver Dam Mine Site and Haul Road (Identification and/or damage to physical and cultural heritage resources – Site 6 and Areas 2 and 3)	Evaluate changes to layout for potential impacts to archaeological resources. Complete intensified historical research, additional shovel pit testing, where required, and detailed documentation at archeological features prior to disturbance cause by Project activities, in conjunction with Mi'kmaq agencies as required. Contact Coordinator of Special Places, Nova Scotia Communities, Culture, & Heritage Department if human remains or archaeological deposits are identified.	L Site 6 will be lost due to Project activities. This site contains the remains of a twentieth century structure. Impacts to Areas 2 and 3 will be minimized where practicable. These areas underwent additional shovel tests in fall 2020 and were cleared of further investigation.	PA Effects confined to the PA.	N/A VC is not expected to be affected by timing.	P Effects are permanent.	O Effects will occur once within the life of the Project.	IR VC will not return to baseline conditions.	Loss of resource	Not significant

Notes: See Section 5.11, Table 5.11-1 for definitions of the below characteristics.

Magnitude		Geographic Extent		Timing		Duration		Frequency		Reversibility	
N	Negligible	PA	Project Area	N/A	Not Applicable	ST	Short-Term	O	Once	R	Reversible
L	Low	LAA	Local Assessment Area	A	Applicable	MT	Medium-Term	S	Sporadic	IR	Irreversible
M	Moderate	RAA	Regional Assessment Area			LT	Long-Term	R	Regular	PR	Partially Reversible
H	High					P	Permanent	C	Continuous		

6.15.10 Proposed Compliance and Effects Monitoring Program

As noted above, there is no determined need for compliance or effects monitoring programs related to physical and cultural heritage. In the event that archaeological resources or human remains are encountered during ground disturbance activities, it is required that all activity stop, and the Coordinator of Special Places, Nova Scotia Communities, Culture, & Heritage Department be contacted. Chance find protocols for archaeological resources will be implemented as part of the Project Environmental Protection Plan (EPP). Personnel will receive the appropriate level of EPP training to properly implement the chance find protocol.

Proposed follow up and monitoring programs have been reviewed with the Mi'kmaq of Nova Scotia during engagement efforts including meetings, sharing of technical documents (Draft EIS, poster boards, Summary of Mi'kmaq Effects and Proposed Mitigation Measures, Plain Language Summary). On-going engagement with the Mi'kmaq will continue through the EA process and associated permitting relating to follow up programs and monitoring.

6.16 Socio-economic Conditions

6.16.1 Introduction

6.16.1.1 Summary of Socio-economic Conditions Before the Updates

The proposed Beaver Dam Mine Project (the Project) 2017 Environmental Impact Statement (EIS) (AGC 2017) submission section on Socio-economic conditions found positive benefits, specifically related to potential tax revenue and jobs created, based on a study completed in 2015. Baseline assessment information was compiled pre-2017, with updates in a Revised 2019 EIS (AMNS 2019a).

6.16.1.2 Summary of Updates to Socio-economic Conditions

The updates to the socio-economic conditions in this section are based on an updated financial analysis for the Project. In addition, a major engagement effort in 2020 resulted in new information that was assessed for impact. Included in this update is an assessment of policy documents and plans, which establishes goals and objectives for both the Local Assessment Area (LAA) and Regional Assessment Area (RAA) by local, provincial, national, international, and Indigenous authorities (Figure 6.16-1). Based on the policy and plan review, and the themes identified from the 2020 engagement activities, topic areas for analysis were identified. Finally, the impact of the global pandemic on baseline conditions is also accounted for within this updated section. A summary or road map of updates specific to the sub-section in Socio-economic Conditions for the Updated 2021 EIS is provided in Table 6.16-1.

6.16.2 Rational for Valued Component Selection

Socio-economic factors can be defined as relating to or concerned with the interaction of social and economic conditions. The Project EIS Guidelines (CEAA 2016) specifically reference that the analysis should "recognize interrelationships, system functions and vulnerabilities."[1]

The Project is assessed a varying geographical scale. The Project is situated near Marinette, Nova Scotia (Figure 16.6-1) is the regional context for this assessment (RAA). Socio-economic assessments also consider impacts at the provincial scale. Each scale of geographical resolution is examined for the appropriate interactions and valued components relevant to Socio-Economics.

Themes and topic areas for the socio-economic analysis are based on best practices of the mining industry, regional and provincial strategy documents, qualitative data gathered through public and rights holder engagement, and guidance provided in the Project EIS Guidelines (CEAA 2016). Atlantic Mining NS Inc. (AMNS) policy documents, corporate commitments and values relating to socio-economic aspirations and goals also influence the themes and topic areas assessed. The analysis is informed by "Social impact assessment in the mining sector: Review and Comparison of indictor frameworks" This report identifies a list of social impacts specific to the mining sector based on a best management practices review.

[1] Source: Section 6.1.10 of the Beaver Dam Mine Project Guidelines (CEAA 2016).

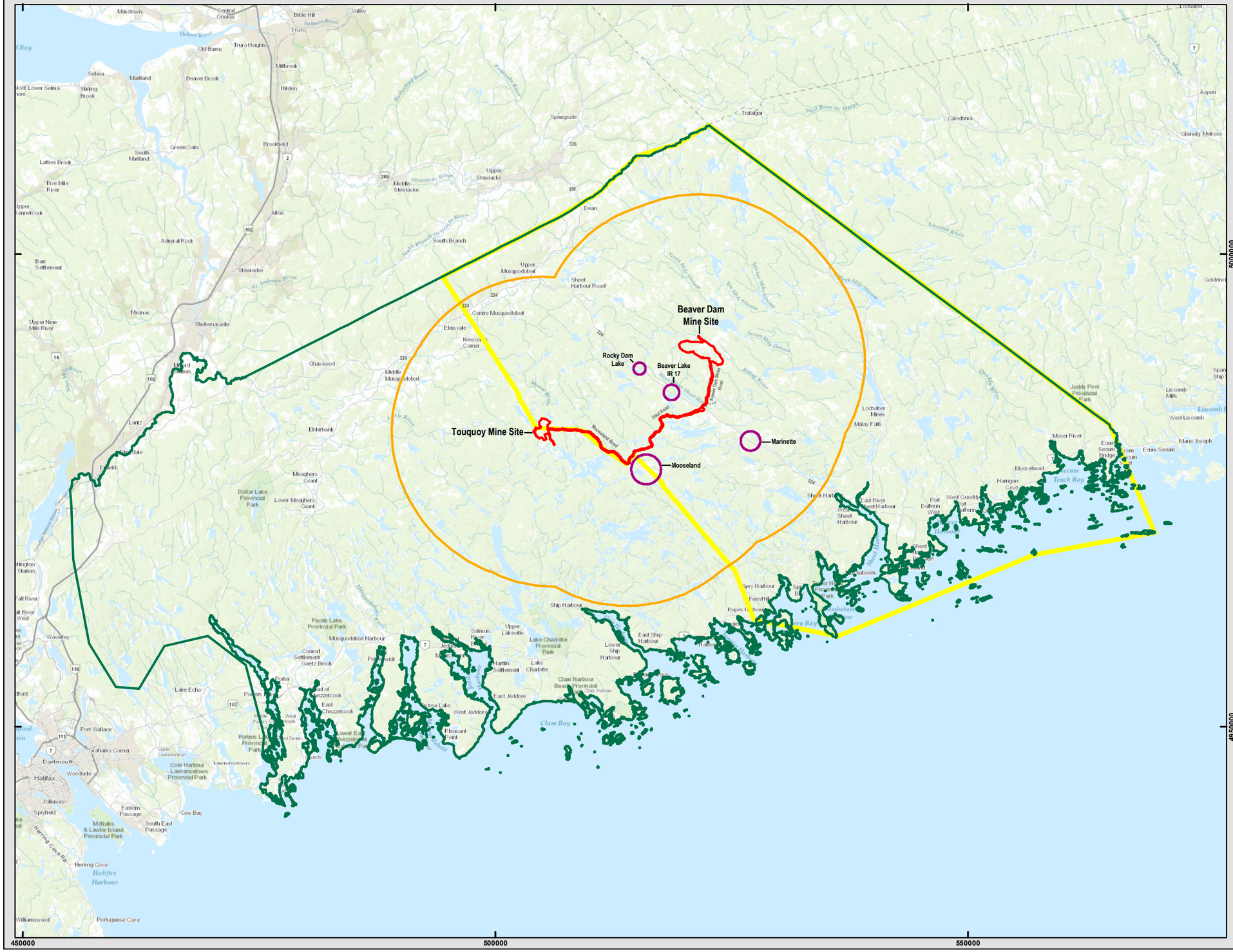
Table 6.16-1: Updated Subsections from the 2019 Revised Environmental Impact Statement – Socio-economic Conditions

2019 Revised EIS Submission (February 28, 2019)	Updated in 2021	Corresponding 2021 EIS Update Section Number	Reason for Update
-	-	6.16.1 Introduction	• New
6.16.1 Rationale for Valued Component Selection	No	6.16.2 Rationale for Valued Component Selection	• N/A
6.16.2 Baseline Program Methodology	Yes	6.16.3 Baseline Program Methodology	• Incorporated provincial and federal plan alignments
6.16.3 Baseline Conditions	Yes	6.16.4 Baseline Conditions	• Updated data and incorporated COVID impacts
6.16.4 Viewshed Analysis	No	6.16.5 Viewshed Analysis	• Updated viewshed analysis
6.16.5 Consideration of Consultation and Engagement Results	Yes	6.16.6 Consideration of Engagement Results	• Updated based on 2020 engagement results
6.16.6 Effects Assessment Methodology	Yes	6.16.7 Effects Assessment Methodology	• N/A
6.16.7 Project Activities and Socio-economic Interactions and Effects	Yes	6.16.8 Project Activities/Interactions with Socio-economic Conditions	• Updated to reflect changes in baseline, project elements and engagement results
6.16.8 Preferred Alternative Haul Road	Yes	Section removed	• Preferred Alternative Haul Road sections and references are removed from the EIS.
6.16.9 Mitigation and Monitoring	No	6.16.9 Mitigation	• Updated to reflect new mitigation and monitoring
6.16.10 Residual Effects and Significance	Yes	6.16.10 Residual Effects and Significance	• Updated based on new data
6.16.11 Proposed Compliance and Effects Monitoring Program	No	6.16.11 Proposed Compliance and Effects Monitoring Program	• N/A

Note: EIS = Environmental Impact Statement; N/A = not applicable; - = no update.

The aspirations, goals and directions of key organizations that influence the socio-economic conditions are used to assess the Socio-Economic Valued Components (VC). Policy documents, plans and strategic documents used in this assessment are summarized in Table 6.16-2. This table focuses on project alignment with strategic document. The Sustainable Development Goals of the United Nations are included in this table to provide best practices for the mining industry.

Effects to Indigenous Peoples from the Project are assessed in Section 6.14 Mi'kmaq of Nova Scotia. The Strategic Pillars of the Kwilmu'kw Maw-klusuaqn Negotiation Office (KMKNO) are included in the strategic documents summarized in Table 6.16-2 to understand interrelationships.



Prepared For:

Atlantic Gold

FIGURE 6.16-1

Beaver Dam Mine Project

Socio-economic Study Areas

- Local Community Area
- Census Tract (2050154.04)
- Socioeconomic Local Assessment Area
- Socioeconomic Regional Assessment Area
- Project Area

Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 4.75 9.5 19 km

1:370,430 Scale when printed @ 11" x 17"

Drawn By: EP
Date: 2021-04-27
Reviewed By: KR

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

McCallum Environmental Ltd.

Document Name: BD_EIS_Figure6-16-XSpatialBound

Table 6.16-2: Beaver Dam Mine Project Alignment Strategic Document Review

Strategic Document Review for Socio-Economic Valued Component	Alignment	Company Document/Initiative
Halifax Partnership		
Grow rural economic development by focusing on broadband/cellular infrastructure, tourism, resource extraction, agriculture, business retention and expansion activities.	Direct Alignment	Vision, Guiding Principles and Commitments
Develop and implement a multi-year plan to attract expatriates back to Halifax.	Direct Alignment	KPMG report regarding jobs
Work with the business community to identify and promote experiential learning opportunities for post-secondary students.	Direct Alignment	Apprenticeship Program
Identify and share existing programs, services and outcomes related to the workforce attachment of Mi'kmaq/Indigenous People, African Nova Scotians and other groups at risk of exclusion.	Direct Alignment	Commitment regarding empowered people diverse teams.
Increase people's access to the outdoors by leveraging the municipality's natural assets.	Direct Alignment	Construction of Haul Road bypass
Develop a climate strategy and implement programs and activities to support energy efficiency and the use of renewable energy in HRM.	Direct Alignment	Variety of Green Initiatives; 2020 Annual Report Page 7
One Nova Scotia		
Nova Scotia will be averaging a net gain of 1,000 working age persons per year.	Direct alignment	KPMG report regarding jobs
With the cooperation of the federal government, Nova Scotia will be receiving annually its proportionate share of all new international immigrants to Canada.	Direct Alignment	KPMG report regarding jobs
10% of foreign students stay in Nova Scotia (up from 5%).	Limited Alignment	KPMG report regarding jobs
The Nova Scotia economy will be home to 50% more high-growth start-up firms.	Direct Alignment	Suppliers' policy and KPMG Cochrane Hill Assessment
Nova Scotia will have increased the total annual value of exports (international and inter-provincial) by 50%.	Limited Alignment	KPMG report regarding benefits to Canada
The number of Nova Scotia firms participating in export trade will have increased by 50 per cent.	Limited Alignment	
Nova Scotia will have a labour force participation rate at least as high as the Canadian rate, bringing more Nova Scotians into permanent attachment to the labour market.	Direct Alignment	KPMG report regarding jobs
The employment rate for First Nations and African Nova Scotians (ANS) will be equal to the provincial average.	Direct Alignment	KPMG report regarding jobs; Diversity and Inclusion Policy; Equal Employment Opportunity Policy
Nova Scotia's youth unemployment rate will be at, or better than, the national rate in that year.	Direct Alignment	KPMG report regarding jobs
The proportion of Nova Scotia's working age population with a post-secondary certificate, diploma or degree, including apprenticeship completion, will have increased from the current 65% to 75%.	Direct Alignment	Apprenticeship Program
Through both individual initiative and expanded collaboration, and with support from government, Nova Scotia's universities and the NSCC will have doubled research funding.	Direct Alignment	Apprenticeship Program; St. Mary's University research project regarding historical tailings

Table 6.16-2: Beaver Dam Mine Project Alignment Strategic Document Review (continued)

Strategic Document Review for Socio-Economic Valued Component	Alignment	Company Document/Initiative
The number of research and development partnerships between business enterprises and Nova Scotia universities and the Community College will have doubled from an average of 1,000 per year to 2,000 per year.	Direct Alignment	St. Mary's Research project regarding tailings; St. Barbara commitments regarding community
As Nova Scotia's leading source of service sector exports, gross business revenues from tourism will reach $4 billion (approximately double the current level).	Limited Alignment	Community Investment Policy
No Nova Scotia Municipal Structure receives an overall Financial Conditions Index (FCI) assessment of high risk.	Limited Alignment	KPMG reports which include municipal tax revenues
Atlantic Growth Strategy		
Attract and retain skilled Workforce and Immigrants.	Direct Alignment	KPMG report
Forster great business innovation, drive leading edge technology and generate new breakthrough ideas.	Direct Alignment	2020 Annual Report of St. Barbara
Respond to climate change and advance clean growth in Atlantic Canada.	Direct Alignment	St. Barbara commitment regarding environment; Environmental Policy
Support growth, engage and connect people through infrastructure.	Direct Alignment	Commitment regarding bypass routes
Department of Mines		
Energy and Mines		
Reducing greenhouse gas emissions.	Direct Alignment	St. Barbara commitment regarding environment; Environmental Policy
Promoting mineral exploration, development opportunities and administering mineral rights.	Direct Alignment	St. Barbara's vision- "Our vision is to be a brilliant, global mining company that frows sustainably and created enduring, positive impacts."
Promoting the energy and mining sectors by showcasing our capabilities and leading trade delegations.	Direct Alignment	St. Barbara's vision- "Our vision is to be a brilliant, global mining company that frows sustainably and created enduring, positive impacts."
KMKNO Pillars		
To achieve recognition, acceptance, implementation and protection of treaty, and other rights of the Mi'kmaw in NS.	Direct Alignment	Diversity and Inclusion Policy;
To develop systems of Mi'kmaw governance and resource management.	Direct Alignment	St Barbara's vision- "Our vision is to be a brilliant, global mining company that grows sustainably and creates enduring, positive impacts."
To revive, promote and protect a healthy Mi'kmaw identity.	Direct Alignment	

Table 6.16-2: Beaver Dam Mine Project Alignment Strategic Document Review (continued)

Strategic Document Review for Socio-Economic Valued Component	Alignment	Company Document/Initiative
To obtain the basis for a shared economy and social development.	Direct Alignment	Diversity and Inclusion Policy; Equal Opportunity Policy
To negotiate toward these goals with community involvement and support.	Direct Alignment	Diversity and Inclusion Policy; Environmental Policy
Sustainable Development Goals		
No Poverty	No Direct Alignment	St. Barbara's vision- "Our vision is to be a brilliant, global mining company that grows sustainably and creates enduring, positive impacts."
Zero Hunger	No Direct Alignment	
Good Health and Wellbeing	Direct Alignment	Health and Safety Policy
Quality Education	Direct Alignment	Apprenticeship Program
Gender Equality	Direct Alignment	Diversity and Inclusion Policy
Clean Water and Sanitation	Direct Alignment	Environmental Policy
Affordable and clean energy	Direct Alignment	Environmental Policy
Decent Work and Economic Growth	Direct Alignment	KPMG Reports, Health and Safety Policy, Modern Safety Policy, Diversity and Inclusion Policy
Industry, Innovation and Infrastructure	Direct Alignment	St. Barbara's vision- "Our vision is to be a brilliant, global mining company that grows sustainably and creates enduring, positive impacts."
Reduced Inequality	Limited Direct Alignment	
Sustainable Cities and Communities	No Direct Alignment	
Responsible Consumption and Production	Direct Alignment	Modern Slavery Policy
Climate Action	Limited Direct Alignment	Environmental Policy
Life below water	Direct Alignment	Environmental Policy
Life on Land	Direct Alignment	Environmental Policy
Peace and Justice Strong Institutions	No Direct Alignment	
Partnerships to Achieve the Goal	Direct Alignment	Donations Sponsorships Community Programs Policy

The VC is socio-economic conditions, and is divided into themes, which are further broken into topics for more detailed analysis During the detailed review of the policy documents and plans impacting the LAA and RAA and comments and feedback from the public; themes emerged. These themes were further grouped into topics for analysis and to assess interrelationships. The themes included:

- Workforce Development;
- Demographics;
- Healthy Communities;
- Land Use;
- Parks and Open Space, Tourism;
- Roads and Traffic; and
- Impact on Government Revenues.

From a socio-economic perspective, the Project will generate employment and economic activity during all Project phases and has the potential to attract new residents to the RAA. During construction and operation there will be significant labour force needs to support the Project's activities. Additionally, with the number of jobs projected at the Beaver Dam Mine Site, increased traffic to and from the mine site from both the staff and visitors, and from trucks that will transport materials to the Touquoy Mine Site will result. Indirect employment will be generated by the Project by external contractors and suppliers.

Tax revenues and royalties will be generated by the Project that will benefit all levels of government: federal, provincial and municipal. Increased economic activity by suppliers and external contractors will contribute to government revenue as well as the local economy.

The increased economic activity has the potential to impact adjacent communities by attracting new residents, creating demand for housing, more traffic, creating opportunities for social conflict, increase the usage of public infrastructure such as health facilities, recreation facilities and other social services. The interrelationship between a positive impact, such as population growth, and other socio-economic topics, such as family doctor availability are identified, where possible.

6.16.3 Baseline Program Methodology

The KPMG report titled "Economic Impact Assessment of the Beaver Dam Mining Project" from November 2020 is based on public information released in the National Instrument (NI) 43-101 (AMNS 2019b). Since this report was issued, financial models for the Project are and will continue to be updated, and the benefits could vary upward or downward depending on the final allocation of Construction, Operation and Sustaining Capital spend. AMNS estimates that an additional 12 to 20 million dollars will be spent on the Project. Therefore, the economic impacts outlined in the "Economic Impact Assessment of the Beaver Dam Mining Project" are conservative (Appendix O.1).

Using financial data provided by AMNS, KPMG studied the static economic impacts that "measure the cascading effects that are produced by an injection of cash in a given territory."[2] The KPMG report uses Statistics Canada Input-Output (I-O) model

[2] Source: Economic Impact Assessment of the Fifteen Mile Stream Mining Project

(Appendix O.1). Other reports commissioned by AMNS from which data was taken include "Economic Impact Assessment of the Moose River Consolidated Project" (Appendix O.2) and "Regional Economic Impact Report." Although the Regional Impact Report focuses on another proposed project, there is data and conclusions that apply to other AMNS projects.

Additional data sources for the socio-economic analysis came from a variety of online sources, published reports, primary data collection and observations that were then synthesized and summarized. Using professional judgement and experience, determinations were made regarding the characterization of residual effects (Section 6.16.12). Qualitative data was gathered from the local community engagement activities, which informs the socio-economic potential impacts of the Project. This qualitative data was gathered through meetings, emails and phone calls to the community relations contact line, open houses, Community Liaison Committee (CLC) meetings and other opportunities for stakeholders to provide data on potential community impacts, identify issues of importance and aspirations for the Project.

6.16.4 Baseline Conditions

The baseline conditions before the mine construction and operation are established to fully understand the potential impacts on the VCs. From this, projections and assessment are made comparing the pre-mine conditions to post mine construction and operation.

COVID-19 has created great uncertainly and the impacts of it may be felt for years. This makes it difficult to forecast future economic conditions. The extent to which the long-term impacts of COVID on the economy and society as whole will be felt is a point of debate and is difficult to quantify while Nova Scotia, Canada and the World continue to be in the midst of this unprecedented public health crisis. In this section, baseline conditions pre-COVID and post-COVID are discussed. During this time of uncertainly, this analysis assumes continued impacts from COVID-19 during 2021 with recovery occurring in 2022 and beyond.

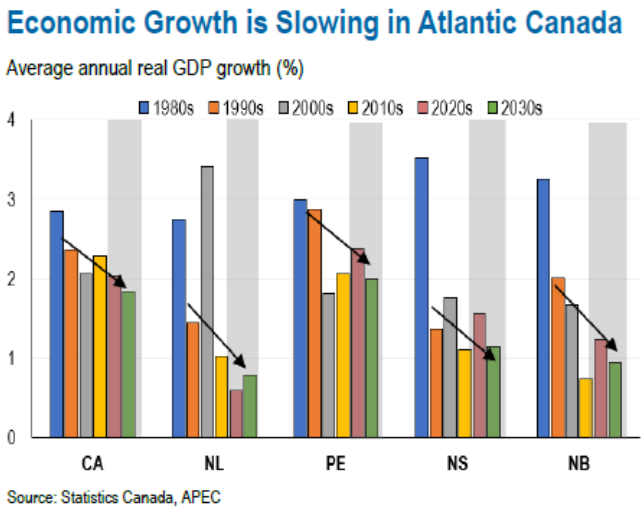
6.16.4.1 The Nova Scotia Economy – Pre COVID

Nova Scotia had the slowest growth in Canada between 1990 and 2009 (Figure 6.16-2). Since then, however, Nova Scotia has seen significant increases in its Gross Domestic Product (GDP), particularly over the last four years. Given the poor economic performance compared to other provinces in 1990s and early 2000s, the Province of Nova Scotia established a commission, "to provide advice to government, business and community leaders on new directions to realize economic growth across economic sectors in all regions of the province." The Now or Never Report (OneNovaScotia 2014) stated a series of troubling conclusions. It also set ambitious goals for the province. The Report's core message was "*Nova Scotia is today in the early stages of what may be a prolonged period of accelerating population loss and economic decline*." The Now or Never Report (OneNovaScotia 2014) identified a series of indicators to track progress against the goals of the report.[3]

The Province of Nova Scotia established 19 goals for addressing and reversing the economic decline identified by the Now or Never Report (OneNovaScotia 2014). These goals are focused on achieving inclusive economic growth, quality education, healthy population and systems, and safe and connected communities. Before the pandemic, there had been progress made on several of these goals, but many still required progress. Data continues to emerge on how the pandemic has impacted the provinces progress on the One Nova Scotia Goals.

[3] Bulletin 1, December 2020 Atlantic Provinces Economic Council.

Figure 6.16-2: Economic Growth Rates in Canada (1980s to 2030s)



In addition to the goals and objectives established by the Now or Never Report, the Province of Nova Scotia became a signatory to the Atlantic Growth Strategy (the Strategy). The Strategy, launched in 2016 by the Government of Canada and Atlantic provincial governments, is designed to strengthen local economies and fuel innovative companies in the region (Figure 6.16-3). The key areas of focus for the Strategy are:

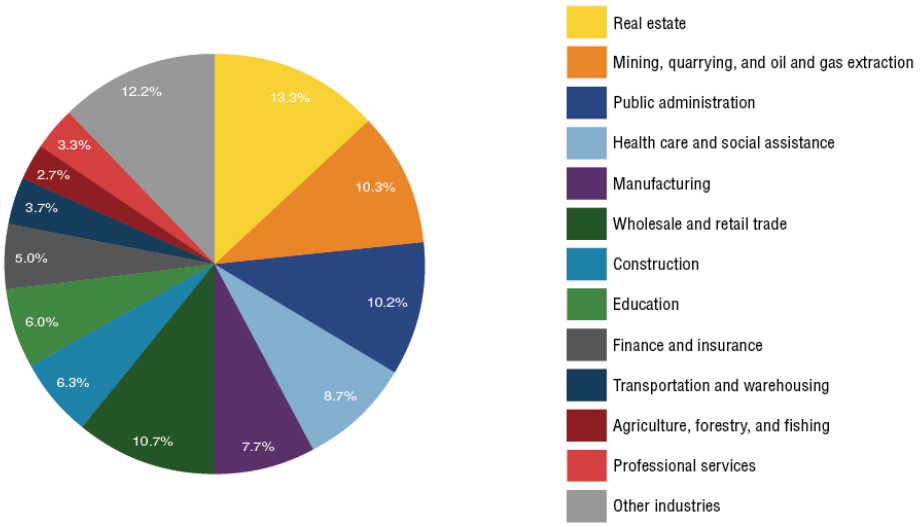
- attract and retain a skilled workforce and immigrants;
- foster greater business innovation, drive leading-edge technology and general new breakthrough ideas;
- reach Climate Change targets and advance Clean Growth in Atlantic Canada;
- create long term growth and high-quality jobs through Trade, Investment and Tourism; and
- support growth, engage and connect people through infrastructure.

The economic outlook of Nova Scotia has improved in the last few years. Pre-COVID, Nova Scotia had a growing economy, with gains in population and the lowest employment rate in 45 years.

6.16.4.2 Baseline Conditions – Post COVID

In March 2020, the province of Nova Scotia in response to a worldwide pandemic, issued a series of public health orders that closed many parts of the economy and limited the movement of people and goods. Nova Scotia was not unique, and the restrictions of this province were mirrored around the country and the world. Not only was the local economy disrupted but so was the broader global economy. It was, and continues to be, a time of uncertainty and devastation for many. Nova Scotia, in terms of number of COVID cases and deaths, has fared better than many other places in Canada and around the world. Nonetheless, the impacts on our communities and economy are severe. In April 2021, Nova Scotia again responded to an increase COVID cases, which resulted in some sectors of the economy be restricted or closed. The impact of this is not included in this analysis.

Figure 6.16-3: Main Industries in Atlantic Canada, 2016 (Percentage of Total Gross Domestic Product)



All levels of government stepped in to provide support to deal with the economic disruption when the public health orders were issued in March 2020. For the province of Nova Scotia, this has resulted in a projected deficit of $778.8 million, which is a deterioration of $883.9 million from the budgeted surplus in the 2020 to 2021 estimates[4]. Government revenues were also impacted. Ordinary Revenue and other recoveries to government is forecasted to decrease by $186.6 million from the budget estimates in the December 2020 Forecast Update[5]. Furthermore, there is a projected decrease of $598.5 million in Provincial Tax revenue. There is also an expected increase in expenses of $708.7 million from original budget estimates for the 2020/2021 fiscal year. Nova Scotia Net Debt is forecast to increase by $1.1 billion in 2020/2021, relative to the budget estimate.

Halifax Regional Municipality (HRM) has experienced significant job losses. During the worst period, HRM saw a 10 percent (%) loss in total employment. Young people and female employees were impacted in greater numbers.[6] In HRM, there was a loss of 23,200 workers in July 2020. The federal government created and delivered financial programs, such as the Canada Emergency Response Benefit (CERB), to support impacted employees but these programs are not anticipated to become a permanent figure of the social safety net. Between March 15 and October 3, 2020, over $84.64 billion was paid through CERB and Employment Insurance benefits. In Nova Scotia, there were over 214,550 applicants to the CERB program.[7]

In September of 2020, the Federal government launched a "transition" program designed to assist people to move from the crisis of early COVID to recovery. The Canada Recovery Benefit and other similar programs are now in place. The impacts of the reduction of the significant dollars injected in the Canadian and Nova Scotian economy by CERB are unknown.

[4] Forecast Update – December 17, 2020 Treasury Board of Nova Scotia.

[5] Forecast Update – December 17, 2020 Treasury Board of Nova Scotia.

[6] Source: https://halifaxpartnership.com/research-strategy/economic-response-and-recovery-plan/economy-covid-19-recovery/

[7] Source: https://www.canada.ca/en/services/benefits/ei/claims-report.html.

The Nova Scotian recovery began September 2020 with a gain of employees in HRM of 4,600 in January 2021.[8] Halifax is experiencing a rapid pace of recovery, but it is unknown if the rural areas of HRM are experiencing the same recovery. The Atlantic Chamber of Commerce has stated that job losses have been great in rural areas.[9] However, there continues to be public health restrictions which have placed significant barriers to key industries such as tourism and the hospitality sector which will hamper recovery in 2021, and potentially beyond. Of the complex interactions arising from COVID is that even with job losses due to the public health restrictions, the Atlantic Provinces Economic Council predicts that "Labour challenges will remain despite the temporary slack due to COVID."[10]

Other impacts of COVID include:

- Short term reductions to in-migration and immigration. Immigration is down 50% across the Atlantic region.[11]
- High unemployment for youth and those with lower education and in low-wage groups.
- Negative impacts on key industries including tourism, primary industry, manufacturing, construction, retail, and restaurants.[12]
- Rapid innovation in new technologies, particularly supporting remote work environments and reductions in length of time to provide internet to underserved areas of the province.[13]
- Reductions on municipal tax revenues and services.[14]
- A move to remote working in the short and possibly medium term. The long-term impacts of this in Nova Scotia are yet to be fully analyzed. However, this could have benefits on the rural economy.[15]
- Concerns about wage gap growing and racialized, low-income and lower educational people not benefiting from the COVID recovery.
- Emergence of a stronger green economy during this time of economic and social restructuring.
- Increased migration to Nova Scotia and impacts on housing market as Nova Scotia is perceived as being "safe" during the pandemic.[16]

[8] Source: Bulletin 1, December 2020 Atlantic Provinces Economic Council.

[9] Source: https://www.apec-econ.ca/publications/view/?do-load=1&publication.id=407; November 16th, 2020 Presentation on Geographic Impacts of COVID-19.

[10] Source: Bulletin 1, December 2020 Atlantic Provinces Economic Council.

[11] Source: IBID

[12] Source: Impact of COVID-19: COVID-19 Atlantic Canada Regional COVID-19 Vulnerability Report, February 24, 2021 Atlantic Provinces Economic Council https://www.apec-econ.ca/publications/view/?do-load=1&publication.id=416&site.page.id=51004

[13] Source: https://internet.developns.ca/project-background/

[14] Source: https://www.halifax.ca/sites/default/files/documents/city-hall/regional-council/200512bc3.pdf, https://assets.kpmg/content/dam/kpmg/ca/pdf/2020/06/covid-19-cities-infrastructure-en.pdf, and https://novascotia.ca/coronavirus/support/#support-for-municipalities

[15] Source: Yesterday's Gone: Exploring possible futures of Canada's Labour market in a post-Covid world- Brookfield Institute: February 2021; Page 15 https://brookfieldinstitute.ca/wp-content/uploads/Yesterdays-Gone_Final.pdf

[16] Source: https://www.nytimes.com/2020/11/18/opinion/covid-halifax-nova-scotia-canada.html

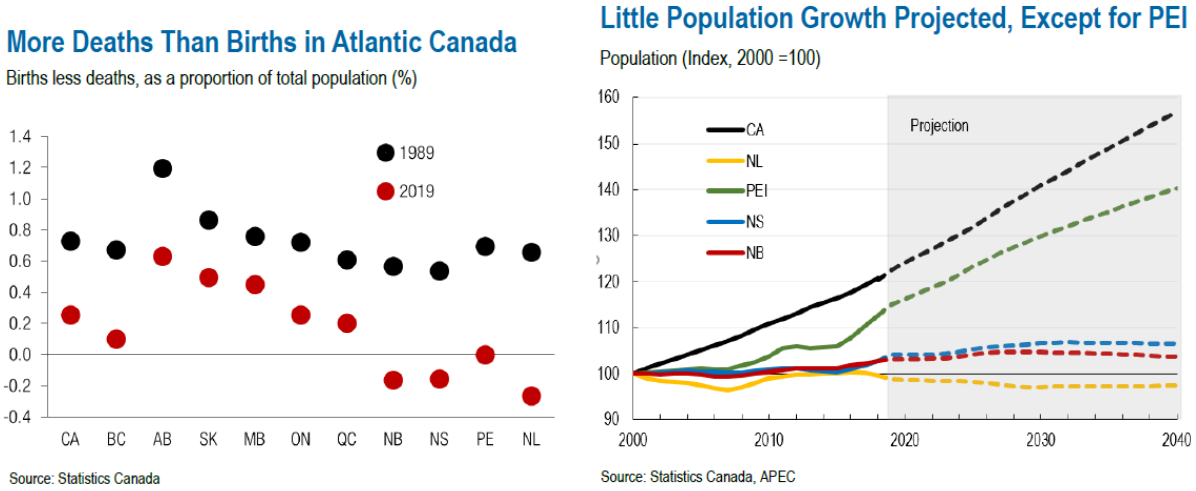
6.16.4.3 Local Context and Population

Nova Scotia has a population growth problem, which was clearly identified in the Now or Never Report. Although urban areas have seen increases in populations, rural areas continue to lag behind. Population estimates of September 2020 estimate that Nova Scotia's population is 979,351, and the almost 1% growth in population was the third largest population growth since 1971.[17]

Regardless of the encouraging signs particularly within Halifax but more broadly for the entire province, the Nova Scotia population experiences more deaths than births (Figure 6.16-4). Nova Scotia continues to lag behind all other provinces in Canada. According to the Atlantic Provinces Economic Council (APEC),[18] "without net in-migration, Atlantic Canada's population would be shrinking." Immigrants, interprovincial migrants and non-permanent residents are the reason population growth is occurring.

The Project Area (PA) is in a largely unpopulated area within rural HRM. The closest population centre to the Beaver Dam Mine is Sheet Harbour; however, there are small communities that are nearer to the Haul Road. For the purposes of this study, the rural eastern portion of HRM will serve as a boundary when discussing demographic impacts (Section 6.16.9.1 where spatial boundaries are discussed).

Figure 6.16-4: Atlantic Provinces Population Charts



Nova Scotia, in 2020, had the third highest median age in Canada at 45. This median age has remained relatively stable since 2016, but was rapidly rising from 43 between 2011 to 2015. Although Nova Scotia's population median age is no longer increasing, Nova Scotia still is "older" than most other provinces in Canada and the over 65 cohort continues to rise, with a total number surpassing the under 17 age group (Figure 6.16-5). [19]

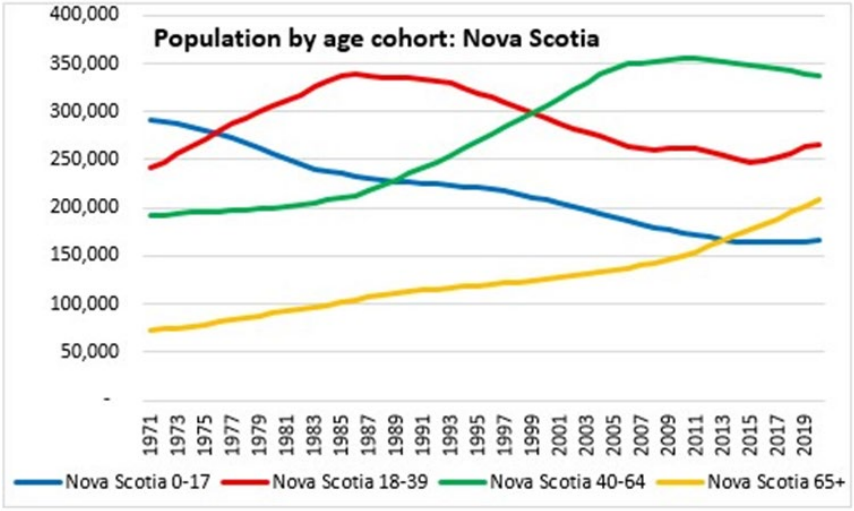
The Eastern Rural area is a sub-area within the Census Metropolitan Area (CMA) and is composed of several census track areas. The Great Halifax Partnership collated and analyzed this data in "Halifax Community Profile: Eastern Rural."

[17] Source: https://novascotia.ca/finance/statistics/news.asp?id=16179

[18] Source: Bulletin 1, December 2020 Atlantic Provinces Economic Council.

[19] Source: https://novascotia.ca/finance/statistics/news.asp?id=16179 Median Age: July 1, 2020.

Figure 6.16-5: Population Age Cohorts in Nova Scotia



The population of Eastern Rural HRM is 19,189 people as of the 2016 Census, which is a reduction of 1.7% in population since the 2011 Census (Table 6.16-3). This is consistent with recent historical trends.[20]

Table 6.16-3: Population Trends Eastern Halifax Regional Municipality

Category	Nova Scotia	Halifax CMA	Eastern Rural
Population, 2016	923,598	403,390	19,189
Population, 2011	921,727	390,328	19,528
Growth, 2011 to 2016	0.2%	3.3%	-1.7%
Annualized Growth, 2011 to 2016	0.0%	0.7%	-0.3%

Note: CMA = Census Metropolitan Area.

Compared to a population increase of 3.3% for HRM and 0.2% for Nova Scotia as a whole, the Eastern Shore is experiencing population decline. In general, the Eastern Shore a has lower percentages of its population in the youth and working age categories and high percentage in the senior categories.[21]

The labour force in the Eastern Rural declined between 2011 to 2016 and labour force participation fell from 62.1 to 60.7%. This is substantially below the 67% labour force participation rate for Halifax CMA. The trades and transport occupation, along with sales and services group are the two largest occupation groups.[22]

Generally speaking, rural areas, such as the Eastern Shore, are projected to continue to lose populations, continue to see reductions in working age populations, have fewer young people and school age children and experience labour force challenges.

[20] The Sheet Harbour, Nova Scotia Business Case prepared by the Greater Halifax Partnership http://www.halifaxpartnership.com/site/media/Parent/Appendix%20A-%20Sheet%20Harbour%20Business%20Case.pdf

[21] Halifax Community Profile: Eastern Rural, prepared by the Greater Halifax Partnership: April 2018

[22] Page 6, Halifax Community Profile: Eastern Rural April 2018

The APEC states, "Employers looking to expand in the region should pay close attention to their ability to secure workers when choosing locations for their operations."[23]

Census Tract 2050154.04 (CT) includes Sheet Harbour and several surrounding communities including the Beaver Dam area, north and east to the Halifax County boundary. The total population base of this CT was 3,221 in the 2016 Census, a decline of 6.5 % from 2011. In comparison, the population of Nova Scotia increased by 0.2% and HRM increased by 3.3%. The population density in the CT is 1.8 people per square kilometer (73.4 in HRM and 17.4 in Nova Scotia) (Statistics Canada 2016).

The age distribution in the Sheet Harbour CT indicates an older population with a median age of 54.9, (Nova Scotia – 45.5, HRM – 41.0). In 2016, 16.6% of the population were under the age of 20, and 29.6% of the population was 65 years or older. The male (49.3%) and female (50.7 %) populations are nearly equal. The area is predominantly English (first language) speaking (98.3%) (Statistics Canada 2016).

The cultural origins of the area are mainly Canadian/European; 6% identify as First Nations and about 1% are of other origin (Statistics Canada 2016). The population identifies with a Christian religion (89%) with nearly 10% having no religious affiliation (Statistics Canada 2011). The population of this CT remained relatively constant from the 2016 Census with 8% noting having moved within the previous year as compared to 16.8% having moved in the area 5 years previously (Statistics Canada 2016).

Of the population between 25 and 64 years of age, at least 24% have attained a high school diploma only and 48.6% have received a post-secondary education (apprenticeship or trade certificate – 34%, college diploma/university certificate – 50%, university degree (bachelor's or higher) – 19%) (Statistics Canada 2016).

The average full time employment income in 2015 of people 15 years or older $48,177. The average family income is $65,958 (after tax average - $57,205).

Unemployment rates in Eastern Nova Scotia in 2016 averaged 15.2% (range of 14.7 to 16.5%). The unemployment rate for Eastern Nova Scotia for three-month average, issued in February 2021 is 13.2 %.[24]

6.16.4.4 Community Infrastructure

The Project is located 31 kilometres (km) from Sheet Harbour via the public road system. Sheet Harbour is a community of about 800 people but the Sheet Harbour Chamber of Commerce states that the catchment for the area is approximately 5,000 people. The Port of Sheet Harbour, upgraded in 1988, is the second largest port facility in the HRM and includes an Industrial Park as well as a 500-foot Common User Dock. The 129-acre Industrial Park is marketed as a location for manufacturing, processing and transportation facilities and has additional development potential.[25]

Sheet Harbour is a local commercial centre that provides the following amenities for the surrounding areas:

- Eastern Shore Memorial Hospital;
- Sheet Harbour Branch of the Halifax Public Library System;

[23] Source: APEC Looking Ahead – Bulletin 3: February 2021

[24] Table 14-10-0354-01 Regional unemployment rates used by the Employment Insurance program, three-month moving average, seasonally adjusted.

[25] Source: http://sheetharbourchamber.com/sheet-harbour/

- Marine Drive School Pre-Primary to Grade 12 school;
- Royal Canadian Legion Branch 58;
- Halifax Recreation Facilities;
- Harbourview Lodge Continuing Care Centre;
- LEA Place Women's Resource Centre;
- Living Water Baptist Church;
- Mooseland and Area Community Hall;
- MUSGO Rider Cooperative Ltd – Rural Transportation Association;
- Otter Pond Demonstration Forest;
- Sheet Harbour & Area Chamber of Commerce;
- Sheet Harbour & Area Ground Search and Rescue;
- Sheet Harbour Snowmobile and All-Terrain Vehicle (ATV) Club;
- Sheet Harbour Marina;
- Sheet Harbour Radio;
- Sheet Harbour Wildlife Association; and
- Gerald Hardy Memorial Society - Food Bank.

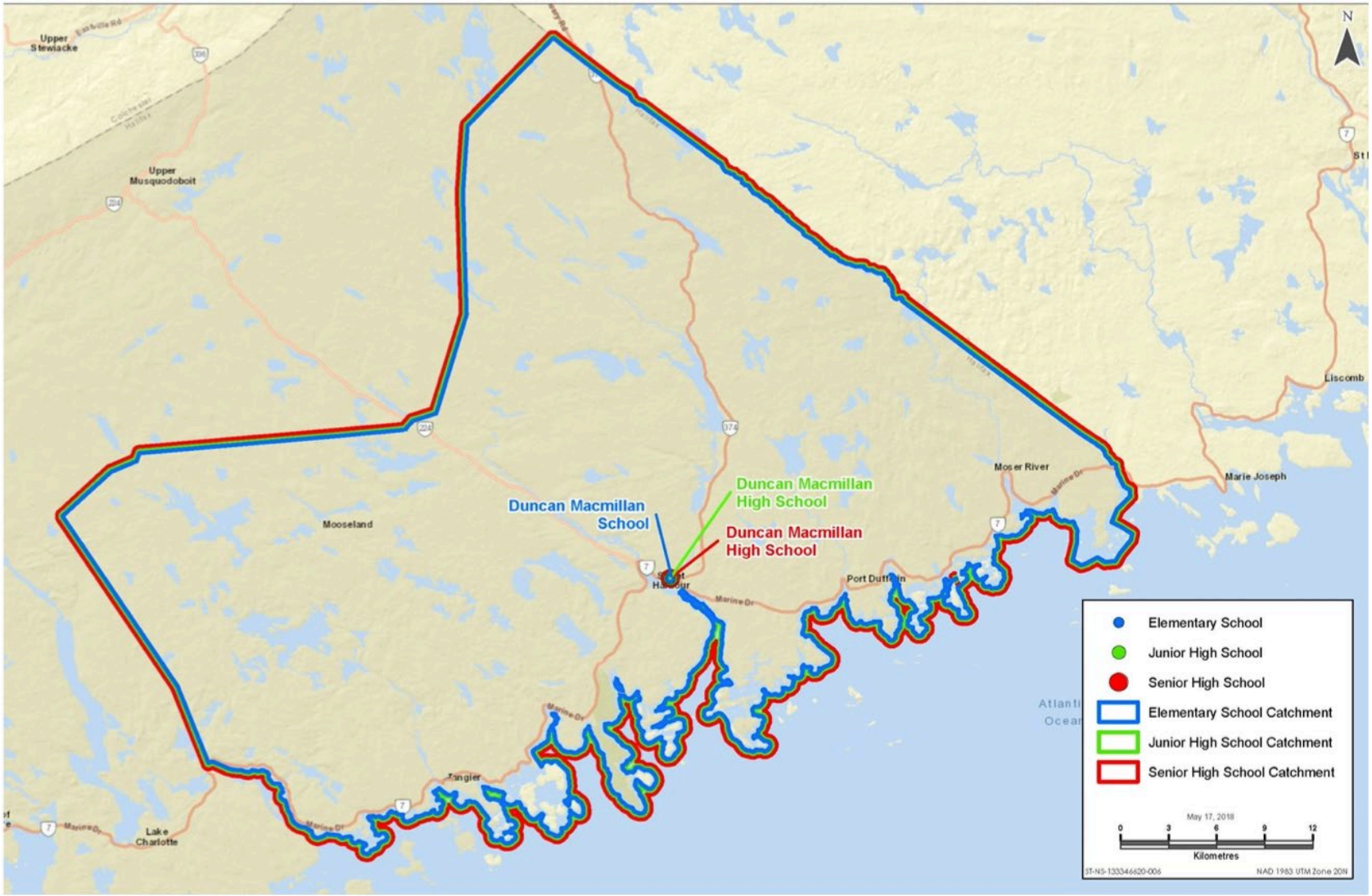
The local school for Sheet Harbour is Marine Drive Academy, which replaced the Duncan MacMillan School in September 2020.[26] This new modern school has an enrollment of 267 students from pre-primary to Grade 12 but can accommodate a population of 530 students. General population growth caused by the Project has the potential to increase the school age population, which has been in decline in the Eastern Shore area, resulting in closing of schools in the general area. The catchment for this school is presented in Figure 6.16-6.[27]

Historic school enrollment and projected enrollment are shown in Table 6.16-4.

[26] Long Range Outlook, Halifax Regional Centre for Education, November 2019, Pg 203.

[27] Source: http://sheetharbourchamber.com/nova-scotia-business-development/

Figure 6.16-6: Sheet Harbour School Catchment Areas



Source: Long Range Outlook, Halifax Regional Centre for Education, November 2019, Pg 203.

Table 6.16-4: Historic Enrollment and Enrollment Projections, Marine Drive School

Historic Enrollment (past 10 years):										
Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Enrollment	400	366	370	356	330	320	290	269	256	241

Current Enrollment (as of Sept. 30):

Year	2018
Enrollment	261

Enrollment Projection (next 10 years):

Year	2019	2020	2021	2022	2023	2024	2025	2026	2027	2018
Enrollment	261	266	260	271	265	253	243	238	235	234

Source: Long Range Outlook, Halifax Regional Centre for Education, November 2019, Pg 204

The projected decline in enrollment reinforces and further substantiates the demographic data regarding the age of the population in the area and the overall population decline.

The Musquodoboit Rural High Family of Schools serves the Middle and Upper Musquodoboit areas and includes three elementary Schools and Musquodoboit Rural High (MRH). MRH, with a school capacity of 497 student, predicts a minor increase in enrollment of 20 students to 290 students by 2028 and has a school utilization rate of 54%.[28] Dutch Settlement Elementary, which has a school utilization rate of 79%. It is more fully utilized than Musquodoboit Valley Education Centre and Upper Musquodoboit Consolidated Elementary both of which have significant ability to absorb new students with utilization rates of 42 and 55% respectively.

The catchment areas for this family of schools are presented in Figure 6.16-7.

The closest hospital for the Beaver Dam Mine Site is the Eastern Shore Memorial Hospital (ESMH), which has a 24-hour emergency department, a variety of clinics and services, and hospital beds. The emergency department at the ESMH experiences frequent closures due to staff shortages. As of March 1, 2019, the Nova Scotia Health Authority estimates that 5.0% of the population in the Central Zone (HRM, Eastern Shore and West Hants areas) is without a family doctor.[29]

6.16.4.5 Recreational Facilities

According to HRM, the recreational facilities of the eastern shore portion of HRM are, "purposely separate from each other in order to retain their unique identities but all are experiencing difficulty sustaining their respective facilities." Funding for recreational facilities is difficult to justify as there are more facility space per capita then recreational standards outline." HRM assessment of recreation indicates that the declining and aging population contribute to the lack of investment in new recreational space.[30]

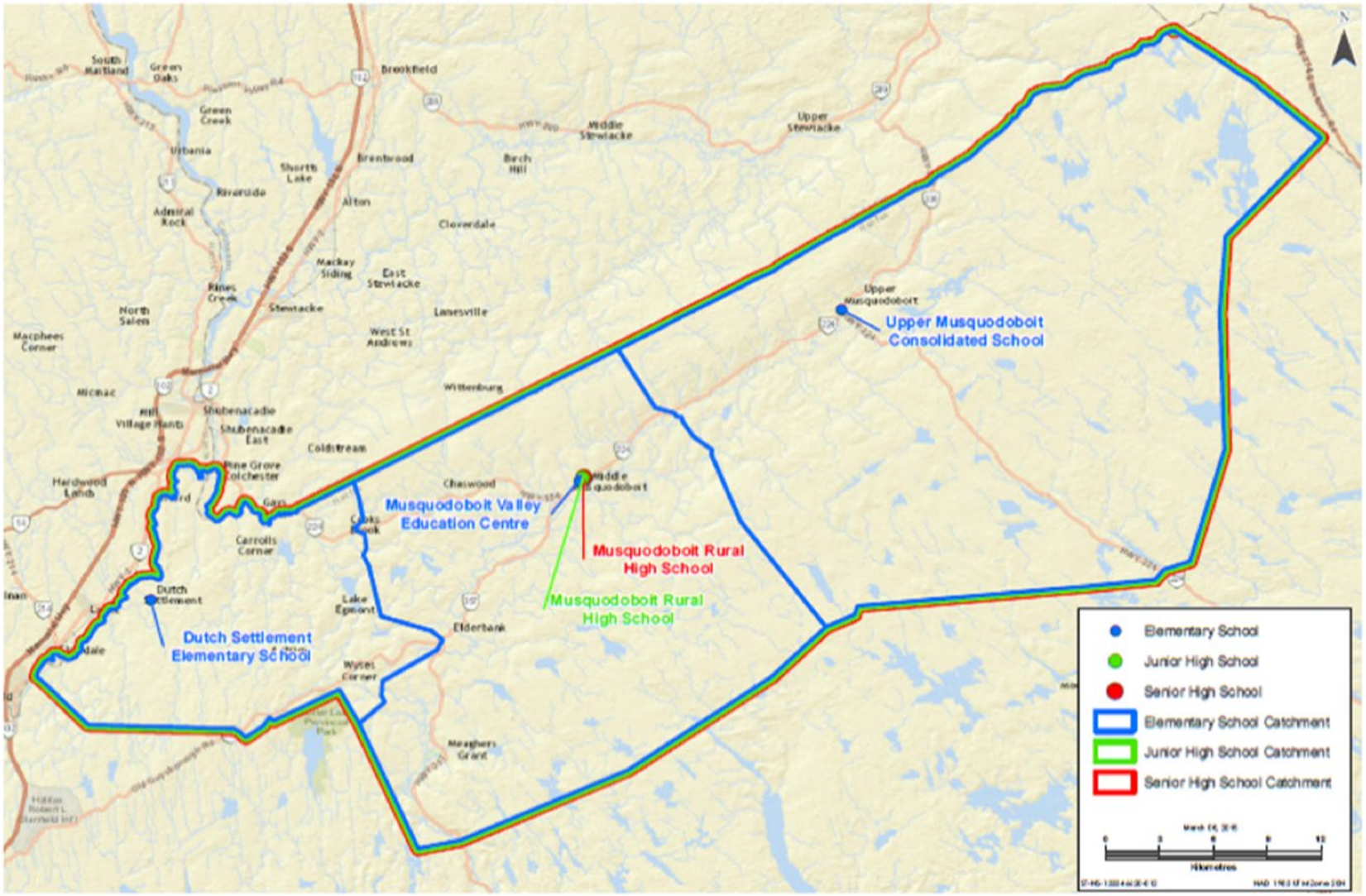
A new recreational facility is being considered for Sheet Harbour and funding sources are being secured for its ultimate development. HRM has allocated capital funding to support the development of an Eastern Shore Lifestyle Centre, as the existing facility, the Sheet Harbour Lions Community Centre is non-operational.

[28] Source: Ibid Pg 391

[29] Source: http://www.nshealth.ca/need-family-practice-data as of February 25th, 2019

[30] Source: Community Planning and Economic Development Standing Committee, September 17, 2015 and Halifax Regional Council Report January 24, 2017.

Figure 6.16-7: Musquodoboit Rural High Family of Schools



Source: Long Range Outlook, Halifax Regional Centre for Education, November 2019, Pg 390.

6.16.4.6 Local Economy

As of December 2017, Statistics Canada reported 613 businesses located in the Eastern Rural area of HRM. Most have fewer than five employees and 88% have less than 20 employees. There are nine businesses with over 100 employees, with three in transportation and warehousing, two in mining, quarry and oil and gas extraction, one in manufacturing, one in wholesale trade, retail trade and accommodation and food services. The Touquoy Mine is one of the nine businesses with over 100 employees. Sheet Harbour also is the home to of a variety of commercial amenities such as overnight accommodations, NSLC, drugstore, grocery store, gas stations, hardware store, banks and credit unions.

Coastal areas along the Eastern Shore are being promoted as an eco-tourism destination due to its topography, coastal access and views and its natural beauty. The Wild Islands Tourism Advancement Partnership mission is, "to position and advance Musquodoboit Harbour to Sherbrooke as a dynamic new in-demand destination offering the best designed touring, outdoor and nature infrastructure and experiences in Nova Scotia."[31] The Eastern Shore is an Area of Interest as a Marine Protected Area by Fisheries and Oceans Canada. This focus of having tourism as an economic development driver is reinforced in the Eastern HRM Strategic Plan prepared in 2014.[32]

The Eastern Shore has lower total household incomes then both the Nova Scotia average and the broader HRM region. Approximately one-sixth of all income received is from government transfers, versus one-tenth for Halifax. This is again likely due to the number of seniors who received payments such as Old Age Security or the Guaranteed Income Supplement.[33]

6.16.4.6.1 Housing

Housing more generally within the Eastern Rural HRM area is characterized by residency in single detached houses, with an average household size of 2.3 people per dwelling (ppd).[34]

Housing Starts within CT 2050154.04, which is the area that encompasses the proposed mine and the Sheet Harbour areas have been slow with six in 2020, five in 2019, five in 2018 and six in 2017.[35] In the Census division for Halifax East, the total number of housing starts was 146. In October 2020, there were 43 rental units listed as available in Halifax County East. The total number of households in Halifax County East in core housing need, meaning it does not meet one of more standards for housing adequacy, suitability or affordability and if it would have to spend 30% of more of its pre-tax income to pay the median rent is 9.8% as of October 2020.

6.16.4.6.2 Temporary Housing

There are several temporary housing accommodation options including: bed and breakfasts (2), motels (3), and campgrounds (2) in the Sheet Harbour area that cater to both tourist and business traffic. Most are seasonal operations (May to October) but some offer service outside of the tourist season.

[31] Source: www.witap.ca.

[32] Source: https://mhacc.ca/wp-content/uploads/2017/02/eastern_hrm_strategic_plan_2014.pdf.

[33] Source: Page 3, Halifax Community Profile: Eastern Rural April 2018.

[34] Source: Halifax Community Profile: Eastern Rural, prepared by the Greater Halifax Partnership: April 2018

[35] Data taken from CHMC Housing Portal.

6.16.4.6.3 Water, Wastewater, and Solid Waste Management

Water supply in the region is by drilled or dug well. Wastewater is managed through individual septic fields. Solid waste management is handled by the municipality in the form of weekly garbage and recyclable collection. Waste transfer stations are located at Middle Musquodoboit and Sheet Harbour and solid waste is disposed of at the Otter Lake Waste Processing and Disposal Facility.

No central water services are available in Sheet Harbour, although HRM has received requests for both central water and sewer. Municipal Council is monitoring the extent of the environmental or public health concerns and may investigate the feasibility of services in the future.[36]

The nearest known domestic well is approximately 5 km southwest from and down-gradient of the Beaver Dam Mine Site, at a residence along Highway 224. Potable water for the mine will be sourced from Crusher Lake as discussed in the Project Description (Section 2). Recreational water quality is assessed in the Human Health Risk Assessment (Appendix C.2). This assessment indicates that while there is uncertainty, the incremental increase in risk related to recreational water uses (e.g., swimming) exposure is likely negligible. For fish consumption, baseline exposure was considered in the assessment, and some incremental increase over baseline could occur in the future scenarios. In addition, homes, seasonal cottages/camps, and campgrounds may be impacted by project development and operation, such as Camp Kidston, located approximately 20 km west of the Beaver Dam Mine Site (and 3.4 km north of Touquoy), which uses groundwater as a source for public drinking water, and offers recreational boating, swimming, and fishing on Long Lake.

Wells are also located near the Haul Road. A seasonal dwelling with an onsite well is within 100 m of the Mooseland Road. Also, the community of Mooseland is located to the south of the entrance to the Haul Road where there are both season and permanent dwellings with onsite water systems. The Human Health Risk Assessment (Appendix C.2) concludes there is no impact to groundwater wells resulting from the Project.

6.16.4.7 Roads and Traffic

This part of HRM is protected by the Royal Canadian Mounted Police (RCMP), based in Sheet Harbour, and is considered to have a very low crime rate (Greater Halifax Partnership).

The crime rate, including violent crime, property crime and other crime (expressed per 10,000 people), in Halifax County (outside the urban core) is generally half of the corresponding urban Halifax crime rate. The five-year average of total crime incidents is 485 /10,000 in the county. The provincial rate in 2015 was 1,172/10,000 (Statistics Canada 2016). Violent crime has risen but total crime has decreased.

The Halifax Regional Fire and Emergency Service has fire stations located at Sheet Harbour, Upper Musquodoboit and Middle Musquodoboit that are near to the Site. They also have several other stations on the Eastern Shore that can be called out depending on the complexity and severity of an incident.

[36] Source: Municipality Planning Strategy for East Shore (East), policy E-13.

6.16.4.8 Parks and Open Space

The Project lies in a broad area of diverse landscapes with varying degrees of present day and historical human activities that have modified what we see currently. The land surrounding the Project has typically been used as forest resource management/harvesting and mineral exploration associated with the Beaver Dam deposit. This activity has allowed for increased public access with interconnected resource and logging roads that extend between Mooseland Road east to Highway 224 and to Highway 374.

The Study Area has lands with different levels of provincial protection located in proximity to the PA. These areas include:

- **Game Sanctuaries** – Game Sanctuaries were established early in the 20th century to protect wildlife and a "nucleus of breeding stock". Today, wildlife management tools reduce the risk of extinction, but the game sanctuary designation remains as a tool for government to regulate lands, "where unusual concentrations of wildlife are vulnerable to site specific threats."[37] Game Sanctuaries are enabled under the *Nova Scotia Wildlife Act*.
- **Wilderness Areas** – These are provincially significant protected areas which are designated under the *Nova Scotia Wilderness Areas Protection Act*. Forestry and road development are not permitted. Other activities such as mining, vehicle use, building structures or trails, and managing or removing plants are prohibited except in certain circumstances as outlined in the legislation.[38] Hunting is permitted.
- **Nature Reserves** – Nature reserves are areas selected to preserve and protect, in perpetuity, representative and special nature ecosystems, plant and animal species, features and natural processes.[39] Scientific research and education are the primary uses of nature reserves and recreation is generally restricted. Nature Reserves are protected under the *Nova Scotia Special Places Protection Act.*

The approximate distances of these areas from the PA (i.e., Beaver Dam Mine Site, Haul Road, and Touquoy Mine Site) are summarized in Table 6.15-5. These areas are presented on Figure 6.16-8.

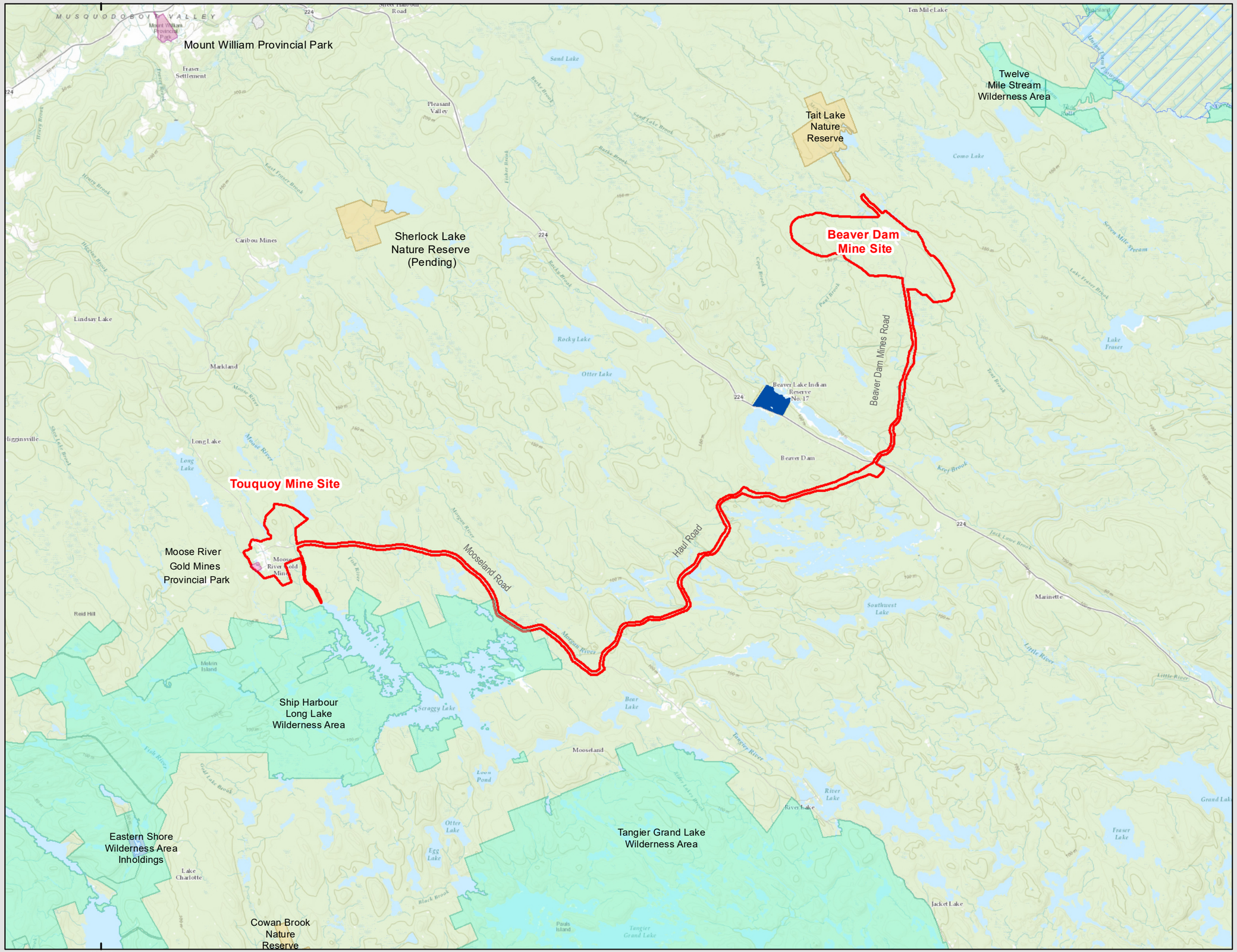
Table 6.16-5: Protected Areas with Provincial Designation

Provincially Designated Areas	Approximate Distance (from the Beaver Dam Mine Project)	Direction	Type of Designation
Tait Lake Nature Reserve	1 km from Beaver Dam Mine Site	North	Nature Reserve
Cowan Brook Nature Reserve	9.5 km from Touquoy Mine Site	South	Nature Reserve
Twelve Mile Stream Wilderness Area	4.5 km from Beaver Dam Mine Site	Northeast	Wilderness Area
Liscomb Game Sanctuary	7.3 km from Beaver Dam Mine Site	East	Game Sanctuary
Tangier Grand Lake Wilderness Area	2.2 km from intersection of Moose River Cross Road and Mooseland Road	South	Nature Reserve
Ship Harbour Long Lake Wilderness Area	Adjacent to Mooseland Road	West	Nature Reserve

[37] Source: https://novascotia.ca/natr/wildlife/habitats/sanctuaries/background.asp

[38] Source: https://novascotia.ca/nse/protectedareas/faq_wa.asp

[39] Source: https://novascotia.ca/nse/protectedareas/naturereserves.asp.



Prepared For:

Atlantic Gold

FIGURE 6.16-8

Protected Areas in Proximity to the Project Area

- Indian Reserve Lands
- Project Area

Existing or Pending Protected Areas

- Land Trust or Conservation Easement
- Nature Reserve
- Wilderness Area
- Provincial Park
- Liscomb Game Sanctuary



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 1.25 2.5 5 km

1:100,000 Scale when printed @ 11" x 17"

Drawn By: EP Date: 2021-04-27

Reviewed By: XX

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

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Document Name: BD_EIS_Figure6-16-XProtectedAreas

The presence of unauthorized cabins and hunting blinds on private land is a good indicator that the area is used for hunting and fishing activity. The area is open to several seasons of hunting, the most popular include deer, bear, snowshoe hare, ruffed grouse, and ring-necked pheasant. Recreational fishing occurs in areas near the Beaver Dam Mine Site. Camp Kidston, which operates only in the summer months, is located 3.5 km northeast (upstream) of the Touquoy Mine Site, and offers swimming, water activities, and canoeing as part of its program. In addition, the camp uses groundwater as a source for public drinking water.

There is no documented, observed or anecdotal evidence that supports recreational swimming in the area of the Beaver Dam Mine Site. However, through engagements there are reports of swimming in the rivers and lakes adjacent to the Haul Road. There are many structures that are built on lands that are not owned by private individuals that appear to be used by multiple parties throughout the region. Scraggy Lake has a number of private land holdings on its shore that have some type of cottage and outbuildings. A total of 12 cottages/camps were noted during a survey in July 2007 and a survey of aerial photographs from 2016 did not reveal any additional camps. Scraggy Lake camp owners have seen very limited boating canoe use and mainly in the spring if any as low water levels in the summer present extra challenges for navigability (rocks). Swimming is not a typical activity in Scraggy Lake.

6.16.4.9 Tourism

Tourism is not significant within the communities directly adjacent to the proposed Beaver Dam Mine Site. Upon review of tourism promotional materials and website, the following tourism and cultural assets are noted in near the Touquoy Mine Site portion of the PA.[40] These tourism assets are described below and presented on Figure 6.16-9:

- Icelandic Memorial Society of Nova Scotia – This society interprets the history of Iceland Immigration to Nova Scotia. The Markland Settlement, situated between the village of Caribou Gold Mines and Moose River Gold mines, was home to 32 Icelandic families between 1875 to 1882. Today, there is a memorial cairn at the entrance, a log cabin replica and interpretive signage.[41]
- Moose River Gold Mine Museum and Moose River Gold Mine Provincial Park – located at 6990 Moose River Road provides interpretation on the 1936 mine collapse and generally on gold mining. It consists of a main building, picnic/day use area and outhouse facilities.
- Touquoy View Deck – In 2019, AMNS constructed a viewing decking for the public to view the pit area of the Touquoy mine. The view deck is serviced by a large parking area and included interpretative signage.

Mooseland and Marinette, Nova Scotia the two communities directly adjacent to the mine and haul road do not have any tourism sites promoted by Nova Scotia Tourism in the 2020 Doers and Dreamers Guide.[42] Sheet Harbour and Middle Musquodoboit have restaurants, breweries, over night accommodations and other tourism related activities. Sheet Harbour has a Visitor Information Centre to serve the travelling public.

The Wild Islands Tourism Advancement Partnership is guiding the 100 Wild Island Campaign to, "position the area from Musquodoboit Harbour to Sherbrooke as a one-of-a-kind sustainable tourism destination that is recognized internationally."[43] This initiative focuses on the coastal areas of the eastern shore and not the inland area where the PA is located but is within the RAA.

[40] Source: https://www.novascotia.com/ and the Doers and Dreamers Guide 2020.

[41] Source: http://novascotiaicelanders.ca/

[42] Source: https://www.novascotia.com/travel-info/travel-guide.

[43] Source: http://www.witap.ca/



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FIGURE 6.16-9

Beaver Dam Mine Project

Tourism Assets near the Beaver Dam Mine Project Area

- Icelandic Memorial Features
- Touquoy Viewing Deck
- Moose River Gold Mine Museum
- Moose River Gold Mine Provincial Park
- Project



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 0.25 0.5 1 km

1:28,000 Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed By: XX

Date: 2021-04-27

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri

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Document Name: BD_EIS_Figure6-16-XProtectedAreas

COVID has taken a heavy toll on tourism globally. The Tourism Forecast for 2020 suggested that tourism revenues in Nova Scotia will decline by $1.7 billion, and that total revenues will not surpass $900 million.[44] It is difficult to predict when the tourism industry will approach pre-COVID levels. In 2018, Nova Scotia tourism revenues reached $2.61 billion but had a stated goal of trying to reach $4 billion but this will be unattainable with COVID.[45] The Eastern Shore has a minor share of tourism visitation at 5%. Most of the visitors to the eastern shore visited Sheet Harbour (21%), Musquodoboit Harbour (29%) and Sherbrook (16%).[46] The Eastern Shore has low levels of business travel, with only 3%.

6.16.4.9.1 Indigenous Communities

There are two First Nations (Mi'kmaq) reserves in the area of the Project. Beaver Lake Indian Reserve 17 and Sheet Harbour Indian Reserve 36, which are approximately 5 km southwest and 20 km south of the Project, respectively. Both of these communities are part of Millbrook First Nation and are discussed in more detail in Section 6.14.4. First Nations communities rely primarily on the fishing industry as a source of income, as is the case with the Millbrook First Nation, but Millbrook in particular has significant economic interests and successful businesses in and around the primary community of Millbrook Additional information on Indigenous Communities can be found in Section 6.14.

6.16.4.10 Health and Well-being

The Project site extending from Beaver Dam to Moose River is covered under the Nova Scotia Health Authority, which provides services through community-based facilities located at Middle Musquodoboit (Musquodoboit Valley Memorial Hospital [MVMH]) and Sheet Harbour (Eastern Shore Memorial Hospital [ESMH]). Both facilities offer a community emergency department (MVMH 8 am to 8 pm; ESMH 24 hour) and a variety of other inpatient and outpatient services.

Table 6.16-6: Hospitals Offering Services to the Project Area

Hospital	Services	Beds
Musquodoboit Valley Memorial	Acute Home Nursing Care, Clinical nutrition, Diabetic Clinic and Meals-on-Wheels, Diagnostic services including laboratory, EKG and radiology, Emergency services, Family Practice, Mental Health, Occupational therapy, Outpatient services, Palliative services, Public health, Physiotherapy, Social work	6
Eastern Shore Memorial	Palliative and Respite Care, Acute Care, Outpatient/Emergency, Ambulatory Care, Diagnostic Imaging, Laboratory Services, Physiotherapy, Occupational Therapy, Clinical Nutrition, Social Services, Adult Day Clinic, Diabetic Clinic, Meals-on-Wheels, Addiction Prevention and Treatment Services, Public Health Home Care Nova Scotia, Nova Scotia Hospital Outreach, IWK Health Centre - Metal Health and Family Services	Not Specified

[44] Source: https://tourismns.ca/tourism-revenues.

[45] Source: 2018 Nova Scotia Tourism Performance Media Kit https://tourismns.ca/sites/default/files/2019-04/Media%20Kit%20-%202018%20Nova%20Scotia%20Tourism%20Performance.pdf.

[46] Community Report – 2019 Visitor Exit Survey https://tourismns.ca/sites/default/files/2021-01/2019%20VES%20Community%20Report.pdf.

An elder care facility, Harbourview Lodge Continuing Care Centre, is attached to ESMH. Braeside Nursing Home is located in Middle Musquodoboit. Social services are offered in both centres. Several denominations of churches are found between Sheet Harbour and Middle Musquodoboit.

6.16.4.11 Emergency Services

The Eastern Shore area of HRM is serviced by the RCMP, which is based in Sheet Harbour. It provides services such as criminal records checks, non- emergency complaints, outside detachment emergency phone, general information, reporting a crime, fingerprints and police certificates. It is open Monday to Friday, 8 am to 4 pm. No recent crime statistics are available for the Sheet Harbour area. There are also RCMP detachments in Musquodoboit Harbour and Middle Musquodoboit.

Fire Station 28 in Sheet Harbour is a composite fire service (i.e., containing both professional and volunteer fire fighters). Fire Station 39, located in Upper Musquodoboit is a volunteer fire department that provides service to the rural parts of HRM as does the composite Fire Station 38 in Middle Musquodoboit.

6.16.4.12 Land and Resource Use

6.16.4.12.1 Existing Land Use

The Beaver Dam Mine Site is in the Halifax Regional Municipality approximately 20 km north-northeast of Sheet Harbour and 7 km east of Highway 224 in Marinette, NS. The surrounding area is undeveloped land that has had resource use (forestry, mining) for a century or more. The Project site is accessed by the Beaver Dam Mines Road (BDMR) which is a privately owned road up to the Mine Site. BDMR is used frequently by the public and appears to be considered a public right of way by the public. Beyond the mine site, private roads developed by forestry companies access the interior areas of the region. The network of roads is extensive and provides access to the public for recreational activity, namely for hunting, fishing, and ATV use. There is one permanent resident on Beaver Dam Mines Road, located close to the intersection of Beaver Dam Mines Road and Highway 224 (Figure 6.16-10). The next nearest resident to the Mine Site, is more than 5 km to the west. The Haul Road entrance from the Mooseland Road is approximately 800 m from a cluster of permanent and seasonal residences (Figure 6.16-10).

The proposed Haul Road is located through an area of managed forest by several forest companies and is part a logging road network. The Haul Road will also include approximately 4 km of new road construction. The existing Haul Road, known locally as the old dump road, connects Highway 224 west to Mooseland Road. There are no residences along this private road; however, there is camp near the Tangier River which is primarily used as a hunting camp during the fall hunting season (Figure 6.16-10).

The Mine Site is located on land predominantly owned by Northern Timber Nova Scotia Limited and the Province of Nova Scotia. Northern Timber also owns the Beaver Dam Mines Road and land adjacent to it. One parcel of Crown land is adjacent to the Beaver Dam Mines Road (Figure 6.16-10).

The Haul Road is a private logging road owned by the various landowners that include Northern Timber and the Province, and for the last 1.5 km owned by Musquodoboit Lumber Co. and Prest Bros. Ltd. AMNS has acquired access rights to the Musquodoboit Lumber Co. and Prest Bros. Ltd. lands and is in negotiations with Northern Timber for usage of its lands.

Municipal planning regulations are administered by Halifax Regional Municipality. The Beaver Dam Mine Site and Touquoy Mine Site are located in the Musquodoboit Valley and Dutch Settlement Plan Area. The Land Use By-law and Municipal Planning Strategy for this area were last amended in November 2018. The area is zoned mixed use and extractive facilities, of which mining related infrastructure is one, are permitted within this zoning designation. The by-law for mixed-use land use prescribes minimum separation distances from features such as lot lines, dwellings, watercourses, domestic wells, and residential zones. The resource mining is not specified in the by-law as it is governed in the provincial and federal regulatory process.

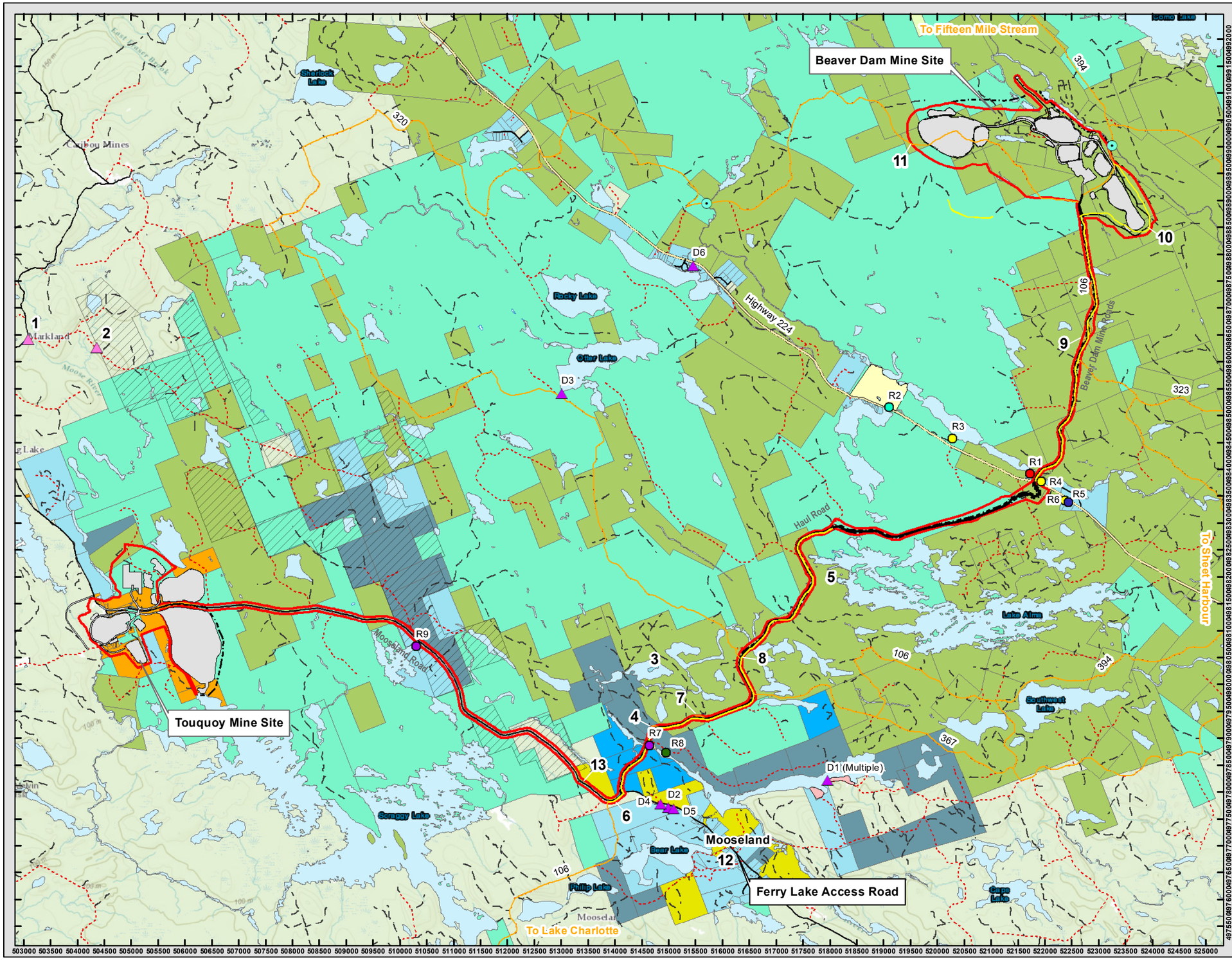

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Figure 6.16-10

Beaver Dam Mine
Project Existing Land and Resource Use

Receptors
- Year round, Drilled well
- Year round, No well
- Year round, Well unknown
- Seasonal use, Dug well
- Seasonal use, No well
- Seasonal use, Well unknown
- Dwelling
- Icelandic Settlement Features
- Lime Doser
- Multiuse Bypass Road
- Haul Road
- Ferry Lake Properties
- Beaver Lake IR 17
- ATVANS Active Trail
- Updated Planned Infrastructure
- Project Area
- Proposed Property Boundary
- Icelandic Settlement Area (approx.)

Property
- ATLANTIC MINING NS CORP
- DEEPWOOD ESTATES LIMITED
- FORESTEX LIMITED
- MUSQUODOBOIT LUMBER CO LTD
- NORTHERN TIMBER NS CORP
- PREST BROS LIMITED
- PREST ENTERPRISES LIMITED
- CROWN
- PRIVATE
- UNKNOWN
- ROAD
- WATER

Roads
- Highway
- Local Road
- Local - Unpaved
- Secondary - Unpaved
- Dry Weather/Seasonal Road
- Track/Forestry Road

Note: Details and descriptions of receptors, dwellings, features and properties listed in the legend are discussed in Section 6.16 (Socio-economic Conditions) and in Tables 6.16-12 through 6.16-17.



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 5 10 20 Kilometers

1:65,000 Scale when printed @ 11" x 17"

Drawn By: SS

Date: 2021-03-12

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The majority of the haul route is located in the Eastern Shore (East) Plan Area, while a minor portion is located in the Musquodoboit Valley and Dutch Settlement Plan Area.[47] The area is zoned mixed use under the Musquodoboit Valley and Dutch Settlement Land Use By-law, and rural resource under the Eastern Shore (East) Land Use By-law.

6.16.4.12.2 Indigenous Peoples Land and Resource Use

The Confederacy of Mainland Mi'kmaq (CMM) was retained in 2009 by GHD Limited on behalf of the AMNS to complete a Mi'kmaq Ecological Knowledge Study (MEKS) for the proposed Beaver Dam Mine Project at the Beaver Dam Mine Site. In 2015, CMM was retained to update the MEKS, due to changes in the Haul Road to include approximately 4 km of new construction. CMM was then retained again in 2016 to finalize the MEKS to include the revised PA and any additional information.

In addition to the MEKS cited above, in 2018, a Traditional Land and Resource Use Study (TLRUS; MFC 2019) was undertaken by Millbrook First Nation to document historical and current use of the Project Area and surrounding areas by the Millbrook First Nation. This document was shared with AMNS under a confidentiality agreement. AMNS has integrated information obtained from the TLRUS, with permission from Millbrook First Nation, in appropriate sections of the EIS.

There are a number of activities associated with the harvest and use of plants, animals and fish within the PA and in the LAA that relate to historical traditions and customs of the Mi'kmaq that are still practiced today. As described, the TLRUS (MFC 2019), the MEKS and residents of the Beaver Lake IR identify trapping and hunting activities, plant and berry gathering, and fishing in, near and surrounding the PA for purposes of sustenance, spiritual and cultural practice. The TLRUS (MFC 2019) described the frequency of use within the LAA which can be summarized as regular: weekly to annually across all seasons. This means the area was, and still is, an important resource area for the Millbrook First Nation community members and by extension, all Mi'kmaq of Nova Scotia, and any Project activities may have potential impacts on the ability of the Mi'kmaq of Nova Scotia to access certain areas to practice their rights where species with important cultural relevance may be found. Wild meat was traditionally a staple of the Millbrook First Nation diet, and a few of the harvesters interviewed for the TLRUS (MFC 2019) indicated they rely mainly on this food source and they share their food with other community members, rather than purchase their meat at a local supermarket.

Some Mi'kmaq community members have camps on Crown land where they go to enjoy peaceful recreational and traditional activities with family and community members. There are five camps documented within 1 km of the Haul Road and multiple other camp locations throughout the LAA (MFC 2019).

Additional details on potential impacts to traditional harvesting is provided in Section 6.14 (Mi'kmaq of Nova Scotia) and the Human Health Risk Assessment (Appendix C.2).

6.16.4.13 Natural Resource Use

Natural resources include forestry, mining, and water. As previously stated, the region of the Project has had considerable activity related to forest harvesting activities and locally from mineral exploration and mining activities extending more than 100 years. There is no water use for any purpose currently. Historically, a flume was known to have been used from Crusher Lake to power mills for forestry and mining activity. There is a historic tailings management area under the proposed mine pit that is discussed in Geology, Soils and Sediment Quality (Section 6.5).

[47] Confirmed through review of Explore HRM mapping system.

6.16.5 Themes and Topic Areas

As a result of the data gathered as part of the baseline assessment, stakeholder and rights holder engagement and a review of local, provincial, and international objectives, several key lines of inquiry are identified. Themes are pervasive ideas that arose from the data gathering, which are broken into more detailed topic areas that will be analyzed to assess impacts against the baseline conditions. The topic areas reflect issues that have been identified as important to the nearby local communities, the region or the province as a whole.

The following section provides an analysis of the potential impacts on themes and its component topics.

6.16.5.1 Workforce Development

6.16.5.1.1 Introduction

Many of the objectives and goals for the province and Atlantic region link to the development of a sustainable workforce to support economic growth, business development and business retention. In fact, the Now or Never Report identifies the need to shift our demographics so that the tax base can sustain services (OneNovaScotia 2014). Nova Scotia must grow, attract immigrants, improve labour force participation, and pursue equitable economic growth. The idea of equitable economic growth is a key concept for the provincial government, as it is widely recognized that certain groups are not equally benefiting or fully participating in the economy, while others benefit more

The following topic areas are identified as important topics of the Workforce Development theme.

6.16.5.1.2 New Employment – Direct and Indirect

In November 2020, KPMG completed an Economic Impact Assessment of the Project (Appendix O.1) which evaluated the benefits coming from the construction and operation of the Project to Nova Scotia and Canada. The KPMG Assessment does not include potential benefits from exploration or closure, and reclamation activities.

The KPMG Assessment considers direct employment as well as indirect. Direct effects are direct expenditures and include the salaries paid to AMNS or prime contractors' staff, and other revenues generated (Appendix O.1). Indirect effects are the incomes from the demand for goods and services generated by the project in other sectors. This would include suppliers selling their goods and services, such as professional and engineering services, specialized technical services, and other similar services. Indirect impacts include salaries paid to employees of the various suppliers and revenues generated by these suppliers.

In Nova Scotia alone, Beaver Dam Mine Project is expected to create 137 jobs (Full-time equivalents [FTE]) during the one year of the construction phase and 311 (FTE) jobs during the five years of operations. Of particular note are the number of indirect jobs, a total of 161 FTE's, projected to be created. Refer to Section 6.16.5.1.8 for a description of suppliers and additional analysis on this potential impact (Tables 6.16-7 and 6.16-8).

Table 6.16-7: Economic Impacts on Nova Scotia Stemming from the Construction – Beaver Dam Mine Project

Nova Scotia Province	Direct Effects(a)	Indirect Effects	Total
In millions of dollars			
Total value added, of which:	**15.1**	**3.2**	**18.3**
Salaries and wages before income taxes	11.6	2.1	13.7
Other revenues before income taxes	3.5	1.1	4.6
In person-year (FTE)			
Jobs in person-years	**108**	**29**	**137**

Source: Simulations of Statistics Canada based on data from AMNS, KPMG Assessment (Appendix O.1).

Notes: For one year, in millions of dollars and in person-years.
Due to rounding, the sum of items may not add up to the total. FTE = Full-time equivalent.

Table 6.16-8: Economic Impacts on Nova Scotia Stemming from Operations – Beaver Dam Mine Project

Nova Scotia Province	Direct Effects	Indirect Effects	Total
In millions of dollars			
Total value added, of which:	**8.8**	**22.4**	**31.2**
Salaries and wages before income taxes	8.8	15.5	24.3
Other revenues before income taxes	0.0	6.9	6.9
In person-year (FTE)			
Jobs in person-years	**150**	**161**	**311**

Source: Simulations of Statistics Canada based on data from AMNS, KPMG Assessment (Appendix O.1).

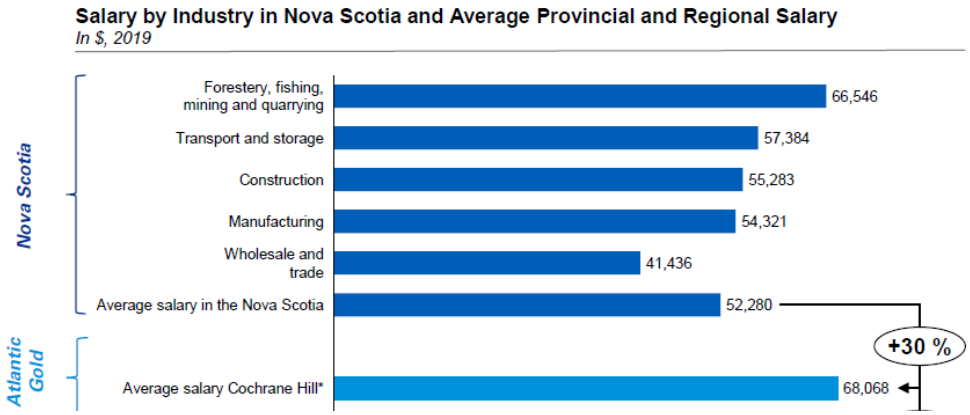
Notes: Typical year, in millions of dollars and in person-years.
Due to rounding, the sum of items may not add up to the total. FTE = full-time equivalent.

In an analysis of the Regional Impact of the proposed Cochrane Hill Gold Project commissioned by AMNS in 2020,[48] KPMG noted that the average salaries to workers at the mine is 30% above the provincial average (Figure 6.16-11). The Beaver Dam mine is not any different in terms of the salary comparison than the proposed Cochrane Hill Gold Mine Project and provides a valuable indicator regarding the quality of the employment.

For Canada as a whole, the mine is projected to create 157 jobs (FTE equivalents) during construction and 421 (FTE equivalents) during operations over the five years of operations (Tables 6.16-9 and 6.16-10).

[48] Source: KPMG Regional Economic Impact, 2020.

Figure 6.16-11: Salary Comparison by Industry, Nova Scotia



Source: KPMG Assessment (Appendix O.1).

Table 6.16-9: Economic Impact on Canada Stemming from the Construction – Beaver Dam Mine Project

Canada	Direct Effects[a]	Indirect Effects	Total
In millions of dollars			
Total value added, of which:	**15.1**	**6.0**	**21.1**
Salaries and wages before income taxes	11.6	3.9	15.5
Other revenues before income taxes	3.5	2.1	5.6
In person-year (FTE)			
Jobs in person-years	**108**	**49**	**157**

Source: Simulations of Statistics Canada based on data from AMNS, KPMG Assessment (Appendix O.1).

Notes: For one year, in millions of dollars and in person-years.
Due to rounding, the sum of items may not add up to the total.

(a) The direct economic impacts from subcontractor activity were considered to be part of the direct impacts of construction (this is consistent with best practice). FTE = Full-time equivalent.

Table 6.16-10: Economic Impact on Canada Stemming from Operations – Beaver Dam Mine Project

Canada	Direct Effects	Indirect Effects	Total
In millions of dollars			
Total value added, of which:	**8.8**	**42.2**	**51.0**
Salaries and wages before income taxes	27.9	17.3	45.2
Other revenues before income taxes	0.0	9.4	9.4
In person-year (FTE)			
Jobs in person-years	**305**	**271**	**421**

Source: Simulations of Statistics Canada based on data from AMNS, KPMG Analysis (Appendix O.1).

Note: Typical year, in millions of dollars and in person-years.
Due to rounding, the sum of items may not add up to the total. FTE = Full-time equivalent.

6.16.5.1.3 Training Opportunities

AMNS supports apprenticeships through a partnership with the Nova Scotia Community Colleges. In 2021, apprenticeships exist in Heavy Equipment Technician, Millwright, Instrumentation, and Electrician trades.

AMNS is currently developing an apprenticeship programme that would lead to Red Seal Certification for women in trades. In 2018, AMNS began training four millwright apprentices and two heavy equipment apprentices. AMNS plans to include future opportunities for Industrial Electricians and Instrumentation Technician apprenticeships.

AMNS fully supports each apprentice through employment to ensure they receive the required hours on the job and while they attend the educational portion of the apprenticeship at a recognized institution. As AMNS continues to grow in the province of Nova Scotia, it plans to grow the apprenticeship program to meet the need for Red Seal qualified tradespeople.

6.16.5.1.4 Opportunities for Advancement in Career

AMNS offers a variety of career advancing opportunities and has a mission to provide the local community with good employment leading to internal career progression. Through structured professional development and education assistance, AMNS enhances the skills of the internal workforce and extended family community by applying a "Grow our own Success"[49] approach. Specific career advancing training includes:

- a structured Work Performance System that incorporates training and development plans for all employees;
- internal development programs including a Mentoring Program, Leadership Development Programs, Leadership Essentials Series;
- Women's Internal Network;
- the ability to pursue career development through funding for formal accredited courses of study and safety courses including funding First Aid Certification for employees;
- payment of Professional Memberships;
- comprehensive onboarding and safety training for all employees and contractors;
- train-the-trainer customized for unique industrial environment;
- under development is PC usage and keyboarding support for non-tech users with potential to expand to extended family and local community; and
- site wide development opportunity in work-focused courses including time management, communication skills, managing effective meetings, and more.

AMNS commits to encourage a safe and tolerant workplace and has adopted an Equal Employment Opportunity Policy from the parent company St Barbara Limited.[50]

[49] Source: Grow your Own Success is an internal strategy document.

[50] Source: https://stbarbara.com.au/wp-content/uploads/2018/03/Equal-Employment-Opportunity-Policy-Statement.pdf

6.16.5.1.5 Labour Force Participation

Nova Scotia has established a goal of having a labour force participation rate as high as the Canadian rate (Table 6.16-11). Labour force participation is defined as "the number of people of working age who are active in the labour market – either employed or unemployed – as a ratio of the total working-age population."[51] The Province has tracked the progress toward this goal and has determined that it is "Not Progressing/Not On Track."[52] The gap between the Canadian participation rate and the Nova Scotian rate is larger than the baseline of 0.8 established by the Now or New Report (OneNovaScotia 2014).

Table 6.16-11: Labour Participation Rates between Nova Scotia and Canada

Age Group	Gap
15-19	2
20-24	4
25-29	0.9
30-34	0.5
35-39	-1.2
40-45	-0.6
45-49	-0.9
50-54	-1.3
55-59	-2.9
60-64	-6.9

Source: Gap Between the NS and CA Participation Rates by 5 Year Age Groups (2018) Data Table – One NS Dashboard.

The difference in labour participation rates between Canada and Nova Scotia by age group is shown in Table 6.16-11. The largest gap in participation rates occurs in the older age demographics. The younger demographic is above the national average, meaning that a higher number of younger people are participating in the labour force. Although no stated data as to why Nova Scotia's labour participation rate is below the national average, reasons could include:

- outmigration of younger people looking for job opportunities;
- Nova Scotia being marketed as a retirement destination;
- health and accessibility restrictions at workplaces making it harder for older workers to find suitable employment; and
- discouraged workers who cannot find employment may be more common in older workers.

The Project will provide many direct and indirect jobs, which could potentially attract older workers back to the workforce or assist in keeping the prime working age demographic in Nova Scotia.

[51] Source: https://www.onens.ca/goals/goal-7-labour-force-participation-rate March 3,2021.

[52] Source: https://www.onens.ca/goals/goal-7-labour-force-participation-rate March 3, 2021

Promoting equitable economic growth includes supporting a strong labour force while considering Diversity and Inclusion. AMNS has a Diversity and Inclusion policy to, "facilitate a diverse and representative workforce and management structure."[53]

6.16.5.1.6 Impact on Educational Attainment

AMNS will need a relatively large labour force with skills or education to complete specialized tasks. The Mineral Resourcing Engineering program at Dalhousie graduates individuals who suited for employment in the mining sector. Other university programs, such as accounting, environmental sciences, communication, and geology, will help supply AMNS's employment needs. The Nova Scotia Community College also graduates a variety of students in programs of interest to AMNS.[54] These range from Office Administration to a variety of apprenticeship and ticketed professions, Law and Security, GIS Technician, plus many others. Given Nova Scotia's stated goal of keeping new graduates in the province, graduates from post secondary programs to jobs with above average salaries is a support to this goal.

AMNS also provides coop opportunities to university students, which can be a requirement of attaining a degree in their chosen fields.

6.16.5.1.7 Youth Employment Rate

Youth Employment (for ages 15 to 24) is a goal of the province, but also through engagement with communities the need to provide employment opportunities for the next generation was identified as desirable to sustaining our economy and our local communities. The gap between the rates of employment of young people and the rest of the population have been closing in recent years. The impacts of COVID 19 on youth employment rates has been significant and it is too early to tell what the long-term recovery will be.

AMNS has no data to indicate the breakdown of its future workforce and if the impacts to this group will be measurable or significant. However, by providing employment opportunities it may help the younger generation decide to stay in Nova Scotia instead of moving away for potential employment opportunities.

6.16.5.1.8 Suppliers

AMNS undertook a study in 2020 to understand the regional impacts of the proposed Cochrane Hill Gold Project, and used the supplier data from the Touquoy Mine to project supplier spending for that proposed project. No regional impact report exists for Beaver Dam, but the Cochrane Hill Study provides locational data of current suppliers to Touquoy. This data can be used to assist in making projects regarding potential suppliers for Beaver Dam. The supplier data "heat map" is shown below, with the darker colour showing the areas of more spending and the lighter areas with less spending. During construction for Touquoy the spending was distributed as illustrated in Figure 6.16-12.

It is anticipated that the supplier spending will be distributed in a similar way as for the Touquoy mine site, with benefits both within the LAA and RAA.

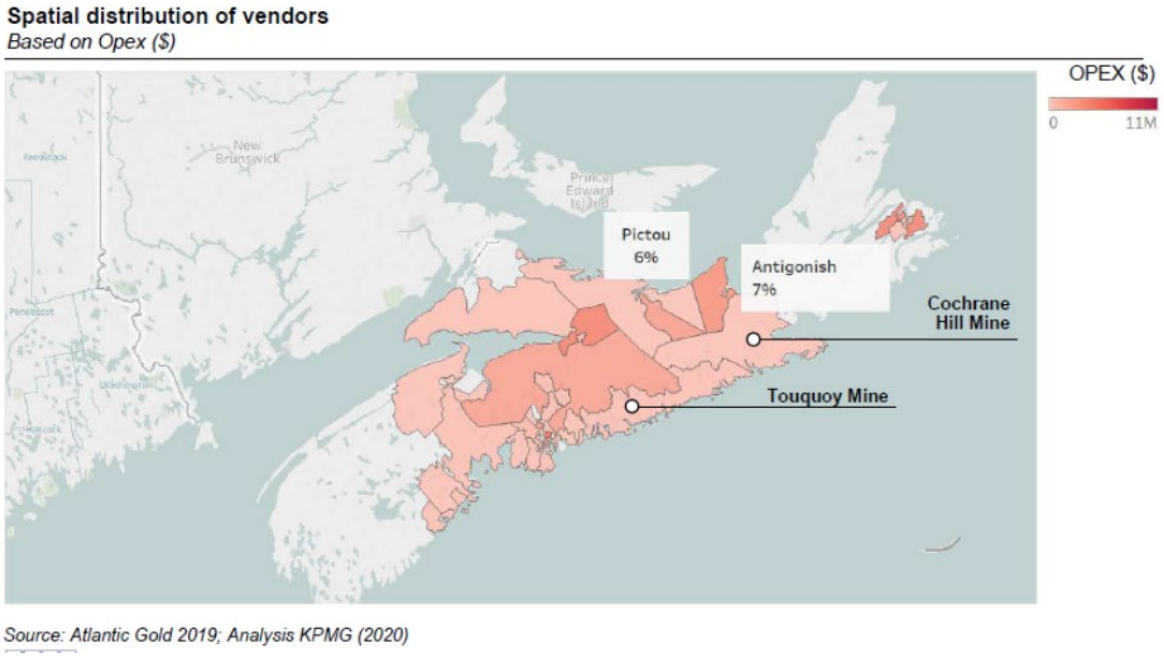
The AMNS Supplier Code of Conduct commits to using suppliers who match the corporate values. This requires that suppliers comply with the Supplier Code of Conduct. The elements of this Code include the following:

[53] Source: Diversity and Inclusion Policy https://stbarbara.com.au/wp-content/uploads/2021/02/Board-Policy-Diversity-and-Inclusion-Policy.pdf.

[54] Source: Programs of the NSCC for 2021-2022 https://www.nscc.ca/admissions/program_openings/default.aspx#School-tab

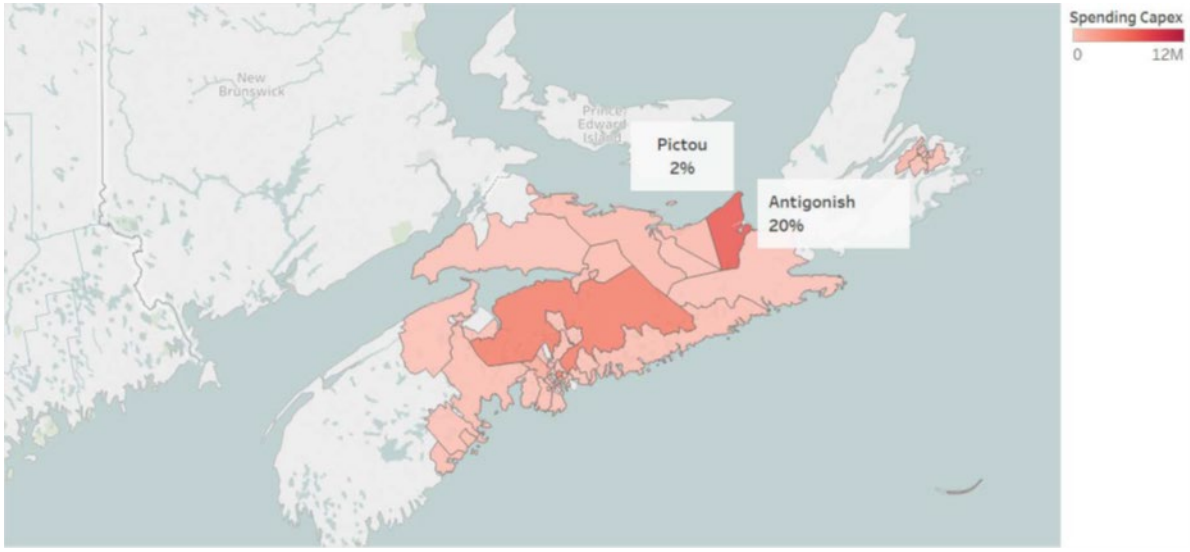
- Anti-bribery and corruption;
- Diversity and inclusion;
- Health and Safety;
- Modern Slavery; and
- Sustainability.

Figure 6.16-12: Supplier Data Heat Maps



Source: Atlantic Gold 2019; Analysis KPMG (2020)

During operations, spending from Touquoy is spread more evenly through Nova Scotia.



6.16.5.2 Demographics

6.16.5.2.1 Introduction

To sustain the province, Nova Scotia must grow its population and change the demographic make up so that the population is younger.[55] During engagement with the public, we often heard about the need for jobs for "their children" or the desire for the next generation or stay or return "home" (Appendix A.4a). Although urban Halifax is growing, the Eastern Shore has not seen the same growth in population. The depopulation of the rural areas results in aging infrastructure not being replaced, local services consolidating in larger centres, business community reductions, and general lack of community vitality. When a population is decreasing, it is difficult to justify new infrastructure investments.[56]

During engagement, often-repeated themes were poor roads and the need to find younger people to take over positions within the community (Appendix A.4a). Some organizations stated that they are having difficulty finding volunteers and taking leadership responsibilities within the community. It was important to note that AMNS's team did observe organizations having younger people within its ranks.

The following topic areas are identified as important aspects of the demographics theme.

6.16.5.2.2 In-migration

In-migration from other provinces or countries is a goal of Nova Scotia and in recent years there has been significant progress made toward reaching the provincial goal.[57] AMNS provides employment that is higher than the provincial average, which creates opportunities to support in-migration.

6.16.5.2.3 Rural Repopulation

AMNS has an active workforce attraction strategy focused on recruiting and attracting local employees, but also recognizes that employees may also be required to relocate from other places in Canada or the world.[58]

The proposed Beaver Dam Mine Site is approximately 1.5 hours commuting time from the peninsula of Halifax; however, depending on the volume of traffic and weather conditions travel can extend to 2 or more hours. AMNS recognizes that the commuting distance and time to the Project is a barrier to workers who live in urban HRM. In 2019, the average commuting time for Canadians was 24 minutes. Halifax has 3% of its population who spend 60 minutes or more travelling to work.[59] The commuting time data is a good indicator of how long workers or potential workers are prepared to commute.

[55] Source: Now of Never Report (OneNovaScotia 2014).

[56] Source: https://fcm.ca/sites/default/files/documents/resources/report/rural-challenges-national-opportunities.pdf

[57] Source: https://www.onens.ca/goals/goal-2-international-immigration

[58] Source: One NS Goal and Atlantic Growth Strategy both include immigration goals to support growth.

[59] Results from the 2016 Census: Long Commutes to work by Car: Release Date: February 2019.

A long commute may be a discouragement to potential employees, and it has impacts on personal health, environmental health, infrastructure, and individuals' personal finances. Studies have suggested that men are more likely to have long commutes then woman, due to household responsibilities.[60] Long commuting distances may also reinforce barrier for women in the workforce.

The proposed Beaver Dam Mine Site and the existing Touquoy Mine Site will require on-site workers. Although a post-COVID world may entrench remote working as a viable option for some office work, the operational staff who run the mill, work at the pit and drive the trucks will need to be on site. The distance from the nearest population centre and the need to recruit new staff may encourage workers to relocate to adjacent rural communities, such as Mooseland, Marinette, Sheet Harbour and the surrounding communities.

6.16.5.3 Healthy Communities

6.16.5.3.1 Introduction

It is well understood that healthy communities need more than just employment opportunities. Healthy communities include, for example, cultural activities, food security, links to open space, recreational amenities, economic and racial equality, a sustainable population, personal and community wellness, adequate housing, and a healthy environment. A healthy community can be defined as, "a place where healthy built, social, economic and natural environments give citizens the opportunity to live to their full potential."[61]

AMNS supports healthy communities through its Donations Sponsorships Community Programs, which guide community investments to contribute to the communities in which it operates. The policy states, "St Barbara's aim is to make a positive, meaningful and sustainable difference to those communities in a fair, transparent and ethical manner and to build strong relations based on respect, trust and transparency."[62]

The following topic areas are identified as important aspects of the Healthy Communities theme.

6.16.5.3.2 Hospitals

The main hospitals that would service the Project are the Musquodoboit Valley Memorial and the Eastern Shore Memorial Hospital (ESMH). Musquodoboit Valley Memorial and the Eastern Shore Memorial Hospital are subject to frequent closures of its emergency department. It was reported that during December 2020 the emergency departments for three hospitals servicing the Eastern Shore communities were closed 40 times, with the ESMH closing 14 times, Musquodoboit Valley Memorial closing 13 times, and Twin Oaks Memoria closing 13 times.[63] Staffing shortages of doctors and nurses is a long-standing issue.[64] New reports indicate that these closures are a concern for local residents. The Nova Scotia Health Authority is working with local community members in Sheet Harbour to assist with recruitment, but this work has been delayed by COVID.

[60] Results from the 2016 Census: Long Commutes to work by Car: Release Date: February 2019 where example studies are referenced.

[61] Policy on Heathy Community Planning, prepared by the Canadian Institute of Planner: 2018.

[62] Donations, Sponsorships and Community Programs Policy, page 4 https://stbarbara.com.au/wp-content/uploads/2018/03/Donations-Sponsorships-Community-Programs-Policy-approved-10-December-2019.pdf.

[63] Source: https://globalnews.ca/news/7561843/eastern-shore-physician-discusses-impacts-of-rising-emergency-department-closures/.

[64] Source: https://globalnews.ca/news/7556686/emergency-closures-eastern-shore-ns/.

Although the province supports rural development and growth through encouraging rural resource uses and tourism, for example, increases in population would put increased pressures on rural health care providers. AMNS does include on site first responder capabilities by having trained staff. The impact of the proposed mine site and the potential population growth it may bring could have impacts on existing hospital services, but these are not expected to be significant. Further study may be helpful to understand the impact AMNS's operations on short- and long-term population growth.

6.16.5.3.3 Primary Care Provider Availability

Finding a family doctor for many in Nova Scotia is a challenge. The Nova Scotia Health Authority releases monthly statistics tracking the number of people looking for a primary care provider. As of March 1, 2021, 6.1% of the population of Nova Scotia, or 60,154 Nova Scotians were registered on the Need a Family Practice Registry. In the Eastern Shore Cluster, 559 people were registered, or 3.2% of the population.[65] This is an increase of 1.2% from March 2020.

Any population growth is likely to have a negative impact on primary care provider availability if no additional family doctors are recruited and established in the LAA.

6.16.5.3.4 Seniors Support

An elder care facility, Harbourview Lodge Continuing Care Centre, is attached to ESMH. Braeside Nursing Home is located in Middle Musquodoboit. Social services are offered in both centres.

AMNS has been active in supporting seniors' facilities, particularly during the COVID pandemic. Contributions include:

- $5,000 contribution to Braeside Seniors home in April 2020 for the purchase of technology to support calls with family members;
- $1,000 to Braeside for garden equipment;
- $3,000 to Harbourview Seniors Home in Sheet Harbour; and
- Approximately $1,000 to High Crest Seniors Home in Sherbrooke.

6.16.5.3.5 Schools

Most school aged children in the LAA and RAA attend the Pre-Primary to Grade 12 school in Sheet Harbour. This school is seeing declining attendance (Section 6.16.4.4). The mine operation has the potential, with increased employment and potential relocations to the area, to support this school population.

6.16.5.3.6 Recreational Facilities

Recreational facilities are integral part of community wellness. In Mooseland, there is a Community Hall, which serves as a hub for residents of Mooseland. The facility is the home base for the Mooseland and Area Community Association, which host a variety of small events, such as card parties and community suppers for local residents. The Hall is a former school, which then became a fire hall and is now a community hall. This Hall is important to the local residents of Mooseland. AMNS is currently in discussions to support the Association's activities through a long-term partnership arrangement.

[65] Source: https://www.nshealth.ca/files/finding-primary-care-provider-nova-scotia-march-2021.

The Eastern Shore Lifestyle Centre, to be ultimately located in Sheet Harbour, is a major community initiative where significant funders will need to come to the table to support the development of a regional recreation centre. Rural development projects such as these helps attract residents to the area and AMNS sees opportunities to support its development.

By supporting recreational facilities, AMNS wants to increase the attractiveness of the local communities to potential future employees of the mine site. Recreational facilities are important when trying to attract new residents to communities. AMNS is prepared to consider supports to recreational and community facilities as part of employee attraction to the area.

6.16.5.3.7 Housing

Housing options along the Eastern Shore are limited. Most residences are in private ownership and there is a lack of rental housing. Increased population growth could apply pressure on the existing housing market and impact housing prices. Increased demand may also result in new housing developments and forms. Increased housing demand can also result in increased greenfield development or redevelopment of existing brownfield sites or residential dwellings.

As of March 2021, house prices in HRM have increased substantially, which appears to be encouraging potential purchasers to look for more affordable housing options outside of urban Halifax. The long-term impact of this housing inflation is unclear but it may impact general affordability of homes in the RAA.

6.16.5.3.8 Location Taxation

HRM is the local taxation authority. In 2020/2021, the municipality projected property total tax revenues of $509,169,000 for residential, commercial and resource properties.[66] The KPMG Assessment provides projections, both direct and indirect, of the Project on municipal revenues. It is anticipated that during the one year of construction, the Municipality will receive a $500,000 increase in revenues. During the five years of operations, the local taxation authority is projected to receive $1.2 million per year in revenue from AMNS.

6.16.5.4 Land Use, Recreational and Indigenous

6.16.5.4.1 Introduction

The land use of the area is mainly forestry and recreational. The Community of Mooseland is located near the junction of the Haul Road with the Mooseland Road and no haulage will occur through the community itself. Through engagement, AMNS learned of a variety of activities, uses and locations of importance to local users (Appendix A.4a Public Engagement Activity Log). Any land use interactions resulting from the Project will apply the appropriate mitigation measures. The potential land use interactions, sensitive receptor locations (i.e., used in modelling for noise, air and light) and specific dwellings in proximity to the Beaver Dam Mine Site identified through engagement are described in Tables 6.16-12 to 6.16-14 and shown in Figure 6.19-10.

The following topics are identified as important aspects of the Land Use theme.

[66] Source: 2020-21 Budget Recast Budget; Halifax Regional Municipality

Table 6.16-12: Beaver Dam Mine Project Potential Land Use Interactions

Feature #	Use	Impacted Party	Description	Potential Interaction	Perceived Level of Interaction by User	Severity of Interaction	Likelihood of Interaction	Potential Mitigation	Level of Interactions after Mitigation
1	Cairn	Icelandic Society	Heritage memorial and location of interpretative signage	Low	Low	Low	Low	None required	Low
2	Cabin/Interpretive Area	Icelandic Society	Re-creation of an original cottage and the location of the original homesteads	Low	Low	Low	Low	None required	Low
3	Sandy Pond Island (Prest Property)	Marilyn Prest	No dwelling at this time.	Low	Low	Low	Low	None required	Low
4	Property access road	Marilyn Prest	Access road to Sandy Pond Island property	High	High	High	High	Provide access to Sandy Pond Island via Haul Road bypass and construction of a field driveway.	Low
5	Lake Alma access/boat launch/camps	Lake Alma properties	Multiple camps (10-20) along Lake Alma	Medium	Low	Low	Low	Allow access to Haul Road so people can access their camps.	Low
6	ATV Trail	Recreational ATV clubs, snowmobilers	Off-road pilot project area where ATV's will be permitted on the public ROW	Low	Low	Low	Low	Work with TIR to upgrade Mooseland Rd and provide sufficient shoulder for ATV traffic	Low
7	ATV Trail/Vehicle access	Recreational ATVs, snowmobilers, local hunters and fishers, possibly Indigenous, local community members; Lake Charlotte ATV Club, PUMA ATV Club, ATVANS, and Sheet Harbour ATV and Snowmobile Club	Trail #106 of the provincial ATV trails runs along the south portion of the haul route between Mooseland Road and Trail #367. Concerns regarding vehicle (truck) access along the Haul Road between Mooseland Rd and Hwy 224, specifically for boating/camp access	High	High	High	High	Build ATV trail alongside proposed haul route between Mooseland Rd and ATV Route 367. Build service road along side Haul Road.	Low
8	Haul Road Crossing	ATV clubs, snowmobilers, local residents, potentially Indigenous	Allow for east- west travel. This would connect Trail #367 to Trail# 320	High	High	High	High	Create a controlled crossing point on a Haul Road.	Medium
9	ATV Trail	Sheet Harbour ATV Club; ATVANS, other recreational users, potentially Indigenous	Trail# 106 runs along the BDMR.	High	High	High	Low	Build BDMR bypass road between Hwy 224 and mine site	Low
10	Mine Site Rd	ATV clubs, snowmobilers, NSSA, hunters and fishers, potentially Indigenous	Trail# 106 re-routed around the mine site.	High	High	High	High	Construction of a bypass road around the mine site for recreational traffic	Low
11	ATV Trail, property access	ATVANS, Rocky Lake Residents, Indigenous	Trail #320 dead-ends at mine. Access to camps (multiple) on Ten Mile Lake via ATV Trail #320, which will be severed due to Beaver Dam Mine Site.	High	High	High	High	Construction of an ATV trail that links trail# 320 to the BDMR bypass.	Low
12	Ferry Lake Access Road (also known as River Road)	Mooseland Residents; Ferry Lake property owners	Mooseland residence concerns about alternate ATV access point if trail closures.	Low	High	Low	Low	Construct Haul Road bypass so users do not use the Ferry Lake access road to access Lake Alma and other locations.	Low
13	Proposed alt Haul Road/Mooseland Road access point	Gillis, Glawson and adjacent properties	Noise concerns regarding proximity of planned Mooseland Road/Haul Road access point and to address recreational parking	Low	High	Low	Low	Consider installation of parking area to address parking concerns.	Low

Table 6.16-13: Dwellings in Proximity to Beaver Dam Mine

Structure ID	Structure Description	Distance from PA	Distance from Closest Mine Site	Dwelling Type	Seasonal/ Permanent	Potable Well (Y/N)	Well Type
D1	Ferry Lake (Multiple Properties)	3.5 km east of Haul Road	5 km South of Beaver Dam Mine Site	Multiple properties	Seasonal		
D2	4305 Mooseland Road (Gillis Property)	850 m east of Haul Road	9 km east of Touquoy Mine Site	House/cottage	Seasonal	Yes	Dug
D3	Hunting Camp	6 km west of Haul Road (off ATV trail)	8 km southwest of Beaver Dam Mine Site, 8 km northeast of Touquoy Mine Site	Camp	Seasonal		
D4	4315 Mooseland Road (Glawson Property)	850 m east of Haul Road	9 km east of Touquoy Mine Site	Camp/cottage	Seasonal		
D5	Mooseland Road (Multiple Properties, adjacent to Gillis and Glawson Properties)	850 m east of Haul Road	9 km east of Touquoy Mine Site	Multiple properties			
D6	Rocky Lake (Multiple Properties)	7 km west of the Haul Road, along Hwy 224.	4.5 km SW of Beaver Dam Mine Site	House/cottage	Seasonal		
D7	Camp	9 km north of Beaver Dam Mine Site	9 km north of Beaver Dam Mine Site	Camp	Seasonal		

Note: Approximate locations show in Figure 6.16-10.

Table 6.16-14: Beaver Dam Mine Project Sensitive Receptor Locations (Used for Modelling Purposes)

Receptor ID	Structure Description	Modelling Report			Distance from PA	Distance from Closest Mine Site	Dwelling Type	Seasonal/ Permanent	Potable Well (Y/N)	Well Type
		Noise	Air	Light						
R1	9 Beaver Dam Mine Road (Marlborough Property)	Yes	Yes	Yes	Directly Adjacent -Northwest side of Hwy 224 and Beaver Dam Mines Road	5 km South of Beaver Dam Mine Site	House	Year round	No	N/A
R2	4112 Highway 224 (Beaver Lake IR)	Yes	Yes	Yes	2.3 km north of Haul Road	5 km South of Beaver Dam Mine Site	House	Year round	Yes	Drilled well
R3	4115 Highway 224 (Cottage on Crown land)	Yes	Yes	Yes	1.4 km north of Haul Road	5 km South of Beaver Dam Mine Site	Cottage	Seasonal	No	N/A
R4	3492 Highway 224 (Hobbs Property)	Yes	Yes	Yes	Directly Adjacent - East side of Hwy 224 and Beaver Dam Mines Road	5 km South of Beaver Dam Mine Site	Hunting camp/ cottage	Seasonal	No	N/A
R5	3379 Highway 224 (McLeod Property)	Yes	Yes	Yes	350 m Southeast of Haul Road	6 km South of Beaver Dam Mine Site	Cottage/ trailers on site	Seasonal	No - Rainwater harvesting	N/A
R6	3373 Highway 224 (Smith Property)	Yes	Yes	Yes	425 m Southeast of Haul Road	6 km South of Beaver Dam Mine Site	Cottage	Year round	Inconclusive	-
R7	Tangier River (Deepwood Estates Property)	Yes	Yes	Yes	Directly Adjacent - South side of Haul Road	9 km southeast of Touquoy Mine Site	Cottage	Seasonal	Yes	Dug well
R8	Tangier River (John Dickson Leasehold property)	Yes	Yes	Yes	350 m Southwest of Haul Road	9 km southeast of Touquoy Mine Site	Trailer(s)	Seasonal	Inconclusive	-
R9	5579 Mooseland Road (Lloy Property)	Yes	Yes	Yes	Directly Adjacent - East side of Mooseland Road	5 km East of Touquoy Mine Site	Cottage	Seasonal	Yes	Dug well

Notes: Approximate locations show in Figure 6.16-10.

For more details regarding Receptor Locations and completed Modelling refer to Sections 6.1 (Noise), 6.2 (Air), and 6.3 (Light) and Appendices B.2 (Updated Noise Impact Assessment Technical Report), C.1 (Air Emissions Assessment Technical Report), and D.1 (Light Impact Assessment).

6.16.5.4.2 Snowmobiling and ATV Use

The ATV Association of Nova Scotia is the umbrella association for the recreational ATV clubs, which are located throughout the province.

Three main clubs are active within the LAA. These are:

- PUMA ATV Club located in Dean;
- Sheet Harbour Snowmobile and ATV Club located in Sheet Harbour; and
- Lake Charlotte ATV Association in Lake Charlotte.

The LAA is heavily used by ATV and snowmobiles, which includes both ATV Clubs and other recreational users. It is difficult to estimate with accuracy the number of non-club members who use the trails within the LAA. Consultation with the local clubs shows that the trails are part of the formal ATV network that connects different communities to each other. The trails used by the ATV clubs are well organized and numbered, and organized events occur on this trail regularly. The trails are part of a larger pan-provincial ATV and snowmobile network.

The ATV associations have "ATV highways" which are numbered. Perhaps the most well used of these highways is Trail# 367, (known locally as the H Road) which is travelled by the Lake Charlotte members when travelling from Lake Charlotte to Sheet Harbour (Figure 6.19-10). The riders travel over Trail# 106, cross Mooseland Road to the Haul Road and then turn south on to Trail# 367. It is estimated that 2,000 riders a year travel this route (Figure 6.16-10).[67]

Another well-traveled route is from Sheet Harbour along Trail# 367, crossing the Haul Road to connect to Trail# 320 (Figure 6.16-10). This route takes riders to Otter Lake, a popular Lake for fishing and recreation purposes. There is also a camp located on Otter Lake which is privately owned but is known locally as a resting place or emergency stopping location for recreational users (Figure 6.19-10 and Appendix A.4a). According to engagement, Trail# 367 has been a stopping spot for over 50 years and connects to many canoeing and fishing waterways, including Blacky's Meadow, Otter Lake Flowage and Shingle Lake (Appendix A.4a).

Trail# 320 continues North and then turn west to cross Highway 224 (Figure 6.16-10). ATV clubs and non-club members who live in the Rocky Brook Lake area use Trail #320 to access recreational lands to the west of Killag. Engagement with Rocky Brook Lake residents indicated that the connection of Trail #320 to Trail #394 is important for residents and for the broader ATV community (Appendix A.4a). Rocky Brook Lake resident use Trail #320 for dog walking, ATV riding, hiking and general access to nature (Appendix A.4a). None of the Rocky Brook Lake residents, as of the date of an engagement with them in December 2020, are members of an ATV club.

Though engagement, it has been identified that the intersection of the Mooseland Road and Trail# 106 is a concern as this location is used as a parking location for boats and recreational vehicles heading toward the Tangier Grand Lake Wilderness Area (Figure 6.16-10). Both the Mooseland and Area Community Association and individual property owners in the area have provided pictures and videos showing that trucks, cars and trailers parked on the Mooseland Road, unload their gear and ATV or snowmobile for the day (Appendix A.4a). According to community members, this creates a potentially unsafe traffic and pedestrian situation once the Haul Road is operational. AMNS will investigate options during detailed road design to address this concern and find a solution to increase safety. Options may include creating parking area or altering the access to the Haul Road. Mitigations will be

[67] Personal Communication with S. Foley, Lake Charlotte ATV Club.

reviewed by the Mooseland community members through the development of a working group before implementation (Appendix A.6 draft Public Engagement Plan).

6.16.5.4.3 Active Transportation and Recreation

Local residents and recreational users have indicated that the proposed Haul Road is used for local walking and hiking, with no formal trails or active transportation pathways in the area. A search of NS Trails online Trail Finder[68] showed no designated trails within the project area, nor is there any tourism literature found promoting the Project Area as a hiking or outdoor adventure location. Hikes are occasionally held at the Otter Pond Demonstration Forest, which is outside of the PA but is within the LAA.[69]

Within the project area there is evidence of recreational usage. The Glawson, Prest, and Gillis family, along with several individuals who made submissions to the Impact Assessment Agency of Canada (IAAC) website, describe multigenerational usage within the LAAA and RAA for skating, tobogganing, canoeing, swimming, fishing, hunting and group outings.[70] In particular, Krista Gillis and Mitchell Glawson have spoken about the importance of having access to nature and the places they visited as children, and where they now take the next generation (Appendix A.4a). Residents of Rocky Brook Lake spoke of the importance of walking and interacting with nature, as did Frank and Brenda Lloy and Deborah Marlborough, both of whom own houses near the proposed Haul Road. Access to the recreational areas is by truck, jeep, foot, ATV and snowmobile. Community members have expressed the expectation that access to land and nature be maintained (Section 3 and Appendix A.4a).

AMNS is committing to a series of bypass routes to allow continued access to the recreational areas and to allow continued recreational usage. The bypass roads are shown in Figure 6.16-10.

6.16.5.4.4 Access to Camps

Several camps are located around the PA, but not within it. Through the construction of series of bypass roads and Haul Road crossings, access to all camps will be maintained. Specific locations are described in Table 6.16-15 and Figure 6.16-10.

Table 6.16-15: Locations of Camps around the Project Area

Owner Name	Location	Map Reference[(a)]	Access Routes
Musquodoboit Lumber Company – Leaseholder: John Dickson	Near the bridge where the Haul Road crosses the Tangier River	R8	Haul Road
Darren Lasaga Camp	Otter Lake	D3	Via Highway 224 to Trail #320
Harry Casey et al. Camp	10 Mile Lake	Not shown	Via Trail #320 to Trail #394
Jeff Bevis Camp	Lake Alma	Not shown	Summer: Truck access via Highway #224 to Trail #394 Winter: ATV/snowmobile access via Haul Road to Trails# 367 and #106
Alfonse Gloade Camp	Lake Alma	Not shown	Mi'kmaq of Nova Scotia (Section 6.14)

[68] Source: https://novascotatrails.cioc.ca/

[69] Source: https://www.otterponds.ca/workshops--events.html.

[70] Source: IAAC: Canadian Impact Assessment Registry, Beaver Dam Mine Project Comments: https://iaac-aeic.gc.ca/050/evaluations/proj/80111/contributions?id=80111&culture=en-CA

Deepwood Estates Camp and Property - Property in AMNS ownership as of December 2020	Tangier River	R7	Access Via Haul Road
Marilyn Prest – Land only	Island	3	Haul to trail which starts west of Tangier River

Notes: [(a)] Figure 6.16-10.
ATV = All-terrain vehicle.

Access to all camps will be maintained through the construction of a bypass road which will consist of a single 4 m lane and with a 1 m shoulder on each side, for a total of a 6 m right-of-way. This bypass road will start at Mooseland Road and connect to the existing forestry road that intersects with the stretch of proposed new portion of the Haul Road to the west. The Haul Road Bypass specific location will be determined as part of the detailed design.

6.16.5.4.5 Haul Route Safety

The Haul Route will be used to transport ore between the processing facility at Touquoy and the Beaver Dam Mine Site. Most of the Haul Route will be privately maintained by AMNS, but a short portion of the Haul Route will use the Mooseland Road, a public road. The Mooseland Road between the Touquoy mine site and the entrance to the Haul Road is primarily a gravel road with some paving.

Local Mooseland residents have expressed concern about public safety along the Haul Route, particularly along the Haul Road (the portion of the Haul Route between Mooseland Road and Highway 224) and at the entrance of to the Haul Road from Mooseland Road (Figure 6.16-10, Section 2, Figure 2.3-3 and Appendix A.4a). The concern relates to shared usage of the Haul Road with light traffic, ATV and snowmobile traffic. This community concern is proposed to be mitigated by the construction of a series of bypass roads that will separate recreational and light vehicle traffic from the AMNS haul truck traffic itself. Dedicated at-grade crossings will be constructed to cross the Haul Road. All crossings will provide adequate stop sighting distances for recreational users. The Haul Road Bypass will have a minimum of three formal crossings for ATVs and light vehicles, with specific designs and location will occur during detailed design. It is anticipated that crossings will be located at the junction of the Haul Road, and Trail #320, to provide access to the Marilyn Prest lands, and at the Haul Road and existing forestry road to the west. The Beaver Dam Mines Road (BDMR) will also have a bypass road built to the same specification as detailed above. The BDMR bypass will include at least one crossing to access a newly created trail that will connect Trail #320 to Trail #106. This trail will be built and operated by the local ATV clubs through a separate permitting process. All crossings will be signed.

AMNS will develop an Access and Safety Management Plan that will guide Haul Road Usage. Other mitigations to address safety concerns are established in Table 3.7-3 of the Section 3 (Public Engagement), particularly related to Indicators of Success for engagement activities.

The Access and Safety Plan will be developed through the establishment of an Ad Hoc Advisory group that will include residents, representatives of the ATV/snowmobile associations, representative from the Rocky Brook Lake area and other stakeholders. (Appendix A.6). AMNS intends to establish Ad Hoc Advisory Group in 2021.

6.16.5.4.6 Noise

A noise assessment was undertaken and is presented in Section 6.1. The assessment evaluated 19 receptors situated at varying distances to the Project (i.e., mine site and haul road). The assessment indicated that the closest receptors are within noise Nova Scotia Pit and Quarry Guidelines (NSEL 1999), which include 65 dBA during daytime and 60 during the evening. Although mining operations will be 24 hours, transport of ore by Haul trucks will be limited to daytime and evening hours (i.e., 7 am to 11 pm). A

noise complaint operational procedure will be developed and established before construction to ensure that residents complaints are addressed. In response to IR2 CEAA 2-32 a draft noise complaint process that includes contact information, formal investigation, and follow-up mitigations to address residents' concerns to the extent possible and is included as Appendix A in the draft Public Engagement Plan (Appendix A.6). In addition, AMNS will continue to engage with local communities with respect to their concerns throughout the life of the Project.

6.16.5.4.7 Hunting and Fishing

The land around the PA has a concentration of lakes and forests, which make it a popular for hunting and fishing.

The PA is in Deer Hunting zone 106, which covers almost all of the Eastern Shore from the edge of urban HRM to the far end of Guysborough county. In 2019, the last year reported by the Province, reporting showed that the Eastern Shore had less than 5% of all reported bucks and anterless deer taken in Nova Scotia.[71] This is consistent with previous years. Halifax County does have higher levels of upland game, which includes snowshoe hare, ruffed grouse and pheasant, harvested then other areas of the province.[72] There is no data specific to the project areas regarding hunting for upland game. During engagement, many reported that this area was a popular hunting location, particularly in the fall of the year (Section 3 and Appendix A.4a).

Through engagement efforts, AMNS has learned that there are many lakes that are regularly visited by the local season and permanent residents. It has also been reported to AMNS that some recreational fishers leave boats moored in Lake Alma for the summer.

AMNS heard concerns that the Haul Road may restrict hunting. The 2020 Hunter manual indicates that no person shall discharge a firearm or hunt within 30 m of a travelled portion of any highway or within 182 m of a woods operation.[73] This would remove the area adjacent from the Haul Road from hunting during the operation of the Haul Road.

Impacts on access to fishing locations within the LAA and RAA will be maintained by the bypass roads. Harry Casey, a resident of the area who is an active fisherman, has identified all lakes he and others in his circle use for fishing. Access to all lakes and fishing areas will be maintained upon construction of the bypass routes (Section 3 and Appendix A.4a).

6.16.5.5 Parks and Open Space, Tourism

6.16.5.5.1 Introduction

Nova Scotia has a variety of formal parks and open spaces which provide space for recreational pursuits, protect sensitive or important habitats, and create opportunities for people to be in nature. Parks and Open Space also serve the tourism goals of the province and local communities.

The following topic areas are identified as important aspects of the Parks and Open Space, Tourism theme.

[71] Source: https://novascotia.ca/natr/hunt/deer-stats.asp

[72] Source: https://novascotia.ca/natr/hunt/uplandgame-stats.asp#calculated15

[73] Source: https://novascotia.ca/natr/hunt/pdf/Hunting_Summary.pdfm Pg 90.

6.16.5.5.2 Protected Areas and Wilderness Areas

There are no protected and wilderness areas within the PA. There are Protected areas within the LAA (Table 6.16-5).

The closest Protected area to the Project Area is the Ship Harbour Long Halke Wilderness Area (Figure 6.16-9), which is directly adjacent to the Mooseland Road. Noise and air assessment indicates that impacts are within regulated guidelines (Section 6.1 and Section 6.2, respectively).

6.16.5.5.3 Local Community Sites

Through engagement with the local community, AMNS has identified several community sites which have been identified as important to the local community (Table 6.16-16).

Through conversations with local stakeholders, AMNS learned of a "date rock". According to local knowledge, the date was carved into the rock when the road (referred to herein as the Haul Road) was built. Some of the older community members re-paint the date so that it visible and keep the site clear of brush (Section 3 and Appendix A.4a).



Picture 1: Date Rock

AMNS was contacted by a resident of Ferry Lake to express concerns (Section 3 and Appendix A.4a). Ferry Lake is the location of a several cottages, which do not appear to be used year-round. Ferry Lake is outside the LAA. Through engagement, AMNS learned that there were concerns that the road that Ferry Lake property owners use to access their properties (River Road) may experience increased traffic. With the construction of a bypass road, existing recreational use traffic will continue to travel along the Haul Road bypass road.

6.16.5.5.4 Tourism Opportunities

Tourism is not a significant activity in or near the PA or with in the communities immediately adjacent to it. The Project is not anticipated to have any impacts on Tourism activities. The RAA does have many tourism assets and the 100 Wild Islands continues to be a focus. However, the PA is inland and is not located on a public road and will not be visible to the traveling public.

6.16.5.5.5 Regional Visitation

AMNS has heard through public engagement that, although the PA and local communities may not have significant draw for tourism, that it does attract people from the broader region, which is undefined, to use the trails, fish and hunt. No data exists on the regional visitation for recreational purposes. However, with the construction of the planned bypass routes, access to the crown land is still available for those who hunt, access points will be constructed to the lakes of the area and other recreational activities can continue to occur. The bypass routes will provide improved access to the areas in question.

Table 6.16-16: Community Sites

Community Site	Location	Discussion
Date Rock	Along the Haul Road between Mooseland Road and Highway 224	Request by community members to maintain the rock. Rock will be maintained or, if required, moved to a site acceptable to the community.
Otter Lake	Otter Lake is a popular recreational area located to the north of the Haul Road, along Trail #320	This area is a destination for family and outdoor recreational pursuits. The cabin, located on the shore of Otter Lake, is a known stopping location. Access to Otter Lake will not be restricted and the Haul Road bypass will include a crossing to access Trail #320. Otter Lake can also be directly accessed from Hwy 224.
Lake Alma	Lake Alma is located to the south of the Haul Road	Lake Alma is a fishing and boating, and there are a l camps located near it on or on its shores. During engagement, at least one person indicated that he left his boat moored during the summer in Lake Alma. Lake Alma can be accessed from Highway 224 and via Trails # 394 and 106. Access to Lake Alma from Mooseland will be maintained via the Haul Road bypass.
10 Mile Lake	Located west of the Mine Site and Cameron Flowage	There are camps located on 10 Mile Lake and this area is also identified for recreational uses. This area is accessed via Trail # 394. Trail # 106 and #320 both connect to Trail #394. Trail# 320 will be dead-ended at the Project Area boundary. A new connector trail between Trail #320 and the BDMR Bypass will be created, as will a Mine Site Bypass that will allow ATV and light vehicles to access Trail#394 and the 10 Mile Lake area.
Otter Lake Demonstration Forest (OLDF)	To the southeast of the community of Mooseland	The OLDF is, "…a place for all Nova Scotians to learn about forest ecology and the sustainable management of our nature.
Mooseland and Area Community Hall	4032 Mooseland Road	This is a community centre that is used for local residents. AMNS is in talks with the Mooseland and Area Community Association (MACA) to develop a partnership. MACA is identified in the draft Public Engagement Plan (Appendix A.6) as a key stakeholder and includes several commitments regarding ongoing information sharing and relationship development.
Ferry Lake	Located approximately 4 km southwest from the Haul Road	Seasonal dwellings are located on the southern shore of Ferry Lake. No impact to residents are predicted based on the impact assessment. A technical memorandum assessing possible linkages is provided in Appendix F.9. The technical memorandum concludes that there are no impacts from dust, noise or surface and groundwater quality to Ferry Lake residents.,

Notes: AMNS = Atlantic Mining NS Inc.; ATV = All-terrain vehicle; BDMR = Beaver Dam Mines Road.

6.16.5.6 Roads and Traffic

6.16.5.6.1 Introduction

The Beaver Dam Mine Project, during operations, will transport ore from the Beaver Dam Mine Site to the Touquoy processing facility for processing. The number of haul trucks is based on a number of factors including size and availability in Nova Scotia. Two scenarios were assessed one with 95 trucks and 164 trucks (one way). Additional traffic on the Haul Road will including maintenance vehicles to provide a combination of services include trucks designated to apply dust mitigations.

The haul route for the ore will be primarily over private roads but will include travel on the Mooseland Road between the entrance of the Haul Road, known locally as the "Old Dump Road" and the Touquoy mine site. The Mooseland Roads falls under the jurisdiction of the Department of Transportation and Infrastructure Renewal.

The following topics are identified as important aspects of the Roads and Traffic theme.

6.16.5.6.2 Road Infrastructure

The Mooseland Road is designated a Class D road according to the Department of Transportation and Active Transit (NSTAT), which are Intermediate Weight Roads (45,500 kg).[74] The Mooseland Road is a gravel road for most of the distance where the mine trucks will travel, but AMNS is working with NSTAT to assess what upgrades may be required. The Mooseland community has asked that the currently unpaved portion of Mooseland Road between Touquoy and the Haul Road entrance be upgraded, and AMNS supports this request to NSTAT.

Public sources of data for traffic are available and were used to the greatest extent possible. Observations made by the Project team through the course of EIS work from 2015 to present indicate that there is great variability in numbers and frequency on the public (e.g., Highway #224) and the local roads (e.g., Beaver Dam Mines Road). Records of traffic over a nine-year period (2004-2014 the current data set available) show annual average daily traffic on Highway 224 between Beaver Dam Mines Road., and Pleasant Valley Road to range between 150 to 340 vehicles per day. Beaver Dam Mines Road is used as a resource road and no traffic counts are publicly available and no baseline studies were completed for this aspect; however, it is estimated at approximately 10 vehicles per day. Based on observations, the traffic and vehicle types on the Beaver Dam Mines Road is dependent on activities taking place/time of year. Increased local traffic was more evident during hunting season in the fall/winter and lower during spring thaw when road conditions were poor.

The remaining portion of the ore haul road along the Mooseland Road to the Touquoy Mine Site is on a public road limited public information on traffic. The Touquoy Mine Site is operational and thus traffic now consists of local residents, service vehicles and mine workers forming the new baseline. Data is not available from Nova Scotia Department of Transportation and Infrastructure Renewal (NSTIR) on this route and based on observation it is assumed the number of vehicles is within the same range as traffic (types, count and frequency) as on Highway 224. The data for Highway 224 has therefore been used in the assessment of this portion of the Haul Route.

Table 6.16-17: Highway 224 Section 025 Beaver Dam Mines Road (Marinette) to Pleasant Valley Road Traffic Count

Start Date	Location Description for Count	Group	Type	% TRK	Average Daily Traffic	Average Annual Daily Traffic	Direction
June 27, 2007	1 km West of Fisher Lake Road (Westbound)	A	VC	:8	168	150	W
June 27, 2007	1 km West of Fisher Lake Road (Eastbound)	A	VC	:3	169	150	E
November 12, 2009	1 km West of Fisher Lake Road	A	TC		336	340	
October 17, 2011	1 km West of Fisher Lake Road	A	TC		295	290	
November 22, 2012	1 km West of Fisher Lake Road	A	TC		254	370	
September 3, 2013	1 km West of Fisher Lake Road	A	VC	:1	386	340	

[74] Source: https://novascotia.ca/tran/trucking/roaddesignation.asp

6.16.5.6.3 Private Road Infrastructure

The Haul Road connects Highway 224 and Mooseland Road. Currently, local traffic from seasonal properties, forestry and recreational activities use the proposed Haul Road. In the past (not observed during baseline studies) it is reported that the Haul Road will have intermittent high use periods (up to 100 truck trips per day) associated with forestry worker trucks from logging activities. The Haul Road includes three bridge upgrades including one bridge that crosses the Tangier Rivere, which will require upgrades for the mine operations, which AMNS will undertake. The existing bridge will form part of the Haul Road bypass route and a new bridge will be installed to accommodate mine truck traffic. The other two bridges requiring upgrades are located along the Beaver Dam Mine Road.

The BDMR is a gravel private road but is maintained closer to a public road standard as it is used for forestry trucks. Northern Timber (NT) and its contractors were the main users of the road and during peak operations, NT estimates approximately 3,000 use this road per year. The BDMR has two bridges, both of which will require upgrades for mine operations. The existing bridges will form part of the bypass route and a new bridge will be installed to accommodate mine truck traffic.

When mining ceases, the bypass routes, Haul Road upgrades and BDMR upgrades will remain providing improved transportation infrastructure to the PA.

6.16.5.6.4 Public Road Crossing

The haul road for the Project is primarily on private roads, except for the portion on the Mooseland Road. There is a planned crossing of Highway 224, which will be designed to NSTAT standards, including stop sighting distance requirements.

6.16.5.6.5 Pedestrian Safety

Little pedestrian activity has been seen along the Haul Route during field visits. There are no sidewalks and the area is sparsely populated. Through engagement, AMNS has learned that there are hikers, hunters and dog walkers who use the Haul Road. With the construction of the bypass road, continued usage will be permitted and enabled (Section 3 and Appendix A.4a). With the construction of the Bypass Routes, hikers and walkers will be separated from the mine truck traffic. The Bypass route will improve safety for pedestrians.

6.16.5.6.6 Project Duration Changes

The maximum anticipated daily volume on the Highway 224 and Beaver Dam Mines Road associated with the Beaver Dam Mine Project would therefore be 175 (passenger and service vehicles). However, based on use of the Haul Road, intermittent service vehicle schedules and car-pooling, the number on Highway 224 could be reduced by 50% to around 85 to 90 per day over a 24-hour period or roughly 4 per hour on Highway 224. For staff and service vehicles this increase may come from the north or south depending on the current or planned residences of workers and the direction from which deliveries are made. During construction, Highway 224 will likely be used to transport equipment from Touquoy Mine Site to/from Sheet Harbour to Beaver Dam, but the frequency and volume is not determined. Highway 7 to the Mooseland Road is available as an east-west then north route option to the Touquoy Mine Site as well thereby reducing the number on Highway 224.

Traffic on Highway 224 will therefore remain within the traffic count ranges as provided by the former NSTIR. Highway 224 will be crossed at Beaver Dam Mines Road, south of Beaver Lake IR 17, by the project related trucks transporting ore to the processing facility but will not travel north or south on Highway 224 and therefore not add to the overall traffic count on that highway corridor. Project and service vehicles will also use the Haul Road and Highway 224.

The Haul Road portion from the Mooseland Road to Touquoy Mine Site will have an increase in traffic by haul trucks transporting ore to the Touquoy Mine Site and addition of Project related staff vehicles and possibly service vehicles (e.g., 3/4-ton trucks).

Traffic volumes on those existing roads are unknown and variable both seasonally and annually. Project activities will increase the traffic levels by an average 95 trucks per day for approximately 16 hours a day during the operation phase of the Project. As noted above the baseline for this portion of the ore Haul Road has been assumed to be in the range for Highway 224 and therefore the Project related traffic increase should be within the existing range based on published data (150 to 340 per day).

6.16.5.6.7 Foreseeable Projects – Traffic Impacts

- Proposed Cochrane Hill Gold Project – No project related changes to traffic volumes or frequency on Highway 224 are anticipated due to the location of Cochrane Hill being of some distance from Beaver Dam. That Project would be accessed by staff and service vehicles via Highway 7, 347, and 348.
- Proposed Fifteen Mile Stream Gold Project – No project related changes to traffic volumes or frequency on Highway 224 are anticipated as that project would be accessed by staff and service vehicles via Highway 7 and 374.

6.16.5.7 Impact on Government Revenues

6.16.5.7.1 Introduction

The KPMG study provides information on the impact on federal and provincial revenues of the potential Project. In addition to this project specific study, AMNS commissioned a further study, Economic Impact Assessment of the Moose River Consolidated (MRC) Project, which assesses the cumulative economic impact of the MRC (Appendix O.2).[75] The MRC includes Touquoy, Beaver Dam Mine, Fifteen Mile Stream Gold and Cochrane Hill Gold, which are separate but interrelated projects.

The KPMG Economic Impact Assessment (Appendix O.1) assesses both direct and indirect impacts of the Project. Direct effects are the revenues that flow directly from the spending of the Project. The indirect effect is the income effects that come from the goods and services created by the Project in other sectors, such as from suppliers selling their good and services.

Gross Domestic Project (GDP) is another key metric when considering economic impacts (Appendix O.1). Given the Province's stated goal to decrease the net debt to GDP ratio, the amount of contribution to the GDP is also important to understand. The Province is interested decreasing this ratio because, "the size of the GDP is a common measure of the province's tax base from which to draw revenue, and thus a measure of its ability to pay down the debt."[76] All spending directly contributes to the GDP, and the royalties and taxes contribute to the government's ability to pay down the debt.

Table 6.16-18: Distribution of Spending: Beaver Dam Mine Project (Over the Entire Life of the Project)

Spending Category	Value Added ($M)	As a Percentage of the Total (%)
Construction (1 year)	27.7	5.3
Operation (5 years)	489.6	93.1
Sustaining capital	8.3	1.6
Total	**525.6**	**100**

Source: KPMG Economic Impact Assessment (Appendix O.1).

Notes: Due to rounding the sum of items may not add up to the total. $M = million dollars.

[75] Source: Economic Impact Assessment of the Moose River Consolidated Project – February 2021.

[76] Source: https://www.onens.ca/goals/goal-19-net-debt-gdp.

When considering the Moose River Consolidated (MRC) project, which includes existing Touquoy Mine, proposed Beaver Dam Project, proposed Fifteen Mile Stream Gold Project and the proposed Cochrane Hill Gold Project, the projected economic spin-offs are much more significant. Within the context of the social-economic analysis, the four project's cumulative impact provides an opportunity for the province to make headway on the One Nova Scotia Goal 19. With a projected impact of over $1 billion over 10 years and the creation of over 11,409 jobs, the MRC cumulative impact is significant.[77]

Table 6.16-19: Impact on Value Added and Employment for Nova Scotia Stemming from Overall Expenses related to the Moose River Project (Over the Entire Life of the Project)

Nova Scotia	Value Added ($M)	Jobs (In Person-years)
Exploration	49.9	397
Construction	375.5	2,803
Operation (over life of mine)	640.2	8,209
Total	**1,067.4**	**11,409**

Sources: Statistics Canada, AMNS, KPMG Economic Impact Assessment (Appendix O.1).

Note: Due to rounding, the sum of items may not add up to the total. $M = million dollars.

AMNS has based its total spending, and its contribution to the GDP, on the 2019 N1 43-101 report, which is a public facing document. Since this report was issued, AMNS increased its estimates for the project. Due to increased spending on items such as water management and new costs associated with the construction of a bypass road, the total project costs will increase by 12 to 20 million dollars. This represents approximately a 2 to 4% increase in overall spending from the 2019 study, which translates into a commensurate increase in economic impact of the Project. These increased as not reflected in the 2019 NI 43 101, and therefore not included in the results from the Input-Output Model used in the Economic Impact Assessment Report or the Economic Impact Assessment of the MRC (Appendix O.2).

The following are identified as important topics of the Impacts on Government theme.

6.16.5.7.2 Provincial Taxation and Benefits

For the Beaver Dam Mine Project, AMNS plans to spend $525.6 million in Nova Scotia over a 5-year period, which includes construction.

During the 1-year construction period, the province of Nova Scotia would see increases in revenue to the provincial government of $1.3 million. During the five years of operations, the province would see $4.8 million in additional revenues. The projected revenues are presented in Table 6.16-20, the revenues are expressed in millions.

Table 6.16-20: Projected Provincial Revenue from the Beaver Dam Mine Project

Jurisdiction	Timing	Royalties	Personal Income Tax	Taxes on Products	Taxes on Production	Total
Province of Nova Scotia	Construction (1 year)	N/A	0.8	0.4	0.1	1.3
Province of Nova Scotia	Operations (5 years)	0.6	1.4	2.7	0.1	4.8

Note: N/A = not applicable.

[77] Source: Economic Impact Assessment of the Moose River Consolidated Project, Pg 5.

If the Beaver Dam is considered within the MRC Project, then the cumulative impact of the total project is much greater. Although Beaver Dam is being evaluated as a standalone project, from a socio-economic analysis perspective it is linked to the other project as there is the use of shared infrastructure and that much of the baseline data provided is at a regional scale. In addition, socio-economic conditions are about interrelationships which makes it difficult to assess socio-economic factors project by project. Therefore, from a socio-economic perspective, the Project is contributor toward to the overall MRC Project.

Table 6.16-21: Projected Provincial Revenue from the Moose River Consolidated Project

Jurisdiction	Personal Income Tax	Taxes on Products	Taxes on Production
Province of Nova Scotia	10.4	20.9	32.2

6.16.5.7.3 Federal Taxation and Benefits

During the approximate one-year construction period, the federal government would see increases in revenue of $1.4 million. During the five years of operations, there would be $3.4 million in additional revenues. The projected revenues are broken out as follows (expressed in millions):

Table 6.16-22: Projected Federal Revenue from the Beaver Dam Mine Project

Jurisdiction	Timing	Personal Income Tax	Taxes on Products	Taxes on Production	Total
Government of Canada	Construction (1 year)	1.2	0.2	0	1.4
Government of Canada	Operations (5 years)	1.8	1.6	0	3.4

Similar to the previous section, when the project is considered within the context of the MRC, the project will generate $32.2 million during construction and $93.2 million during operations.

6.16.6 Viewshed Analysis

Nortek Resource Solutions Inc. (Nortek) has completed a viewshed analysis of the Project to support a visual representative of where the Project will be visible from surrounding vantage points (Appendix M.2). This was completed to respond to IR2 CEAA 2-01.

The Zone of Visual Influence (ZVI) provides a spatial overview of where the proposed Project stockpiles will be visible across a 20 km radius. The Beaver Dam Mine Site is predominantly forested and therefore the existing forest stand data was included in the analysis. The analysis consisted of preparing a Digital Surface Model (DSM) which included the proposed stockpiles. Once the model was prepared, a visibility analysis was completed to determine all areas on the DSM in which the stockpiles are visible. This analysis focused on stockpile locations as they are the highest infrastructure proposed at the Beaver Dam Mine Site.

The ZVI was generated for the region within a 20 km radius of the Beaver Dam Mine Site. The Nova Scotia Provincial Digital Terrain Model (DTM) at 20 m resolution was used as a base layer for the analysis. The proposed stockpiles were rasterized and added to the base DTM so that they were included in the model. A visibility analysis was run using the upper rims of the stockpiles as targets and receptor heights of 1.7 m. The resulting raster was clipped with forest stand polygons that have an average height of 2 m or less which excluded areas were the forest is higher than eye height. The final results show where the proposed stockpiles will be visible assuming summer, leaf on forest conditions.

The Visual Zone of Influence (ZVI) (Appendix M.2) identifies where stockpiles (highest elevation features on the Beaver Dam Mine Site) are visible from the surrounding landscape. The NAG pile, which will be present during operations and closure, is 185 masl. The LGO and till stockpiles are 180m asl, which will both only be present only during operations. These are the highest infrastructure features associated with the Project. On the ZVI, these areas where stockpile(s) are predicted to be visible are shown in green. This ZVI was prepared to provide a general overview of where the Project will be visible from, and also to demonstrate a visual representation of what the visual influence will look like from specific locations. As shown in Appendix M.2 the Project stockpile(s) will be visible from the east and west of the Beaver Dam Mine Site including from West Lake, from the north of the Beaver Dam Mine Site in Como Lake, directly south of the Beaver Dam Mine Site, and also to the west of Beaver Lake IR along the north and south side of Highway 224. Commercial and recreational activities (boating, fishing, swimming) along Cameron Flowage will observe an adjusted viewplane with visible stockpile(s). The ZVI also demonstrates as a user moves farther away from the Beaver Dam Mine Site, the mine infrastructure will be visible from higher elevation points on the landscape, including several high points northwest of the Beaver Dam Mine Site and south of the mine including near Lake Alma. The user will not observe the infrastructure from the majority of lakes surrounding the Beaver Dam Mine Site, with the exception of those described above.

To support Project development, there will be a local bypass road constructed to allow for continued access around the Beaver Dam Mine Site and the lands to the north of the Beaver Dam Mine Site. Based on a review of the ZVI, the Project stockpiles will be visible from the bypass road directly south of the mine site and around the organic stockpile.

Through a review of the ZVI results, several photos were then taken from various vantage points to attempt to demonstrate specific locations where visual influence of the Project would be greatest. Visual Simulations 1 to 4 in Appendix M.2 show these four vantage points and what will be visual during operations and closure phases of the Project.

Visual Simulation 1 illustrates the view from the north side of the Beaver Dam Mine Site just north of Cameron Flowage, looking southwest towards the Project. The NAG stockpile will be visible during operations and closure phases, as shown on this figure (Appendix M.2). Visual Simulation 2 illustrates a similar view from the north side of the Beaver Dam Mine Site but looking farther southwest/west. The full extent of the NAG stockpile will be visible during operations and closure phases from this location, as shown on Visual Simulation 2. Visual Simulation 3 illustrates the view from west of the Beaver Lake IR on Highway 224 where the ZVI also predicted a visual change from the Project. The PAG, NAG and LGO stockpiles will be visible from this vantage point during the operation phase, as shown on Visual Simulation 3. During reclamation, only the PAG and NAG piles will remain. Finally, Visual Simulation 4 illustrates the view from a forestry road near Cope Brook, south of the NAG pile. From this location, the NAG stockpile will be visible during both the operations and closure phases. These four vantage points were selected to be representative of expected maximum change in viewscape and the locations where anticipated human activities is likely to occur (e.g., near access trails, lakes and other access points).

6.16.7 Reclamation and Closure

AMNS is committed by legislation to reclamation planning that is focused on safety and creating physically, chemically and biologically stable elements that are self sustaining ecosystems in keeping with the surrounding natural areas. AMNS also has publicly stated the desire to continue to engage the public and the Mi'kmaq of Nova Scotia in reclamation planning through the CLC and information sessions/workshops prior to the active closure phase (Sections 2, 3, 4, 6.14). These sessions are typically the time to discuss site-specific reclamation objectives such as plant types, the degree to which recreational use features such as trails, boat launches, docks, and interpretive panels will be incorporated into the final reclamation plan.

The reclamation planning phase presents opportunities for involvement for several groups including public, community, Mi'kmaq, academic institutions, environmental groups and others. Additional engagement opportunities exist during actual reclamation activities for earthworks, shoreline development, revegetation programs, habitat development and restoration) reclamation involvement, employment, research and long-term monitoring programs.

6.16.8 Consideration of Engagement Results

Section 3 Public Engagement summarizes engagement that has occurred through the Environmental Assessment. This section breaks issues into:

- Issues Raised During Stakeholder Engagement 2015-2019 (Table 3.7-2); and
- Key Issues Raised During 2020 Public Engagement Meeting (Table 3.7-3).

During the 2020 engagement, the main concerns raised are be summarized under the following topics:

- Haul Road Access and Recreational Usage;
- Traffic;
- Noise; and
- Improved Communications.

Concerns about recreational usage and the impact of the Haul Road on recreational usage was the most common concern expressed. In particular, stakeholders wanted assurance that they would be able to access locations, camps and routes that were used for recreational purposes. AMNS learned about the importance of this recreational access to many in the community of Mooseland and to the residents of Rocky Brook Lake.

To address this concern, AMNS is proposing a series of bypass roads to provide access to recreational areas, camps, hunting and fishing areas and ATV routes. The Bypass routes will be built and maintained by AMNS during the life of the project, and the public will be engaged through various means to adapt to any concerns that arise. AMNS is also exploring a partnership with the Sheet Harbour ATV Club to support the construction of short trail to support recreational vehicle access near the mine site.

Concerns about increase in traffic on the Mooseland Road and on the Haul Road was also expressed by some stakeholders. The maintenance of the gravel portion of the Mooseland Road and the impact that the mining trucks will have on the road was a concern. AMNS is working with NSTAT to assess what upgrades will be required on the Mooseland Road and supports the community's request to have the section of the Mooseland Road between Touquoy to the entrance of the Haul Road paved. AMNS, in response to concern about traffic speeding in the community of Mooseland, is working with the Community and NSTAT to install Radar Speed Signs to gather data on speeding and to respond to community concerns about speeding.

AMNS heard from community members about parking of trucks and trailers on Mooseland Road near the entrance to the Haul Road. The concern is that the increase in truck traffic from the ore trucks will create a safety concern. AMNS is working with NSTAT and the local community to address this concern through detailed design of the entrance of the Haul Road.

Noise impacts are addressed in Section 6.1.

AMNS, in response to the comments from the public, developed a draft Public Engagement Plan (Appendix A.6), which includes a variety of commitments to improve communication and consultation with stakeholders. Elements of the plan include regular open

houses with the community, the use of ad hoc committees to address specific issues, identification of key stakeholders and an action plan to address issues and opportunities.

During the 2015-2019 engagements, the issues raised during public consultation engagement relating to socio-economic considerations include potential adverse effects associated with potential effects to natural environments (e.g., surface water, groundwater, air emissions, etc.) during planned Project activities and unplanned accidents and malfunctions, such as traffic accidents. Questions on access to land and changes to land use were noted by members of the public and landowners, as well as the Mi'kmaq of Nova Scotia in terms of access to traditional land and resources. Maintenance of existing access for recreation, such as ATV, fishing, etc., was also identified as an issue. Volume of trucks on existing public roads was expressed as a key concern in terms of safety and road condition. Members of the public and Mi'kmaq community members expressed interest in employment and economic development opportunities associated with the Project.

The results of the public consultation and Mi'kmaq engagement have been considered in the environmental effects assessment, including AMNS's commitments to include the Mi'kmaq in the development and implementation of mitigation and monitoring measures and proposed compliance and effects monitoring programs, as well as AMNS's broader commitment to ongoing public consultation and Mi'kmaq engagement. Specific to evaluating the effect on socio-economic considerations, these are found within the following environmental effects assessment.

6.16.9 Effects Assessment Methodology

6.16.9.1 Boundaries

6.16.9.1.1 Spatial Boundaries

Since the Project site is remote, the spatial boundary for socio-economic conditions assessment of potential impacts to the local economy extends beyond the footprint of the Project (Beaver Dam Mine Site), and are classified as the PA, LAA, and RAA. Since there is no opportunity for the purchase or exchange of goods and services within the Project footprint. The LAA spatial boundary, extends to parts of Eastern Halifax County. This boundary captures all economic exchange and movement connected to potential project-related employment and trades in goods and services based on population density and proximity to the Project (Figure 6.16-1). Given the Beaver Dam Mine Site's remote location, within the LAA, there is a "local community area" (LCA) where potential impacts are evaluated and assessed.

The Project Socio-economic RAA captures all potential socio-economic considerations (Figure 6.16-1) with the exception of the economic parameters referenced in the KPMG reports (Appendix O.1 and Appendix O.2), which are focussed on provincial and national scales.

The Project has the potential to cause direct and indirect effects to socio-economic conditions beyond the footprint of the Project, the defined LAA and RAA are the most appropriate spatial boundaries, respectively (Figure 6.16-1).

6.16.9.1.2 Temporal Boundaries

The Project four distinct phases - Construction (1 year), Operation 5 years) and Active Closure (2 years) and Post-Closure Monitoring (10+ Years). These phases define the temporal boundary for assessment of impacts on the socio-economic conditions of the Project. Post closure monitoring is estimated to be 10+ years with monitoring data informing the focus and extent of future monitoring activities as well as determine adaptive management measures that may be necessary. Overall, the goal is to achieve a physically, chemically, and biologically stable landforms that can support self-sustaining ecosystems.

6.16.9.1.3 Technical Boundaries

Economic effects potential is a qualitative assessment based on a comparison of the relative scale of predicted Project-related employment levels (person-hours; wages) with existing employment opportunities within the HRM, especially the area between Middle Musquodoboit and Sheet Harbour. Statistical data is used where available for these VCs.

6.16.9.1.4 Administrative Boundaries

The Nova Scotia Municipal Government Act (1998 c.18 s.1) empowers the HRM to enact and enforce a Municipal Planning Strategy (MPS; HRM MPS 2014) that describes Halifax's approach to planning within its jurisdiction. The MPS outlines criteria for Council and planning staff to consider when evaluating development proposals and issuing development permits. Together with the Land Use Bylaw and Subdivision Bylaw, the MPS controls future land use and development in the Municipality. Recreational activities, such as hunting and fishing are regulated by the Province of Nova Scotia under the Wildlife Act and for hunting migratory birds by federal authority under the Migratory Birds Convention Act, 1994 and Migratory Birds Regulations.

6.16.10 Project Activities/Interaction with Socio-economic Conditions

Potential interactions between Project activities and Socio-economic Conditions are outlined in Tables 6.16-23 to 6.16-25.

Positive socio-economic impacts are associated with the Project, including long-term employment gain and/or sustained activity within the area. All phases of the Project will provide employment opportunities for local residents and Indigenous Peoples, as well as provide tax revenue for the municipal, provincial, and federal levels of government. It is anticipated that additional labour force will be required during construction and a smaller, but still significant, labour force will be required during operation.

With increase job opportunities and supplier needs, the potential to have a positive impact on community vitality and development exists. There is potential for increased relocation to the area of the mine of working age people and their families. This may increase the general population and help support the local school. Rural depopulation is a concern and by having jobs in the area, people will be attracted to this area.

Table 6.16-23: Potential Project Activities/Interactions with Socio-economic Conditions at Beaver Dam Mine Site

Project Phase	Duration	Relevant Project Activity
Construction	1 year	• Clearing, grubbing, and grading in preparation of construction • Drilling and rock blasting in preparation of construction • Topsoil, till and waste rock transport and storage from site preparation • Wetland and watercourse alteration • Mine Site road construction • Surface infrastructure installation and construction • Collection and settling pond construction
Operation and Maintenance	5 years	• Rock blasting to access and extract ore • Surface water management • Petroleum products management • Site maintenance and repairs
Active Closure	2 years	• Infrastructure demolition • Site reclamation
Post-Closure	10+ years (monitoring, adaptive management)	• Environmental Monitoring • Adaptive Management

Table 6.16-24: Potential Project Activities/Interactions with Socio-economic Conditions along the Haul Road

Project Phase	Duration	Relevant Project Activity
Construction	1 year	• Clearing, grubbing, and grading in preparation of construction • Rock blasting in preparation of construction • Till and waste rock from site preparation transport and storage • Watercourse and wetland alteration • Haul road construction and upgrades
Operation and Maintenance	5 years	• Ore transport along Haul Road • Haul road maintenance and repairs
Active Closure	2 years	• N/A[(a)]
Post-closure	10+ years (monitoring, adaptive management)	• N/A

(a) Decommissioning and Reclamation of the Haul Road is not expected. The Haul Road will be returned to owner for forestry industry. N/A = not applicable.

Table 6.16-25: Potential Project Activities/Interactions with Socio-economic Conditions at Touquoy Mine Site

Project Phase	Duration	Relevant Project Activity
Construction	1 year	• Tailings pipeline, make-up water pipeline alteration, and relocation of reclaim infrastructure
Operation and Maintenance	5 years	• Surface water management • Petroleum products management • Site maintenance and repairs
Active Closure	2 years	• Infrastructure demolition • Site reclamation
Post-Closure	10+ years (monitoring, adaptive management)	• Environmental Monitoring • Adaptive Management

With increases in working age populations, comes a deeper pool of potential volunteers for community organizations. Through engagement AMNS heard that local community groups were having difficulty attracting volunteers. Increases in population also help support the business case for increased recreational programs and infrastructure.

Indirect employment will be generated by the Project through the use of external contractors and suppliers. Emphasis on the local economy may shift slightly from Middle Musquodoboit to Sheet Harbour depending on contract services for mine operation, however the overall regional economy will benefit equally from both sites operating simultaneously.

The construction of a new portion of road and upgrades to existing roads will provide local residents and recreational users improved access to the interior areas of the region (Section 2, Figure 2.3-2). The bypass road will improve access to the current recreationally used lands.

Traffic will increase on the Mooseland Road between Touquoy and the Haul Road entrance. With upgrades to the Mooseland Road, the Mooseland Road will be able to accommodate the increased traffic and the condition of the Mooseland Road will improve, similar to the public road improvements, the paving of the Moose River Road to the north, that occurred to access the Touquoy mine site.

The potential exists for the population within the RAA to increase. This would have positive benefits for local community organizations, support recreational infrastructure requests, support local school populations, and require additional housing which could result in

additional property tax revenue. With an increase in population, increased pressure on the health system may occur and the need to a great variety of housing types and tenures. Rental housing may be under stress to accommodate workers, contractors, and supplier staff.

The potential does exist for a mobile equipment accident along the Haul Road. Haul trucks will travel daily from the Beaver Dam Mine Site to the Touquoy Mine Site, which is discussed in the Accident and Malfunction (Section 6.18). The number of return truck trips per day will be an annual average of approximately 190 for 16 hours per day, 350 days per year for the duration of the mine Project (5 years). The maximum number of truck trips will occur in years 2 to 3 of operations with significant reduction in year 1 and years 4 to 5. During construction (approximately 1 year), the number of trips will be less. The Haul Road will be dual lane and designed to facilitate the safe passage of two-way truck traffic at 70 km per hour. Speed limit and right-of-way signage will be installed, and all haul truck operators will receive operator training to minimize the risk of haul truck collisions. All intersections will be designed to NSTIR Standards. A haul truck accident may result in fuel and/or other spills, fires, and/or injury or death to site workers and the general public. Discussions with NSTAT will identify additional mitigation measures that may be required, in particular at the Hwy 224 crossing.

The economic and community benefits of this project are significant. The Project supports many of the provincial growth goals and the Atlantic Growth Strategy. Most adverse impacts identified by stakeholders are address through mitigations.

6.16.10.1 Touquoy Mine Site

The Touquoy facility is currently operational. There are no effects to socio-economic conditions anticipated to be caused by the processing of ore and the management of tailings (exhausted pit) from the Project. The primary effect of the continued use of the Touquoy facility on socio-economic conditions is the provision of employment for an additional four years in the processing facility.

6.16.11 Mitigation

Recreational activities that currently occur within the spatial boundaries of the Project, such as hunting and fishing, will, for safety reasons, be restricted during construction and operation. Recreational users will be notified of restricted access by signage at the entrance to the Beaver Dam Mine Site. Site restrictions will be within the PA and within the fly rock management area during blasting activities only. Liaison with local recreational groups, such as ATV associations, will be undertaken. Access to other recreational areas near the Beaver Dam Mine Site will be maintained through the construction of a series of bypass roads. Engagement with user groups will continue throughout the life of the project and operational procedures will be adjusted with advice of the user groups.

A potential adverse effect on socio-economic conditions is related to a risk for mobile vehicle accidents along the Haul Road, in particular at the Highway 224 crossing. Speed limit and right-of-way signage will be installed, and all haul truck operators will receive operator training to minimize the risk of collisions. Intersection requirements and additional mitigation measures will be determined through discussions with NSTIR.

Table 6.16-26: Proposed Mitigation for Socio-economic Conditions

Project Activity	Mitigation Measures
Construction	• Restriction of recreational activities within the spatial boundaries of the Project. Notification will be provided by signage. • Communication Plan to communication access information to key stakeholders (Sections 3 and 4 [Public Engagement and Indigenous Peoples Engagement, respectively]). • Liaison with any local recreation groups, such as ATV associations through an Ad Hoc group. • Equipment maintenance. • Reduction of mobile equipment accident risk through discussions with NSTIR, appropriate signage, and operator training.
Operation	• Restriction of recreational activities within the spatial boundaries of the Project. Notification will be provided by signage. • Liaison with local recreation groups, such as ATV associations. • Equipment maintenance. • Limiting haul truck operational hours to approximately 16 hours per day. • Reduction of mobile equipment accident risk through discussions with NSTIR, appropriate signage, and operator training. • Ongoing engagement with community associations, CLC and residents to assess and adaptively manage the site. • Potential housing and employment studies to monitor impacts on population growth and housing market.
Active Closure	• Ongoing engagement with community associations, CLC and residents to assess and adaptively manage the site.

6.16.12 Residual Effects and Significance

There are no significant adverse environmental effects anticipated on socio-economic conditions, once mitigation measures are applied. Positive impacts are anticipated in the form of direct and indirect employment, and tax revenues for municipal, provincial, and federal governments. Additionally, improvements to local roads will be completed as part of the Project, which will provide improved access to the region's interior.

Significant adverse environmental effect for Socio-economic Conditions are not predicted for the Project. This determination includes consideration of the ecological and social context of the LAA surrounding the Project:

- **During Construction:** Changes occur but are similar to those that have occurred or will occur in other areas of the LAA and in line with the ecological and social context of the LAA surrounding the Project.
- **During Operations:** Changes occur but are similar to those that have occurred or will occur in other areas of the LAA and in line with the ecological and social context of the LAA surrounding the Project.
- **During Active Closure:** Changes occur but are similar to those that have occurred or will occur in other areas of the LAA and in line with the ecological and social context of the LAA surrounding the Project.

Table 6.16-27: Residual Effects and Significance Rating Criteria

Criteria	Description of Ratings
Direction	• **Positive**: the change results a measurable positive effect • **Negative**: the change results a measurable negative effect • **Neutral**: there is no measurable change
Magnitude	• **Negligible**: the impact is not measurable or minimally measurable • **Low**: The impact has interaction if less than 3 other topic areas and can be measured within the LAA • **Medium**: The impact as interactions with more than 7 topic areas or 2 or more topic areas and can be measured within the LAA, and RAA • **High**: The impact has interactions all other themes and many topic areas and can be measured at the RAA level and beyond
Duration	• **Short-term**: effect is restricted to Construction Phase and EOM Phase • **Long-term**: Effect occurs in Construction Phase and EOM Phase and/or persists in PC
Geographical Extent	• **Discrete**: effect is limited to the Project Area (PA) • **Local**: effect is limited to the Local Assessment Area • **Potential Regional**: effect persists to the Regional Assessment Area
Reversibility	• **Reversible**: effect can be reversed • **Partially reversible**: effect can be partially reversed • **Irreversible**: effect cannot be reversed, is of permanent duration
Frequency	• **Intermittent**: VC interaction or effect will occur at irregular intervals throughout any Project Phase • **Regular**: effect occurs on a regular basis but not continuous basis • **Continuous**: effect occurs constantly (e.g., every model timestep in a given Project Phase).

Residual effects of the Project on the socio-economic VC identified are characterized using standard criteria, including magnitude, geographical extent, duration, frequency, reversibility, and context of the effect (Table 6.7-28). The residual effects assessment concludes with a determination of Significance. The screening of project effects, mitigation measures, and the projections regarding impacts are assessed in aggregate to determine whether the residual impacts are “Not Significant” or “Significant” according to the following definitions:

- **Significant Residual Effect:** have high magnitude, be of potential regional geographic extent and of medium to long term duration, occur at any frequency and partially reversible to irreversible.
- **Insignificant Residual Effect**: are negligible to moderate magnitude, are restricted to the PA, are intermittent or short term in duration, occur at any frequency and are reversible to partially reversible.

Table 6.16-28: Residual Environmental Effects for Socio-economic Conditions

Theme Areas	Topics within Theme Area	Linkages to other Plans and Guiding Documents	Pathway	Mitigation	Direction	Magnitude	Duration	Geographical Extent	Reversibility	Frequency	Residual Effect
Workforce Development	Training Opportunities	One NS Goal, Atlantic Growth Strategy	Apprenticeship training program and internal training opportunities provide opportunities for certifications and training.	N/A	Positive	L	Short Term	RAA	N/A	C	Insignificant
	Opportunities for Advancement within career	One NS Goal	Internal hiring and opportunities for graduates provided by AMNS employment opportunities, support career advancement.	N/A	Positive	L	Short Term	RAA	N/A	C	Insignificant
	New employment - direct and indirect	One NS Goal, Atlantic Growth Strategy	Beaver Dam will provide new employment opportunities, both through direct and indirect sources.	N/A	Positive	H	Short Term	LAA	N/A	C	Significant
	Labour Force attachment	One NS Goal	New high quality employment opportunities provide opportunities for working age people to attached to the labour force.	N/A	Positive	L	Short Term	RAA	N/A	C	Insignificant
	Impact on Educational Attainment	One NS Goal, Atlantic Growth Strategy; SDG	Apprenticeship training program supports educational attainment and providing opportunity for graduates of both NSCC and university programs.	N/A	Positive	N	Short Term	RAA	N/A	C	Insignificant
	Youth Employment Rate	One NS Goal; Halifax Partnership	Employment opportunities for young people (under 30) through both direct and indirect sources.	N/A	Positive	N	Short Term	RAA	N/A	C	Insignificant
	Suppliers	Halifax Partnership, One NS Goal	There will be need for suppliers from the local areas to provide supports, which may impact the suppliers labour needs.	N/A	Positive	M	Short Term	RAA	N/A	C	Significant
	Labour Force Attachment - Indigenous	One NS Goal; Halifax Partnership; KMKNO Pillars	MOU and IBA provide support to Mi'kmaq lead employment programs.	N/A	Positive	N	Short Term	RAA	N/A	C	Insignificant
Demographics	In-Migration	Halifax Partnership, One NS Goal, Atlantic Growth Strategy	New employment opportunities may attract new residents to the province.	N/A	Positive	N	Short Term	LAA	N/A	C	Insignificant
	Rural Re-Population	Halifax Partnership, One NS Goal	New employment opportunities may attract new residents to the LOA supporting communities that are seeing population declines.	Monitoring of population growth related to mine operations	Positive	N	Short Term	LAA	N/A	C	Insignificant
Healthy Communities	Hospitals	SDG	With new populations and industry, local hospital usage may increase.	N/A	Negative	N	Short Term	LAA	R	C	Insignificant
	Family Doctor Availability	SDG	New resident may impact family doctor availability.	N/A	Negative	N	Short Term	LAA	R	C	Insignificant
	Seniors Supports	SDG	Through Community investment AMNS has made and plans to continue to make investments to seniors related initiatives.	N/A	Positive	N	Short Term	LAA	R	I	Insignificant
	Schools	SDG	If rural re-population occurs, there may be an increase in school populations.	N/A	Positive	N	Short Term	LAA	R	C	Insignificant
	Recreational Facilities		Potential increase of recreational facilities or support for new recreation facilities planned for the area.	N/A	Positive	N	Short Term	LAA	R	I	Insignificant
	Housing	SDG	Impact on housing availability requires further study and is market dependent	Monitoring of population increase on housing market		U	Short Term	LAA	R		
	Climate Change and Energy	SDG					Short Term				
	Local Taxation	Once Nova Scotia	Direct and indirect benefits to the local, provincial and federal governments.	N/A	Positive	L	Short Term	LAA	R	C	Insignificant

Table 6.16-26: Residual Environmental Effects for Socio-economic Conditions (continued)

Theme Areas	Topics within Theme Area	Linkages to other Plans and Guiding Documents	Pathway	Mitigation	Direction	Magnitude	Duration	Geographical Extent	Reversibility	Frequency	Residual Effect
Land Use, Recreational	Snowmobiling and ATV Use	Halifax Partnership	Support and upgrades to existing and proposes off-road trail systems and potential partnership opportunities.	Construction of bypass roads.	Positive	N	Long Term	LAA	R	C	Significant
	Active Transportation	HRM Policies	Increased traffic on public roads in limited locations may create concerns about walking and biking safety.	Construction of bypass roads	Negative	N	Long Term	LAA	R	C	Significant
	Access to Camps		With the construction of a haul road, access to camps will be maintained or possibly improved.	Construction of bypass roads	Positive	N	Long Term	LAA	R	C	Significant
	Haul Road Safety		The existing haul road will have increase operational safety parameters which will improve the safety on the road by separating heavy traffic from recreational users, small vehicles and non motorized usage.	Construction of bypass roads	Positive	N	Short Term	LAA	R	C	Significant
	Noise		See section on noise.	See Chapter ???					R		
	Hunting and Fishing	Halifax Partnership	The haul road and mine site may impact hunting by altering migration patterns and by reducing hunting opportunities near the mine site and haul road, as required by the relevant act. Access to fishing areas will be improved, potentially leading to increased recreational fishing.	Construction of bypass roads	Negative	L	Short Term	LAA	R	C	Significant
Parks and Open Space, Tourism	Protected Areas and Wilderness Areas	Halifax Partnership	No impact.	N/A	Neutral	N	Short term	LAA	N/A	N/A	Insignificant
	Local Community Sites	SDG	No impact.	Protection of Date Rock	Neutral	N	Short Term	LAA	R	C	Insignificant
	Tourism Opportunities	Halifax Partnership, One NS Goal	Potential for increased attraction to the area to view mining related activities.	N/A	Positive	N	Short Term	LAA	N/A	N/A	Insignificant
	Regional Visitation	Halifax Partnership, One NS Goal	No anticipated impact.	N/A	Neutral	N	Short Term	LAA	N/A	N/A	Insignificant
Roads and Traffic	Traffic Impact		Increased traffic on public roads in limited locations may create concerns about walking and biking safety.	Access and Safety Plan	Negative	M	Short Term	LAA	R	C	Insignificant
	Road Infrastructure		Potential for improvements to public roads to address increased usage by proponent. Increased usage may result in negative impacts or degradation of public road infrastructure.	Insert language about paying for paving.	Negative and Positive	M	Long Term	LAA	R	C	Insignificant
	Private Road Infrastructure		Private road will be improved to a high standard, which will be left in place after mine operations cease.	N/A	Positive	N	Long Term	LAA	R	C	Insignificant
	Public Road Crossings		Improvements to road crossings at the haul road and highway 224.	Install crossings to allow access to other lands	Positive	N	Permanent	LAA	R	C	Insignificant
	Pedestrian Safety		Increased traffic on public roads in limited locations may create concerns about walking and biking safety.	Access and Safety Plan	Negative	N	Short Term	LAA	R	C	Insignificant
Impact on Government Revenues	Provincial Taxation and Benefits	One Nova Scotia	Direct and indirect taxation benefits to the province.	N/A	Positive	L	Short Term	RAA	R	C	Insignificant
	Federal Taxation and Benefits	Atlantic Growth Strategy	Direct and indirect taxation benefits to the province.	N/A	Positive	L	Short Term	RAA	R	C	Insignificant

Notes: Section 5.11, Table 5.11-1 and Table 6.16-27 for definitions of the below characteristics.

Magnitude		Geographic Extent		Timing		Duration		Frequency		Reversibility	
N	Negligible	LAA	Local Assessment Area	N/A	Not Applicable	ST	Short-Term – within life	O	Once	R	Reversible
L	Low	RAA	Regional Assessment Area	A	Applicable	LT	Long-Term Beyond life	I	Intermittent	IR	Irreversible
M	Moderate					P	Permanent	R	Regular		
H	High							C	Continuous		

6.16.13 Proposed Compliance and Effects Monitoring Program

Given the variability of COVID impacts and the complexity of modeling socio-economic impacts during this time of social and financial upheaval, AMNS's compliance and effects monitoring program includes the following:

- Ad-Hoc Committee for the development and monitoring of the Access and Safety Plan for the Haul Road.
- Housing Assessment study to assess impacts of AMNS staffing on local markets.
- Rural Impact Study to assess impacts of in-migration, job creation and economic activity on LAA

6.17 Assessment of Valued Components within Federal Jurisdiction

6.17.1 Introduction

6.17.1.1 Summary of Assessment of Valued Components within Federal Jurisdiction Before the Updates

This section summarizes the changes to the environment that may be caused by a Project on environmental components listed in paragraph 5(1)(a) of CEAA 2012. This includes fish and fish habitat as defined in the *Fisheries Act*, migratory birds as defined in the *Migratory Birds Convention Act, 1994,* and species designated by the *Species at Risk Act.*

6.17.1.2 Summary of Updates to Assessment of Valued Components within Federal Jurisdiction

The assessment of Valued Components (VCs) within Federal Jurisdiction on the Project has been updated to reflect updates of the Project Description (Section 2) and to address Round 2, Information Requests (IR2) issued by the Impact Assessment Agency of Canada (IAAC, formerly the Canadian Environmental Assessment Agency [CEAA 2019]) and Nova Scotia Environment (NSE 2019). This includes:

- adjustments to Project Description (Section 2);
- updates to reflect the modernized *Fisheries Act* and more detailed effects assessment, particularly related to evaluation of indirect effects to fish and fish habitat;
- updates to monitoring programs for Avifauna;
- development of a draft Wildlife Mitigation and Monitoring Plan (Appendix P.7) and associated Landbird Species at Risk (SAR) Mitigation and Monitoring Plan (Appendix A of Appendix P.7 [draft Wildlife Mitigation and Monitoring Plan]);
- development of a draft Lichen Mitigation and Monitoring Plan (Appendix P.6);
- ongoing and continued engagement with Mi'kmaq of Nova Scotia, key stakeholder grounds (i.e., community and recreational associations) and members of Public; and
- *Fisheries Act* Authorization will be required based on confirmed direct and indirect impacts to fish and fish habitat.

An outline of updates to the assessment of VCs within Federal Jurisdiction on the Beaver Dam Mine Project are summarized in Table 6.17-1.

Table 6.17-1: Updated Subsections from the 2019 Revised Environmental Impact Assessment - Assessment of Valued Components within Federal Jurisdiction

2019 Revised EIS Submission (February 28, 2019)	Updated in 2021	Corresponding 2021 EIS Update Section Number	Reason for Update
-	-	6.17.1 Introduction	• New
6.17.1 Environmental Effects within Federal Jurisdiction	Yes	6.17.2 Environmental Effects within Federal Jurisdiction	• Updates to for this subsection are outlined in the rows below
Numbered heading title was not used	Yes	6.17.2.1 Fish and Fish Habitat	• Updates to reflect the modernized *Fisheries Act* and more detailed effects assessment, particularly related to evaluation of direct and indirect effects to fish and fish habitat • Updates as a result of revisions to Project infrastructure (Section 2 Project Description), and IR2s
Numbered heading title was not used	Yes	6.17.2.2 Migratory Birds	• Updates to the Project Description (Section 2) • Updated monitoring program.
Numbered heading title was not used	Yes	6.17.2.3 Species at Risk	• Development of a Lichen Mitigation and Monitoring Plan • Project layout modification for infrastructure micro-sitting • Updates as a result of revisions to Project infrastructure (Section 2), and IR2s. • Development of a Wildlife Mitigation and Monitoring Plan and the associated Landbird SAR Mitigation and Monitoring Plan (Appendix A of Appendix P.7 Wildlife Mitigation and Monitoring Plan)
6.17.2 Environmental Effects on Federal or Transboundary Lands	No	6.17.3 Environmental Effects on Federal or Transboundary Lands	• N/A
6.17.3 Environmental Effects on Indigenous Peoples	Yes	6.17.4 Environmental Effects on Indigenous Peoples	• Ongoing and continued engagement
6.17.4 Power or Duty by Federal Authority	Yes	6.17.5 Power or Duty by Federal Authority	• *Fisheries Act* Authorization will be required based on confirmed direct and indirect impacts to fish and fish habitat
6.17.5 Environmental Effects Incidental of Decisions Made by a Federal Authority	No	6.17.6 Environmental Effects Incidental of Decisions Made by a Federal Authority	• N/A

Notes: - = no update; IR2s = Round 2, Information Requests; SAR = Species at Risk; EIS = Environmental Impact Statement; N/A = not applicable.

6.17.2 Environmental Effects within Federal Jurisdiction

This section summarizes those changes to the environment that may be caused by the Project on environmental components listed in paragraph 5(1)(a) of *CEAA 2012*. This includes fish and fish habitat as defined in the *Fisheries Act*, migratory birds as defined in the *Migratory Birds Convention Act, 1994,* and species designated by the *Species at Risk Act.* These VCs have been discussed in greater detail in Sections 6.9 (Fish and Fish Habitat), 6.12 (Avifauna), and 6.13 (Species of Conservation Interest and Species at Risk) and are summarized below. It is not anticipated that changes to the environment arising as a result of a federal decision will affect migratory birds or species at risk, once appropriate mitigation and compensation is considered. It has been determined that fish and fish habitat as defined in the *Fisheries Act* will require a federal authorization/decision. This is discussed in greater detail in the following sections.

6.17.2.1 Fish and Fish Habitat

Development of the Project will result in direct and indirect impacts to fish and fish habitat mostly within the construction phase of the Project during development of the open pit and its associated infrastructure. Impacts to fish and fish habitat are also expected during operations of the mine from on-going dewatering efforts within the open pit, surface water management of mine contact water, and resulting changes to flow patterns in adjacent stream systems.

Construction of the Haul Road is expected to result in direct impacts to fish and fish habitat mostly within the construction phase of the Project during clearing, grubbing and construction of new road components, culvert installation, and road widening where necessary. During construction, positive direct impacts to fish and fish habitat are also expected where current culverts that are hung or crushed can be either replaced or removed and fish passage and habitat re-established. All direct and indirect impacts to fish and fish habitat have been quantified and described in detail within this EIS with the understanding that a *Fisheries Act* Authorization will be required for the Project. These fish and fish habitat losses are included in the draft Fish Habitat Offset Plan (Appendix J.3).

Direct impacts to fish and fish habitat will result from dewatering lands that overly the open pit and associated infrastructure. Mitigation will be implemented to reduce the potential for direct fish mortality where fish are observed through fish rescue efforts prior to commencement of construction and completion of relevant construction activities. Construction activities will occur in confirmed fish habitat within approved timing windows for construction (June 1 to Sept 30) to reduce potential for mortality of eggs and juvenile fish, especially within Wetland 59. A preliminary fish rescue plan has been described in Section 6.9.8.2.2 and in IR2 response CEAA 2-11.

Maintaining water quality and quantity downstream in the Project (PA) and Local Assessment Area (LAA) is paramount for limiting broader fish and fish habitat impacts within each affected watershed associated with the PA. Water treatment is planned during construction to treat for metals associated with historic tailings to ensure that effluent discharge from the Beaver Dam Mine Site into Cameron Flowage/Killag River will comply with all regulatory guidelines to ensure the protection of aquatic health. Although water quality modelling does not predict exceedances of metals during operations this water treatment module will remain on site as a precautionary mitigation. In addition, a separate water treatment will be established on the Beaver Dam mine site to during operations to treat for elevated N species during operations. Indirect impacts to down-gradient watershed water quality and quantity within the PA and LAA that may affect fish and fish habitat are not expected from the Haul Road infrastructure (re-alignment and widening) once best management practices construction methods for culvert installation and mitigation strategies are implemented during road widening and re-alignment.

6.17.2.2 Migratory Birds

Project construction and operation will cause temporary and medium-term loss of habitat for birds and may cause disturbance or displacement of species. The baseline condition of the PA is a mix of disturbed habitats resulting from historical mining and forestry activities, and intact mixed wood forest habitats and wetlands. Habitat fragmentation may alter habitat suitability for those species which rely on interior forest conditions.

Lighting at the Beaver Dam Mine Site may cause disturbance or displacement of species, while attracting other species, or may cause general behavioral changes (DaSilva et al. 2015). For those species which may be attracted to lights (i.e., insectivores), lights may increase potential for direct mortality of these species or may increase habitat suitability by supplementing their source of prey.

Increased truck and vehicular traffic will increase noise levels, which may displace and/or disturb birds. Heavy machinery operation during open pit development, road construction, and construction of mine infrastructure will increase dust generation, which may affect surrounding vegetation and, consequently, birds (Farmer, 1993). Blasting and drilling of in-situ rock during open pit mining will increase dust emissions, which may affect surrounding vegetation and, consequently, birds (Farmer, 1993).

There is the potential for migratory bird mortality during clearing activities. Birds (particularly injured or fledglings) may get trapped in the open pit or collide with other Project infrastructure (crushers or trucks), which could lead to death or injury. Vehicle activity and heavy machinery operation may cause bird injury or mortality.

The overall effect of the Project on birds and bird habitat is assessed as not significant after mitigation measures have been implemented. Mitigation measures are detailed in Section 6.12.9.

6.17.2.3 Species at Risk

Three priority species have been identified or are expected to reside within watercourses in the PA (American eel, Atlantic salmon, and Brook trout). Although these species are not listed under provincial or federal endangered species legislation, Fisheries and Oceans Canada (DFO) has indicated that American eel and Atlantic salmon are currently being reviewed for protection under SARA. This is discussed further in the Fish and Fish Habitat Section 6.9.4.2.3. Standard mitigation and monitoring for fish and fish habitat (Section 6.9.8) will address direct and indirect effects to Atlantic salmon, Brook trout, and American eel.

Development of the Beaver Dam Mine Site and upgrading and construction of new sections of the Haul Road (Section 2, Figure 2.3-2) will result in direct impacts to vascular and non-vascular individuals and to flora communities at the full or partial forest stand level. Micro-siting of infrastructure has been completed to avoid priority flora and lichen species and has reduced the direct impact of the Project on flora and lichens. A Lichen Mitigation and Monitoring Plan has been developed (Appendix P.6).

The division and micro-siting of the waste rock storage areas (non-acid generating [NAG] waste rock and potential acid generating [PAG] waste rock) has relocated infrastructure out of the confirmed critical function zone for three historical locations of boreal felt lichen, south of the Beaver Dam Mine Site. The critical function zone is used to protect critical habitat for boreal felt lichen (NSLF, 2020).

Micro-siting and PA modifications of the Beaver Dam Mine Site has allowed for avoidance of all eight of the known locations of frosted glass-whiskers and reduced the number of individuals of blue felt lichen directly impacted from three to two, which are proposed for translocation (Appendix P.6). These two occurrences are located within the proposed NAG waste rock storage area and open pit area. Ten species of conservation interest (SOCI) lichen will be directly impacted by Beaver Dam Mine Site

infrastructure: six occurrences of salted shell lichen, two occurrences of slender monk's hood lichen and one eastern candlewax lichen. No priority vascular flora are anticipated to be directly impacted within the Beaver Dam Mine Site. The most recent Project design changes avoided two clusters of Wiegand's sedge by relocating the eastern waste rock storage area.

Within the Haul Road, no priority lichen species are anticipated to be directly impacted. One occurrence of southern twayblade within Wetland 161, is found withing the proposed alignment and is expected to be directly impacted.

Potential indirect impacts to vascular plants and lichens surrounding Project infrastructure will be reduced through best management strategies and mitigation measures.

Indirect effects to habitat and flora described in Section 6.10 are relevant to priority flora species as well. Lichens are sensitive to changing environmental conditions, particularly air quality. As such, Project activities may indirectly affect priority lichen species which have been avoided but exist near Project infrastructure. As mentioned, a draft Lichen Mitigation and Monitoring Plan (Appendix P.6) has been developed to monitor for changes in lichen health attributed to the Project.

Terrestrial fauna priority species of conservation interest and species at risk (SOCI/SAR) observed during field surveys within the PA include the mainland moose and the snapping turtle.

Development of the Beaver Dam Mine Site and associated upgrades to the Haul Road will result in direct impacts to habitat used by terrestrial fauna, including wetlands with suitable hibernacula for snapping turtles, and those with abundant submergent and emergent vegetation for mainland moose. A Preliminary Wetland Compensation Plan (Appendix H.3) has been developed to restore wetland habitat and snapping turtle and landbird SAR habitat. Sensory disturbance to terrestrial fauna would result from rock blasting, clearing and grubbing, infrastructure construction during the construction phase and, overall increased traffic, blasting, mining activities and trucking during operations within the PA. This may result in localized wildlife avoidance of the PA, including moose and snapping turtle. Direct mortality of priority fauna species could result from Project activities, particularly due to the increase in traffic during construction and operation of the facility. Increased traffic poses a risk to wildlife such as the mainland moose and snapping turtle along the entire length of the Haul Road between the Beaver Dam Mine Site and the Touquoy Mine Site. Indirect mortality to these species could also occur from exposure to contaminants or spills from unplanned incidents.

With appropriate mitigation and monitoring, no direct mortality of priority bird species is anticipated, with the exception of the low potential for a bird strike with a haul truck. Avian usage of the PA during construction and operation of the Beaver Dam Mine Site will largely be driven by changes to habitat, resulting in localized avoidance of the PA by some species. Some priority species may avoid the PA in favor of undisturbed habitat in the surrounding landscape. Other priority species are anticipated to be attracted to the mine infrastructure and newly created habitat.

Most direct and indirect impacts on birds, including SAR, are accounted for in general mitigation/monitoring for all birds, since many have legislated protection under the *Migratory Birds Convention Act* (primarily through avoiding clearing/grubbing during nesting season, and conducting detailed pre-construction nest searches if clearing or grubbing must occur during nesting season). These pre-construction nest searches are particularly important in wetlands which provide suitable breeding habitat for the Olive-sided Flycatcher, Canada Warbler and Rusty Blackbird. A draft Wildlife Mitigation and Monitoring Plan (Appendix P.7) and associated Landbird SAR Mitigation and Monitoring Plan has been developed (Appendix A of Appendix P.7).

6.17.3 Environmental Effects on Federal or Transboundary Lands

There are no federal or transboundary lands located within or adjacent to the PA. Given the distance from the Project site to federal lands and the analysis completed in Section 6, the Project has limited potential to result in a change to the environment on federal lands. The nearest federal lands to the PA are the Beaver Lake IR 17, located approximately 5 km from the Beaver Dam Mine Site and 3 km from the nearest point of the Haul Road.

6.17.4 Environmental Effects on Indigenous Peoples

Beaver Lake IR 17 is located approximately 5 km from the Beaver Dam Mine Site and 3 km from the nearest point of the Haul Road.

The Confederacy of Mainland Mi'kmaq (CMM) was retained in 2009 by GHD Limited on behalf of the AMNS to complete a Mi'kmaq Ecological Knowledge Study (MEKS) for the proposed Beaver Dam Mine Project. In 2015, CMM was retained to update the MEKS, due to changes in the Haul Road to include approximately 4 km of new construction. CMM was then retained again in 2016 to finalize the MEKS to include the revised PA and any additional information.

In addition to the MEKS cited above, in 2018, a Traditional Land and Resource Use Study (TLRUS; MFC 2019) was undertaken by Millbrook First Nation to document historical and current use of the Project Area and surrounding areas by the Millbrook First Nation. This document was shared with AMNS under a confidentiality agreement. AMNS has integrated information obtained from the TLRUS, with permission from Millbrook First Nation, in appropriate sections of the EIS.

There are several activities associated with the harvest and use of plants, animals and fish within the PA and in the LAA that relate to historical traditions and customs of the Mi'kmaq that are still practiced today. As described, the TLRUS (MFC 2019), the MEKS and residents of the Beaver Lake IR 17 identify trapping and hunting activities, plant and berry gathering, and fishing in, near and surrounding the PA for purposes of sustenance, spiritual and cultural practice. The TLRUS (MFC 2019) described the frequency of use within the LAA which can be summarized as regular: weekly to annually across all seasons. This means the area was, and still is, an important resource area for the Millbrook First Nation community members and by extension, all Mi'kmaq of Nova Scotia, and any Project activities may have potential impacts on the ability of the Mi'kmaq of Nova Scotia to access certain areas to practice their rights where species with important cultural relevance may be found. Wild meat was traditionally a staple of the Millbrook First Nation diet, and a few of the harvesters interviewed for the TLRUS (MFC 2019) indicated they rely mainly on this food source and they share their food with other community members, rather than purchase their meat at a local supermarket.

Some Mi'kmaq community members have camps on Crown land where they go to enjoy peaceful recreational and traditional activities with family and community members. There are five camps documented within 1 km of the Haul Road and multiple other camp locations throughout the LAA (MFC 2019).

Additional details on potential impacts to traditional harvesting is provided in Section 6.14 and the Human Health Risk Assessment (Appendix C.2).

There will be a reduction in area available for hunting, trapping, gathering, fishing, spiritual ceremonies and other Millbrook and broader Mi'kmaq traditional activities within the Beaver Dam Mine Site and Haul Road. The infrastructure footprint (mine site and haul road) will result in direct habitat loss and the Project will restrict access within a proposed property boundary/compliance boundary for a period of eight years.

Additionally, due to the proximity of the Beaver Dam Mine Site and Haul Road to traditional harvesting areas as discussed in the TLRUS (MFC 2019) and MEKS, there will potentially be an area outside of the Beaver Dam Mine Site and Haul Road where Millbrook community members and other Mi'kmaq hunters may observe a changed pattern of wildlife movement. This area has been identified as a potential wildlife environmental effects zone. Within close proximity to the proposed property boundaries of the Beaver Dam Mine Site and Haul Road, there is the potential for sensory disturbance to wildlife and birds from noise and light above background conditions resulting in potential changes to wildlife patterns and by extension, hunting practices for the Mi'kmaq of Nova Scotia. There are limited Project effects expected to hunting, gathering and trapping activities beyond the potential Wildlife Environmental Effects Zone.

The Mi'kmaq may experience hunting limitations near the Beaver Dam Mine Site and Haul Road for the use of firearms. Participants in the TLRUS described how they might be displaced along the Haul Road and in proximity to the Beaver Dam Mine Site where they "may feel uncomfortable using their firearms for safety reasons" (MFC 2019, p. 54). This limited firearms zone is shown on Figure 6.14-5 and demonstrates the maximum potential "loss of harvesting area for those individuals who do not feel comfortable shooting towards an active mine or haul road" (MFC 2019).

These impacts are predicted to be low magnitude, as defined in Section 6.14.6.2 and in consideration of mitigation and accommodation. A low magnitude change is defined (in part) by an observable change in the availability and baseline condition of the lands and resources for traditional purposes for a short temporal window (<20 years) and with commitment to appropriate and negotiated accommodation and compensation with the affected Mi'kmaq community(s).

6.17.5 Power or Duty by Federal Authority

Should the Project require a federal authority to exercise a power or perform a duty, Section 5(2)(b) of *CEAA, 2012* requires the following environmental effects to be considered:

a) *a change, other than those referred to in paragraphs (1)(a) and (b) [of Section 5, CEAA 2012], that may be caused to the environment and that is directly linked or necessarily incidental to a federal authority's exercise of a power or performance of a duty or function that would permit the carrying out, in whole or in part, of the physical activity, the designated Project or the Project; and*

b) *an effect, other than those already described related to aboriginal peoples, of any change referred to in paragraph (a) on*

   i. *health and socio-economic conditions;*

   ii. *physical and cultural heritage; or*

   iii. *any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.*

Any physical activities in wetlands, watercourses or waterbodies may require authorization in accordance with the *Fisheries Act*.

For the Beaver Dam Mine Project, within the Beaver Dam Mine Site, the project team has conservatively calculated a maximum HADD of 415.75 HEU of fish habitat to support the mine development (direct and indirect impact to confirmed fish habitat based on watercourse and wetland characterization, electrofishing and manual fish collection results).

There is also potential for indirect impacts to additional fish habitat surrounding the Project. However, with proper mitigation and monitoring techniques employed (Section 6.9.8 and 6.9.10), the likelihood of this occurring is low.

The predicted residual environmental effects of Project development, operations and active clos on fish and fish habitat are determined to be adverse, but not significant. The overall residual effect of the Project on fish and fish habitat is assessed as not significant after mitigation measures have been implemented, including proposed offsetting measures. During permitting, detailed design will focus on reduction of impact to fisheries resources as much as is possible. A *Fisheries Act* Authorization will be required, based on confirmed direct impacts to fish and fish habitat associated with the mine development infrastructure, and the upgrade and new construction associated with the Haul Road.

6.17.6 Environmental Effects Incidental of Decisions Made by a Federal Authority

Section 5(2)(b) of *CEAA, 2012* identifies that if the Project requires a federal authority to exercise a power or perform a duty or function required by an Act to allow the Project to proceed, environmental effects must be taken into account, including effects on the following:

a) Health and socio-economic conditions;

b) Physical and cultural heritage; or

c) Any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.

As a result of the predicted residual environmental effects on fish and fish habitat, associated changes to the environment are described in accordance with 5(2) of *CEAA 2012*. Table 6.17-2 described the linkages to relevant VCs (if any), where the related effects assessment is present within the EIS, and additional effects assessment, if necessary.

Table 6.17-2: Linkages to Environmental Effects Assessment for Relevant Valued Components

Federal Permit/Decision Required	Project Component(s)	Linkage to Other Valued Component	Effects Evaluation Location in EIS	Additional Evaluation Needed
Fisheries Act Authorization	Waste Rock Storage Area, Stockpiles and Open Pit within mine footprint. Haul Road upgrades and new construction	Wetlands	Section 6.8	none
		Surface Water	Section 6.7	none
		Groundwater	Section 6.6	none
		Habitat/Flora	Section 6.10	none
		Terrestrial Fauna	Section 6.11	none
		Birds	Section 6.12	none
		Species at Risk	Section 6.13	none

Note: EIS = Environmental Impact Statement.

The Beaver Dam Mine Site is currently accessible through a network of existing forestry access roads, and small truck/ATV trails. Several camps and site of community importance have been identified through engagement efforts. The mine site land is owned either by Northern Timber or the Crown. Land directly adjacent to the mine site is leased by the Nova Scotia Salmon Association for a lime doser and the Proponent has committed to work with the NSSA to provide access to this site. Forestry activity surrounding the PA has been significant. The Haul Road has multiple owners , which the two largest being the Crown and Northern Timber. Prest Bros Ltd and Musquodoboit Lumber company own lands near the entrance to the Haul Road from Mooseland Road, but AMNS has secured a lease with both companies. The Proponent also owns a small piece of land within the PA, along the Haul Road.

The PA is located outside a populated centre, with the nearest locality being the small community of Mooseland located at the intersection of the Mooseland Road and the Haul Road. There is significant recreational activity in and around the PA, both from

organized recreational groups and from permanent and seasonal residents of the area. The Mi'kmaq also use the area for traditional activities, such as harvesting, hunting and fishing . Through engagement, the Proponent has been informed that the area near the mine site and haul road is popular for hunting and fishing. The trail system that crosses both the mine site and the haul road is used by owners of camps for access and forms part of the provincial snowmobile/ATV network.

Loss of fish habitat within the mine footprint will result from the development of the open pit, waste rock storage areas and other temporary stockpiles. First order stream habitat and associated headwater and throughflow wetland habitat will be directly disturbed and/or altered to support the development of the mine, which is described in Section 6.9. Wetland habitat that will be altered has been determined to support passage for fish, refuge habitat for fish, and feeding habitat for fish. Several wetlands also have sufficient depth to potentially support overwintering populations of fish. These wetland habitats do provide some hiking, berry picking, bird watching, hunting and recreational opportunities, but provide limited to no fishing opportunities. As a result, the potential effect of a *Fisheries Act* Authorization on Indigenous and non-Indigenous health and socio-economic conditions (e.g., reduction of fishing activity) is expected to be very low due to the loss of fish habitat associated with the mine development.

6.18 Accidents and Malfunctions

6.18.1 Summary of Accidents and Malfunctions Before the Updates

Accidents and malfunctions have the potential to occur through every phase of the Project. To decrease the likelihood of occurrence and level of magnitude should these accidents and malfunctions occur, AMNS will implement a preventative system approach to environmental protection, and worker health and safety. Contractors will be subject to the same health, safety, and environment policies and procedures, and all personnel (employees and contractors) will receive site specific training to prevent and mitigate workplace accidents and malfunctions. The health, safety, and environment policies and procedures implemented for the Touquoy Project will be extrapolated to the Beaver Dam Mine Project and made site specific, where required.

Accidents and malfunctions that have the potential to occur through every phase of the Project were described and an analysis of the risks/hazard assessment was applied to determine effects. The assessment focused on the following:

- Structural Failures (i.e., slope failures);
- Settling Pond Failure;
- Infrastructure Failure;
- Accidents (i.e., fuel and other spills);
- Unplanned Explosive Events;
- Mobile Equipment Accident; and
- Other Malfunctions (i.e., forest fires).

The effects assessment is based on risk/hazard matrix to likelihood of occurring an event occurring. The key is the implementation of design criteria and emergency response planning necessary to prevent accidents and malfunctions from occurring. The emphasis is placed on design criteria as well as emergency preparedness and response.

6.18.2 Summary of Updates to Accidents and Malfunctions

The Accident and Malfunctions section is updated to reflect changes in the Project Description, including advancement of detailed engineering as well as responses to Round 2, Information Requests (IR2s) (e.g., CEAA 2-15 to CEAA 2-18). The IR2s requested additional information on settling pond failures, fuel spills associated with transport and other accidents. Updates to the Accident and Malfunctions Sections are summarized in Table 6-18-1.

Engineering of the settling ponds have been advanced since the Revised 2019 EIS (AMNS 2019) to include design criteria that addresses both major storm events and climate change. In addition, there is contingency planning that includes additional spillways, shut off valves to stop discharge to Cameron Flowage and pumping system to direct water to the north settling pond or open pit. Engineering has also been advanced for permanent (e.g., non-acid generating [NAG] and potential acid generating [PAG]) and temporary stockpiles (e.g., topsoil, till and organic). A geotechnical assessment of stockpile designs has been undertaken by Golder (2021; included as Appendix A.2a) to review potential for slope failures, safety factors, stability, and susceptibility to other risks (i.e., seismic). The assessment concluded that the design parameters are within acceptable safety factor and will be stable. Currently a geotechnical assessment by Golder (In Progress) of the open pit design to evaluate safety factor, stability and risk and hazards associated with the overall design.

Accidents and Malfunctions has been updated to consider design and operations environmental protections as well as contingencies and emergency response planning. The methods have been adjusted slightly from the Revised 2019 EIS to provide more clarity however accidents and malfunctions lends itself to a risk hazard assessment, which is standard practice in assessing potential accidents and malfunctions in mining (Tubis et al. 2020, Asgarian et al. 2017, Bach et al. 2016). The emphasis is on prevention, environmental controls and procedures and contingency to mitigate the risk.

Table 6.18-1: Updated Subsections from the 2019 Revised Environmental Impact Statement – Accidents and Malfunctions

2019 Revised EIS Submission (February 28, 2019)	Updated in 2021	Corresponding 2021 EIS Update Section Number	Reason for Update
-	-	6.18.1 Summary of Accidents and Malfunctions Before the Updates	• New • Summary of Revised 2019 EIS results
-	-	6.18.2 Summary of Updates to Accidents and Malfunctions	• New • Summary of Updated 2021 EIS
Numbered heading title was not used immediately after the main section heading (i.e., 6.18 Accidents and Malfunctions)	Yes	6.18.3 Introduction	• Minor updates to provide additional context and reference to IR2s
6.18.1 Assessment Methodology	Yes	6.18.4 Assessment Methodology	• Minor updates to indicate standard practices for assessment of accident and malfunctions in Environmental Assessment (CEAA 2-15)
6.18.2 Hazard Identification	Yes	6.18.5 Hazard Identification	• Minor updates to hazard classification to be in line with industry standards
6.18.3 Structural Failures	Yes	6.18.6 Structural Failures	• Updates based on design criteria and environmental considerations (CEAA 2-15, CEAA 2-16,
6.18.4 Accidents	Yes	6.18.7 Accidents	• Updates to Address CEAA 2-15, CEAA 2-16, CEAA 2-17, and CEAA 2-18, expanded discussion to include additional details to address slope failures fuel transport and potential release of fuels from storage facilities
6.18.5 Other Malfunctions	Yes	6.18.8 Other Malfunctions	• Minor Updates (CEAA 2-18)
6.18.6 Risk Assessment	Yes	6.18.9 Risk Assessment	• Updates to risk assessment criteria to be in line with industry practices
6.18.7 Discussion	Yes	6.18.10 Discussion	• Minor updates to conclusion

6.18.3 Introduction

Accidents and malfunctions, Section 19(1) of the Canadian *Environmental Assessment Act, 2012* (CEAA 2012) states:

> *"The environmental assessment of a designated project must take into account the following factors:*
>
> a) *the environmental effects of the designated project, including the environmental effects of malfunctions or accidents that may occur in connection with the designated project and any cumulative environmental effects that are likely to result from the designated project in combination with other physical activities that have been or will be carried out;*

b) *the significance of the effects referred to in paragraph (a)".*

Accidents and malfunctions refer to events that are not part of any planned activity or normal operation of a project that is proposed by a proponent. Many accidents and malfunctions are preventable, and their consequences can be severely limited by applying a precautionary approach during planning and design, establishing environmental controls and standard operating procedures, applying mitigation measures and developing a comprehensive emergency response. Accidents and malfunctions, however, still have the potential to occur and create adverse effects to the environment and worker health even with the implementation of best management practices and preventative measures. Identifying likely worst-case accidents and malfunctions and assessing their effects should they occur, AMNS can develop preventative and responsive procedures to reduce or control adverse effects caused by unplanned events resulting from accidents and malfunctions. Preventative and responsive procedures will be developed via the following principles:

- worker health and safety will be the central focus of process and mine safety management;
- best management practices and proven technologies will be utilized to undertake the Project and all planned releases to the environment and their effects will be properly managed;
- implement environmental protections and controls as well as planned contingencies to address unplanned events;
- undertake reviews of engineered structures to ensure they achieve safety and stability requirements;
- develop and apply procedures and training that will aim to promote safe operation of mining equipment and facilities; and
- develop and implement emergency response procedures that will reduce and control the adverse effects of an accident or malfunction.

The Project will be designed to implement preventative (i.e., environmental protection and controls as well as contingency as part on mine planning) and mitigation procedures throughout life of mine that will minimize the potential for accidents and malfunctions to occur. Should those accidents or malfunctions occur, emergency response procedures would be implemented to, reduce or control the resulting adverse effects. Control and contingency measures are included in the design of the Project.

6.18.4 Assessment Methodology

The assessment of effects from potential accidents and malfunctions were based on a credible worst-case scenario, which employs a risk-based approach that involves identifying hazards associated with Project infrastructure and activities, as well as the consequences should those hazards create an accident and malfunction. The identification of hazards was completed utilizing the operational expertise, best management practices, and consulting other projects similar to the Project. The identification of worst-case scenarios/consequences were determined using a qualitative risk assessment to determine the likelihood that hazards would create an accident and malfunction and determining the level of magnitude of those accidents and malfunctions should they occur.

Accidents and malfunctions that are considered either likely to occur, or have a significant effect should they occur, are included in this assessment. For each potential accident and malfunction, the following details will shape the effects assessment:

- a threshold for determination of significance is provided to set a benchmark for significance of an accident and malfunction;
- the interactions between the accident and malfunctions and specific VCs and the resulting effects are discussed in reference to their significance.
- mitigation measures are presented and designed to prevent the occurrence of accidents and malfunctions; and

- preliminary emergency response measures are discussed to lessen the magnitude of accidents and malfunctions should they occur.

Accidents and malfunctions have the potential to occur through every phase of the Project. To decrease the likelihood of occurrence and level of magnitude should these accidents and malfunctions occur, AMNS will implement a preventative system approach to environmental protection and worker and health and safety. Contractors will be subject to the same health, safety, and environment policies and procedures, and all personnel will receive site specific training to prevent and mitigate accidents and malfunctions. AMNS has developed an Environmental Management System and Health and Safety Plans at the fully approved and operating Touquoy Gold Project. These Plans will extend to the activities at the Beaver Dam Mine for all phases of the processing of ore from the Project. These plans will be examined and refined where needed to reflect BMP prior to the time that the Beaver Dam ore is processed at the Touquoy Mine Site. Revised versions of these Plans will also be developed specific to the Beaver Dam Mine Site and operations.

This methodology has also been utilized for a number of other mining-related undertakings which were subject to a proponent environmental assessment that were reviewed by Federal and Provincial government agencies in other jurisdictions including but not limited to *Ontario Environmental Assessment Act, BC Environmental Assessment Act*, Mackenzie Valley *Resource Management Act* and other stakeholders.

6.18.5 Hazard Identification

Nearly all Project components and activities outlined in Sections 2 of this EIS, including the processing activities at the Touquoy mine of ore from Beaver Dam Mine Site, have the potential to create accidents and malfunctions give ideal conditions; however, the likelihood is often extremely low. Those hazards considered to have the greatest likelihood to create an accident and malfunction, or have a significant effect should those accidents and malfunctions occur are outlined by phase in Table 6.18-2.

Table 6.18-2: Summary of Potential Accidents and Malfunctions

Hazard Categories	Potential Accidents and Malfunctions Scenarios	Site Preparation and Construction	Operation and Maintenance	Active Closure and Monitoring
Structural Failures	Open Pit Mine Slope Failure	○	●	○
	Stockpile Slope Failure	○	●	○
	Settling Pond Failure	○	●	○
	Infrastructure Failure	○	●	○
Accidents	Fuel and/or Other Spills	●	●	○
	Fuel Release during Truck Transportation	●	●	○
	Fuel Release from Storage Facilities and Dispensing Areas	●	●	○
	Transportation Accident – Hazardous Materials (excluding fuel)	●	●	○
	Transportation Accident –Non-hazardous Materials	●	●	○
	Unplanned Explosive Event	○	●	N/A -
	Mobile Equipment Accident	●	●	○

Table 6.18-2: Summary of Potential Accidents and Malfunctions (continued)

Hazard Categories	Potential Accidents and Malfunctions Scenarios	Site Preparation and Construction	Operation and Maintenance	Active Closure and Monitoring
	Tailings and Reclaim Water pipeline Spills at Touquoy	N/A	●	N/A
	Cyanide Spills at Touquoy	N/A	●	N/A
Other Accidents and/or Malfunctions	Forest and/or Site Fires	●	●	○

Notes: Potential for Adverse Effects: ● = High potential for adverse effects; ○ = Low potential for adverse effects; N/A = not applicable.

6.18.6 Structural Failures

6.18.6.1 Open Pit Mine Slope Failure

All phases of the Project have the potential for structural failures of slopes within the footprint of the open pit. The potential slope failures are as follows:

- failure of overburden slopes caused by erosion from vegetation stripping and surface water runoff; and
- failure of bedrock faces caused by improperly designed benches and erosion/fracturing from groundwater inflow.

A worst-case scenario is the severe collapse of areas directly adjacent to the open pit and ground surface slump of the surrounding area possibly affecting the site's infrastructure, Haul Roads, and on-site access roads and worker safety. However, the site's components and infrastructure have been designed as far from the perimeter of the open pit as possible so it is not expected that slope failure would affect the site's components and infrastructure.

During the initial stages of site preparation and construction, potential slope failures caused by erosion from vegetation stripping and surface water runoff will be limited to overburden; however, as blasting, and ore and non-ore bearing waste rock extraction commences, bedrock faces have the potential to fail if not properly designed and groundwater inflow is not properly managed. Based on the current delineation of ore, the mine will be excavated through bedrock to an end depth of approximately 170 m below ground surface. Currently, bench heights of 10 m are designed with 8 m wide berms placed every two benches. Actual bench face angles will be implemented for specific depths and zones of the open pit as prescribed by a qualified professional based upon a geotechnical study (Golder 2021, In Progress).

Geotechnical work has been completed at the Touquoy site and the expertise gained from working with these materials will be applied to the final design of the Beaver Dam disturbed areas using actual geotechnical data collected at Beaver Dam to supplement the abundant public information available. The soil and bedrock at the site are well understood from a geotechnical and construction standpoint including extreme conditions such as drought, freeze-thaw cycles, and weather (high rainfall events or storm events and wind). All of these "extreme" factors have been accounted for in the design of the Project and will be for all phases of the Project.

A geotechnical assessment on slope stability is currently being undertaken by Golder (2021, In Progress). The assessment will determine safety factor among other variables of the overall stability of the pit slopes. The design of the open pit may be modified based on this assessment.

6.18.6.1.1 Threshold for Determination of Significance

The criteria that would determine a significant effect should an overburden or bedrock slope fail, is based primarily on worker health and safety, and secondarily on property damage. Should a slope failure result in injury or death to a worker, or loss of mobile equipment the event will be considered significant.

6.18.6.1.2 Potential Interactions and Effects

The potential interactions between an open pit mine slope failure and VCs are outlined in Section 5.8, Tables 5.8-1 to 5.8-3. Additional detail by VC is outlined in Table 6.18-3. Only those interactions with a high potential to cause adverse effects should they occur are discussed in detail.

Table 6.18-3: Open Pit Mine Slope Failure Interactions with Valued Components

Valued Component	Potential Open Pit Mine Slope Failure and Valued Component Interaction	Potential for Adverse Effects
Noise	No potential interaction anticipated	-
Air	Failure of overburden slopes could potentially cause temporary dust generation	Low
Light	No potential interaction anticipated	-
Greenhouse Gases	No potential interaction anticipated	-
Geology, Soil, and Sediment Quality	No potential interaction anticipated	-
Surface Water Quality and Quantity	No potential interaction anticipated	-
Groundwater Quality and Quantity	No potential interaction anticipated	-
Wetlands	No potential interaction anticipated	-
Fish and Fish Habitat	No potential interaction anticipated	-
Habitat and Flora	No potential interaction anticipated	-
Avifauna	No potential interaction anticipated	-
Terrestrial Fauna	No potential interaction anticipated	-
Species of Conservation Interest and Species at Risk	No potential interaction anticipated	-
Mi'kmaq of Nova Scotia	No potential interaction anticipated	-
Physical and Cultural Heritage	Failure of overburden slopes could potentially cause destruction of archaeological, historical, and paleontological sites	Low
Socio-economic Conditions	Failure of overburden slopes and bed rock faces could potentially result in injury or death to mine workers	High

Note: - = not applicable.

Dust generated from the failure of an open pit slope would be temporary and localized to the area directly around the slope failure. In addition, the physical and cultural heritage artifacts in the area of any open pit slope failure are likely to be identified during mine development. As a result, potentially adverse effects to the atmospheric environment and physical and cultural heritage are considered low.

Surface mines with improperly designed benches and slopes and poor surface water and groundwater management pose a health and safety risk to workers during the site preparation and construction, and operation and maintenance phases, as well as a financial liability risk related to mobile equipment damage or loss.

The maximum effect of an overburden or bedrock face slope failure as it relates to worker health and safety would be a death caused by falling objects. The maximum effect of an overburden or bedrock face slope failure as it relates to financial liability would be a total loss of one or more pieces of mobile equipment.

Overburden or bedrock face slope failure may also occur during the decommissioning and reclamation/closure phase of the Project as the open pit fills with water via surface water runoff and groundwater inflow. Surface water runoff may erode overburden to a point of failure, while groundwater inflow may weaken major bedrock joints or discontinuities and cause a failure. However, as this decommissioning activity is passive, it will not involve direct interaction between workers and slopes and given a lack of environmental receptors in the open pit and that all effects from a slope failure will be contained to the open pit, potential adverse effects to other VCs from an overburden slope failure or bedrock face failure are anticipated to be non-existent.

6.18.6.1.3 Mitigation and Emergency Response

Regional and site-specific drilling has encountered bedrock materials that consist mainly of metamorphosed sedimentary rocks of the Goldenville Group. These materials are very stable and widely used in Nova Scotia for road materials and situations where erosion resistant materials are needed. Abundant highway construction projects leave these strata at vertical or near vertical with limited issues of stability.

A daily inspection of pit slopes by qualified personnel will be undertaken for any work area within the pit prior to employees or machinery entering. It is proposed to have an independent qualified professional review the slopes on a quarterly basis. Pit slopes are based on recommendations of the qualified professional with appropriate design safety factors applied. Slopes will be monitored throughout the life of the operation.

A berm surrounding the open pit will direct surface water runoff into a water diversion channel that discharges to the settling pond to the west. The berm will be keyed into the bedrock to prevent shallow groundwater flow and/or surface water originating in Cameron Flowage from entering the open pit. An in-mine water diversion ditch will be established along the top bench of the mine to intercept any surface water that infiltrates the berm and flows into the mine. This ditch will direct water to in-mine sumps where it will be pumped out of the mine.

Based on the current delineation of ore, the open pit will be excavated through bedrock to an end depth of approximately 170 m below ground surface. Bench heights and bench face angles prescribed by a geotechnical study (Golder *In Progress*) will be implemented for specific depths and zones of the open pit.

If slope failure were to occur, emergency procedures would be implemented that will be outlined in the site emergency response plan. Generally, slope failure emergency response includes evacuation of all equipment and personnel from the area and areas up-slope and down-slope from the slope failure area. An assessment is then made using on-site staff and possibly external resources (geotechnical specialists) to make a determination if the area can be accessed to make repairs, what repairs are needed and actions to prevent future incidents. This will be detailed in a recovery plan. Depending on the regulator involvement there may be a requirement to file incident reports with certain regulatory agencies prior to initiating the repairs and return to work in the area; these are very case specific and often dependent on whether personnel were injured or equipment damaged as a result of the slope failure.

6.18.6.2 Stockpile Slope Failure

All phases of the Project have the potential for structural failures of topsoil, till, and waste rock stockpile slopes. Failure of these slopes may be caused by improperly designed lifts, and erosion from surface water runoff.

Worst-case scenario resulting from stockpile slope failure would be disturbance to surrounding area, including the potential for mine rock and low-grade ore to enter nearby watercourses, damage to infrastructure and worker safety. As discussed below, stockpiles will be constructed in a way to reduce the consequences of the worst-case scenarios.

Topsoil stockpiles will be constructed to completion in single lifts of 10 m with 1.5:1 active slopes during the preparation and construction phase. They will be removed through use in progressive reclamation of the till and waste rock stockpiles during operation and maintenance and will have no significant presence prior to or shortly after decommissioning and reclamation commences.

Till stockpiles will be constructed to completion in single lifts of 15 m with 1.5:1 active slopes during the preparation and construction phase. They will be progressively capped with topsoil excavated from the open pit area and hydro seeded at the end of operations. This should allow for revegetation to being prior to or shortly after the decommissioning and reclamation commences.

The waste rock stockpile will be constructed in multiple lifts of 10 m with each lift having an active slope of 2:1. Construction of the waste rock stockpile will begin during the site preparation and construction phase and will be completed prior to or shortly after the decommissioning and reclamation phase commences. The waste rock stockpile will be progressively capped with topsoil excavated from the open pit area and hydro seeded during the decommissioning and reclamation phase.

Ore stockpiles will be constructed in 15 m lifts with 1.5:1 active slopes during the operation and maintenance phase. High-grade ore will be stockpiled near the crusher on the ROM and facilities pad. The high-grade ore stockpiles will be continually added to by mine trucks and subtracted from by front end loaders. Low-grade ore will be stockpiled east of this area and will remain until near the end of the operation and maintenance phase. All ore stockpiles will be removed prior to the decommissioning and reclamation phase.

Slope failures from stockpiles including waste rock, ore and till stockpiles have been considered and assessed. The stockpiles are situated at least 30 m away from the Cameron Flowage. The stockpiles have been designed to consider climate changes and seismic conditions and are engineered to a recognized industry standard. A geotechnical stability assessment has been undertaken by Golder (2021; included as Appendix A.2a) to evaluate the design criteria for waste rock, till and organic stockpiles. The results of the assessment indicate that they do not represent a safety risk or stability risk. The following provides a summary of description of design considerations and operations environmental protections that will be established to manage slope failures during construction and operations.

6.18.6.2.1 Design and Operation Environmental Protections

A number of design and operation environment protection have been considered to prevent a slope failure these include but not limited to the following:

- Waste rock and stockpile slopes are designed to meet a safety factor of at least 1.5.
- Internal roads will be designed to provide internal drainage and help dissipate construction induced pore pressure within the pile.
- If appropriate during final design, instrumentation may be installed to record pore pressures and deformation of the underlying ground and mineral waste in order to provide an early warning of potential failure.

- Daily inspections, at a minimum, will be undertaken to check for slumping and instability.
- The perimeter runoff collection ditches and sedimentation ponds will allow runoff management by capturing stockpile runoff in ditches and allowing it to settle in ponds prior to discharge to the environment.

6.18.6.2.2 Contingency and Emergency Response Procedures

In the unlikely event of a slope failure, an emergency response action plan will be implemented. Once the failure area is secured, and depending on the scale of the failure, the stockpile slope will be recontoured in place. If any material migrated as far as the perimeter ditch, it would be excavated and returned to the stockpile and if required the drainage ditches repaired. If the slope failure caused effluent in the perimeter ditching to spill, silt fencing could be deployed downstream of the spill to prevent sediment laden waters from entering a watercourse.

6.18.6.2.3 Threshold for Determination of Significance

The criteria that would determine a significant effect should a stockpile slope fail, is based primarily on worker health and safety, and secondarily on property damage and environmental effects. Should a slope failure result in injury or death to a worker, a loss of mobile equipment, or a release of low pH surface water to the environment the event will be considered significant.

6.18.6.2.4 Potential Interactions and Effects

The potential interactions between a stockpile slope failure and the VCs are outlined in Section 5.8, Tables 5.8-1 to 5.8-3. Additional detail by VC is outlined in Table 6.18-4. Only those interactions with a high potential to cause adverse effects should they occur are discussed in detail.

Table 6.18-4: Stockpile Slope Failure Interactions with Valued Components

Valued Component	Potential Stockpile Slope Failure and Valued Component Interaction	Potential for Adverse Effects
Noise	No potential interaction anticipated	-
Air	Failure of overburden slopes could potentially cause temporary dust generation	Low
Light	No potential interaction anticipated	-
Greenhouse Gases	No potential interaction anticipated	-
Geology, Soil, and Sediment Quality	Failure of waste rock and ore stockpile slopes could potentially alter acid rock drainage (ARD) mitigation measures and discharge to settling ponds	Low
Surface Water Quality and Quantity	Failure of waste rock stockpile and ore slopes could potentially alter ARD mitigation measures and discharge to settling ponds	Low
Groundwater Quality and Quantity	No potential interaction anticipated	-
Wetlands	Failure of waste rock and ore stockpile slopes could potentially alter ARD mitigation measures and discharge to settling pond	Low
Fish and Fish Habitat	Failure of waste rock stockpile slopes could potentially alter ARD mitigation measures and discharge to settling ponds	Low
Habitat and Flora	No potential interaction anticipated	-
Avifauna	No potential interaction anticipated	-
Terrestrial Fauna	No potential interaction anticipated	-

Table 6.18-4: Stockpile Slope Failure Interactions with Valued Components (continued)

Valued Component	Potential Stockpile Slope Failure and Valued Component Interaction	Potential for Adverse Effects
Species of Conservation Interest and Species at Risk	No potential interaction anticipated	-
Mi'kmaq of Nova Scotia	No potential interaction anticipated	-
Physical and Cultural Heritage	No potential interaction anticipated	-
Socio-economic Conditions	Failure of stockpile and ore slopes could potentially result in injury or death of mine workers	High

Note: - = not applicable.

Dust suspended from the failure of a stockpile slope would be temporary and localized to the area directly around the slope failure. In addition, production and discharge of ARD to receiving watercourses in the area is unlikely due to all surface water runoff being directed to settling ponds for treatment and monitoring prior to discharge to the environment. As a result, potentially adverse effects to the atmospheric environment, geology, soil, and sediment, surface water quality and quantity, wetlands, and fish and fish habitat are considered low.

Improperly designed stockpiles with poor surface water management pose a health and safety risk to workers and a financial liability risk related to mobile equipment damage or loss through all phases of the Project.

The maximum effect of a stockpile slope failure as it relates to worker health and safety would be a death caused by falling objects. The maximum effect of a stockpile slope failure as it relates to financial liability would be damage to or a total loss of one or more pieces of mobile equipment.

Given proper stockpile design and surface water management, as well as progressive reclamation practices for the till and waste rock stockpiles, stockpile slope failure is most likely to occur during the operation and maintenance phase of the Project when stockpiles are being continually acted upon either through loading, unloading, or shaping of material. Surface water runoff may erode topsoil, till, and waste rock to a point of failure as well.

Given surface water runoff from all stockpiles will be directed to settling ponds for treatment and a slope failure would likely not result in disturbance to environment, potential adverse effects to other VCs from a stockpile slope failure are anticipated to be non-existent.

6.18.6.2.5 Mitigation and Emergency Response

Design and Operation Environmental Protections

A number of design and operation environment protection have been considered to prevent a slope failure these include but not limited to the following:

- Waste rock and stockpile slopes are designed to meet a safety factor of at least 1.5.
- Internal roads will be designed to provide internal drainage and help dissipate construction induced pore pressure within the pile.
- If appropriate during final design, instrumentation may be installed to record pore pressures and deformation of the underlying ground and mineral waste to provide an early warning of potential failure.
- Daily inspections, at a minimum, will be undertaken to check for slumping and instability.

- The perimeter runoff collection ditches and sedimentation ponds will allow runoff management by capturing stockpile runoff in ditches and allowing it to settle in ponds prior to discharge to the environment.

Stockpile slopes will be designed at an angle determined by geotechnical analysis and acceptable safety factors, thereby reducing the likelihood of a slope failure. Placement of materials in the stockpiles would follow a plan developed for the stockpile that would consider thickness of the lift, compaction - if needed, load size, start and stockpile physical limits. Slopes will be monitored throughout the life of the operation with routine inspections by qualified staff and repairs made if warranted.

Surface water run-off from the non-ore bearing waste rock stockpile, Mine Site roads, and till stockpiles will flow by gravity, with the aid of berms and channels, to a settling pond located west of the open pit. Water will be gradually decanted to Cameron Flowage by gravity via a water diversion structure that runs northeast from the settling pond.

6.18.6.2.6 Contingency and Emergency Response Procedures

In the unlikely event of a slope failure, an emergency response action plan will be implemented. Once the failure area is secured, and depending on the scale of the failure, the stockpile slope will be recontoured in place. If any material migrated as far as the perimeter ditch, it would be excavated and returned to the stockpile and if required the drainage ditches repaired. If the slope failure caused effluent in the perimeter ditching to spill, silt fencing could be deployed downstream of the spill to prevent sediment laden waters from entering a watercourse.

6.18.6.3 Settling Pond Failure

All phases of the Project have the potential for a settling pond failure. A failure of the settling pond is defined as a breach of the banks through overflow or bank structure failure resulting in the release of sediment laden water to the environment. A worst-case scenario would be complete failure of the settling pond, resulting in uncontrolled discharge of sediment laden water into the surrounding environment. The capacity demand of the settling pond will increase as open pit depth increases and more infiltrated groundwater is pumped out of the mine.

Surface water run-off from the non-ore bearing waste rock stockpile, Mine Site roads, topsoil stockpiles, and till stockpiles will flow by gravity, with the aid of berms and channels, to a settling pond located west of the open pit. This settling pond will also receive water from the open pit dewatering program. Treatment of surface water runoff and mine infiltration groundwater will be passive. Water will eventually decant to Cameron Flowage through a fringe wetland and by gravity via a water diversion structure that runs northeast from the settling pond.

Surface water runoff from the Beaver Dam Mine Site ROM and facilities pad will flow by gravity, with the aid of berms and channels, to a collection pond located between the crushing operation and water storage tanks. A culvert located beneath the mine entrance road will facilitate decant overflow from the pond to a water diversion structure that splits the two ore stockpiles. The water diversion structure will discharge to a channel that will run down gradient to the northeast and ultimately discharge to Cameron Flowage. The discharge point will be equipped with a concrete flow-control structure with the ability to be shutoff allowing no flow to leave if needed.

The updated Beaver Dam Mine Project Mine Water Management Plan is summarized below. Additional detail is presented in Appendix P.4 (Mine Water Management Plan) and Appendix C (draft Erosion and Sediment Control Plan) of Appendix P.4.

The Beaver Dam Mine Site has a network of drainage ditches and ponds supporting onsite water management including:

- North Settling Pond;
- East Settling Pond;
- South Settling Pond;
- West Settling Pond; and
- Evaporation Pond.

6.18.6.3.1 Potential Concern

Environmental concerns relate to failure of settling ponds may contain elevated levels of water quality parameters (e.g., total suspended solids [TSS]) can be toxic to aquatic life and could harm local fish, amphibian and benthic invertebrate populations. Suspended solids can interfere with aquatic life, particularly during periods of egg incubation. Sediments can damage fish gills, interfere with feeding or if they are deposited, they can smother eggs by preventing oxygen exchange.

6.18.6.3.2 Designs and Environmental Protections

- **A:** The likelihood of failure of the North Settling Pond is expected to be low. There are two potential pathways for pond failure: overtopping and piping. With respect to overtopping failure, the pond will be designed to control site runoff up to and including the 100-year storm event, with a minimum freeboard of 0.3 m above the 100-year water level. Larger flow events will be controlled through one of two emergency spillways (two-way pump and overflow spillway weir) that will be directed to the sump within the open pit. Water collected in the pit will be pumped back into the pond after the storm event, as storage becomes available. As a result, pond failure by overtopping will not impact fish or fish habitat in the Killag River. The North Settling Pond will be designed to mitigate failure of the containment berm by piping. The operating water level (permanent pool) of the pond will be below the ground elevation on the downstream side of the berm. Only the active storage portion of the pond has potential for piping failure. In addition, the pond will be lined with an impermeable geosynthetic liner to prevent seepage through the pond berms. Further, due to the temporary nature of water storage in this part of the settling pond (only after a storm event and for approximately 24 hours afterwards) there is low risk for piping failure to form.

  The East, West and South Settling ponds will also be designed to control site runoff generated from the 100-year storm event, with the 0.3 m freeboard above the 100-year water level. Both ponds will also be lined with an impermeable geosynthetic liner to prevent seepage through the pond berms and minimizing the potential for piping failure. Larger events will be controlled through the emergency spillways. With planned site erosion and sediment controls in place, discharge via the emergency spillway is anticipated to have diluted total suspended solids (TSS) concentrations.

  All pond berms and outlet structures will be monitored regularly to detect any deficiencies that may result in failure. In addition, all ponds will have short service lives as they will be decommissioned post-closure. As a result, all discharge from the Site Settling Ponds to Cameron Flowage will be treated and overflow will not negatively impact fish or fish habitat in Cameron Flowage.

- **B:** The settling pond systems will be monitored regularly during mine operations to ensure the water levels are within the operational range, and the active and passive flood control infrastructure is in good working order, so that they perform as intended during major storm events. The North Settling Pond will be designed with a multi-level approach to flood control. A two-way pump will be installed to pump water between the pond and the pit. If a large storm event is anticipated, pond water can be pumped to the pit in advance of a storm event to increase the active storage volume of the pond. The pumps will run over the duration of the storm event. The pond will also include an emergency spillway, which will be designed to passively

control larger than the 100-year storm event (designed to the Hurricane Beth historical storm) discharge toward the pit, in the event the pumps become overwhelmed or inoperable. The emergency response plan will include evacuation of all equipment and site personnel downstream of the settling ponds and within the pit in anticipation of a major storm event.

- **C:** The North, East, West and South Settling Ponds will be designed to control site runoff generated up to and including the 100-year storm event through passively controlled primary outlet structures. Each pond will be equipped with an emergency spillway, sized to control the Hurricane Beth discharge. The North Settling Pond emergency spillway will be directed into the open pit, which will be dewatered back into the North Settling Pond when storage becomes available.
- **D:** The North, East, West and South Settling Ponds will be designed to control site runoff generated up to and including the 100-year storm event through passively controlled primary outlet structures. Each pond will be equipped with an emergency spillway, which will be activated during events in exceedance of the 100-year storm. The emergency spillways will be sized to control the Hurricane Beth discharge. Climate change impacts were incorporated (approximately 6% increase in IDF 100-year 24-hour rainfall depths) into the pond design as the ponds will only be in service during the mine operations, which is projected to be 7 years. The ponds will be decommissioned post-mine closure.
- **E:** The likelihood of failure of the North Settling Pond is expected to be low. The pond will be designed to control site runoff generated from the 100-year storm event. Larger flow events will be controlled through an emergency spillway that will be directed to the sump within the open pit. Water collected in the pit will be pumped back into the pond after the storm event, as storage becomes available. As a result, pond failure by overtopping will not impact fish or fish habitat in the Killag River. In addition, the North Settling Pond will be designed to mitigate failure of the containment berm by piping. The operating water level (permanent pool) of the pond will be below the ground elevation on the downstream side of the berm.

The predictive water quality analysis demonstrates that discharge from the East and South Settling Ponds does not require treatment for metals; as such, these ponds will provide TSS removal only. With the planned site erosion and sediment controls in place, discharge via the emergency spillway would have low and significantly diluted TSS concentrations compared to the runoff generated from more frequent storm events. As a result, the spillway discharge is expected to have minimal negative impacts to fish communities.

6.18.6.3.3 Threshold for Determination of Significance

The criteria that would determine a significant effect should a settling pond fail, is based primarily on environmental protection. Should a settling pond failure result in an uncontrolled discharge of sediment laden water to Cameron Flowage the event will be considered significant.

Comparison of surface water samples to CCME FWAL TSS guidelines and MMER TSS guidelines will be utilized to determine if sediment laden water will have an impact on surface water quality in Cameron Flowage and subsequently on fish and fish habitat.

6.18.6.3.4 Potential Interactions and Effects

The potential interactions between settling pond failure and the VCs are outlined in Section 5.8, Tables 5.8-1 to 5.8-3. Additional detail by VC is outlined in Table 6.18-5. Only those interactions with a high potential to cause adverse effects should they occur are discussed in detail.

Table 6.18-5: Settling Pond Failure Interactions with Valued Components

Valued Component	Potential Settling Pond Failure and Valued Component Interaction	Potential for Adverse Effects
Noise	No potential interaction anticipated	-
Air	No potential interaction anticipated	-
Light	No potential interaction anticipated	-
Greenhouse Gases	No potential interaction anticipated	-
Geology, Soil, and Sediment Quality	Failure of settling pond could potentially cause contaminated suspended solids to settle in Cameron Flowage and effect sediment quality	Low
Surface Water Quality and Quantity	Failure of settling pond could potentially cause sediment laden water to discharge to Cameron Flowage via the fringe wetland around Mud Lake	High
Groundwater Quality and Quantity	No potential interaction anticipated	-
Wetlands	Failure of settling pond could potentially cause sediment laden water to discharge to fringe wetlands around Mud Lake	High
Fish and Fish Habitat	Failure of settling pond could potentially cause sediment laden water to discharge to Cameron Flowage via the fringe wetland around Mud Lake	High
Habitat and Flora	No potential interaction anticipated	-
Avifauna	No potential interaction anticipated	-
Terrestrial Fauna	No potential interaction anticipated	-
Species of Conservation Interest and Species at Risk	Failure of settling pond could potentially cause sediment laden water to discharge to Cameron Flowage via the fringe wetland around Mud Lake	High
Mi'kmaq of Nova Scotia	No potential interaction anticipated	-
Physical and Cultural Heritage	No potential interaction anticipated	-
Socio-economic Conditions	No potential interaction anticipated	-

Note - = not applicable.

The degree to which suspended solids are expected to settle out of solution in a concentrated area should a settling pond failure occur is considered minimal. As a result, potentially adverse effects to the sediment quality portion of the geology, soil, and sediment quality VC are considered low.

Inadequate settling pond capacity and water level monitoring, combined with a significant precipitation event may cause a settling pond failure and thus, pose a risk to surface water quality, wetlands, fish and fish habitat, and SOCI/SAR through all phases of the Project.

The maximum effect of a settling pond failure as it relates to VCs above would be heavy siltation of wetlands and Cameron Flowage and subsequent stresses on fish and other aquatic species.

Given inputs for the settling pond would originate partially from the open pit dewatering program, settling pond failure is more likely to occur as development of the open pit progresses. Extracting waste rock and ore from the open pit will increase the potential for groundwater infiltration, thus increasing the amount of water that needs to be pumped from the open pit to the settling pond. As a result, the capacity requirements of the settling pond will increase the further the open pit is advanced and the potential for settling pond failure through bank overflow and structure failure increases as well.

Given the settling pond is a passive treatment process and it will not provide habitat for terrestrial species, adverse effects to other VCs from a settling pond failure are anticipated to be non-existent.

6.18.6.3.5 Mitigation and Emergency Response

The water diversion structure leading from the collection pond will discharge to a channel that will run down-gradient to the northeast and ultimately discharge to Cameron Flowage. The discharge point will be equipped with a concrete flow-control structure. Sediment laden water from the settling pond will be gradually decanted to Cameron Flowage via a water diversion structure that runs northeast from the settling pond.

The settling pond will be lined with suitable materials, such as clay or a plastic liner. In the event of a 1 in 100-year precipitation event that creates volumes in excess of the capacity available in ponds and ditching, or infrastructure failure, a spillway into the water diversion structure will be used for overflow. In the case of a storm event or infrastructure failure, settling ponds will be monitored regularly.

If settling pond failure were to occur, emergency procedures would be implemented that will be outlined in the site emergency response plan. Generally, settling pond failure emergency response includes raising the alarm and evacuation of all equipment and personnel from the area. If settling pond contents encroach on neighbouring properties or public roadways, appropriate authorities will be notified and construction of bunds and/or diversion drains may be required to contain settling pond contents on-site. An assessment is then made using on-site staff and possibly external resources (surface water specialists) as to what repairs are needed and actions to prevent future incidents. This will be detailed in a recovery plan. Depending on the regulator involvement there may be a requirement to file incident reports with certain regulatory agencies prior to initiating the repairs and return to work in the area, these are very case specific and often dependent on whether personnel were injured or equipment damaged as a result of the settling pond failure.

6.18.6.4 Infrastructure Failure

All phases of the Project have the potential for failures of infrastructure. Failure of these structures may be caused by improper design and construction, or natural causes such as hurricanes or earthquakes. A worst-case scenario would be failure of multiple operational components as a result of a natural cause impacting worker health and safety and the surrounding environment. The following operational facilities will be installed or constructed to support the Project:

- septic tanks and leach drains;
- raw water and potable water tank;
- diesel fuel storage and distribution system;
- diesel generators and power distribution overhead transmission lines;
- pole mounted lighting;
- vehicle washdown facility;
- pre-fabricated office facility and workshop building; and
- fire protection systems.

All infrastructure will be located on a central operational and ROM facilities pad that will provide quick access to the Haul Road and open pit. These components are described in detail in Project Description Section 2 of this EIS.

6.18.6.4.1 Threshold for Determination of Significance

The criteria that would determine a significant effect should an infrastructure failure occur is based primarily on worker health and safety and environmental impact, and secondarily on property damage. Should an infrastructure failure result in injury or death to a worker or a loss of infrastructure the event will be considered significant.

Should an infrastructure failure event result in the loss of any quantity of fuel, oil, lubricant, or other Project related raw materials to the environment such that a measurable contamination of soil, surface water, or groundwater results, the event will be considered significant.

Contamination is defined as the following:

- Soil:
  - when concentrations of any contaminant exceed the guidelines provided in the Nova Scotia Contaminated Sites Regulations - Tier 1 Environmental Quality Standards for Soil at a Non- potable Site, Section 1, Table 1B.
- Surface Water:
  - when concentrations of any contaminant exceed the guidelines provided in the Nova Scotia Contaminated Sites Regulations - Tier 1 Environmental Quality Standards for the Protection of Freshwater Aquatic Life in Surface Water, Section 1, Table 3.
- Groundwater:
  - when concentrations of any contaminant exceed the guidelines provided in the Nova Scotia Contaminated Sites Regulations - Tier 1 Environmental Quality Standards for Groundwater at a Non-potable Site, Section 1, Table 4.

6.18.6.4.2 Potential Interactions and Effects

The potential interactions between infrastructure failure and VCs are outlined in Section 5.8, Tables 5.8-1 to 5.8-3. Additional detail by VC is outlined in Table 6.18-6. Only those interactions with a high potential to cause adverse effects should they occur are discussed in detail.

Table 6.18-6: Infrastructure Failure Interactions with Valued Components

Valued Component	Potential Infrastructure Failure and Valued Component Interaction	Potential for Adverse Effects
Noise	No potential interaction anticipated	-
Air	An infrastructure failure event could potentially cause a fuel oil spill or small fire and release particulate matter, carbon monoxide, sulphur dioxide, nitrous oxides, and volatile organic compounds to the atmosphere	Low
Light	No potential interaction anticipated	-
Greenhouse Gases	An infrastructure failure event could potentially cause a fuel oil spill or small fire and release particulate matter, carbon monoxide, sulphur dioxide, nitrous oxides, and volatile organic compounds to the atmosphere	Low
Geology, Soil, and Sediment Quality	An infrastructure failure event could potentially cause a release of fuel oil to soil if released to the terrestrial environment	Low
Surface Water Quality and Quantity	No potential interaction anticipated	-

Table 6.18-6: Infrastructure Failure Interactions with Valued Components (continued)

Valued Component	Potential Infrastructure Failure and Valued Component Interaction	Potential for Adverse Effects
Groundwater Quality and Quantity	No potential interaction anticipated	-
Wetlands	No potential interaction anticipated	-
Fish and Fish Habitat	No potential interaction anticipated	-
Habitat and Flora	No potential interaction anticipated	-
Avifauna	No potential interaction anticipated	-
Terrestrial Fauna	No potential interaction anticipated	-
Species of Conservation Interest and Species at Risk	No potential interaction anticipated	-
Mi'kmaq of Nova Scotia	No potential interaction anticipated	-
Physical and Cultural Heritage	No potential interaction anticipated	-
Socio-economic Conditions	Failure of infrastructure could potentially cause injury or death to mine workers	High

Note: - = not applicable.

The emissions produced through volatilization of fuel oil or through a small fire from an infrastructure failure event would be temporary and localized to the area directly around the failure. In addition, a release of fuel oil, lubricants or other Project related raw materials would be minor in volume and likely contained and cleaned up prior to significantly effecting soil. As a result, potentially adverse effects to the atmospheric environment, and geology, soil, and sediment quality are considered low.

Infrastructure that is improperly designed and constructed poses a health and safety risk to workers during the site preparation and construction, and operation and maintenance phases, as well as a financial liability risk related to infrastructure damage or loss.

The maximum effect of an infrastructure failure as it relates to worker health and safety would be a death caused by falling objects or collapsing structures. The maximum effect of an infrastructure failure as it relates to financial liability would be damage to or a total loss of one or more pieces of infrastructure.

Given proper design and construction of infrastructure, failure will most likely to occur during the operation and maintenance phase of the Project when infrastructure is being worn and torn through operational processes. Infrastructure with moving components, such as the crusher and conveyor, are more likely to fail than static infrastructure, such as the office and workshop facilities.

Given infrastructure failure would likely not result in disturbance to a greenfield environment, potential adverse effects to other VCs from an infrastructure failure occurrence are anticipated to be non-existent.

6.18.6.4.3 Mitigation and Emergency Response

Infrastructure at the Beaver Dam Mine Site will be minimal and given the short life of the Project, failure should not occur without being acted upon by extreme natural causes, such as a hurricane or earthquake, or human error.

On-site infrastructure would be informally inspected by site personnel for signs of premature failure through the normal course of the working shift. More rigorous inspection would occur with routine maintenance. Existing legislation is well established and understood by the Proponent personnel through the development and future operation of the Touquoy Mine Site.

A Health and Safety Plan will be developed and implemented for the Beaver Dam Mine Site, which will include evacuation procedures, proper housekeeping procedures for the storage and use of small equipment, and materials.

6.18.7 Accidents

6.18.7.1 Fuel and/or Other Spills

All phases of the Project have the potential for fuel and/or other spills to occur. The perceived risk of a spill is most logical during the operation and maintenance phase when the following is occurring at the Beaver Dam Mine Site:

- bulk storage of diesel fuel is present on-site;
- frequent transfer and handling of diesel fuel is occurring;
- mobile equipment is operating and being maintained; and
- waste fluids such as oils, lubricants, and antifreeze are produced.

The site preparation and construction, and decommissioning and reclamation phases of the Project will have reduced risk due to a number of these activities not yet occurring or ceasing once the operation and maintenance phase is over.

Spills associated with these activities may occur through failure of storage tanks, improper fuel transfer procedures, fuel/hydraulic line breaks or leaks, spillage or failure of storage containers, and/or mobile equipment and refueling truck accidents.

A worst-case scenario would be a transportation collision causing the entire amount of material being transported to be spilled into a water body. The effects of the spill would vary depending on the material spilled; diesel fuel and gasoline are toxic to aquatic life and would have the greatest impact to the environment.

Diesel fuel will be delivered to double-walled aboveground storage tanks via licensed tanker trucks and be used in all mobile equipment and to power on-site generators. Other petroleum based and non-petroleum-based liquids will be used for equipment maintenance.

Diesel fuel and lubricant storage will be located away from wetlands and watercourses to the extent practical and a dedicated refueling truck will deliver these materials to the mine and maintenance mobile fleet, as well as diesel powered generators. The fleet of Haul Road trucks required to transport crushed ore from the Beaver Dam Mine Site to Touquoy Mine Site will be refueled at the Beaver Dam Mine Site as needed using the fuel and lube truck noted above.

6.18.7.1.1 Fuel Transport

In response to CEAA 2-17, the following provides additional details on the following transport of fuels and potential effects fish as well as key mitigations.

AMNS intent is to address the potential impact of fuel spills through project design and operational performance to ensure a safe and environmentally mine site. The response, therefore, is focused on the environmental designs and protections that that will be in place to address potential fuel spills before there is an impact to fish and fish habitat.

Fuel Release during Transport

Fuel will be transported to the proposed Beaver Dam Mine Site along the regional road network by tanker trucks. The tanker trucks will consist of single units that typically have a capacity of 30,000 L. Dual trailer units (B-trains) will not be used. Tanker trucks are generally compartmentalized, such that if there were to be an accident, only a portion of the load will be lost except in a catastrophic incident. The principal type of fuel used at the site will be diesel for generators and propane for power during the construction and operation phases as well as heavy equipment operation during construction, operation and closure.

The average fuel consumption of is approximately 3 million L/a during operations and approximately 500,000 L/a during the construction. Fuel is transported safely throughout the local region and across Canada on a routine basis, by licenced and trained drivers, and the risk of incident involving a serious collision where fuel is released into the environment is small.

Smaller quantities of gasoline will be trucked to site by tanker truck or container on truck, also using licenced and trained drivers.

Potential Environmental Concerns

Despite all reasonable safeguards, there is a small potential for spills from tanker trucks due to collisions, accidents related to poor weather conditions, or other mishaps. A diesel spill from a truck travelling to site could affect the soil (or snow in winter) in the vicinity of the spill, and could potentially enter a waterbody if the accident occurred on or near a water crossing.

Diesel fuel and gasoline is toxic to aquatic life when spilled in fresh water. A tanker truck spill will have the greatest environmental impact if the spill reached a major watercourse that supports aquatic life. The diesel slick will move downstream, potentially impacting riverbanks over the length of the watercourse until the spill could be contained or it naturally degrades. A spill on land will be comparatively easy to contain and clean up, particularly under frozen ground conditions.

Design and Operations Environmental Protections

Regular maintenance of fuel trucks can significantly reduce the chance of an equipment failure caused accident. The need for compliance with the Transportation of Dangerous Goods Act and associated Regulations will be reinforced in all applicable contracts and vendor agreements.

The potential for environmental impacts associated with malfunction and accidents on the trucking route will be minimized by the following operational procedures which will be incorporated into the environmental management system as possible and into trucking / supply contracts as reasonable:

- speed limits are to be strictly adhered to;
- strict adherence to national trucking hour limits and other applicable requirements;
- drivers will be required to meet all applicable regulatory training requirements, be trained in spill response procedures for the materials they transport, and carry the appropriate Material Safety Data Sheets;
- all vehicles transporting materials to site will be required to maintain a supply of basic emergency response equipment, including communication equipment, first aid materials and a fire extinguisher; and
- penalties for operational violations.

6.18.7.1.2 Threshold for Determination of Significance

The criteria that would determine a significant effect should a fuel and/or other spill occurs is based primarily on environmental protection. Should a spill result in the loss of any quantity of fuel, oil, lubricant, or other Project related raw materials to the environment such that a measurable contamination of soil, surface water, or groundwater results, the event will be considered significant.

Contamination is defined as the following:

- Soil:
  - when concentrations of any contaminant exceed the guidelines provided in the Nova Scotia Contaminated Sites Regulations - Tier 1 Environmental Quality Standards for Soil at a Non- potable Site, Section 1, Table 1B.
- Surface Water:
  - when concentrations of any contaminant exceed the guidelines provided in the Nova Scotia Contaminated Sites Regulations - Tier 1 Environmental Quality Standards for the Protection of Freshwater Aquatic Life in Surface Water, Section 1, Table 3.
- Groundwater:
  - when concentrations of any contaminant exceed the guidelines provided in the Nova Scotia Contaminated Sites Regulations - Tier 1 Environmental Quality Standards for Groundwater at a Non-potable Site, Section 1, Table 4.

6.18.7.1.3 Potential Interactions and Effects

The potential interactions between fuel and/or other spills and VCs are outlined in Section 5.8, Tables 5.8-1 to 5.8-3. Additional detail by VC is outlined in Table 6.18-7. Only those interactions with a high potential to cause adverse effects should they occur are discussed in detail.

Table 6.18-7: Fuel and/or Other Spills Interactions with Valued Components

Valued Component	Potential Fuel and/or Other Spills and Valued Component Interaction	Potential for Adverse Effects
Noise	No potential interaction anticipated	-
Air	Fuel and/or other spills could potentially volatilize into the atmosphere	Low
Light	No potential interaction anticipated	-
Greenhouse Gases	Fuel and/or other spills could potentially volatilize into the atmosphere	Low
Geology, Soil, and Sediment Quality	Fuel and/or other spills could potentially contaminate bedrock and soil if released to the terrestrial environment Fuel and/or other spills could potentially contaminate sediment if released to the aquatic environment along the Haul Road	High
Surface Water Quality and Quantity	Fuel and/or other spills could potentially contaminate surface water if released to the aquatic environment	High
Groundwater Quality and Quantity	Fuel and/or other spills could potentially contaminate groundwater if released to the terrestrial environment and soil/bedrock conditions allow vertical migration	High
Wetlands	Fuel and/or other spills could potentially contaminate wetlands if released to the aquatic or terrestrial environment	High
Fish and Fish Habitat	Fuel and/or other spills could potentially adversely affect fish and fish habitat if released to the aquatic environment	High

Table 6.18-7: Fuel and/or Other Spills Interactions with Valued Components (continued)

Valued Component	Potential Fuel and/or Other Spills and Valued Component Interaction	Potential for Adverse Effects
Habitat and Flora	No potential interaction anticipated	-
Avifauna	Fuel and/or other spills could potentially adversely affect birds	Low
Terrestrial Fauna	Fuel and/or other spills could potentially adversely affect fauna	Low
Species of Conservation Interest and Species at Risk	Fuel and/or other spills could potentially adversely affect species of conservation interest and species at risk if released to the terrestrial environment and/or aquatic environment	High
Mi'kmaq of Nova Scotia	Fuel and/or other spills could potentially adversely affect Indigenous Peoples	High
Physical and Cultural Heritage	No potential interaction anticipated	-
Socio-economic Conditions	No potential interaction anticipated	-

Note: - = not applicable.

Volatilization of fuel oil and/or other substances should they be spilled would be localized to the area directly around the spill. In addition, only a minor portion of diesel fuel oil, the most widely used substance for the Project, is considered volatile. Adverse effects to birds and fauna are considered low due to the developed nature and lack of habitat in areas (Beaver Dam Mine Site) considered being at the greatest risk for fuel and/or other spills. As a result, potentially adverse effects to the atmospheric environment, birds, and fauna are considered low.

Accidents that cause a fuel and/or other spill pose an environmental risk to the following VCs:

- geology, soil, and sediment;
- surface water quality and quantity;
- groundwater quality and quantity;
- wetlands;
- fish and fish habitat; and
- SOCI/SAR; and
- Indigenous Peoples.

Indigenous Peoples' use of land and resources for traditional purposes has the potential to be adversely affected from the underlying changes to other VCs that a fuel and/or other spill would cause. Depending on the location and timing of a potential fuel and/or other spill both groundwater and surface water quality could be affected, which in turn could directly affect traditional practices and drinking water of Indigenous people. There also could be potential indirect effects as a result of a spill event to the current land and resource use due to potential adverse effects to fish, fish habitat, wetlands and terrestrial habitats and species.

The greatest potential for a fuel and/or other spills to occur is during the site preparation and construction, and operation and maintenance phases when the greatest amount of fuel is being stored, handled, and transferred on-site.

Small spills like those seen due to improper transfer procedures during refueling of equipment will likely have negligible environmental effects, while larger spills like those seen due to equipment/storage tank failures and mobile equipment accidents may have significant environmental effects.

The location of the spill will also determine the magnitude of effects. A spill occurring within the Beaver Dam Mine Site is unlikely to cause significant environmental effects as the area will be largely devoid of ecological receptors and the presence of hundreds of workers will likely lead to quick and efficient containment and cleanup efforts. The primary receiver for spills in this area is the soil portion of the geology, soil, and sediment quality VC. Spills are unlikely to reach surface water, sediment, groundwater, wetlands, and fish habitat due to anticipated spill response times, as well as containment and cleanup efforts. A spill occurring due to an accident along the Haul Road may have more significant environmental effects if the accident occurs in close proximity to a watercourse or wetland. If not, the primary receiver for spills along the Haul Road is the soil portion of the geology, soil, and sediment quality VC.

6.18.7.1.4 Mitigation and Emergency Response

The source of greatest risk for potential spills and releases of diesel fuel relates to the improper execution of procedures for transfer and handling to and from stationary and mobile tankage. Other sources of potential spills and releases of diesel fuel relate to equipment failures, damage to storage or piping systems, mobile equipment accidents, and mobile refueling truck accidents. Releases of maintenance fluids pose a lesser risk in terms of magnitude, but can still occur due to equipment failures, damage to storage containers, and mobile equipment accidents. A release of these fluids may result in soil, groundwater, and/or surface water contamination that may adversely ecological receptors through absorption, and/or ingestion of contaminated media.

An Emergency Response Plan, including a Spill Contingency Plan, forms part of the environmental management system that will address the primary hazardous materials on site including procedures for spill response on the trucking route to the site. Materials to be maintained in vehicles will be identified in the draft Emergency Response Plan (Appendix P.1) and are likely to include absorbent materials and equipment to contain spilled material.

At the Beaver Dam Mine Site, the following additional controls will be in place to reduce the potential for or the severity of accidents involving hazardous materials:

- speed limits, to be posted and enforced by RRP security personnel;
- right of way procedures will be defined and haul trucks and loaded vehicles will be given preference;
- traffic will be required to yield to wildlife as observed; and
- where possible, heavy traffic will be limited to site haul roads and other traffic limited to site access roads.

Preventative procedures will be also be undertaken and fuel storage and transfer areas will be designed to accommodate these procedures and controls, such as limiting areas of fuel transfer. Staff will be trained in spill response measures and spill response kits will be accessible in areas of fuel transfer. A spill response plan, noted above, will be developed. The contingency measures developed as part of the spill response plan will be focused on areas of high ecological importance and areas used by Indigenous Peoples and will provide a plan on how such areas could/would be protected in the event of a spill. AMNS has committed to keep fuel storage on site

If a spill were to occur, emergency procedures would be implemented that will be outlined in the site emergency response plan. Generally, spill response includes raising the alarm, evacuation of all equipment and personnel from the area and possibly the area up wind, away from any vapour cloud, and establishment of a 500 to 1000 m radius exclusion zone from the spill location. An assessment is then made using on-site staff and possibly external resources (air quality specialists) to determine the type, quantity and source of the spill and whether Emergency Services are required. If required, Emergency Response Team will be contacted. The safety data sheet for the spilled material will be reviewed and will be made available to Emergency Response Team. A plan to contain and clean up the spill, as well as actions to prevent future incidents, will be detailed in a recovery plan. If it is safe to do

so, the spill source will be shut down and any ignition sources will be isolated. Barriers and signs to prevent access to the affected area may be required until the spill is completely contained and cleaned up. AMNS will file appropriate incident reports with regulatory agencies and will provide details, as required in an Industrial Approval.

6.18.7.2 Unplanned Explosive Event

An unplanned explosive event is limited to the site preparation and construction, and operation and maintenance phases of the Project. The worst-case scenario would be bodily harm as a result of improperly handling explosives.

Explosives will be supplied by an off-site contractor and there will be no requirement for an on-site magazine.

6.18.7.2.1 Threshold for Determination of Significance

The criteria that would determine a significant effect should an unplanned explosive event occur is based primarily on worker health and safety and secondarily on property damage and environmental protection.

Should an unplanned explosive event result in injury or death to a worker or a loss of infrastructure or mobile equipment the event will be considered significant.

Should an unplanned explosive event result in the loss of any quantity of fuel, oil, lubricant, or other Project related raw materials to the environment such that a measurable contamination of soil, surface water, or groundwater results, the event will be considered significant.

Contamination is defined as the following:

- Soil:
  - concentrations of any contaminant exceed the guidelines provided in the Nova Scotia Contaminated Sites Regulations - Tier 1 Environmental Quality Standards for Soil at a Non- potable Site, Section 1, Table 1B.
- Surface Water:
  - concentrations of any contaminant exceed the guidelines provided in the Nova Scotia Contaminated Sites Regulations - Tier 1 Environmental Quality Standards for the Protection of Freshwater Aquatic Life in Surface Water, Section 1, Table 3.
- Groundwater:
  - concentrations of any contaminant exceed the guidelines provided in the Nova Scotia Contaminated Sites Regulations - Tier 1 Environmental Quality Standards for Groundwater at a Non-potable Site, Section 1, Table 4.

6.18.7.2.2 Potential Interactions and Effects

The potential interactions between an unplanned explosive event and VCs are outlined in Section 5.8, Tables 5.8-1 to 5.8-3. Additional detail by VC is outlined in Table 6.18-8. Only those interactions with a high potential to cause adverse effects should they occur are discussed in detail.

Table 6.18-8: Unplanned Explosive Event Interactions with Valued Components

Valued Component	Potential Unplanned Explosive Event and Valued Component Interaction	Potential for Adverse Effects
Noise	No potential interaction anticipated	-
Air	An unplanned explosive event could potentially cause suspension of dust particles into the atmosphere	Low
Light	No potential interaction anticipated	-
Greenhouse Gases	An unplanned explosive event could potentially cause suspension of dust particles into the atmosphere	Low
Geology, Soil, and Sediment Quality	An unplanned explosive event could potentially cause a release of fuel oil and/or ammonium nitrate to soil	Low
Surface Water Quality and Quantity	No potential interaction anticipated	-
Groundwater Quality and Quantity	No potential interaction anticipated	-
Wetlands	No potential interaction anticipated	-
Fish and Fish Habitat	No potential interaction anticipated	-
Habitat and Flora	No potential interaction anticipated	-
Avifauna	An unplanned explosive event could potentially cause behavioral effects to birds in the area	Low
Terrestrial Fauna	An unplanned explosive event could potentially cause behavioral effects to fauna in the area	Low
Species of Conservation Interest and Species at Risk	An unplanned explosive event could potentially cause behavioral effects to species of conservation interest and species at risk in the area	Low
Mi'kmaq of Nova Scotia	No potential interaction anticipated	-
Physical and Cultural Heritage	An unplanned explosive event could potentially destroy undiscovered archaeological, historical, and/or paleontological artifacts	Low
Socio-economic Conditions	An unplanned explosive event could potentially cause injury or death to mine workers	High

Note: - = not applicable.

Dust suspended from an unplanned explosive event would be temporary and localized to the area directly around the explosion. In addition, a release of ammonium nitrate or fuel oil to the environment is considered unlikely as the majority of these substances will be consumed should an explosion occur.

Effects to birds, fauna, and SOCI/SAR will likely be minimal due to the Beaver Dam Mine Site being devoid of habitat once blasting commences. Effects to physical and cultural heritage will likely be minimal as well; it is anticipated that anywhere an unplanned explosive event as the potential to occur, the ground will already be disturbed by site preparation and construction activities. As a result, potentially adverse effects to the atmospheric environment, birds, fauna, SOCI/SAR, and physical and cultural heritage are considered low.

Explosives that are improperly handled pose a health and safety risk to workers during the site preparation and construction, and operation and maintenance phases of the Project, as well as a financial liability risk related to infrastructure and mobile equipment damage or loss.

The maximum effect of an unplanned explosive event as it relates to worker health and safety would be a death caused by direct interaction or from falling objects or collapsing structures damaged from the explosion. The maximum effect of an unplanned explosive event as it relates to financial liability would be damage to or a total loss of one or more pieces of infrastructure or mobile equipment.

Explosives will be supplied and managed by a licensed contractor.

6.18.7.2.3 Mitigation and Emergency Response

Blasting will be undertaken by a qualified contractor and explosives who will be responsible for all licensing and approvals as required by Natural Resources Canada for this Project. Transportation, storage and handling of explosives will be carried out in compliance with the *Explosives Act* and any other relevant legislation. If an unplanned explosive event were to occur, emergency procedures would be implemented that will be outlined in the site emergency response plan. Generally, unplanned explosive event response includes raising the alarm and evacuation of all equipment and personnel from the area. No attempt to approach or extinguish any fire should be made. An assessment is then made using on-site staff to determine whether Emergency Services are required. If required, Emergency Services will be contacted. A safe zone around the affected area will be established, the size of which will be determined by on-site staff and possibly external resources (explosive specialists). Barriers and signs to prevent access to the affected area may be required until clean-up is complete. Depending on the regulator involvement there may be a requirement to file incident reports with certain regulatory agencies prior to initiating the clean-up and return to work in the area, these are very case specific and often dependent on whether personnel were injured or equipment damaged as a result of the unplanned explosive event.

6.18.7.3 Mobile Equipment Accident

All phases of the Project will have the potential for vehicular accidents to occur. A worst-case scenario would be a severe accident-causing injury or death.

The majority of mobile equipment traffic will be limited to the Beaver Dam Mine Site where guided traffic patterns, speed limits, right-of-way signage, and training will minimize the risk of vehicular accidents. The remaining mobile equipment will include haul trucks, which will transport crushed ore 30 km from the Beaver Dam Mine Site to the Touquoy Mine Site. The number of return truck trips per day will be an annual average of approximately 185 for 12 or 16 hours per day, 350 days per year for the anticipated duration of the mine Project (3.3 years). During construction and pre-production (8 months), the number of trips will be less and required for moving material from Touquoy to Beaver Dam and construction and upgrade of the Haul Roads.

The Haul Road will be dual lane and designed to facilitate the safe passage of two-way truck traffic at 70 km/h. Speed limit and Right-of-way signage will be installed and all haul truck operators will receive operator training to minimize the risk of haul truck collisions. All intersections will be designed to NSTIR Standards.

6.18.7.3.1 Threshold for Determination of Significance

The criteria that would determine a significant effect should a mobile equipment accident occur is based primarily on worker health and safety and secondarily on property damage and environmental protection.

Should a mobile equipment accident result in injury or death to a worker or a loss of infrastructure or mobile equipment the event will be considered significant.

Should a mobile equipment accident result in the loss of any quantity of fuel, oil, lubricant, or other Project related raw materials to the environment such that a measurable contamination of soil, surface water, or groundwater results, the event will be considered significant.

Contamination is defined as the following:

- Soil:
  - concentrations of any contaminant exceeding the guidelines provided in the Nova Scotia Contaminated Sites Regulations - Tier 1 Environmental Quality Standards for Soil at a Non- potable Site, Section 1, Table 1B.
- Surface Water:
  - concentrations of any contaminant exceeding the guidelines provided in the Nova Scotia Contaminated Sites Regulations - Tier 1 Environmental Quality Standards for the Protection of Freshwater Aquatic Life in Surface Water, Section 1, Table 3.
- Groundwater:
  - concentrations of any contaminant exceeding the guidelines provided in the Nova Scotia Contaminated Sites Regulations - Tier 1 Environmental Quality Standards for Groundwater at a Non-potable Site, Section 1, Table 4.

6.18.7.3.2 Potential Interactions and Effects

The potential interactions between a mobile equipment accident and VCs are outlined in Section 5.8, Tables 5.8-1 to 5.8-3. Additional detail by VC is outlined in Table 6.18-9. Only those interactions with a high potential to cause adverse effects should they occur are discussed in detail further.

Table 6.18-9: Mobile Equipment Accident Interactions with Valued Components

Valued Component	Potential Mobile Equipment Accident Interactions with Valued Component	Potential for Adverse Effects
Noise	No potential interaction anticipated	-
Air	A mobile equipment accident could potentially cause a fuel oil spill or small fire and release particulate matter, carbon monoxide, sulphur dioxide, nitrous oxides, and volatile organic compounds to the atmosphere	Low
Light	No potential interaction anticipated	-
Greenhouse Gases	A mobile equipment accident could potentially cause a fuel oil spill or small fire and release particulate matter, carbon monoxide, sulphur dioxide, nitrous oxides, and volatile organic compounds to the atmosphere	Low
Geology, Soil, and Sediment Quality	A mobile equipment accident could potentially cause a release of fuel oil to soil if released to the terrestrial environment A mobile equipment accident could potentially cause a release of fuel oil to sediment if released to the aquatic environment.	Low
Surface Water Quality and Quantity	A mobile equipment accident could potentially cause a release of fuel oil to watercourses	High
Groundwater Quality and Quantity	No potential interaction anticipated	-
Wetlands	A mobile equipment accident could potentially cause a release of fuel oil to wetlands	High
Fish and Fish Habitat	A mobile equipment accident could potentially cause a release of fuel oil to fish habitat	High

Table 6.18-9: Mobile Equipment Accident Interactions with Valued Components (continued)

Valued Component	Potential Mobile Equipment Accident Interactions with Valued Component	Potential for Adverse Effects
Habitat and Flora	No potential interaction anticipated	-
Avifauna	A mobile equipment accident could potentially cause bird mortality through direct strikes	Low
Terrestrial Fauna	A mobile equipment accident could potentially cause fauna mortality through direct strikes	Low
Species of Conservation Interest and Species at Risk	A mobile equipment accident could potentially cause a release of fuel oil to watercourses along the haul road A mobile equipment accident could potentially cause aquatic based species of conservation interest and species at risk mortality through direct strikes	High Low
Mi'kmaq of Nova Scotia	No potential interaction anticipated	-
Physical and Cultural Heritage	No potential interaction anticipated	-
Socio-economic Conditions	A mobile equipment accident could potentially cause injury or death to mine workers	High

Note: - = not applicable.

The emissions produced from a mobile equipment accident would be temporary and localized to the area directly around the accident. In addition, a release of fuel oil, lubricants or other Project related raw materials would be minor in volume and likely contained and cleaned up prior to significantly effecting soil or sediment quality. Effects to birds, fauna, and SOCI/SAR would be limited to death by direct strike, which would be limited to individuals rather than species populations. As a result, potentially adverse effects to the atmospheric environment, geology, soil, and sediment quality, birds, fauna, and SOCI/SAR are considered low.

Mobile equipment accidents pose an environmental risk to the following VCs:

- surface water quality and quantity;
- wetlands;
- fish and fish habitat; and
- SOCI/SAR.

The greatest potential for a mobile equipment accident to occur and cause adverse environmental effects is during the site preparation and construction, and operation and maintenance phases when the largest amount of mobile equipment is in use. The primary risk for the VCs listed above is associated with the release of fuel oil to the environment.

The magnitude of a release from mobile equipment is dependent on the severity and type of accident that occurs. A large spill can occur if an accident results in the complete destruction of a storage tank, or a small spill can occur if an accident results in a fuel line leak.

The location of the mobile equipment accident will also determine the magnitude of effects. An accident occurring within the Beaver Dam Mine Site boundaries is unlikely to cause significant environmental effects as the area will be largely devoid of ecological receptors and the presence of hundreds of workers will likely lead to quick and efficient containment and cleanup efforts. The primary receiver for spills as a result of accidents in this area is the soil portion of the geology, soil, and sediment quality VC. Spills are unlikely to reach surface water, sediment, groundwater, wetlands, and fish habitat due to anticipated spill response times, as

well as containment and cleanup efforts. A spill occurring due to an accident along the Haul Road may have more significant environmental effects if the accident occurs in close proximity to a watercourse or wetland. Should this occur, the effects to surface water quality, wetland health, fish and fish habitat, and SOCI/SAR may be more pronounced.

A mobile equipment accident may pose a health and safety risk to workers during all phases of the Project, as well as a financial liability risk related to mobile equipment damage or loss. The risk of a mobile equipment accident may decrease once the operations and maintenance phase ceases, as decommissioning and reclamation will likely require fewer pieces of mobile equipment.

The maximum effect of a mobile equipment accident as it relates to worker health and safety would be a death caused by a collision of two pieces of mobile equipment, a single equipment crash, or a direct strike from mobile equipment. The maximum effect of a mobile equipment accident as it relates to financial liability would be damage to or a total loss of one or more pieces of mobile equipment.

6.18.7.3.3 Mitigation and Emergency Response

The majority of mobile equipment traffic will be limited to the Beaver Dam Mine Site where guided traffic patterns, speed limits, right-of-way signage, and training will minimize the risk of vehicular accidents. The remaining mobile equipment will include haul trucks, which will transport crushed ore 30 km from the Beaver Dam Mine Site to the Touquoy Mine Site. The Haul Road will be dual lane and designed to facilitate the safe passage of two-way truck traffic at 70 km/h. Speed limits will be enforced on the Mine Site and Haul Road.

Speed limit and right-of-way signage will be installed and all haul truck operators will receive operator training to minimize the risk of haul truck collisions. All intersections will be designed to NSTIR Standards. Communications will be maintained between vehicles using radios so that adverse conditions or collisions may be reported immediately. The operators training will include proper procedures for daily travel to minimize the risk of vehicular accidents, as well as procedures related to emergency response should there be a vehicular accident.

Good maintenance practices for equipment and vehicle maintenance will be undertaken, including regular maintenance as specified by suppliers.

An emergency response plan will be developed for the Project and will include procedures to be followed in the event of a mobile equipment accident. The legislation is well established and understood by the Proponent's staff and will be conveyed to any contractors at the site so that all know of actions to take and reporting requirements.

If a mobile equipment accident were to occur, emergency procedures would be implemented that will be outlined in the site emergency response plan. Generally, mobile equipment accident response includes raising the alarm, providing first aid to any injured persons, and securing all equipment in the area. An assessment is then made using on-site staff to determine whether Emergency Services are required and the cause of the accident. If required, Emergency Services will be contacted. A plan to determine what repairs are needed and actions to prevent future incidents will be detailed in a recovery plan. Depending on the regulator involvement there may be a requirement to file incident reports with certain regulatory agencies prior to initiating the clean up and return to work in the area, these are very case specific and often dependent on whether personnel were injured or equipment damaged as a result of the mobile equipment accident.

6.18.7.4 Touquoy Mine

The Project will utilize the existing processing facility at the Touquoy Mine Site to process Beaver Dam ore. The Touquoy Mine Site is a fully permitted and approved facility currently operating as part of the Touquoy Gold Mine Project in Moose River, Halifax County, Nova Scotia.

Only minor changes to the existing works will be necessary to modify the Touquoy Mine Site to process Beaver Dam ore. The minor modifications to the processing facility can be accommodated within the existing footprint and do not result in a change the processing flowsheet. Beaver Dam tailings will be stored in the exhausted Touquoy open pit as opposed to the Touquoy tailings management facility. The tailings and reclaim water lines will be re-routed in order to transport Beaver Dam tailings to the exhausted Touquoy pit and return process water to the mill. The Touquoy Mine Site footprint will, as a result, be maintained as originally permitted.

An amendment to the Touquoy IA will be sought as necessary to accommodate these changes. As well, the currently approved Reclamation Plan will be updated to reflect the above changes and re-submitted.

The continued operation of the Touquoy processing plant and the use of the open pit mine for tailings storage will create the potential for accidents and malfunctions to occur at the Touquoy Mine Site for an additional four years. The potential for accidents and malfunctions at the Touquoy Mine Site will continue to be mitigated through the application of existing environmental management plans, operating procedures and monitoring programs.

6.18.7.5 Tailings and Reclaim Water Pipelines Spills

Prior to the completion of mining operations at the Touquoy Mine Site, a tailings line will be routed to the exhausted Touquoy pit in preparation to receive Beaver Dam tailings. Tailings will flow by gravity from the mill to the open pit. Initially, reclaim water will continue to be withdrawn from the supernatant pond in the existing TMF via the existing reclaim works to supply processing water needs for Beaver Dam ore. A reclaim water pump and barge, with a new pipeline to the process water tank, will be installed when process water accumulation from the tailings slurry deposited in the open pit is adequate. The transition from the TMF to the open pit reclaim water system is expected to be smooth, requiring minimal downtime and no expected extra freshwater requirements beyond what is currently permitted from Scraggy Lake under Touquoy's water withdrawal approvals. The existing TMF will only be used for initial process water requirements and will not be used for tailings storage in the processing of Beaver Dam ore.

Supernatant water collected in the open pit will be pumped to the process water tank located next to the pre-leach thickener. The sections of the tailings and reclaim pipelines between the plant site and open pit will be double-walled and run in HDPE lined trenches to an adequately sized lined collection ponds capable of containing the volume of the pipeline. Monitoring systems will be installed on the pipelines for leak detection and triggering shutdown procedures.

The Touquoy Project currently employs an Operation, Maintenance and Surveillance (OMS) Manual for the existing TMF. This manual will be updated in advance of using the open pit for storage of Beaver Dam tailings in order to reflect changes in operating conditions and environmental factors. As well, Touquoy also currently employs an Emergency and Spill Response Plan which will also be updated, Environmental monitoring will continue as prescribed under the Touquoy IA which will be amended as necessary to reflect the changes in processing of Beaver Dam ore and storage of Beaver Dam tailings in the exhausted pit.

6.18.7.5.1 Threshold for Determination of Significance

The criteria that would determine a significant effect should a tailings or reclaim water pipeline fail, is based primarily on environmental protection. Should a pipeline failure result in an uncontrolled discharge of tailings and/or process water to the receiving surface water environment the event will be considered significant.

Comparison of receiving surface water samples to CCME FWAL TSS guidelines and MMER TSS guidelines will be utilized to determine if tailings/process water will have an impact on surface water quality and subsequently on fish and fish habitat.

6.18.7.5.2 Potential Interactions and Effects

The potential interactions between a tailings or reclaim water pipeline accident and VCs are outlined in Section 5.8, Tables 5.8-1 to 5.8-3. Additional detail by VC is outlined in Table 6.18-10. Only those interactions with a high potential to cause adverse effects should they occur are discussed in detail further.

Table 6.18-10: Unplanned Tailings/Reclaim Water Line Event Interactions with Valued Components

Valued Component	Potential Unplanned Tailings/Reclaim Water Line Event and Valued Component Interaction	Potential for Adverse Effects
Noise	No potential interaction anticipated	-
Air	No potential interaction anticipated	-
Light	No potential interaction anticipated	-
Greenhouse Gases	No potential interaction anticipated	-
Geology, Soil, and Sediment Quality	No potential interaction anticipated	-
Surface Water Quality and Quantity	Failure of a tailings or reclaim water pipeline could potentially cause tailings solids and/or contaminated process water to discharge to surface waters	Low
Groundwater Quality and Quantity	No potential interaction anticipated	-
Wetlands	No potential interaction anticipated	-
Fish and Fish Habitat	Failure of a tailings or reclaim water pipeline could potentially cause tailings solids and/or contaminated process water to discharge to surface waters	Low
Habitat and Flora	No potential interaction anticipated	-
Avifauna	No potential interaction anticipated	-
Terrestrial Fauna	No potential interaction anticipated	-
Species of Conservation Interest and Species at Risk	No potential interaction anticipated	-
Mi'kmaq of Nova Scotia	No potential interaction anticipated	-
Physical and Cultural Heritage	No potential interaction anticipated	-
Socio-economic Conditions	No potential interaction anticipated	-

Note: - = not applicable.

6.18.7.5.3 Mitigation and Emergency Response

The sections of the tailings and reclaim pipelines between the plant site and open pit will be double-walled and run in HDPE lined trenches to an adequately sized lined collection pond capable of containing the volume of the pipeline. The catchment pond will be lined with suitable materials, such as clay or a plastic liner.

Process controls will be in place to detect a pipeline leak or spill and initiate shutdown procedures.

The potential for accidents and malfunctions at Touquoy mine will continue to be mitigated through the application of existing environmental management plans, operating procedures and monitoring programs, including the OMS Manual and Emergency and Spill Response Plan.

Given the location of the pipelines, trench and catchment pond within the mine production area and in close proximity to other facilities and personnel, detection and response to any spill would be expected to be rapid and confined to the mine footprint area and not result in significant release to the receiving environment.

If a tailings and/or reclaim water pipelines spill were to occur, emergency procedures would be implemented that will be outlined in the site emergency response plan. Generally, tailings and/or reclaim water pipelines emergency response includes evacuation of all equipment and personnel from the area. If tailings and/or reclaim water encroach on neighbouring properties or public roadways, appropriate authorities will be notified and construction of bunds and/or diversion drains may be required to contain tailings and/or reclaim water on-site. Other immediate responses may include lowering tailing pond levels, stopping the inflow into the tailings pond from the mill, stabilizing unstable slopes, and mitigating downstream consequences. An assessment is then made using on-site staff and possibly external resources (surface water specialists) as to what repairs are needed and actions to prevent future incidents. This will be detailed in a recovery plan. Depending on the regulator involvement there may be a requirement to file incident reports with certain regulatory agencies prior to initiating the repairs and return to work in the area, these are very case specific and often dependent on whether personnel were injured or equipment damaged as a result of tailings and/or reclaim water pipelines spill.

6.18.7.6 Cyanide Release

Cyanide Handling

Sodium cyanide (NaCN) is a key reagent used in the Carbon-In-Leach (CIL) process to leach gold from a sold matrix to form a gold cyanide complex that can be extracted from the slurry by adsorption onto activated carbon.

NaCN is delivered to Touquoy in the form of in dry briquettes from an approved supplier as per International Cyanide Management Code (ICMC) standards. NaCN deliveries are made by truck in one tonne secured (strapped) wooden crates. Within the crates the NaCN is double wrapped and sealed closed. Upon receipt at Touquoy, the sodium cyanide is stored in a locked, fenced area within the secure reagent building and kept under camera surveillance.

Prior to use, NaCN is mixed with water and sodium hydroxide (NaOH) for dilution and pH control within a mixing tank. Prior to mixing, operators suit up in full personnel protective equipment (PPE) including Tyvek suits and powdered air purifying respirators (PAPR). Water and NaOH are added to the cyanide mix tank. The wooden crates are opened, and a gantry crane lifts the bags out and transports them to the mix tank. The bags are lifted by crane into the bag cutter on top of the mix tank and the door is shut to enclose the bag. The bag is slowly lowered onto the bag cutter and the dry solids are emptied into the mix tank. The bag cutter has water sprays to clean the cyanide bags prior to removing from the enclosure. This process is repeated for 4 cyanide (NaCN) bags to achieve a mix concentration of ~22%. Once the NaCN storage tank level drops below 20% the contents of the mix tank are then transferred to the storage tank for distribution throughout the plant.

Cyanide is added into three areas; Leach tank #1, Intensive Leach Reactor (ILR) and Barren Eluate tank #12. Leach tank #1 is a continuous addition whenever the leach circuit is being fed with ore. It is controlled based on constant cyanide titrations throughout the leach/CIL circuit. The ILR and Barren Eluate tank are dosed based on a batch process. When a batch is ready, the dosage is

controlled based on a flowmeter to a targeted concentration. All these addition points have pH control reagents (NaOH or Lime) with automated interlocks that will not permit NaCN addition until a suitable pH is achieved to avoid the formation of hydrogen cyanide (HCN) gas.

Cyanide target concentrations are as follows:

- Leach tank # 1 = 50 ppm (0.005%). By the end of the CIL circuit (CIL tank #6), the remaining cyanide is about 30 ppm (0.003%).
- ILR = 14,000 ppm (1.4%). Once the process is complete, this small volume (5.2 m^3) is transferred and diluted in the much larger Leach/CIL circuit (9,100 m^3) for consumption.
- Barren Eluate Tank #12 = 1,000 ppm (0.1%). Once the process is complete, the remaining cyanide stays in the tank to be re-used during the next batch. Each new batch, the cyanide is just topped up to the target concentration.

6.18.7.6.1 Cyanide Detoxification

Cyanide detoxification occurs within the cyanide destruction circuit. Slurry passing through the carbon safety screen gravitates to two 300 m^3 cyanide detoxification tanks which are designed on the conventional air-SO_2 process and can operate in series or parallel for operational flexibility. The average slurry residence time at 250 t/h is 1.5 hours.

The tanks utilize high shear agitators and air injection to enhance high oxygen dissolution in the slurry to meet the high oxygen demand of the cyanide destruction process. Sodium metabisulphite and copper sulphate solutions are dosed into either tank providing the oxidizing agent and catalyst respectively for the cyanide destruction. Acid generation is neutralized by the addition of lime slurry to the detox tanks via a ring main.

The detoxified slurry stream gravitates to the tailings hopper from where it is pumped through a single pipeline to the TMF by variable speed tailings pumps (1 duty/1 standby). The tailings slurry is then discharged at selected outlet points around the periphery of the facility. Pipe runs are designed to be self- draining to avoid dead legs.

Contingency measures for cyanide detoxification include primary linear and secondary rotary vezin tailings samplers taking representative tailings samples after the slurry has been detoxified and prior to entering the tailings hopper. The cyanide destruction and tailings hopper area has a dedicated bunded concrete area for collecting spillage. A local sump pump returns any spillage to the carbon safety screen. The area is enclosed for cold weather protection. A CNWAD analyzer automatically monitors slurry levels and a HCN detector provides monitoring for airborne gas.

Shutdown procedures are in place in the event of process upsets including cyanide detoxification.

6.18.7.6.2 Threshold for Determination of Significance

The criteria that would determine a significant effect should an unplanned cyanide release occur is based primarily on worker health and safety and environmental impact. Should an unplanned cyanide release result in injury or death to a worker or contamination of the receiving environment the event will be considered significant.

6.18.7.6.3 Potential Interactions and Effects

The potential interactions between an unplanned cyanide release and VCs are outlined in Section 5.8, Tables 5.8-1 to 5.8-3. Additional detail by VC is outlined in Table 6.18-11. Only those interactions with a high potential to cause adverse effects should they occur are discussed in detail further.

Table 6.18-11: Unplanned Cyanide Event Interaction with Valued Components

Valued Component	Potential Unplanned Cyanide Event and Valued Component Interaction	Potential for Adverse Effects
Noise	No potential interaction anticipated	-
Air	An unplanned cyanide release event could potentially cause short term toxic effects within the localized area	Low
Light	No potential interaction anticipated	-
Greenhouse Gases	No potential interaction anticipated	-
Geology, Soil, and Sediment Quality	No potential interaction anticipated	Low
Surface Water Quality and Quantity	An unplanned cyanide release event could potentially cause toxic effects within the localized area	Moderate
Groundwater Quality and Quantity	An unplanned cyanide release event could potentially affect groundwater within the localized area	Low
Wetlands	No potential interaction anticipated	-
Fish and Fish Habitat	An unplanned cyanide release event could potentially cause toxic effects within the localized area	Moderate
Habitat and Flora	An unplanned cyanide release event could potentially cause toxic effects within the localized area	Low
Avifauna	An unplanned cyanide release event could potentially cause toxic effects within the localized area	Low
Terrestrial Fauna	An unplanned cyanide release event could potentially cause toxic effects within the localized area	Low
Species of Conservation Interest and Species at Risk	An unplanned cyanide release event could potentially cause toxic effects within the localized area	Low
Mi'kmaq of Nova Scotia	An unplanned cyanide release event could potentially affect land use in short or long term	Low
Physical and Cultural Heritage	No potential interaction anticipated	-
Socio-economic Conditions	An unplanned cyanide release event could potentially cause effects to safety and land use	Moderate

Note: - = not applicable.

6.18.7.6.4 Mitigation and Emergency Response

Cyanide handling and use is highly regulated and subject to strict practices and procedures. Cyanide as delivered in dry briquette form is relatively safe from spills and easy to clean up in the event of a transportation or handling incident. Cyanide in solution is restricted to use within the processing facility with an abundance of design and process controls, as well as occupational health and safety practices, to prevent release of cyanide solution or gas within and without the building structure. Cyanide solution is detoxified by a proven and efficient process and tested by an automated in-line sampler prior leaving the processing facility, making the release of a high concentration (i.e., non-detoxified) cyanide solution outside the confines of the process facility a highly unlikely event.

If cyanide exposure were to occur, emergency procedures would be implemented that will be outlined in the site emergency response plan. Generally, cyanide exposure response includes raising the alarm, contacting Emergency Services, evacuation of all personnel from the area to fresh air, removal of contaminated clothing, washing of cyanide residue from affecter personnel, administering oxygen, and securing the area. A plan to determine what repairs are needed and actions to prevent future incidents will be detailed in a recovery plan. Depending on the regulator involvement there may be a requirement to file incident reports with certain regulatory agencies prior to initiating the clean-up and return to work in the area, these are very case specific and often dependent on whether personnel were injured as a result of the cyanide exposure.

6.18.8 Other Malfunctions

6.18.8.1 Forest and/or Site Fires

All phases of the Project will have the potential for forest and/or site fires to occur. A worst-case scenario is an extreme fire that results in worker injury or death or that causes significant damage to the environment. A forest fire may occur through human or natural causes, while a site fire may occur due to an equipment failure and/or human error. Forest fires have the potential to affect the Project at the Beaver Dam Mine Site and at the Touquoy Mine Site; however, due to a lack of vegetation at the Beaver Dam Mine Site and Touquoy Mine Site, it is unlikely that a site fire could spread to and affect the surrounding forest. Forest fires along the Haul Road have the potential to affect Haul Road operations and likewise, site fires along the Haul Road could spread to and affect the surrounding forest.

6.18.8.1.1 Threshold for Determination of Significance

The criteria that would determine a significant effect should a forest and/or site fire occur is based primarily on worker health and safety and secondarily on property damage and environmental protection.

Should a forest and/or site fire result in injury or death to a worker or a loss of infrastructure or mobile equipment the event will be considered significant.

Should a forest and/or site fire result in the loss of any quantity of fuel, oil, lubricant, or other Project related raw materials to the environment such that a measurable contamination of soil, surface water, or groundwater results, the event will be considered significant.

Contamination is defined as the following:

- Soil:
  - concentrations of any contaminant exceed the guidelines provided in the Nova Scotia Contaminated Sites Regulations - Tier 1 Environmental Quality Standards for Soil at a Non- potable Site, Section 1, Table 1B.
- Surface Water:
  - concentrations of any contaminant exceed the guidelines provided in the Nova Scotia Contaminated Sites Regulations - Tier 1 Environmental Quality Standards for the Protection of Freshwater Aquatic Life in Surface Water, Section 1, Table 3.
- Groundwater:
  - concentrations of any contaminant exceed the guidelines provided in the Nova Scotia Contaminated Sites Regulations - Tier 1 Environmental Quality Standards for Groundwater at a Non-potable Site, Section 1, Table 4.

Potential Interactions and Effects

The potential interactions between a forest and/or site fire and VCs are outlined in Section 5.8, Table 5.8-1 to 5.8-3. Additional detail by VC is outlined in Table 6.18.12. Only those interactions with a high potential to cause adverse effects should they occur are discussed further.

Table 6.18-12: Forest and/or Site Fire Interactions with Valued Components

Valued Component	Potential Forest and/or Site Fire and Valued Component Interaction	Potential for Adverse Effects
Noise	No potential interaction anticipated	-
Air	A forest and/or site fire could potentially release particulate matter, carbon monoxide, Sulphur dioxide, nitrous oxides, and volatile organic compounds to the atmosphere	Low
Light	No potential interaction anticipated	-
Greenhouse Gases	A forest and/or site fire could potentially release particulate matter, carbon monoxide, Sulphur dioxide, nitrous oxides, and volatile organic compounds to the atmosphere	Low
Geology, Soil, and Sediment Quality	No potential interaction anticipated	Low
Surface Water Quality and Quantity	A forest and/or site fire could potentially cause surface water runoff to erode and entrain suspended solids for deposition into water courses A forest and/or site fire could potentially reduce surface water quantity through extraction to extinguish the fire	Low
Groundwater Quality and Quantity	No potential interaction anticipated	-
Wetlands	A forest and/or site fire could potentially cause wetland destruction through burning of vegetation	Low
Fish and Fish Habitat	A forest and/or site fire could potentially cause surface water quality and quantity issues that may indirectly effect fish and fish habitat	Low
Habitat and Flora	A forest and/or site fire could potentially cause destruction of habitat and flora	High
Avifauna	A forest and/or site fire could potentially cause destruction of bird habitat and/or direct mortality	High
Terrestrial Fauna	A forest and/or site fire could potentially cause destruction of fauna habitat and/or direct mortality	High
Species of Conservation Interest and Species at Risk	A forest and/or site fire could potentially cause destruction of species of conservation interest and species at risk	High
Mi'kmaq of Nova Scotia	A forest and/or site fire could potentially cause effects to the current use or land and resources for traditional purposes by Indigenous Peoples	Low
Physical and Cultural Heritage	No potential interaction anticipated	-
Socio-economic Conditions	A forest and/or site fire could potentially result in injury or death of mine workers	High

Note: - = not applicable.

The topographic profile of the region allows for precipitation to be retained in soil and numerous watercourses and wetlands to form. As a result, large forest and/or site fires are unlikely to occur. In the unlikely event a forest and/or site fire occurs, the following adverse effects to VCs are considered low:

- emissions produced from a forest and/or site fire would be temporary; however, may adversely affect ambient air quality in the area;
- surface water run-off created from extinguishing the fire may transport sediment and potential contaminants towards watercourses along the Haul Road; thereby affecting surface water quality;
- surface water quantity in watercourses near the Beaver Dam Mine Site may be slightly affected through extraction and use of surface water for extinguishing the fire; however, these watercourses will only be utilized to aid in extinguishing small localized fires;
- effects to wetlands and fish and fish habitat are expected to be minimal due to the presence of water and saturated soils and flora; and
- unless a forest and/site fire extends to the Beaver Lake IR 17, it is unlikely that Indigenous Peoples will be adversely affected by forest and/or site fires.

As a result, potentially adverse effects to the atmospheric environment, surface water quality and quantity, wetlands, fish and fish habitat, and Indigenous Peoples are considered low.

The greatest potential for a forest and/or site fire to occur as a result of the Project is during the site preparation and construction, and operation and maintenance phases when the greatest amount of physical activity is occurring at the at the Beaver Dam Mine Site and along the Haul Road. The primary risk for the environment is associated with physical habitat destruction and death of terrestrial species.

A forest and/or site fire caused by the Project has the potential to modify terrestrial habitat and cause direct mortality to wildlife populations, especially during the breeding season when the mobility of immature individuals is limited. The destruction of habitat may result in the loss of breeding, nesting, rearing, and/or other habitat for birds, fauna, and SOCI/SAR. Habitat fragmentation created by a fire may cause potential adverse effects for species that migrate throughout a landscape based on resources that are seasonally available.

Although a forest and/or site fire caused by the Project is likely to be extinguished before it creates a significant effect to the local area, it is unlikely that terrestrial habitat loss or direct individual mortality would create population viability issues if an uncontrollable fire was allowed to burn. It is likely that mobile terrestrial species will move to adjacent areas and any habitat loss would lead to regrowth within a few generations. In addition, habitat types in the area of the Project are not unique and would be easily supplanted with minor migration efforts by terrestrial species.

A forest and/or site fire created by the Project would likely result from a structural failure or accident identified in Sections 6.18.4 and 6.18.5 of this EIS. Should the mitigation measures for these structural failures or accidents be implemented, it is extremely unlikely that a forest and/or site fire created by the Project would occur.

6.18.8.1.2 Mitigation and Emergency Response

Fire protection for the plant site will be via a "wet system" with hydrants located around the plant site area. The water contained within the lower portion of the raw water tank will be reserved for fire protection. Fire detection systems will be installed in all buildings and in key areas of the Mine Site.

In each area, a combination of heat and smoke detectors will be provided with break-glass units mounted externally to the buildings. The large primary mining fleet including excavators, front end loader, haul truck, dozers and drills will be fitted with fire suppression systems in case of fire.

The water truck will be fitted with a pump and 2.5-inch hydrant hose reel for firefighting. Supplementary hand-held fire extinguishers, each suitable for its specific area, will be mounted in all buildings and vehicles. The site will have fire-fighting and fire-suppression capabilities that will be supplemented by support from the local community.

Fire response training and fire extinguisher training will be provided to all staff. An emergency response plan will be developed for the site, which will include fire response.

The site will be staffed to varying levels 24 hours a day with personnel in all areas of the Beaver Dam Mine Site. Fires, if they occur, would be quickly detected and emergency procedures able to be acted on. The availability of water, equipment and nearby personnel from volunteer fire departments and NSL&F staff with expertise in forest fire control are all benefits to the Project and greatly reduce the possibility of fires that would not be able to be quickly controlled, and damage limited.

If a forest fire were to occur, emergency procedures would be implemented that will be outlined in the site emergency response plan. Generally, forest fire response includes raising the alarm and evacuation of all personnel from the area. If required, Emergency Services will be contacted.

6.18.9 Risk Assessment

Each potential accident and malfunction identified in the previous sections was assessed considering the likelihood of occurrence and the level magnitude should these accidents and malfunctions occur.

The likelihood of occurrence is given a score of 1 to 5 with an associated rating as defined below:

1. **Negligible:**

- Accident or malfunction not likely to occur with a less than 1 in 10,000 probability of occurrence per year.

2. **Low:**

- Accident or malfunction unlikely to occur with a less than 1 in 1,000 probability of occurrence per year.

3. **Moderate:**

- Accident or malfunction has potential to occur with a less than 1 in 100 probability of occurrence per year.

4. **High:**

- Accident or malfunction may occur with a less than 1 in 10 probability of occurrence per year.

5. **Extreme:**

- Accident or malfunction is likely to occur with a greater than 1 in 10 probability of occurrence per year.

The level of magnitude should these accidents and malfunctions occur is also given a score of 1 to 5 with an associated rating as defined below:

1. **Negligible:**

- preventative requirements are minimal,
- no long-term effects are expected, and
- readily remediated with funds in the $0 to $10,000 range.

2. **Low:**

- preventative requirements are minimal,
- limited long-term effects are expected, and
- limited remediation required with funds in the $10,000 to $100,000 range.

3. **Moderate:**

- preventative requirements are moderate,
- moderate long-term effects are expected, and
- moderate remediation required with funds in the $100,000 to $1,000,000 range.

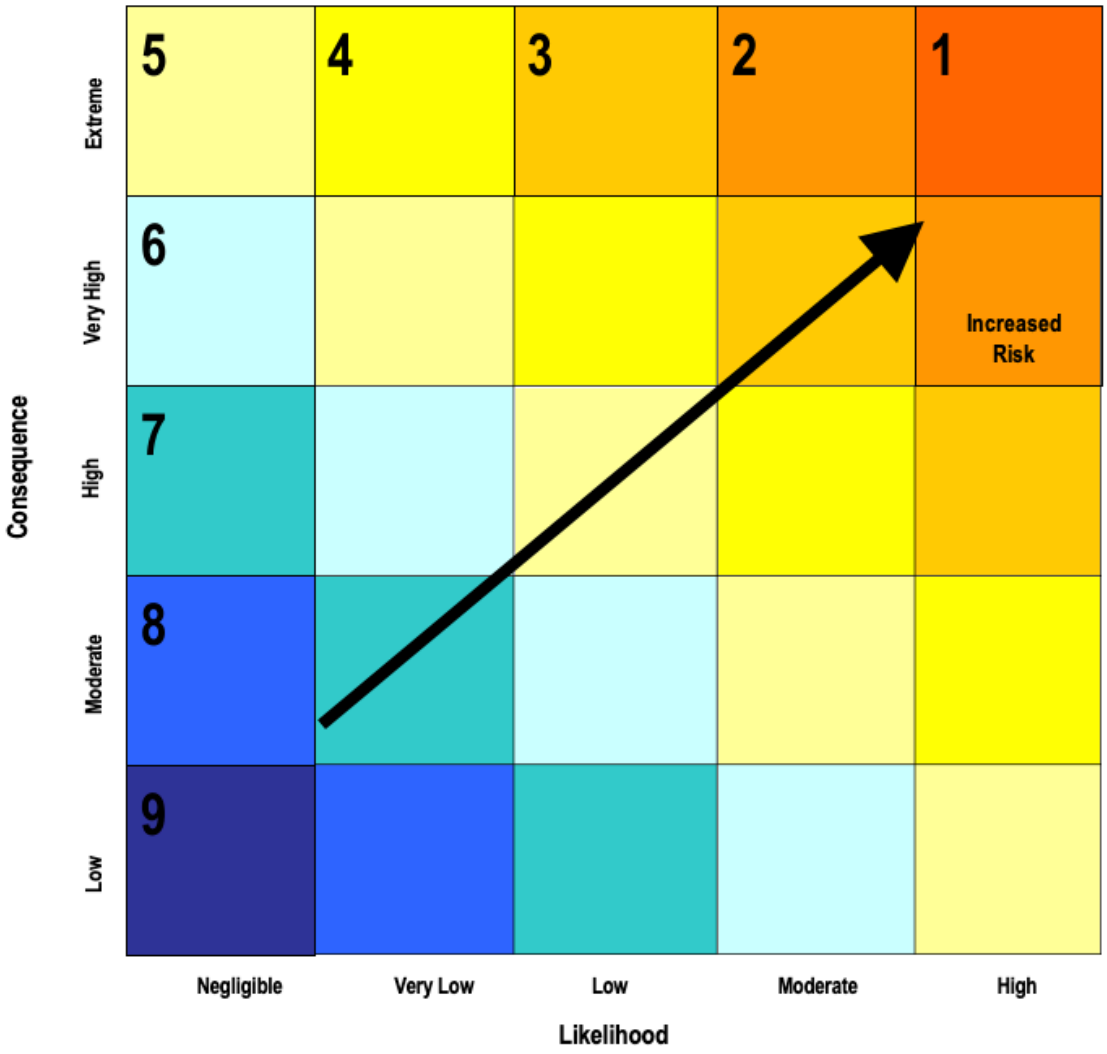
4. **High:**

- preventative requirements are high,
- significant long-term effects are expected, and
- significant remediation required with funds in the $1,000,000 to $10,000,000 range.

5. **Extreme:**

- Preventative requirements are very high,
- permanent effects are expected, and
- highly significant remediation required with funds in the $10,000,000 plus range.

Figure 6.18-1: Risk Ranking Matrix



Each credible potential accident and malfunction discussed was assessed according to likelihood of occurrence and magnitude / consequence of occurrence, and given a risk ranking of between 1 (highest) and 9 (lowest). Each risk ranking refers to a diagonal row of cells within a risk matrix shown in the same colour (Table 6.18-13). As shown in the risk matrix, increased risk is associated with malfunctions and accidents having a greater likelihood of occurrence and increased level of consequence, as is intuitively true. The breakdown of ratings each accident and malfunction, as well as summarizes the key VCs that would likely be affected is provided in Table 6.18-13.

Table 6.18-13: Accident and Malfunction Characterization Criteria for Risk Rating Matrix

Accident / Malfunction	Concerns	Key Valued Components Potentially Affected	Likelihood	Consequence	Risk Ranking
Slope Failures	Ground surface slump of the surrounding area affecting the site's infrastructure, Haul Roads and onsite access roads and worker safety	Socio-economic Conditions	Low	Moderate	6
Open Pit Slope Failure	Affects to habitat and limited flooding of open pit	Socio-economic Conditions Physical and Cultural Heritage	Low	Moderate	6
Waste Rock Stockpile Slope Failure	Affects to Terrestrial habitat and aquatic life	Surface Water Quality and Quantity Wetlands Fish and Fish Habitat Species of Conservation Interest/Species at Risk	Very Low	High	6
Till/Organic Stockpile Slope Failure	Affects to terrestrial habitat and aquatic life	Surface Water Quality and Quantity Wetlands Fish and Fish Habitat Species of Conservation Interest/Species at Risk	Very Low	Moderate	7
Settling Pond Failure	Affects to aquatic life	Surface Water Quality and Quantity Wetlands Fish and Fish Habitat Species of Conservation Interest/Species at Risk	Negligible	Moderate	7

Table 6.18-13: Characterization Criteria for Risk Rating Matrix (continued)

Accident / Malfunction	Concerns	Key Valued Components Potentially Affected	Likelihood	Consequence	Risk Ranking
Infrastructure Failures	Failure of multiple operational components as a result of a natural cause impacting worker health and safety and surrounding environment	Socio-economic Conditions Surface Water Quality and Quantity Wetlands Fish and Fish Habitat Species of Conservation Interest/Species at Risk	Negligible	Moderate	7
Explosives Accident	Human environment	Socio-economic Conditions Fish and Fish Habitat	Negligible	Low	9
Fuel Release during Truck Transport	Affects to aquatic life and downstream human environment	Socio-economic Conditions Surface Water Quality and Quantity Wetlands Fish and Fish Habitat Species of Conservation Interest/Species at Risk	Very Low	High	6

Table 6.18-13: Characterization Criteria for Risk Rating Matrix (continued)

Accident / Malfunction	Concerns	Key Valued Components Potentially Affected	Likelihood	Consequence	Risk Ranking
Fuel Release from Storage Facilities and Dispensing Area	Affects to habitat	Socio-economic Conditions Surface Water Quality and Quantity Wetlands Fish and Fish Habitat Species of Conservation Interest/Species at Risk	Low	Low	7
Transportation Accident – Hazardous Materials (excluding fuel)	Affects to habitat, aquatic life and downstream human environment	Socio-economic Conditions Human Environment Surface Water Quality and Quantity Wetlands Fish and Fish Habitat Species of Conservation Interest/Species at Risk	Very Low	High	6
Transportation Accident – Non-hazardous Materials	Affects to local terrestrial environment	Socio-economic Conditions Habitat and Fauna Wetlands Species of Conservation Interest/Species at Risk	Low	Low	7

Table 6.18-13: Characterization Criteria for Risk Rating Matrix (continued)

Accident / Malfunction	Concerns	Key Valued Components Potentially Affected	Likelihood	Consequence	Risk Ranking
Mobile Equipment Accident	Severe accident-causing injury or death, property damage and environmental impacts	Surface Water Quality and Quantity Wetlands Fish and Fish Habitat Species of Conservation Interest/Species at Risk Socio-economic Conditions	Very Low	High	6
Tailings/Reclaim Water Pipeline Spill	Uncontrolled discharge of tailings and/or contaminated water into the surrounding environment	Surface Water Quality and Quantity Fish and Fish Habitat	Negligible	Moderate to Very High	6 to 8
Cyanide Release	Uncontrolled release of cyanide into the workplace and/or surrounding environment resulting in worker injury or death and/or causing significant damage to the environment		Negligible	Moderate to Very High	6 to 8
Project-related Fires	Affects Human environment, local terrestrial habitat loss	Habitat and Flora Avifauna Terrestrial Fauna Species of Conservation Interest/Species at Risk Socio-economic Conditions	Negligible	Moderate to Very High	6 to 8

6.18.10 Discussion

Potential accidents and malfunctions assigned a risk rating of 1 to 5 are considered low risk, those assigned a risk rating of 6 to 15 are considered moderate risk, and those assigned a risk rating of 16 to 25 are considered high risk. If an accident or malfunction is assigned a risk rating of 16 or higher, it is considered significant and requires further consideration during the Project's detailed design phase. The results of this qualitative analysis indicate that a mobile equipment accident and fuel and/or other spill are considered the most risky; however, all identified accidents and malfunctions have a low or moderate risk rating and are therefore considered not significant.

7 EFFECTS OF THE ENVIRONMENT ON THE BEAVER DAM MINE PROJECT

7.1 Introduction

7.1.1 Summary of Effects of the Environment on the Beaver Dam Mine Project Before the Updates

Section 7 described the effects of the environment on the Project that includes how local conditions, natural hazards, climate change and external events could affect the Project.

The Beaver Dam Mine Site infrastructure are designed to accommodate the conditions imposed by the natural environment and to accommodate the effects of external events on the Project, as much as possible. Climate change is not anticipated to have a significant effect on the Project, based on the relatively short duration of the Project.

There are no significant adverse environmental effects anticipated due to the changing environmental conditions. Potential effects of the environment on the Project will be reduced as much as practicable through proper design and planning and mitigation measures. Extreme weather events cannot be predicted, but through proper design and planning the majority of the effects of these events on the Project may be minimized.

7.1.2 Summary of Updates to Effects of the Environment on the Beaver Dam Mine Project

The effects of the environment on the Project has been updated to reflect updates of the Project Description (Section 2) and to address Round 2, Information Requests (IR2) issued by the Impact Assessment Agency of Canada (IAAC, formerly the Canadian Environmental Assessment Agency [CEAA 2019]) and Nova Scotia Environment (NSE 2019). This includes:

- Update of the data set that was used for the precipitation and temperature profiles at Middle Musquodoboit Station
- Updated the climate data set to include lake evaporation climate normals (1981–2010) which were taken from the Truro climate station
- Effects of the environment, specifically climate change, was considered in the design of settling ponds and ditches that were designed as a result of the update of the Project Description

The changing environment is not an assessment endpoint in themselves but rather an assessment of how these conditions have been considered in project design, predictive modelling, mitigation, monitoring and management plans.

An outline of updates to the effects of the environment on the Beaver Dam Mine Project are summarized in Table 7.1-1.

Table 7.1-1: Updated Subsections from the 2019 Revised Environmental Impact Statement – Effects of the Environment on the Beaver Dam Mine Project

2019 Revised EIS Submission (February 28, 2019)	Updated in 2021	Corresponding 2021 EIS Update Section Number	Reason for Update
-	-	7.1 Introduction	• New
7.1 Environmental Considerations	No	7.2 Environmental Considerations	• N/A
7.1.1 Climate	Yes	7.2.1 Climate	• Updated to reflect changes in data set. Lake evaporation climate normal data (1981 – 2010) was used in the assessment which was taken from the Truro climate station (ID#8205990). • Temperature and Precipitation subsections and tables updated to reflect changes in data set.
7.1.2 Extreme Weather	Yes	7.2.2 Extreme Weather	• Flood and Drought Conditions and Extreme Temperatures, Storms, and Wind subsections updated to reflect changes in data set.
7.1.3 Climate Change	Yes	7.2.3 Climate Change	• Regional Future Projections subsection Updated to reflect changes in data set. • Climate Change Mitigation and Adaptation subsection updated to reflect contingency to water management facility and collection ponds designs.
7.1.4 Slope Stability	Yes	7.2.4 Slope Stability	• Updated to reflect information from the geotechnical stability of permanent and temporary stockpiles undertaken by Golder (Appendix A.2a).
7.1.5 Seismic Events	Yes	7.2.5 Seismic Events	• Updated to reflect information from the geotechnical stability of permanent and temporary stockpiles undertaken by Golder (Appendix A.2a).
7.2 Mitigations	No	7.3 Mitigation	• Updated to include monitoring to be conducted during construction, operations, and active closure of engineered structures.
7.3 Residual Effects	Yes	Section removed	• N/A
-	-	7.4 Summary	• New

7.2 Environmental Considerations

The changing environment is not an assessment endpoint in themselves but rather an assessment of how these conditions have been considered in project design, predictive modelling, mitigation, monitoring and management plans.

Environmental conditions include, natural hazards, climate change and external events could affect the Project. Additionally, the accidents or malfunctions (Section 6.18) considers these conditions when developing mitigation measures and contingencies in the event of upset conditions.

The natural environment has the ability to potentially adversely impact the Project through events which may include the following:

- flooding;
- drought;
- extreme temperatures;
- severe weather events, including snow, ice, rain, and windstorms;
- lightning strikes;
- landslides, erosion, or subsidence;
- fire; and
- seismic events.

The Beaver Dam Mine Site infrastructure will be designed to accommodate the conditions imposed by the natural environment and to accommodate the effects of external events on the Project, as much as possible.

7.2.1 Climate

Climate refers to average long-term (typically minimum 30-year record) weather patterns within a particular area (NASA, 2005). Average weather patterns that define a climate include measures of temperature, humidity, precipitation, evaporation and wind velocity. Phenomena such as frost, fog and hail storms are also considered when defining the climate of an area (NASA, 2005).

As stated in Section 6.2.4 (Air – Baseline Conditions), the nearest climate station with historical data is the Middle Musquodoboit climate station (ID# 8203535) operated by the Co-operative Climate Network (CCN). The station is located approximately 15 km northwest of the Mine Site, near Middle Musquodoboit (45° 04'N, 63° 06'N). The following is a summary of average climate conditions at the Middle Musquodoboit station, based daily rainfall, snowfall and mean temperature data published by Environment and Climate Change Canada for the 41 year period of record including 1968 to 2005, 2009, 2014 and 2016. Wind data is taken from the Halifax Airport climate station (MSC ID# 202250), which is located approximately 45 km west of the Mine Site. This is the closest station to the site for which wind data exists. Lake evaporation climate normals (1981–2010) are taken from the Truro climate station (ID# 8205990), the closest climate station to the site which collects lake evaporation data.

7.2.1.1 Temperature

Temperature data for the Middle Musquodoboit Station is provided in Table 7.2-1. The annual mean temperature is estimated as 6.4ºC. The mean summer high temperature is 18.5ºC for July, while the winter mean low temperature is -6.2ºC in January. The lowest extreme minimum temperature was -34.0ºC January 1993 and December 1989, and the highest extreme maximum was in August of 1976 at 35.6ºC (Table 7.2-2) There is an average of 312 days per year with an average temperature above 0ºC.

7.2.1.2 Precipitation

The mean climate normal monthly precipitation data are provided in Table 7.2-3. The mean annual average precipitation is 1,356 mm. Approximately 87.5% of the total precipitation was in the form of rain and 12.5% as snowfall. The extreme daily precipitation amounts are shown in Table 7.2-4. The highest rainfall experienced was 172.2 mm in 1971 and the highest snowfall experienced was 70.0 cm in 1981. The highest precipitation generally occurs in the months of November and December, with lowest precipitation in the month of June. Measurable precipitation occurs on an average of 164 days per year, with 141 days of

measurable rainfall and 31 days of measurable snowfall. Hurricanes are also possible in this region. The largest hurricane on record, recorded at Halifax International Airport (approximately 80 kilometres [km] west of the Site), was Hurricane Beth in 1971 with 296.4 mm of rainfall over 48 hours.

7.2.1.3 Wind

Wind direction is generally westerly to northerly in November through April and southerly in May through October. Wind speeds average approximately 16.5 km/h, with an average range of 13.3 km/h in August to 18.5 km/h in March.

Table 7.2-1: Mean Temperature Profiles at Middle Musquodoboit Station

Value	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Daily Average (°C)	-6.2	-5.3	-1.1	4.3	9.9	15.0	18.5	18.3	13.9	8.3	3.4	-2.5	6.4
Daily Maximum (°C)	-1.0	-0.1	3.9	9.5	15.9	21.3	24.7	24.5	20.2	13.9	7.8	2.1	12.0
Daily Minimum (°C)	-11.5	-10.9	-6.2	-1.0	3.6	8.4	12.2	12.1	7.7	2.9	-1.0	-7.1	0.8

Source: ECCC 1971 to 2000 Canadian Climate Normals (climate ID: 8203535).

Table 7.2-2: Minimum and Maximum Temperature Extremes

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Extreme Maximum (°C)	16.5	17.0	26.0	30.5	33.3	33.9	34.5	35.6	33.0	26.7	23.5	15.6
Year	1995	1994	1998	2009	1977	1975	1999	1976	2001	1968	1994	1969
Extreme Minimum (°C)	-34.0	-33.0	-31.0	-12.0	-6.7	-3.0	1.7	-1.5	-4.5	-10.6	-21.0	-34.0
Year	1993	1993	1985	2016	1972	1997	1972	1978	1978	1974	1989	1989

Source: ECCC 1971 to 2000 Canadian Climate Normals (climate ID: 8203535).

Table 7.2-3: Mean Monthly Precipitation Profiles at Middle Musquodoboit Station

Value	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Precipitation (mm)	128.8	103.3	125.6	105.1	102.6	94.8	97.8	97.7	103.0	123.9	137.1	136.0	1,355.7
Rainfall (mm)	82.9	62.1	94.7	94.5	101.8	94.8	97.8	97.7	103.0	122.7	129.7	103.8	1,185.5
Snowfall (cm)	45.9	41.2	30.9	10.6	0.8	0.0	0.0	0.0	0.0	1.2	7.4	32.2	170.2

Source: ECCC 1971 to 2000 Canadian Climate Normals (climate ID: 8203535).

Table 7.2-4: Precipitation Extremes

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Extreme Daily Precipitation (mm)	80.8	86.8	76.0	78.2	61.9	64.0	90.0	172.7	75.6	74.0	66.0	71.4
Year	1978	1981	1979	1982	2001	1990	1983	1971	2014	1988	1972	1990
Extreme Daily Rainfall (mm)	80.8	51.1	76.0	78.2	61.9	64.0	90.0	172.7	75.6	74.0	66.0	71.4
Year	1978	1971	1979	1982	2001	1990	1983	1971	2014	1988	1972	1990
Extreme Daily Snowfall (cm)	36.0	70.0	34.0	22	11.4	0.0	0.0	0.0	0.0	18.0	23.0	33.0
Year	2005	1981	2014	2016	1972	1962	1961	1961	1961	1972	1989	1970

Source: ECCC 1971 to 2000 Canadian Climate Normals (climate ID: 8203535).

7.2.2 Extreme Weather

7.2.2.1 Flood and Drought Conditions

Flooding or drought conditions may occur during the lifespan of the Project. These events can generally be accommodated in the Project design and construction. As stated above, the historical mean annual total precipitation for the Middle Musquodoboit climate station is 1,356 mm. Approximately 87.5% (1,186 mm) falls as rain, while 12.5% (170 cm) falls as snow. Although extreme precipitation events may occur at any time during the year, rainfall in the Project area is generally highest during autumn months (September to November). The largest historical extreme one- day precipitation events recorded at the Middle Musquodoboit station includes 173 mm of rainfall on August 15, 1971 and 70 cm of snowfall on February 8, 1981 (Table 7.2-4).

The effects of a drought or flood on the Project may include increased dust and decreased availability of water for site operations or an excess of water on the Mine Site and Haul Road. Potable groundwater will be brought to the site and therefore a reduction in the availability of potable groundwater is not anticipated to be an adverse effect. Minimal volumes of water from the settling ponds are anticipated to be re-used on Site for dust suppression purposes, as required. The majority of water collected in the settling pond will be released to Cameron Flowage. A reduction in water being collected by the settling ponds will result in less water being released to Cameron Flowage and is not anticipated to affect site operations. Should a storm event larger than 1 in 100-year precipitation occur that creates volumes in excess of the capacity available in ponds and ditching, or infrastructure failure, a spillway into the pit will be used for overflow. In the case of a storm event or infrastructure failure, settling ponds will be monitored regularly. The Haul Roads could also become flooded and the transportation of ore may temporarily be suspended.

7.2.2.2 Extreme Temperatures, Storms, and Wind

Air temperatures vary seasonally. As stated above, average local temperatures range between from -6.2ºC to 18.5ºC. Temperature extremes can range between -34ºC to 35.6ºC (Table 7.2-2). The Project will be designed to accommodate these temperature ranges.

Extreme temperatures and storms (ice, snow) could cause damage to site infrastructure or could directly impact site workers. An Occupational Health and Safety Plan will be implemented to ensure worker safety during extreme temperature events and storm events.

Maximum hourly speeds can range from 56 km/h in August to 89 km/h in February, with maximum gusts of up to 132 km/h recorded. The Project will be designed to accommodate these wind speed ranges.

7.2.2.3 Lighting Strikes

Thunderstorms are not overly common in the Project area. In Nova Scotia, cloud to ground lightning typically occurs between the months of March to November (ECCC 2016e). The average number of days with lightning (years 1999 to 2013) was 12.1 days in Halifax, and 12.6 days in Truro.

In the event of a lightning strike, damage to site infrastructure or injury to site workers could occur. A power surge or outage could also occur. Designing infrastructure with proper grounding circuits, as per standard practice, would help to prevent damage or injury.

7.2.3 Climate Change

Climate change is anticipated to cause an increase in frequency and intensity of extreme weather events, warmer average temperatures, higher sea levels, and more extreme rainfall and flooding events (DeRomilly and DeRomilly Limited et al. 2005). More frequent and intense extreme weather events could cause an increased risk of flooding and snow and ice storms. Increased flood events would also increase the risk of erosion. Existing infrastructure in Canada was generally not intended to withstand the more extreme and frequent storms that may be experienced in coming years; however, new construction, such as the construction of the Project is designed for these changing weather patterns and extreme events into consideration. In particular, Nova Scotia Environment's *Guide to Considering Climate Change in Environmental Assessments in Nova Scotia* states the importance of environmental assessments as planning tools for the consideration of climate change into project planning, development, operation and decommission (NSE, 2011c).

Over the last several decades, Nova Scotia has already experienced a significant number of adverse impacts of extreme weather events and is experiencing changes in its historical climate. It is very likely that a further increase in temperature, precipitation and other climate drivers will continue to occur throughout the 21st century. It is forecasted that temperature will rise by 2ºC to 4ºC and that storm surges that happened only once in the 20th century could happen up to ten times in the 21st century (NSE, 2009a).

To prepare for adaption to climate change, the NSE Climate Change Unit has published scenarios of possible future climate for 13 regions within Nova Scotia. For each region, historical climate data (1961-1990) and future projections generated using the statistical downscaling method are available. Climate data provided in future projections includes minimum and maximum temperatures, precipitation, extreme precipitation and growing season length. Although advancements in climate modelling projections have occurred over the last decade, the results are not meant to be interpreted as absolutes, but rather used as guidance in the design and planning stages to facilitate climate change adaptation (W. Richards Climate Consulting, 2011).

7.2.3.1 Regional Future Projections

The closest of the 13 regions to the Project is the HRM. Future projections are provided for 2020s, 2050s and 2080s. Since the duration for the Project is relatively short, approximately 8 years including active reclamation but excluding passive pit-refilling and ongoing monitoring) the future climate projections for the 2020s were used for the assessment of the effects of climate change on the Project.

While a significant change in the range of average monthly temperatures is not anticipated for the HRM, it is very likely average temperatures will increase by a maximum of approximately 1.5ºC on average across all seasons in the 2020s (W. Richards Climate Consulting, 2011). Approximately 2 days a year are projected to be over 30ºC with no days reaching a temperature higher than 35ºC. Approximately 243 days a year are projected to have daily mean temperature is greater than 0ºC and two days a year are projected to be less than -10ºC compared to the historical average of 224 days and 3 days respectively (W. Richards Climate Consulting, 2011). The average growing season length in the 2020s is projected to be approximately 209 days, which is 11 days longer than the average historical growing season (W. Richards Climate Consulting, 2011).

Annual precipitation amounts are projected to be 1,453 mm a year, which is a 97 mm increase from the historical average (W. Richards Climate Consulting, 2011). Warmer winter temperatures (14 more days with a daily mean temperature is greater than 0°C) will lead to more precipitation falling as rain instead of snow. Rainstorm events are projected to be more extreme with a 5 percent change in the current 20-year return value of the 24-hour precipitation rate used in building design (W. Richards Climate Consulting, 2011).

7.2.3.2 Effects of Climate Change on the Project

Key potential effects of climate change that could impact the Project include:

- Increasing frequency of unusually high or low daily temperature extremes.
- Long-term increasing or decreasing mean annual temperatures and/or precipitation.
- Increasing or decreasing frequency of storm events (e.g., rainfall, snowfall, extreme wind).

Although the Project is relatively short in duration (approximately 8 years including construction, operations and active closure and not including ongoing monitoring [post-closure]) and therefore the effects of climate change on the Project will likely be insignificant, climate change was still considered for each phase of the Project: construction, operations, and active closure.

7.2.3.2.1 Construction – 1 Year

Since site construction will occur during the first year of the Project and is planned to commence within the near future, rather than considering long term effects of climate change it is more appropriate to consider the potential effects of current weather extremes and variabilities during construction. For the effects of extreme weather events on the Project (Section 7.2.2).

7.2.3.2.2 Operations – 5 Years

Average temperatures and precipitation amounts and intensities projected in the future climate scenario for the 2020s as described above is unlikely to impact the operation of the Beaver Dam Mine as mines are successful operated in areas with higher/lower mean and extreme temperatures and more frequent precipitation than is outlined in this scenario. However, the Project may be affected by climate change-induced events, such as extreme precipitation events. The Project will be designed to withstand these events, including effects of these events such as flooding and erosion. For details of the effects of extreme weather events on the Project (Section 7.2.2).

7.2.3.2.3 Active Closure – 2 Years

The Active Closure of the mine is not anticipated to be affected by higher or lower mean and extreme temperatures or more frequent precipitation. However, the removal of equipment and infrastructure has the potential to be delayed as a result of periods of high precipitation and extreme weather events. The re-vegetated area could be affected from periods of drought, flooding or erosion.

7.2.3.3 Forest Fires

Since the limited duration of the Project on a whole indicates that warming air temperatures will not affect the Project, and as the Beaver Dam Mine Site will be primarily cleared land, the potential for forest fires is considered to be low.

7.2.3.4 Climate Change Mitigation and Adaptation

7.2.3.4.1 Mitigation

To minimize or offset the effects of the Project on climate change, in particular to reduce the greenhouse gas (GHG) emissions associated with the construction, operation and active reclamation of the mine, mitigation measures will be implemented. The federal guidance document *Incorporating Climate Change Considerations in Environmental Assessment: General Guidance for*

Practitioners defines mitigation measures as "Measures to eliminate, reduce or control the adverse environmental effects of a project, including restitution for any damage to the environment caused by such effects through replacement, restoration, compensation or any other means" (CCCEAC, 2003, Page 23). Mitigation measures include actions such as utilizing different technologies and construction materials. Impact Management Measures and BMPs to reduce the Project's effect on the environment will be determined and implemented at the onset of each stage of the Project. Possible BMP/ Mitigation measures include:

- Implement and enforce an anti-idling policy for all vehicles and machinery on-site during the construction and operations;
- Try to utilize materials that have a lower carbon footprint and a long lifespan; and,
- Replace and plant additional native vegetation to create a carbon sink.

Further mitigation measures to reduce the potential effects of the environment on the Project are discussed in Section 7.3.

7.2.3.4.2 Adaptation

Climate change adaptation is focused on addressing effects of climate change on the Project. The federal guide defines adaptation as an "Adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities" (CCCEAC, 2003, Page 23). Although it was determined that climate change will have no significant adverse effects on the Project due to the relatively short duration of the Project, the identification of possible adaptation measures was undertaken to increase both Project and ecosystem resilience to climate change.

Adaptation measures, as noted in the Mine Water Management Plan (Appendix P.4) are strengthen and increase the resilience of the Project and include:

- designing comprehensive water management measures;
- to add contingency to the water management facility designs, the impacts due to climate change were considered in the development of the settling ponds and drainage system. As such, a 5% increase to the historic IDF curve was incorporated to account for potential impacts due to climate change.
- collection ponds have been designed with the capacity to convey runoff from Hurricane Beth, modelled as a 48-hour storm event, through an emergency spillway.
- choosing vegetation known to withstand erosion and climatic stressors such as extreme heat, drought tolerance, and flood resistance; and
- planting additional vegetation as required.

The above is not a comprehensive list of the additional adaption measures that will be considered. The development of Best Management Practices will be implemented at the mine to prepared for a changing climate.

7.2.4 Slope Stability

All phases of the Project have the potential for slope failures within the footprint of the open pit, the topsoil, till, organics, and waste rock stockpiles. The slopes are designed at an angle determined by geotechnical analysis and acceptable safety factors. However, in the event of an extreme weather event or seismic event, slope failure may be possible.

Features constructed from site materials such as permanent waste rock stockpiles and temporary (i.e., till, organic and topsoil) stockpiles will stored at the mine site. The temporary stockpiles will be used as part of final reclamation. A geotechnical stability assessment of permanent and temporary stockpiles has been undertaken by Golder (2021; included as Appendix A.2a) with the exception of the topsoil stockpile because of the small size and height. The assessment undertaken by Golder (2021; included as Appendix A.2a) evaluated the design by assessing the following:

- Seismic site classification and seismic hazard parameters;
- Liquefaction potential;
- Design parameters for foundation and stockpiled materials;
- Equilibrium slope stability (static and seismic) load conditions, and
- Assessment on site preparation and placement.

Recommendations have been incorporated into the final design and operational procedural manual/work instructions will be developed before construction. The outcomes of the assessment is that the design are within an appropriate safety factor. Monitoring will be undertaken during construction, operation and active closure to ensure slope stability is maintained.

7.2.5 Seismic Events

Although seismic activity is unpredictable, the Province of Nova Scotia as a whole is located in a next-to-lowest hazard zone, with moderate to high-hazard zones located offshore in the southern Bay of Fundy and along the Laurentian Slope (NRCAN 2015).

The Northern Appalachians Seismic Zone is located in southwest Nova Scotia. The Beaver Dam Mine Project is located east of this zone. The nearest earthquake to Marinette, Nova Scotia was recorded with a magnitude of 2.7 in 1999 and was located northeast approximately 20 km north of the Project area. If an earthquake occurs, seismic activity may affect the Beaver Dam Mine Project through primary impacts such as slope and mine wall failures, and infrastructure damage facilitated by ground vibrations and secondary impacts such as fires facilitated by damaged infrastructure. In the unlikely event that a Tsunami occur in relation to offshore earthquakes, impacts to the Project are highly unlikely. The Project is approximately 30 km from the coast and at an elevation of 140 masl. Given that Nova Scotia is located in a low-hazard zone, and given the limited extent and duration of the Project, the potential risk of seismic activity affecting the Project is very low and not considered significant.

Site infrastructure will be built to National Building Code of Canada standards to aid in mitigating damage to infrastructure or injury to site workers in the event of an earthquake in the Project area.

A geotechnical stability assessment (Golder 2021; included as Appendix A.2a) has been undertaken on stockpile design that considered potential exposure to seismic event on slope stability. The assess indicated that the design is with in professional safety standards (Appendix A.2c). A similar stability assessment is in Progress for the open pit and recommendations will be integrated into the final design.

7.3 Mitigation

The Beaver Dam Mine Site will be designed to use commonly utilized infrastructure which will be designed to consider extreme weather events. Climate change is not anticipated to have a significant effect on the Project, based on the relatively short duration of the Project and on the climatic scenarios and events outlined above.

The following mitigation measures will be applied to reduce the potential effects of the environment on the Project:

- Project design considers potential flood or drought conditions to minimize the impacts of these events on mine infrastructure.
- Project design accommodates temperature extremes, storms, and wind speed ranges identified for the Beaver Dam Mine Site.
- Project design will follow industry standards, including the National Building Code of Canada, to prevent damage to equipment or injury to site workers.
- Topsoil, till, and waste rock stockpiles will be designed with slopes designed at an angle determined by geotechnical analysis and acceptable safety factors. Stockpiles will be constructed using collected geological data for final design and reduce the possibility of landslides, slope erosion, and subsidence.
- An Emergency Response Plan will be implemented for the Mine Site and will consider measures that may be required during an extreme weather event to secure site infrastructure, mobile equipment, stockpiles, fuel storage, and electrical equipment.
- An Occupational Health and Safety Plan will be implemented for the Mine Site and will consider measures that may be required during an extreme weather or temperature event, flood or drought, or storm event.
- Ongoing monitoring will be undertaken during construction, operations and active closure of engineered structures.

Table 7.3-1: Mitigation for Effects of the Environment on the Beaver Dam Mine Project

Project Phase	Mitigation Measures
C	• Project design to consider extreme weather events, temperature extremes, wind speed ranges, flood or drought conditions, lightning strikes. • Project design will follow industry standards, including the National Building Code of Canada. • An Emergency Response Plan will be implemented during the construction phase. • An Occupational Health and Safety Plan will be implemented to protect worker health and safety
C	• Stockpile design will consider collected geological data and will be designed with slopes at the angle determined by geotechnical analysis and acceptable safety factors. • An Emergency Action Plan will be implemented during the construction phase
O	• An Emergency Action Plan will be implemented during the operations phase. • An Occupational Health and Safety Plan will be implemented to protect worker health and safety
O	• Stockpile design will be re-assessed following material placement to ensure slopes are geotechnical stable and within acceptable safety factors • An Emergency Action Plan will be implemented during the operation phase
CL	• Stockpile design will consider collected geological data and will be designed with slopes at the angle determined by geotechnical analysis and acceptable safety factors.

Note: C = Construction Phase, O = Operations Phase, CL = Active Closure Phase

7.4 Summary

As noted above, consideration of environmental conditions is not a Value Component or an assessment end point. These conditions considered in the design, mitigation, monitoring and management of the Project.

8 CUMULATIVE ENVIRONMENTAL EFFECTS ASSESSMENT

8.1 Introduction

8.1.1 Summary of the Cumulative Effects before Updates

A Cumulative Effects Assessment was carried out in order to meet the general requirements of the CEAA 2012, as well as the specific requirements laid out in the Guidelines for the Preparation of *an Environmental Impact Statement pursuant to the Canadian Environmental Assessment Act, 2012 and Nova Scotia Registration Document pursuant to the Nova Scotia Environment Act – Beaver Dam Mine – Atlantic Gold Corporation*. A 35 km radius of the PA was used to identify 'other projects' with potential cumulative effects for all VCs.

Through the scoping methodology, the following VCs were selected for evaluation of cumulative effects: air, surface water quality and quantity, wetlands, fish and fish habitat, birds, species of conservation interest and species at risk, and Indigenous Peoples. Once the mitigation measures are taken into account, there are no significant residual cumulative effects anticipated for air, surface water, wetlands and fish and fish habitat.

Historical and current land use within the region has undeniably affected the local habitats in ways that have affected the local distribution and abundance of several species of flora terrestrial fauna and birds, including SOCI and SAR. However, the mitigation of the effects originating from regional forestry and land management practices falls outside the scope of the project proponent's authority and responsibility.

The predicted residual cumulative effects on Indigenous Peoples with regards to indirect effects from impacts to water quality, wetland habitats, and road safety, are assessed to be adverse, but not significant. The significant residual effects of historical and current land use within the region to the local distribution and abundance of several species of flora and fauna has presumably affected there use for traditional purposes.

8.1.2 Summary of Updates to the Cumulative Effects

The Cumulative Effects Assessment (CEA) has been revised for all Valued Components (VCs), to ensure consistency with the Cumulative Effects Assessment Methodology Interim Technical Guidance document (version 2), prepared by CEAA (2018), and in response to the second round of information requests related to the 2019 EIS Submission. This evaluation includes clearly defined determinations of Projects and spatial boundaries for each VC, which demonstrates the decision-making process for inclusion and exclusion of particular projects for each VC. The component specific criteria for significance thresholds have been revised through each VC chapter, and carried forward through the CEA, in response to CEAA-2-02. Specific to the Mi'kmaq of Nova Scotia, the spatial boundary has been updated to reflect the Eskikewa'kik territory, as requested in CEAA-2-51.

The Proponent has determined that an ecosystem-based approach to the spatial boundary determination is the most appropriate to identify cumulative effects of the Project. The spatial boundary determination is based on the VC geographic range and the zone of influence (ZOI) for that VC. The ZOI sets a spatial limit beyond which the residual effects of the Project on a VC are not detectable. Through the CEA, it has been determined that the RAA for each respective VC is the appropriate spatial boundary for this assessment, rather than a 35 km radius of the PA for all VCs.

The residual environmental effects for each VC have been updated throughout the CEA, based on the results presented in each updated VC chapter (CEAA IRs 2-05, 2-07, 2-08, 2-09, 2-10, 2-13, 2-14, 2-16, 2-17, 2-26, 2-27, 2-28 and 2-53). Furthermore, the

list of 'other projects' included in the CEA has been updated to reflect all Projects registered or proposed within the RAA for the Mi'kmaq of Nova Scotia since the 2019 EIS submission.

Through the scoping of valued components for inclusion in the CEA, it was determined that further evaluation was warranted for cumulative effects to noise, air, light, surface water quality and quantity, fish and fish habitat, species of conservation interest and species at risk, and the Mi'kmaq of Nova Scotia.

8.1.3 Summary of Approach to Cumulative Effects Assessment

Section 19(1)(a) of the *Canadian Environmental Assessment Act, 2012* (CEAA 2012) requires that an EA of a designated project take into account any cumulative environmental effects that are likely to result from the designated project in combination with the environmental effects of other physical activities that have been or will be carried out[1]

This section presents methodology of the Cumulative Effects Assessment (CEA) that was carried out to meet the general requirements of the *CEAA 2012*, as well as the specific requirements laid out in the *Guidelines for the Preparation of an Environmental Impact Statement pursuant to the Canadian Environmental Assessment Act, 2012* and *Nova Scotia Registration Document pursuant to the Nova Scotia Environment Act – Beaver Dam Mine – Atlantic Gold Corporation* (CEAA 2016) and the second round of information requests (AMNS 2021).

8.2 Types of Cumulative Effects

When considering possible cumulative effects on VCs it is important to understand how the effects may interact and manifest in order to make reasonable and technical sound predictions about the significance of the cumulative effects[2].

There are four main ways that cumulative effects can interact, additive, synergistic, compensatory and masking. The definitions as presented in the draft Technical *Guidance for Assessing Cumulative Environmental Effects under the Canadian Environmental Assessment Act, 2012* (2018) are as follows:

> *"An **additive cumulative effect** is the sum of individual effects of two or more physical activities" (page 42).*
>
> *"A **synergistic cumulative effect** occurs as a result of the interaction between two or more effects, when the resultant combination is greater or different than the simple addition of the effects" (page 42).*
>
> *"**Compensatory cumulative effects** are effects from two or more physical activities that "offset" each other" (page 43).*
>
> ***Masking cumulative effects** are "the effects of one project might mask the effects of another in the field" (page 44).*

1 *Assessing Cumulative Environmental Effects under the Canadian Environmental Assessment Act, 2012*. https://www.canada.ca/en/environmental-assessment-agency/news/policy-guidance/assessing-cumulative-environmental-effects-under-canadian-environmental-assessment-act-2012.html

2 Ibid

8.3 Cumulative Assessment Methodology

The general approach of the cumulative impact assessment is based on the Agency's Operational Policy Statement entitled Addressing Cumulative Environmental Effects under the *Canadian Environmental Assessment Act*, 2012 and the guide entitled Cumulative Effects Assessment Practitioners' Guide, 1999 (Hegmann et al., 1999).

The main steps involved in this approach are as follows:

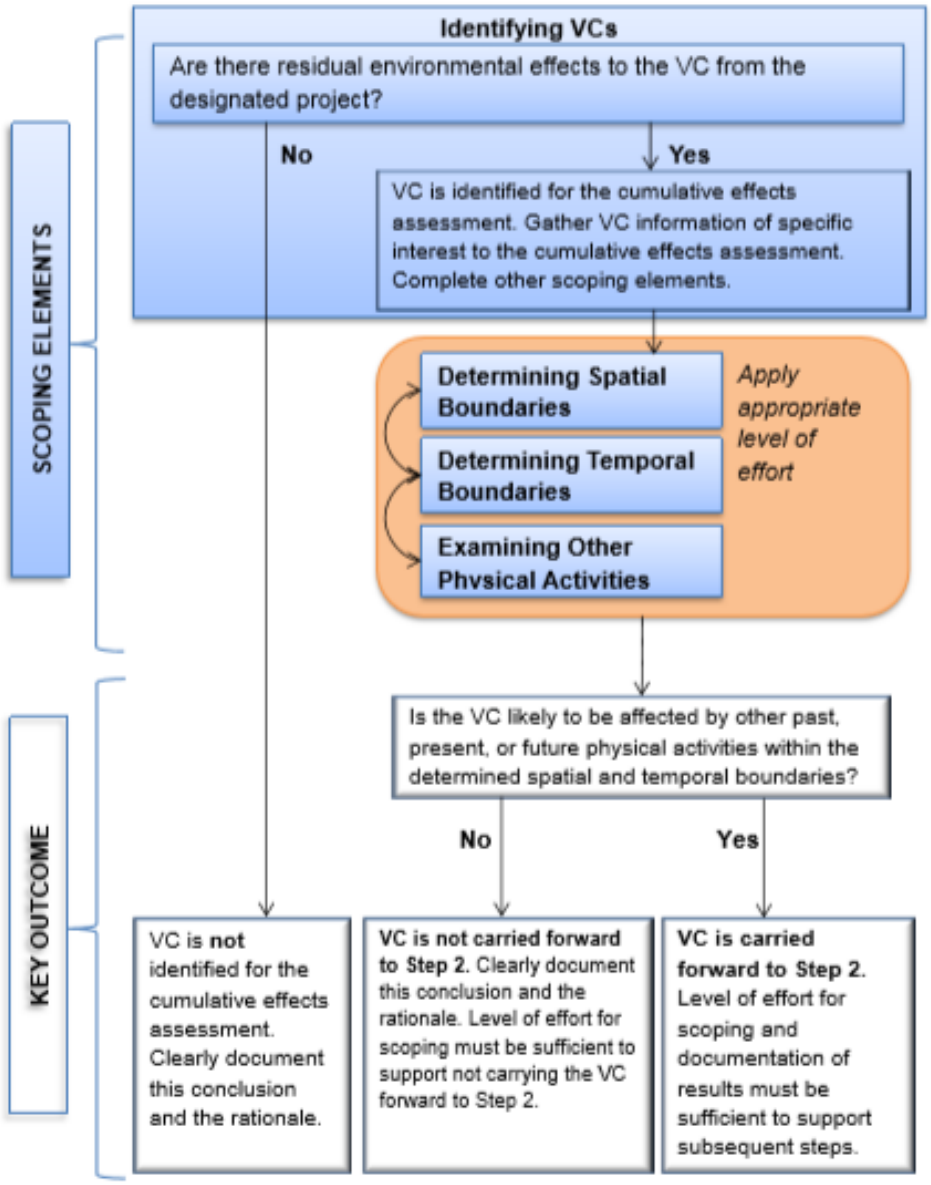
- The initial steps cover the scoping of the Cumulative Effects Assessment and include:
  - Identification of the VCs that will constitute the focus of the Cumulative Effects Assessment.
  - Determining the spatial and temporal boundaries for each VC.
  - Identification, selection and description of physical activities (projects) in the area.
  - Confirmation of the VCs to be carried forward to the assessment stage.
- The following steps constitute the analysis of the CEA and are presented separately for each VC selected at the scoping stage:
  - Description of the baseline conditions.
  - Description of the residual effects of the proposed Project.
  - Description of the effects of other projects in the area.
  - Description of the cumulative effects.
  - Proposed mitigation and monitoring.
  - Residual Cumulative Effects and Significance Assessment.
  - Follow-up.
  - Scoping Approach

8.3.1 Scoping Approach

The scoping methodology as depicted in the draft Technical Guidance for Assessing Cumulative Environmental Effects under the *Canadian Environmental Assessment Act*, 2012 (2018)[3] is presented in Figure 8.3-1 below.

3 Canadian Environmental Assessment Agency. (2014). *Technical Guidance for Assessing Cumulative Environmental Effects under the Canadian Environmental Assessment Act, 2012*

Figure 8.3-1: Generic Approach to Scoping for Cumulative Effects Assessment Adapted from the Technical Guidance for Assessing Cumulative Environmental Effects under the *Canadian Environmental Assessment Act,* 2012



The methodology followed for the four main steps associated with scoping or CEA is described below:

Step 1 - Identification of the Valued Components (VCs) That Will Constitute the Focus of the Cumulative Effects Assessment.

In order to identify the VCs that are likely to be affected by cumulative effects resulting from the proposed Project and other projects in the area, each of the VCs taken into account in the environment effects assessment of the proposed Project (Section 6) was analyzed. In order to be included in the CEA, adverse residual effects must have been identified for the VC. As per the Agency's *Guidelines for the Preparation of an Environmental Impact Statement pursuant to the Canadian Environmental Assessment Act,*

2012 and *Nova Scotia Registration Document pursuant to the Nova Scotia Environment Act – Beaver Dam Mine – Atlantic Gold Corporation* (EIS Guidelines, 2016) the following valued components at a minimum must be considered:

- fish and fish habitat;
- birds (including migratory birds);
- species at risk; and
- Mi'kmaq of Nova Scotia.

As stated in the EIS Guidelines "Valued components that would not be affected by the project or would be affected positively by the project can therefore, be omitted from the cumulative effects assessment" (Section 6.7.3 of the EIS guidelines, CEAA 2016). As such, if any VCs were only positively affected, or if it was determined through the EIS that a particular VC had no residual effects, they were not carried forward to the assessment phase. Documentation of the step is provided in Section 8.4.1.

Step 2- Determining the Spatial and Temporal Boundaries for Each VC.

The spatial and temporal boundaries to be considered in the cumulative effects assessment are determined individually for each selected VC. The Regional Assessment Area (RAA) outlined in each VC section is used as the basis for the cumulative effects assessment. The RAA for each VC was determined based on the potential for cumulative effects.

The main points taken into consideration in determining spatial boundaries were:

- Whether the effects of different projects to a VC could be additive if felt at separate locations; and
- The expected geographical extent of the project effects on the VC.

The determination of the appropriate geographic scale required to assess the effects on a biological population. In most cases, a broad, regional area was considered appropriate, though the existence of physical boundaries between populations was taken into account. For example, effects to fish populations were considered cumulative within a watershed.

In the determination of temporal boundaries, the following points were taken into account:

- Duration of the expected environmental effects;
- The timing of the expected environmental effects; and
- Whether or not the effects are only additive if felt simultaneously.

For example, it was considered for most physical VCs that effects could only be cumulative if the effects of two projects overlap in time and space. For instance, cumulative effects on water quality that exceed those assessed for an individual project are only possible if two projects affect the same body of water. However, for other VCs, such as wildlife or bird populations, effects from projects that do not overlap in space or time may have cumulative effects if their effects reach the same population. The spatial cumulative effects boundaries for such VCs may therefore be wider than those used to assess the effects of an individual project and should generally be determined in a way that is ecologically defensible.

Temporal cumulative effect boundaries take into account the timing at which a type of effect has occurred, is occurring or is expected to occur in the future, as well the expected duration of the effect. For example, the cumulative effects of habitat loss could start with the first historical effects on the habitat in question and end with the recovery of the lost habitat. Documentation of the step is provided in Section 8.4.2.

Step 3 - Identification, Selection and Description of Projects in the Area.

Information regarding upcoming and past projects (also referred to as physical activities under CEAA guidance) was obtained from a review of new and existing projects listed on the NSE Environmental Assessment Division website as well as the CEAA's online registry. In addition, a generalized internet search was used to identify other anticipated or ongoing projects.

A search was conducted to identify all major projects within the region with a potential to have cumulative effects with the Project. Each VC's RAA was used to determine which projects were included in the CEA. Each VC's RAA is considered appropriate for this analysis, because the effects will be assessed within a boundary that is relevant to that particular VC. The Project is not expected to have any direct effects on any VCs outside of their RAA. The RAAs used for the cumulative effects assessment were determined given the social and ecological context of each VC (i.e., the RAA and pursuant cumulative effects assessment for socio-economic impacts is based on municipal boundaries, whereas effects to aquatic ecosystems are based on watershed boundaries). Identified projects in the RAAs were included in the evaluation, regardless of their respective temporal boundaries. Documentation of this step is provided in Section 8.4.3.

Step 4 - Confirmation of the VCs to be Carried Forward to the Assessment Stage.

Upon completion of the three steps listed above, the residual effects to VCs that would likely interact with the effects from other past, present, or future physical activities within the spatial and temporal boundaries of each VC were determined through the application of screening criteria.

The following screening criteria were used:

- level of concern noted during engagement;
- current state of the VC (health/status/condition);
- potential for significant cumulative effects;
- uncertainty in predictions of cumulative effects; and
- potential for follow up or additional mitigation.

The results of the application of the screening criteria for each VC were documented along with a rationale for each VC, which describes whether the VC was carried forward to the CEA or not with an accompanying rationale. Where significant adverse effects are identified, the EIS will discuss the likelihood or probability that the effect will occur.

8.3.2 Assessment Approach

8.3.2.1 Baseline Conditions

A description of the baseline conditions is given for each of the selected VCs through the scoping phase carried forward for analysis within their designated spatial and temporal boundaries. Emphasis is put on aspects of the VC that are likely to be affected by cumulative effects between the Project and the other identified projects in the area.

8.3.2.2 Identification and Assessment of the Cumulative Effects

The first step in the assessment of the cumulative effects is to describe the residual effects of the Project, based on the results of the environmental effects assessment presented in Section 6. The environmental effects assessment methodology used for the Project is presented in Section 5.

This is followed by the identification of any effects of the other projects identified in the area that may act in combination with the residual effects of the Project. If available, environment impact statements or environmental assessments for identified projects with potential cumulative effects were consulted. In addition, information contained in the baseline conditions for a VC often included a description of the effects of past and ongoing activities as these have left their mark on the current conditions.

In the case of past activities, their effects can be used to contextualize the current state of the VC as described in the baseline conditions. Taking this information into consideration, the total cumulative effects of all projects having an effect on the selected VC is then described as to their nature, scope and intensity. An assessment of the relative contribution of the Project on the overall cumulative effects is given by comparing these effects with and without the inclusion of the proposed project.

As indicated in the EIS Guidelines (CEAA 2016), the assessment of cumulative effects on current use of lands and resources for traditional purposes by Mi'kmaq of Nova Scotia focusses on the effects on specific activities such as hunting, fishing, trapping and plant harvesting.

8.3.2.3 Mitigation

As a first step, an assessment of whether any additional mitigation measures beyond those proposed in the environmental effects assessment of the Project (Section 6) is made. If additional technically and economically feasible measures are warranted to reduce the cumulative effects, these are proposed.

Given the large spatial and temporal cumulative effects boundaries of certain VCs, the implementation of mitigation measures may exceed the scope of the Proponent's responsibility. In such cases the parties that have the authority to act are identified and any discussions that have taken place in order to implement the necessary measures over the long term are summarized.

8.3.2.4 Residual Cumulative Effects and Significance Assessment

The residual cumulative effects, taking into account the implementation of the mitigation measures, are described in Section 8.5. These are then compared to the significance thresholds identified for each VC in order to determine if they are significant.

8.3.2.5 Follow-up and Monitoring

If it is considered warranted, after taking into account the confidence level of the predictions of the residual cumulative effects and the expected scale of the effects, a follow-up program is proposed to verify the accuracy of the assessment or to address the uncertainty concerning the effectiveness of mitigation measures for certain cumulative effects.

8.3.3 Consideration of Engagement Results and Indigenous Traditional Knowledge

Key issues raised during public and Mi'kmaq engagement relating to Mi'kmaq of Nova Scotia include: potential habitat loss and effects on individual flora and fauna used in traditional hunting, fishing and trapping activities and medicinal food and plants; loss of access to traditional areas; potential impact to traditional foods from dust deposition; potential impact to surface water and groundwater; and potential impacts to fish and wildlife.

8.4 Scoping of the Valued Components

8.4.1 Identification of the Valued Components

All of the VCs (as listed below) included in the environmental effects assessment of the Project (Section 6) were taken into consideration in the scoping exercise for the CEA.

- Physical Environment:
  - Noise;
  - Air;
  - Light;
  - GHGs
  - Geology, Soil and Sediment;
  - Groundwater Quality and Quantity; and
  - Surface Water Quality and Quantity.
- Biophysical Environment:
  - Wetlands;
  - Fish and Fish Habitat;
  - Habitat and Flora;
  - Terrestrial Fauna;
  - Avifauna; and
  - Species of Conservation Interest and Species at Risk.
- Socio-Economic Environment:
  - Mi'kmaq of Nova Scotia;
  - Physical and Cultural Heritage; and
  - Socio-Economic Conditions.

The initial screening of the VCs listed above is based on the outcome of the environmental effects assessment (Section 6) and is summarized in Table 8.4-1. The table provides the possible pathways for VCs to cause cumulative effects as well as possible linkages of the residual effects on a VC to other VCs. Both the pathway of an effect and possible linkages of the residual effect to other VCs are important to consider from a cumulative effects perspective, specifically when determining the possible interaction of the Project's residual effects with the effects from other activities in the area.

The residual effects of 15 of the 16 identified VCs for the Project were determined not to be significant but were assessed as adverse. The Projects' effects to Socioeconomic Condition are determined to be positive. As described above, VCs with positive residual impacts are not carried forward through the CEA exercise. All other VCs were carried forward for additional consideration in the scoping process.

8.4.2 Determining the Spatial and Temporal Boundaries

8.4.2.1 Spatial Boundaries

Spatial boundaries for cumulative effects assessment are based on setting adequate spatial boundaries that represent anticipated geographic limits that will aid in defining the scale and range of interactions between Project activities and VCs.

A map of the PA is presented in Section 5.5, Figure 5.5-1. The PA used for the environmental effects assessment for all VCs and the LAA and RAA used for each specific VC, as described in Section 6, were established to capture areas broader than the expected Project impacts in considerations of other project boundaries as per cumulative effects methodology. Therefore, the spatial boundaries (PA, LAA, and RAA), established for the environmental effects assessment are appropriate for determining potential cumulative effects. Each boundary is discussed below and presented on a figure in each per VC in Section 6 of this EIS.

8.4.2.1.1 Project Area (PA)

The PA encompasses the immediate area in which direct Project activities may occur and are likely to cause direct and indirect effects to VCs. The PA consists of the three components: the Beaver Dam Mine Site, the Beaver Dam Haul Road, and the Touquoy Mine Site, extending from Marinette to Moose River Gold Mines, Halifax County, NS (Section 5.5, Figure 5.5-1). The PA is the same for each VC.

8.4.2.1.2 Local Assessment Area (LAA)

The LAA encompasses adjacent areas outside of the PA where Project related direct and indirect effects to VCs are reasonably expected to occur. Generally, the LAA is limited to the area in which Project activities are likely to have indirect effects on VCs; however, the size of the LAA can vary depending on the VC being considered, and the biological and physical variables present. The LAA for each VC is defined in Table 8.4-1 and are described in detail in relevant VC sections in Section 6 of this EIS.

8.4.2.1.3 Regional Assessment Area (RAA)

The RAA encompasses all Project and VC interactions and are defined intending to be spatially larger than expected for direct and indirect Project interactions, with the exception of VCs that may have diffuse or longer-range effects such as those from Project activities on socio-economic environments. The RAA varies in size depending on the VC being considered, and the biological and physical variables present. The RAA for each VC is defined in Table 8.4-1 and are described in detail in relevant VC sections in Section 6 of this EIS.

8.4.2.2 Temporal Boundaries

The Project has three distinct phases - Construction (1 year), Operations (5 years), and Active Closure (2 years) with post-closure monitoring proposed for 10 years after the active closure, dependent on water quality and monitoring requirements. These phases define the maximum temporal boundary for assessment of impacts on each VC. The maximum Project life is 8 years for the construction, operation and active closure phases. Monitoring and water treatment, as required, is expected be required for longer during the post-closure stage.

Table 8.4-1: Initial Screening of the Valued Components based on the Outcome of the Environmental Effects

Project VC	EIS Section	Spatial Boundaries		Temporal Boundaries	Summary of A Significant Effect*	Pathway	Adverse Residual Effects			Include in Scoping Exercise	Rationale
		Local Assessment Area (LAA)	Regional Assessment Area (RAA)				Summary	Significance	Linkages to Other VCs (If Applicable)		
PHYSICAL ENVIRONMENT											
Noise	6.1	The LAA for Noise encompasses adjacent areas outside of the PA where Project related effects to Noise are reasonably expected to occur. The LAA constitutes the noise modelling domain based on the location of the Project noise emission sources and predicted noise levels for Project Constriction and Operations phases, as well as the location of potential sensitive receptors. The Noise modelling domain was established so that it would be inclusive of, at minimum, any predicted noise contours above 35 dBA, a threshold value criterion for baseline nighttime noise levels adopted from the Alberta Energy and Utilities Board. See Figure 6.1-2.	The Regional Assessment Area (RAA) extends beyond the LAA as to encompass potential indirect effects of Noise with other related VCs, such as human health and wildlife. See Figure 6.1-2.	The temporal boundary for the assessment of effects to air quality includes the construction, operation and closure (active reclamation and decommissioning) phases.	Significant residual effects for the Noise VC would be defined as having high magnitude (i.e., an exceedance of the maximum noise or vibration limits), occur beyond the PA and LAA, be of long-term to permeant duration, occur at regular intervals or be continuous throughout the Project, and be only partially reversible to irreversible.	Atmospheric	Increased ambient noise.	Adverse, not significant	Fauna, Birds, SAR/SOCI, Mi'kmaq of Nova Scotia	Yes	Adverse residual effects were identified within VC evaluation
Air	6.2	The LAA encompasses a 15 km zone in all directions from the PA. (Figure 6.2-1).	The RAA encompasses 35 km buffer from the PA, which represents the maximum zone of influence. The RAA covers the anticipated maximum extent of particulate deposition under worst case scenarios (Figure 6.2-1).	The temporal boundary for the assessment of effects to air quality includes the construction, operation and closure (active reclamation and decommissioning) phases.	Significant residual effects for the Air VC is defined as having high magnitude (i.e., an exceedance of applicable criteria), occur beyond the LAA, be of long-term to permeant duration, occur at regular intervals or be continuous throughout the Project, and be only partially reversible to irreversible.	Atmospheric	Increased ambient dust.	Adverse, not significant	Flora, SAR/SOCI, and Mi'kmaq of Nova Scotia	Yes	Adverse residual effects were identified within VC evaluation
Light	6.3	The LAA for light variable based on a 1 LUX threshold. Preliminary modelling and evaluation of light has determined this to be the maximum distance of light propagation to a 1 LUX threshold. See Figure 6.3-1.	The RAA for light encompasses a distance defined by 0.1 lux surrounding the PA. This is based on the maximum extent of light propagation. See Figure 6.3-1.	The temporal boundary for the assessment of effects to air quality includes the construction, operation and closure (active reclamation and decommissioning) phases.	Direct light trespass that meets 1 lux light trespass into windows at the nearest receptor. This was determined as a result of the baseline environmental light classification of E2 at the Beaver Dam Mine Site.	Atmospheric	Increased ambient light.	Adverse, not significant	Fauna, birds, SAR/SOCI, Mi'kmaq of Nova Scotia	Yes	Adverse residual effects were identified within VC evaluation
GHG	6.4	The Local Assessment Area (LAA) encompass a 15 kilometre (km) zone in all directions from the PA, based on the expected maximum extent of potential ground level emissions (Figure 6.4-1).	The Regional Assessment Area (RAA) encompasses the province of Nova Scotia. GHG emissions will be compared to Nova Scotia targets and totals (Figure 6.4-1)	The temporal boundaries used for the assessment of effects to GHGs are the construction phase, operational phase, and active closure phase.	An increase in GHG greater than 0.2% pf NS 2018 (CO_2e) levels at the regional scale.	Atmospheric	Increased greenhouse gas emissions	Adverse, not significant	NA	Yes	Adverse residual effects were identified.
Geology, Soil and Sediment	6.5	There is no LAA or RAA for geology, soil and sediment, as impacts to this VC are only expected to occur within the PA.		Project-related impacts may occur during construction, operation, and closure (active reclamation and decommissioning stage) phases of the Project.	There are no regulated or proposed thresholds for geology and soils effects for this site and Project. Both sediment and soils that become mobilized have a linkage with surface water and quality that have regulated thresholds and can be assessed through predictive efforts for the Surface Water VC (Section 6.7 and 6.9) or through the monitoring program proposed.	Soils and Sediment	Erosion, soil and sediment quality	Adverse, not significant	Surface Water, Wetlands, Fish Groundwater, Flora, Fauna.	Yes	Adverse residual effects were identified within VC evaluation

Table 8.4-1: Initial Screening of the Valued Components based on the Outcome of the Environmental Effects (continued)

Project VC	EIS Section	Spatial Boundaries		Temporal Boundaries	Summary of A Significant Effect*	Pathway	Adverse Residual Effects			Include in Scoping Exercise	Rationale
		Local Assessment Area (LAA)	Regional Assessment Area (RAA)				Summary	Significance	Linkages to Other VCs (If Applicable)		
Groundwater	6.6	The LAA for Groundwater Quality and Quantity encompasses an 800 m buffer from the Beaver Dam Mine Site, an 800 m buffer along the portion of the Haul Road that will be upgraded where receptors are present, and the portion of down-gradient habitat from the Touquoy Mine Site. See Figure 6.6-7.	The RAA for Groundwater Quality and Quantity encompasses tertiary watersheds intersecting the PA. See Figure 6.6-7.	The temporal boundary for the assessment of effects to Groundwater Quality and Quantity includes the Construction, Operation and Closure Phases.	A significant adverse effect from the Project on groundwater quality is defined as an effect that results in groundwater quality exceeding the NSE Tier 1 EQS for potable groundwater, GCDWQ or NSE Tier 2 PSS for groundwater discharge to surface water (>10 m). Detailed definition provided in Section 6.6	Groundwater	Disturbance to groundwater quality and quantity	Adverse, not significant	Surface Water, fish, wetlands, SAR/SOCI, Mi'kmaq of Nova Scotia	Yes	Adverse residual effects were identified within VC evaluation
Surface Water	6.7	The LAA is defined by the tertiary watersheds that encompass or intersect the PA, and contains surface water features upstream, downstream and within the PA. The lakes and watercourses that are included as part of the baseline programs and/or predictions of effects are located within the LAA boundary. See Figure 6.7-11.	The RAA in the context of surface water quality and quantity encompasses Secondary Watersheds (East River Sheet Harbour and Fish River), see Figure 6.7-11.	The temporal boundary for the assessment of effects to Surface Water Quality and Quantity includes construction, operation and closure phases.	A repeated or sustained change in water flows that differ substantially from baseline flow conditions (15%); and/or an indicator is predicted to be greater than guidelines and differ substantially from baseline water quality (outside of the 75th to 95th baseline water quality), resulting in a detectable change beyond the range of natural variation. Detailed definition provided in Section 6.7.	Surface Water	Change in Water Quality and Quantity Habitat Loss and disturbance	Adverse, not significant	Fish, Wetlands, SAR/SOCI, Mi'kmaq of Nova Scotia	Yes	Adverse residual effects were identified within VC evaluation
BIOPHYSICAL ENVIRONMENT											
Wetlands	6.8	The LAA is defined by the tertiary watersheds that encompass or intersect the PA (Beaver Dam Mine Site, Haul Road and Touquoy Mine Site), and contains surface water features upstream, downstream and within the PA. The lakes and watercourses that are included as part of the baseline programs and/or predictions of effects are located within the LAA boundary. See Figure 6.7-11.	The RAA encompasses three Secondary Watersheds: West River Sheet Harbour, Tangier River and Fish River-Lake Charlotte). See Figure 6.7-11.	The temporal boundary for the assessment of effects to wetlands includes the construction, operation, closure (active reclamation and decommissioning) and post-closure phases.	A significant adverse effect from the Project on wetlands is defined as an effect that results in an unmitigated or uncompensated net loss of wetland habitat as defined under the NSE Wetland Conservation Policy, and its associated no-net loss policy, or an effect that is likely to cause a permanent loss of >10% wetland habitat for a SAR species identified in the PA within the LAA.	Vegetation, Hydrology	Habitat loss and disturbance	Adverse, not significant	Habitat and flora, fauna, avifauna, fish, SAR/SOCI, surface water, groundwater, Mi'kmaq of Nova Scotia	Yes	Adverse residual effects were identified within VC evaluation
Fish and Fish Habitat	6.9	The LAA is defined by the tertiary watersheds that encompass or intersect the PA (Beaver Dam Mine Site, Haul Road and Touquoy Mine Site), and contains surface water features upstream, downstream and within the PA. The lakes and watercourses that are included as part of the baseline programs and/or predictions of effects are located within the LAA boundary. See Figure 6.7-11.	The RAA encompasses three Secondary Watersheds: West River Sheet Harbour, Tangier River and Fish River-Lake Charlotte). See Figure 6.7-11.	The temporal boundary for the assessment of effects to wetlands includes the construction, operation, closure (active reclamation and decommissioning) and post-closure phases.	A significant adverse effect from the Project on fish and fish habitat is defined as an effect that results in an unmitigated or uncompensated net loss of fish habitat as defined under the *Fisheries Act*, and its associated no-net loss policy.	Aquatic Resources	Habitat loss and disturbance Increased habitat connectivity Decreased water quality	Adverse, not significant	SAR/SOCI, Mi'kmaq of Nova Scotia	Yes	Adverse residual effects were identified within VC evaluation

Table 8.4-1: Initial Screening of the Valued Components based on the Outcome of the Environmental Effects (continued)

Project VC	EIS Section	Spatial Boundaries		Temporal Boundaries	Summary of A Significant Effect*	Pathway	Adverse Residual Effects			Include in Scoping Exercise	Rationale
		Local Assessment Area (LAA)	Regional Assessment Area (RAA)				Summary	Significance	Linkages to Other VCs (If Applicable)		
Habitat and Flora	6.10	The LAA includes a 2 km buffer around the Beaver Dam Mine Site and a 500 m buffer surrounding the Haul Road (excluding Mooseland Road). See Figure 6.10-7.	The RAA encompasses portions of Ecodistrict 440 within Halifax Regional Municipality (HRM), east and north of Lake Charlotte. Where the Ecodistrict boundary approached the northern extent of the Beaver Dam Mine Site, the RAA was enlarged to include a 5 km buffer around the PA. See Figure 6.10-7.	The temporal boundary for the assessment of effects to habitat and flora includes the construction, operation, closure (active reclamation and decommissioning) and post-closure phases.	A significant adverse effect from the Project on habitat is defined as an effect that is likely to cause a permanent, unmitigated, alteration to habitat that supports flora species distribution. For the purposed of this analysis, habitat is defined as: A **natural** environment composed of both living organisms (biotic) and non-living components (abiotic) which function together as an ecological unit and includes managed forests (e.g. treated stands, cutblocks, plantations). Urban and industrial developments (e.g. roads, houses, quarries etc.) are excluded from this definition.	Vegetation	Disturbance and loss of habitat	Adverse, not significant	Fauna, avifauna, SAR/SOCI, wetlands, Mi'kmaq of Nova Scotia	Yes	Adverse residual effects were identified within VC evaluation
Terrestrial Fauna	6.11	The LAA includes a 5 km buffer around the Beaver Dam Mine Site and a 500 m buffer surrounding the Haul Road and Touquoy Mine Site. See Figure 6.11-3.	The RAA encompasses portions of Ecodistrict 440 within Halifax Regional Municipality (HRM), east and north of Lake Charlotte. Where the Ecodistrict boundary approached the northern extent of the Beaver Dam Mine Site, the RAA was enlarged to include a 5 km buffer around the PA. See Figure 6.11-3.	The temporal boundary for the assessment of effects to terrestrial fauna includes the construction, operation, closure (active reclamation and decommissioning) and post-closure phases.	A significant adverse effect from the Project on terrestrial fauna is defined as an effect that is likely to cause a permanent, unmitigated, alteration to habitat that supports fauna species distribution.	Wildlife	Disturbance and loss of habitat	Adverse, not significant	Habitat and flora, SAR/SOCI, wetlands, Mi'kmaq of Nova Scotia	Yes	Adverse residual effects were identified within VC evaluation
Avifauna	6.12	The LAA includes a 5 km buffer around the Beaver Dam Mine Site and a 500 m buffer surrounding the Haul Road and Touquoy Mine Site. See Figure 6.12-2.	The RAA encompasses portions of Ecodistrict 440 within Halifax Regional Municipality (HRM), east and north of Lake Charlotte. Where the Ecodistrict boundary approached the northern extent of the Beaver Dam Mine Site, the RAA was enlarged to include a 5 km buffer around the PA. See Figure 6.12-2.	The temporal boundary for the assessment of effects to avifauna includes the construction, operation, closure (active reclamation and decommissioning) and post-closure phases.	A significant adverse effect from the Project on avifauna is defined as an effect that is likely to cause a permanent, unmitigated, alteration to habitat that supports avian species distribution.	Wildlife	Disturbance and loss of habitat	Adverse, not significant	Habitat and flora, SAR/SOCI, wetlands, Mi'kmaq of Nova Scotia	Yes	Adverse residual effects were identified within VC evaluation

Table 8.4-1: Initial Screening of the Valued Components based on the Outcome of the Environmental Effects (continued)

Project VC	EIS Section	Spatial Boundaries		Temporal Boundaries	Summary of A Significant Effect*	Pathway	Adverse Residual Effects			Include in Scoping Exercise	Rationale
		Local Assessment Area (LAA)	Regional Assessment Area (RAA)				Summary	Significance	Linkages to Other VCs (If Applicable)		
Species at Risk (SAR) /Species of Conservation Interest (SOCI)	6.13	The LAA for SAR and SOCI is equivalent to those described for Habitat and Flora, Terrestrial Fauna, Fish and Fish Habitat, and Avifauna.	The RAA for SAR and SOCI is equivalent to those described for Habitat and Flora, Terrestrial Fauna, Fish and Fish Habitat, and Avifauna.	The temporal boundary for the assessment of effects to SAR and SOCI includes the construction, operation, closure (active reclamation and decommissioning) and post-closure phases.	A significant adverse effect from the Project on SAR and SOCI is defined as an effect that is likely to cause a permanent, unmitigated, alteration to habitat that supports a species' distribution, or alteration of critical habitat. An adverse effect that does not cause a permanent alteration to habitat of SAR or SOCI species is not considered to be significant. Sedentary species such as vascular and non-vascular flora do not have the opportunity to move to avoid direct or indirect impact. For these species, the loss of an individual or individuals of a SAR species that is important in the context of the province, or that species' overall abundance or distribution, may be considered significant, if appropriate mitigation measures are not implemented. Mortality of a single SAR could, under some circumstances, be considered a significant effect.	Wildlife, Vegetation, Aquatic Resources	Disturbance and loss of habitat	Adverse, not significant	Wetlands, Mi'kmaq of Nova Scotia	Yes	Adverse residual effects were identified within VC evaluation
SOCIO-ECONOMIC ENVIRONMENT											
Mi'kmaq of Nova Scotia	6.14	The LAA encompasses a 5 km radius from the PA. The LAA includes the maximum extent of physical disturbance from project and interactions with expected Mi'kmaq current use of lands and resources, and physical and cultural heritage (Figure 6-14.1).	The RAA for the assessment of the Mi'kmaq of Nova Scotia is defined as the territorial boundaries of the *Eskikewa'kik* (meaning 'skin dressers territory'). See Figure 6.14-1.	The temporal boundary for the assessment of effects to the Mi'kmaq of Nova Scotia includes construction (one year), operations (five years), and active closure (two years) phases.	An effect that results in long-term (greater than 20 years) loss of the availability of, or access to, land and resources currently relied upon for traditional use practices or the permanent loss of traditional use areas within a large portion of the PA; an effect on health identified through conclusions of the Human Health Risk Assessment, and/or an unmitigated loss of a physical or cultural structure, site or thing that is of historical, archaeological, paleontological or architectural significance to the Mi'kmaq A detailed definition is provided in Section 6.14.6.2.	Physical and Biophysical pathways and Socio-economic conditions	Loss of plant specimens and habitat Loss of fish habitat Change in species movement pattern Sensory disturbance Visual change Increased Traffic Loss of Access	Adverse, not significant	NA	Yes	Adverse residual effects were identified within VC evaluation
Physical and Cultural Heritage	6.15	There is no LAA or RAA for physical and cultural heritage, as the loss or destruction of heritage or archaeological resources could occur only within the disturbed footprint of the Project (PA).		The temporal boundaries used for the assessment of effects to physical and cultural heritage are limited to the construction phase of the Project. Construction is estimated to take approximately one year.	A significant adverse effect is an uncontrolled (without appropriate study, analysis and mitigation measures in conjunction with the Province and Mi'kmaq archaeologists as required) disturbance to, or destruction of, any unassessed historical or cultural resource of importance in context of the *Special Places Act*.	Cultural Heritage	Loss of archaeological features Site 6 and Areas 2 and 3 will be impacted by the Project. Additional shovel tests were completed within Site 6, Area 2 and Area 3 in fall 2020. No Pre-contact Mi'kmaq archaeological resources were encountered.	Adverse, not significant	Mi'kmaq of Nova Scotia	Yes	Adverse residual effects were identified within VC evaluation

Note: A summary of each VCs threshold for determination of a significant effect is presented herein. For the full definition of a significant effect, including determination of the magnitude, see the effects assessment methodology for each VC in Section 6.

8.4.3 Identification, Selection and Description Past, Present and Future Physical Activities

Major industrial projects that have taken place, are taking place or are known to potentially take place in the future within the RAA for each VC are described in the following sections. Projects were identified as per the methods described in Section 8.3.1 and consider major industrial projects (i.e. those requiring federal or provincial environmental assessment) as well as projects that are known to be present in the area from engagement efforts, common knowledge, aerial imagery review of the local area, or other methods as available. This list is meant to be inclusive, but the Proponent acknowledges the limitations of these methods of project identification; some projects may have been excluded due to ignorance on the part of the EIS team and limited publicly available data. This list of physical activities is current as of April 2021.

The ability to draw conclusions from publicly available data is a considerable limitation for the cumulative effects assessment. The best source of publicly available data for other projects being considered lies in the provincial and federal environmental assessment websites. Some of the projects identified below do not trigger an EA process, but would be regulated under provincial Approvals (i.e. Water Approvals, Integrated Resource Management approvals, or Industrial Approvals). These approval documents, and the supporting information are not readily publicly available. Projects which do trigger a formal environmental assessment process have EARDs or EISs available online, but they do not necessarily follow consistent methodology in the assessment or determination of effects. Furthermore, the details associated with information requests or insufficient information requests are not readily publicly available. Some projects may be currently in review so the outcome of that decision is unknown. As such, there is a risk in using conclusions presented in environmental assessments, because the Proponent is unable to confirm whether the effects assessment determinations presented therein were satisfactory, rigorous or appropriate. Furthermore, some projects (such as timber harvesting on private land, or the Nova Scotia Salmon Association's Acid Mitigation project) relevant to the evaluation of cumulative effects, do not trigger regulatory approvals or an EA process. As a result, publicly available information is limited.

A preliminary assessment of the potential cumulative effects of these projects with the Project is presented. A summary of the identified projects and their potential cumulative effects can be found in Section 8.4.3.1. Where possible the distance of the identified projects from the FMS Mine Site and the Touquoy Mine Site were determined along with the anticipated duration of the identified projects to determine potential interaction of the effects of those projects with the Project's adverse residual effects.

If a project falls within a particular VCs RAA, it is considered in that VCs cumulative effects assessment. As such, within each Project listed below, a list of relevant VCs is provided based on the RAA spatial boundary for each VC. Socioeconomic effects have already been screened out of the CEA, based on predicted residual positive effects.

There is a direct spatial overlap with the Project PA and several projects. These include:

- Historic and current mining activity at the Touquoy Mine Site;
- Historic mining activity at the Beaver Dam Mine Site;
- Proposed usage of the Haul Road for transportation of concentrate from the proposed Fifteen Mile Stream Project;
- Regional forestry operations within the PA; and
- Terrestrial liming within Tent Lake Watershed.

As a result of the direct spatial overlap with the Project PA, these projects are considered in the CEA for all VCs.

8.4.3.1 Current and Past Projects

8.4.3.1.1 Fifteen Mile Stream Historic and Proposed Mining Operations (Past and Future)

Gold mining is known to have occurred in the Fifteen Mile Stream (FMS) Study Area near Trafalgar, NS, since 1874, when development along the Jackson Lead took place, approximately 300 m south of the Egerton-MacLean area). Between 1874 and 1893, a number of different companies were active in the Old Egerton and MacLean Shaft area. At this time, small mines were worked from various shafts with the deepest recorded workings located on the Egerton Lead. In 1879, gold was discovered in the Hudson area, west of Egerton-MacLean, and some mining took place here until 1887, when a fire destroyed the mill and hoist. Mining operations appear to have stopped between 1903-1938. Very little, if any work, occurred between 1941-1980, with the exception of a tailings sampling program which occurred at the Egerton Stamp Mill in 1973. Exploration activities recommenced in the 1980's, but little activity occurred between 1990-2008.

In 2009, Acadian Mining started re-examining some of the historic drill core and in 2010, Acadian took 2,139 samples representing previously unsampled intervals from 22 of the historic drill holes. They demonstrated that much of the previously unsampled core was mineralized and that mineralization was more extensive than had been recognized. In 2011, Acadian drilled 29 diamond holes for 3,741 m. Twenty holes were drilled in the Egerton – MacLean area, ten holes in the Hudson area and the remaining hole in the 149 East Zone. This new information was used, together with the historic drill data by Snowden Consulting for a 2012 estimate of resources.

In 2014, Acadian Mining was acquired by Atlantic Gold Corporation. FSSI Consultants completed a resource update using the same database as that used by Snowden Consulting in the 2012 estimate. In 2016, Atlantic Gold commenced an exploration drilling program to determine mineralization extents at the FMS site. A total of 11 holes were drilled for 945 m. The program was continued in 2017 with a further 180 holes drilled for 23,044 m. In the same year Atlantic Gold commenced infill drilling to improve resource confidence and supplement drilling completed in the early 1980s. A total of 186 holes were drilled for 26,062 m. These additional holes were used, together with the historical drill data, by FSSI Consultants to complete a 2017 resource update. Historic mining activities within the FMS Study Area resulted in some habitat fragmentation and general disturbance, in addition to deposition of tailings along Seloam Brook.

The FMS Gold Project EIS has been submitted to IAAC for review. Upon approval of the proposed Project, extraction will commence in 2024. Concentrate from FMS will be hauled to the Touquoy Mine Site for processing. Tailings from FMS concentrate will be deposited into the exhausted Touquoy pit. The FMS Mine Site is in Trafalgar, Halifax County, Nova Scotia. It is located on land owned partially by MacGregor Properties Ltd, with whom the Proponent has a lease, and the remainder is owned by the Crown and access to the land will be granted by a Crown land lease.

Upon approval and the commencement of mining operations, concentrate from the FMS Gold Project will be transported and processed at the existing plant at the Touquoy Mine Site. The FMS Gold Project is anticipated to commence construction in 2022, come into production in 2023, cease operations in 2027, and then be reclaimed. From 2024 to 2030, concentrate from FMS Gold Project will be processed at the Touquoy Facility along with ore from the Project and concentrate from the Cochrane Hill Gold Project.

As part of the Beaver Dam Mine Project, a Haul Road will be constructed to transport ore to the Touquoy Mine Site. The effects assessment for construction and operation of the Haul Road are presented in this EIS. However, when this haul road is completed, the proposed FMS Gold Project and the proposed Cochrane Hill Gold Project will use the Haul Road to transport gold concentrate to the Touquoy Mine Site. The cumulative effects of increase traffic levels on the Haul Road are assessed herein as a stand-alone

project. The Fifteen Mile Stream site is located approximately 19 km northeast of the Beaver Dam Mine Site, and 38 km northeast of the Touquoy Mine Site.

Spatial overlap with the following RAAs: All VCs

8.4.3.1.2 Beaver Dam Mining Operations (Past)

The area has been subject to exploration and mining activity since gold was first discovered in 1868. Between 1871 and 1949, there were intermittent attempts to develop and mine the area, initially focused on the Austen Shaft area and later on the Mill Shaft area located approximately 1.2 km west of the Austen Shaft. The small Papke Pit located approximately 400 m west of the Austen Shaft was excavated in 1926; however, the majority of development was focused on a belt of quartz veins in greywacke and slates that was approximately 23 m wide where intersected from the Austen Shaft. Approximately 967 ounces of gold production is recorded for Beaver Dam gold deposit between 1889 and 1941. From 1978 until 1988, several companies drilled a combined 251 diamond drill holes for 47,935 m. Some of these drill holes were completed underground via an exploration decline that reached a maximum depth of 100 m below surface. In 1987, a small open pit was also excavated in the Austen Shaft zone. Approximately 2,445 ounces of gold production was also recorded for Beaver Dam gold deposit between 1986 and 1989. Between 2005 and 2009 two companies drilled a combined 153 diamond drill holes for 22,010 m and also completed several other exploration programs including an aeromagnetic survey, a till survey, and a follow-up reverse circulation drilling program for geochemical purposes.

Spatial overlap with the following RAAs: All VCs

8.4.3.1.3 Touquoy Mining Operations (Past, Present and Future)

The Touquoy Mine Site is a fully permitted and approved gold mine in Moose River, Halifax County, Nova Scotia. It is located on land owned by the Proponent and NSL&F. This area has a long history of gold mining, with mining activities occurring periodically since the 1890's. Further details related to the Touquoy Mine Site are presented in Section 2. The Touquoy Gold Project has been fully operational since October 2017 and is described in detail in the Project Description as it relates to the current Project. The current proposed Project involves a temporal extension of the operation of the Touquoy Processing Facility as part of its project description and the effects of the temporal extension are evaluated as effects of the proposed Project.

In the future, it is proposed that the Touquoy pit be expanded to extract additional high grade ore (Appendix F.10). To support cumulative effects assessment for the Project, this expansion is considered herein.

In the future, it is currently proposed that tailings from the processing of ore or ore concentrates from four deposits at the Touquoy mill will be disposed of in the Touquoy pit. These tailings include the processing of lower grades of ore stockpiled for the Touquoy Project, processing of ore transported from the Beaver Dam Project, and processing of ore concentrates from the Fifteen Mile Stream Gold Project and Cochrane Hill Gold Project. Each of these proposed tailings depositions into the Touquoy pit are being evaluated separately as required to reach regulatory approvals. However, to support this cumulative effects assessment for the Project, the cumulative effects from the disposal of tailing from all four projects on Water Resources are assessed in (Appendix F.7). This cumulative assessment memo also considers the proposed expansion of the Touquoy pit.

Possible cumulative effects on the VCs are summarized in Table 8.4-2.

Spatial overlap with the following RAAs: All VCs

8.4.3.1.4 Regional Forestry Operations (Past, Present and Future)

The PA is located on a combination of lands owned by the Crown, and by Northern Timber Nova Scotia Corp. Leases allow forestry to occur on Crown land. In addition to the current forestry activity in the area, evidence of historical forestry is present; clearcutting is a widespread practice throughout the region. The PA contains a diversity of habitat types and landscape features but has experienced a considerable amount of disturbance and habitat fragmentation as a result of historic mine operations, and current and historic timber harvesting practices.

Forestry activities occur in the region surrounding the PA. Due to these operations, the regional area spanning between the Beaver Dam Mine Site and the Touquoy Mine Site is a mosaic of forested habitats at different stages of regeneration, including some relatively undisturbed mature forest. Harvested wood in this area is transported from the area by road. Regional forestry operations are likely to continue into the future following current forest management practices. Forest harvesting may also contribute to traffic on the Beaver Dam Haul Road during the life of the mine projects.

MEL consulted the Nova Scotia Harvest Map Plan Viewer (NSL&F, 2021) and NSL&F to attempt to quantify timber harvesting activity on Crown Lands, to help advise the assessment of potential cumulative effects. NSL&F confirmed that the Harvest Map available to view online identifies forest patches that are proposed or approved for timber harvesting on crown land. This tool has limited application in quantifying harvest operations, because its' intention is for public consultation purposes, and NSL&F does not use this tool to confirm if and when any approved forest patch has been actually harvested. As such, the total area of past, current and proposed crown land timber harvesting within the RAA could not be quantified. Furthermore, this layer applies to crown lands only, and there is no equivalent tracking system for timber harvesting operations on private land (which accounts for approximately 67% of the RAA). As such, timber harvesting operations cannot be discussed in any meaningful, quantitative way. Given the limitations of available data, discussions related to timber harvesting are qualitative in nature. Timber harvesting practices and standards are currently being reviewed under recommendations provided in the Leahy Report (2018). The details associated with which recommendations will be implemented are unknown at this time, though the general intent is to promote more ecologically driven timber harvesting. As a result, the implementation of recommendations outlined in the Leahy report are only anticipated to reduce residual effects of timber harvesting moving into the future, rather than increase residual effects.

Spatial overlap with the following RAAs: All VCs

8.4.3.1.5 Nova Scotia Salmon Association – Acid Mitigation Project

The WRSH watershed is home to one of the largest and longest Atlantic salmon restoration projects in Canada – the WRSH Acid Mitigation Project. Like most watersheds in the SU region, the WRSH has experienced acidification, reducing the habitat quality for spawning Atlantic salmon. Before intervention, the pH range of the main WRSH and Killag River was approximately 4.3 to 5.5 and 4.7 to 5.5, respectively (Halfyard, 2013). In an effort to improve the quality of fish habitat, the Nova Scotia Salmon Association (NSSA) with support from the Atlantic Salmon Federation and numerous other organizations has operated a continuous lime dosing station in the West River since 2005 (6 km southwest of the Beaver Dam Mine Site, and 13 km northeast of the Touquoy Mine Site). A second lime dosing station was installed on the Killag River in 2017. The Killag River dosing station is located approximately 500 m east and downstream of the Beaver Dam Mine Site, and 13 km northeast of the Touquoy Mine Site. Their purpose is to increase the pH of the water to a range that is more suitable for juvenile Atlantic salmon (approximate pH levels of 5.5). As a result of the Acid Mitigation Project, treated river pH within the WRSH has increased to 5.5 to 7.5 (Halfyard, 2013).

In addition to the operation of two lime dosing stations, the NSSA has implemented a terrestrial liming program, to remediate effects of chronic acidification in the watershed, and to complement the ongoing aquatic liming programs. Terrestrial liming involves deposition of dolomitic limestone across the catchment by helicopter, while lime dosers add a slurry of limestone directly into the

watercourse on a continuous basis. To date, terrestrial liming has occurred within the Keef Brook, Paul Brook and Tent Brook tertiary watersheds (Rotteveel, 2018; DFO, 2020; NSSA, 2017).

Spatial overlap with the following RAAs: All VCs

8.4.3.1.6 Goldboro Gas Plant – Sable Offshore Energy Project (Past)

The Goldboro Gas Plant was built to collect and distribute natural gas from the Sable Offshore Energy Project in 1999. The gas plant completed initial processing to prepare natural gas to be sent via pipeline to the Point Tupper Fractionation Plant for additional processing. The gas plant operated for more than ten years, and decommissioning studies and planning commenced in 2012. Well plug and abandonment commenced in 2017. This site is approximately 87 km northeast of the Beaver Dam Mine Site, and 105 km northeast of the Touquoy Mine Site.

Spatial overlap with the following RAAs: Mi'kmaq of Nova Scotia

8.4.3.1.7 Port of Sheet Harbour (Present)

The Port of Sheet Harbour is a deep-water port located 25 km southeast of the Beaver Dam Mine Site and 35 km southeast of the Touquoy Mine Site on the coast of the Atlantic Ocean. The terminal consists of a 152 m wharf with a minimum draft of 10 m and is capable of handling ships of up to 214 m (Port of Sheet Harbour, 2017).

This facility has the capacity to handle aggregates and dry bulk, scrap metal and a variety of large bulky equipment such as neobulk marshalling and load out, fabrication modules including construction equipment and heavy lift project cargo, pipes and tubulars, boilers and transformers, and wind turbines (Port of Sheet Harbour, 2017).

Spatial overlap with the following RAAs: Air, Mi'kmaq of Nova Scotia

8.4.3.1.8 Cook's Brook Sand and Gravel Pit (Present and Future)

Gallant Aggregates Limited operates a sand and gravel pit in Cooks Brook, located approximately 46 km west of the Beaver Dam Mine Site and 30 km west of the Touquoy Mine Site. An eastward extension of the site was approved in 2013 and scheduled to commence that same year. The sand and gravel pit is approximately 500 m long by 250 m wide.

Spatial overlap with the following RAAs: Air, Mi'kmaq of Nova Scotia

8.4.3.1.9 ScoZinc Ltd. Mine (Past and Future)

ScoZinc Limited owns and operates a zinc/lead operation in Cooks Brook, approximately 49 km west of the Beaver Dam Mine Site and 33 km west of the Touquoy Mine Site. The footprint of this mine is approximately 160 hectares. An EARD for the project was approved in 2011; and several temporal extensions of the Approval have been granted as the Project did not commence within the approved timelines. According to the EARD (CRA, 2010), the project includes mineral extraction, milling and reclamation activities.

Spatial overlap with the following RAAs: Air, Mi'kmaq of Nova Scotia

8.4.3.1.10 National Gypsum Quarry (Present)

National Gypsum operates a large quarry in Milford Station, approximately 55 km west of the Beaver Dam Mine Site and 38 km west of the Touquoy Mine Site. It is the largest gypsum quarry in the world and was first constructed in 1955 (National Gypsum 2015). The footprint of the quarry is approximately 2.5 km by 1.1 km. It is anticipated to be in operation for the next 40 plus years.

Spatial overlap with the following RAAs: Mi'kmaq of Nova Scotia

8.4.3.1.11 Murchyville Gypsum Mine (Past)

A small, approximately 275 m by 200 m, gypsum quarry is located in Murchyville, 35 km southwest of the Beaver Dam Mine Site and 18 km west of the Touquoy Mine Site. This quarry is not currently operational and is currently on care and maintenance.

Spatial overlap with the following RAAs: Air, Mi'kmaq of Nova Scotia

8.4.3.1.12 Tangier Gold Mine (Past and Future)

The Tangier Gold Mine is located approximately 29 km south of the Beaver Dam Mine Site, and approximately 28km southwest of the Touquoy Mine Site. The footprint of this mine is approximately 500 m by 150 m, as measured on Google Earth.

The area of the Tangier Gold Mine has seen mining activity since the 1860s. The existing mine began its activities in the 1980s and is currently inactive. According to a press release dated January 29, 2019, the proponent had filed a Notice of Intention to make a proposal under the *Bankruptcy and Insolvency Act* (Resource Capital Gold Corp. 2017), and was deemed officially bankrupt on July 13, 2019 (PwC Canada, 2021).

Spatial overlap with the following RAAs: Air, Mi'kmaq of Nova Scotia

8.4.3.1.13 Dufferin Gold Mine (Past, Present and Future)

The Dufferin Gold Mine is located approximately 27 km southeast of the Beaver Dam Mine Site, and 42 km east of the Touquoy Mine Site. The footprint of this mine is approximately 375 m by 150 m.

Mining has been active in this area for more than a century. The site of the Dufferin Gold Mine began activity in the 1980s and has had sporadic development over the years. In 2014, the mine operated for a short period of time before closing. It is currently under the same ownership as Tangier Gold Mine and there were plans for re-opening to begin in 2017. A bulk sampling program and associated milling was completed in 2018, but in 2019 the proponent (Resources Capital Gold Corporation) filed a Notice of intention to make a proposal under the *Bankruptcy and Insolvency Act* so future plans for this Project are uncertain.

Spatial overlap with the following RAAs: Air, Habitat and Flora, Terrestrial Fauna, Avifauna, SAR and SOCI, Mi'kmaq of Nova Scotia

8.4.3.1.14 Great Northern Timber Wood Chipping and Shipping (Present)

Great Northern Timber owns and operates a chipping and ship loading facility in Sheet Harbour, approximately 25 km southeast of the Beaver Dam Mine Site. Great Northern Timber procures wood chips and roundwood fibre from industrial landowners, sawmills, Crown lands, Private land contractors and Private woodlot management organizations in Nova Scotia, Prince Edward Island, New Brunswick and Quebec.

Spatial overlap with the following RAAs: Air, Mi'kmaq of Nova Scotia

8.4.3.1.15 Taylor Lumber Co. Ltd. Mill (Present)

Taylor Lumber Co. Ltd. has operated a mill in Middle Musquodoboit since 1945. This site, located approximately 30 km west of the Beaver Dam Mine Site and 17 km northwest of the Touquoy Mine Site, includes a saw mill, a finishing plant, a pallet plant, a power plant, a dry-kiln, and a chipping plant. The power plant is a co-generation facility that burns biomass produced from their operation that provides power to their operation as well as to homes and businesses within a 30 km radius (Taylor Lumber, 2017).

Spatial overlap with the following RAAs: Air, Mi'kmaq of Nova Scotia

8.4.3.1.16 Regional Wind Power Projects (Present)

A total of at least five Wind Power Projects (WPP) are present within the broadest RAA (Mi'kmaq of Nova Scotia) to be considered in the cumulative effects assessment. Wind power Projects within this RAA range from single turbines projects with a 1.5 MW capacity to projects with 6 turbines with a capacity of 13.8 MW. The closest WPP to the Study Area is the Sheet Harbour WPP, 24 km southeast of the Beaver Dam Mine Site. The projects reviewed include the Mulgrave WPP, Chebucto – Pockwock WPP, Sable WPP, Gaetz Brook WPP, and Chebucto Terence Bay WPP.

Given the distance between regional WPPs and the proposed Project, and the comparatively small scale of WPPs, and the limited expected residual effects of these wind projects post mitigation efforts, these projects are determined to be unlikely to contribute to cumulative effects with the Project. As such, they are not discussed in any further detail in this Cumulative Effects Assessment. These WPPs fall within the RAA for Mi'kmaq of Nova Scotia, and except at the sites of the turbines themselves, they are not believed to limit land and resource use by the Mi'kmaq of Nova Scotia.

Wind Power Projects spatially overlap with the RAA for Mi'kmaq of Nova Scotia, however these projects are not specifically considered in any VCs, based on justification provided above.

8.4.3.1.17 Porcupine Mountain Quarry (Present)

Porcupine Mountain Quarry is a large aggregate quarry located at Porcupine Mountain, near Mulgrave, Guysborough County. This aggregate quarry exceeds 200 hectares in disturbed area. It has been in operation for more than 70 years, having been used as the source of rock for construction of the Canso Causeway in the 1950s. This site is 119 km northeast of the Beaver Dam Study Area and 138 km northeast of the Touquoy Mine Site.

Spatial overlap with the following RAAs: Mi'kmaq of Nova Scotia

8.4.3.1.18 Mosher Lake Limestone Co. (Present)

Mosher Limestone processing facility is located approximately 20 km northwest of the beaver Dam Mine Site Dam Mine and 16 km north of the Touquoy Mine Site. Mosher Limestone processes and sells limestone products in Nova Scotia and Atlantic Canada. Products include pelletized limestone, powdered limestone, granular limestone, powdered gypsum, pelletized gypsum, and traction sand. The processing facility crushes, packages and ships product.

Spatial overlap with the following RAAs: Air, Mi'kmaq of Nova Scotia

8.4.3.1.19 Great Northern Timber Pellet Facility (Present)

Great Northern Timber Group owns and operates a wood pellet manufacturing facility at Upper Musquodoboit – Great Northern Pellets, since 2017, located approximately 21 km northwest of the Beaver Dam Mine Site and 16 km north of the Touquoy Mine Site. The plant has had a capacity for processing 60,000 tons of wood pellets per year. Past operators shipped product to Europe through the Port of Halifax.

Spatial overlap with the following RAAs: Air, Mi'kmaq of Nova Scotia

8.4.3.1.20 Goff's Quarry Expansion (Present and Future)

Scotian Materials currently operates a quarry on private land, approximately 70 km southwest of the Beaver Dam Mine Site and 52 km southwest of the Touquoy Mine Site. Currently, the quarry is permitted under an industrial approval, as it operates under 4.00 ha. Scotian Materials has submitted an EA registration document to expand the quarry to approximately 41 hectares, extending the life of the quarry by an estimated 25-50 years.

A provincial EA was registered August 7th, 2018 for the proposed undertaking. The Minister released a decision on September 25th, 2018 requesting additional information. On 25 October 2019, the Minister granted Approval for a 14-ha expansion (Phase 1 and Phase 2) of the Project described in the registration document, to ta total quarry footprint of 18 hectares. Spatial overlap with the following RAAs: Mi'kmaq of Nova Scotia

8.4.3.1.21 Lake Major Dam Replacement (Present)

On December 16, 2016, Halifax Water submitted a provincial Environmental Assessment Registration Document for the replacement of a dam on Lake Major in Halifax County. The Project is located 55 km southwest of the Touquoy Mine Site and 70 km southwest of the Beaver Dam Mine Site. The Minister approved the Project on February 9th, 2017, subject to a number of conditions.

Spatial overlap with the following RAAs: Mi'kmaq of Nova Scotia

8.4.3.1.22 Loch Katrine Quarry (Present and Future)

On November 2nd, 2016, Dexter Construction Company Limited submitted a provincial Environmental Assessment Registration Document. The proposed undertaking involves an expansion of the existing 3.94 ha aggregate quarry in Loch Katrine, Guysborough County. The expanded quarry will occupy a maximum footprint of 27.3 ha, providing aggregate for road and local construction industries for up to 40 years. This site is located 73 km northeast of the Beaver Dam Mine Site and 90 km northeast of the Touquoy Mine Site. This project was granted ministerial approval on December 22nd, 2016.

Spatial overlap with the following RAAs: Mi'kmaq of Nova Scotia

8.4.3.1.23 Chedabucto Aggregates Quarry (Present and Future)

On September 17th, 2014, Chedabucto aggregates Limited submitted a provincial Environmental Assessment Registration Document. The proposed undertaking involves an expansion of the existing hectares aggregate quarry in Queensport, Guysborough County to a maximum size of 11.4 ha. This site is located 113 km northeast of the Beaver Dam Mine Site and 130 km northeast of the Touquoy Mine Site. This project was granted ministerial approval on November 6th, 2014.

Spatial overlap with the following RAAs: Mi'kmaq of Nova Scotia

8.4.3.1.24 Highway 107 – Bedford to Burnside (Present)

In June of 2017, Nova Scotia Transportation and Infrastructure Renewal submitted a provincial Environmental Assessment Registration Document for the construction of an extension to Highway 107, from Bedford to Burnside. The Project involves construction of a four-lane highway, approximately 9km in length, connecting Akerley Boulevard and Burnside Drive to the west end of Duke Street. This project also proposes to widen approximately 1.5 km of Duke Street in Bedford which leads to Highway 102. On August 25th, 2017, the Minister released a decision requesting supplemental information. This was provided on June 18, 2018, and the Project was approved on August 7th, 2018.The registration document submitted in June 2018 proposed a construction schedule of 5 years (2018-2022). The project lies approximately 63 km southwest of the Touquoy Mine Site and 80 km southwest of the Beaver Dam Mine Site. Construction commenced on this project in September 2019.

Spatial overlap with the following RAAs: Mi'kmaq of Nova Scotia

8.4.3.2 Future Physical Activities (Certain, Reasonably Foreseeable or Hypothetical)

It is expected that the forestry industry will continue into the foreseeable future throughout the RAA for Mi'Kmaq of Nova Scotia (the largest RAA). The mining industry could become more active if the price of minerals, notably gold, increases. This could hypothetically lead to the expansion of existing projects or the proposal of other new mining projects as exploration for mining is active in the region.

In addition to the ongoing forestry industry and the potential increase in general mining activities, two projects proposed by the Proponent, the Fifteen Mile Stream Mine Project and the Cochrane Hill Gold Project that are associated with the Touquoy Mine Site were identified as potential future projects. Neither project has been approved, as they are both currently undergoing federal environmental assessments; they are therefore determined as reasonably foreseeable projects for the purpose of this CEA.

8.4.3.2.1 Cochrane Hill Gold Project (Future)

The proposed Cochrane Hill Gold Project comprises of the development, operation, closure and reclamation of a surface gold mine in association with the Touquoy mine, which would produce approximately two million tonnes of gold-bearing ore a year. The Cochrane Hill surface mine is located within Guysborough County, in central Nova Scotia, approximately 145 km northeast of Halifax, and 62 km northeast of the Beaver Dam Mine Project. The property covers the historic Cochrane Hill Gold District located on NTS sheets 11E01/D, 11E08/A, and 11E05/B. Concentrate from Cochrane Hill Mine Site will be trucked to the Touquoy Mine Site for processing, along with FMS concentrate and ore from Beaver Dam. This proposed transportation route includes the use of the Beaver Dam Haul Road.

Processing the gold concentrate produced the Cochrane Hill Gold Project at the Touquoy facility will eliminate the need for a separate processing facility at the Cochrane Hill Mine Site. It is anticipated that 350,000 tonnes of tailings would be deposited into the Touquoy exhausted pit as a result of processing the gold concentrate from the Cochrane Hill Gold Project.

To facilitate the processing of the gold concentrate produced at the Cochrane Hill Mine Site, minor changes to the Touquoy facility would be needed. Additional concentrate storage and the addition of a second gravity concentrate leach reactor and a gravity electrowinning cell would have to be added. However, all of these items can be accommodated within existing footprint at the Touquoy mine.

There is also potential for cumulative effects associated with the effects resulting from the continued use of the Touquoy Mine Site. The residual effects for the Cochrane Hill Gold Project resulting from use of the Touquoy Mine Site would be a temporal extension

of the residual effects defined for the Touquoy Gold Project. The cumulative impacts of the addition of the Cochrane Hill Gold Project must take into account the extension of the temporal boundaries for the effects at the Touquoy Mine Site, alongside the same extension from the Project and the Beaver Dam Mine Project. Also, any such effects that are lasting could accumulate over time. Possible cumulative effects on the VCs are summarized in Table 8.4-2.

Spatial overlap with the following RAAs: Mi'kmaq of Nova Scotia

8.4.3.2.2 Beaver Dam Haul Road use by the Project, Cochrane Hill (Future), Beaver Dam Mine Project, and Forestry Activities (Future)

The gold concentrate from the Cochrane Hill Mine Site and FMS Mine Site as well as ore from the Beaver Dam Mine Site will be transported to the Touquoy Mine Site for processing. The Beaver Dam Haul Road is proposed for construction as part of the Beaver Dam Mine Project, at which point, it will be used to transport ore and concentrate from the Project to the Touquoy Mine Site. A total of 190 return trips are expected to travel on the Beaver Dam Mine Haul Road to facilitate transportation of Beaver Dam ore to the Touquoy Mine Site. Both Cochrane Hill and FMS Projects will contribute an additional 11 return trips each per day.

In addition, the Haul Road may also occasionally be used by forestry harvesters in the local area. In addition to 7 return trips by forestry trucks estimated per day, it is estimated 3/4-ton service trucks would make up to approximately 20 round trips per day on the haul roads.

The Project Team was unable to ascertain specific data regarding schedule or frequency of cutting within this area, or the resulting number of trucks that could be present from harvesting activities in the same temporal boundary as the projects as the Beaver Dam, Fifteen Mile Stream and Cochrane Hill Projects. As a result, this activity has been evaluated in a qualitative way as part of this cumulative effects assessment, where possible, given the data limitations.

The possible cumulative effect includes an expected increase in traffic on the Beaver Dam Haul Road between Highway 224 and the Mooseland Road, and the small contribution of each project to the overall disturbance of natural habitats at the regional scale for both humans (traditional usage and local residents) and flora and wildlife.

Spatial overlap with the following RAAs: All VCs

8.4.3.2.3 Goldboro Gold Mine (potential Future)

In August 2018, Anaconda Mining Inc. submitted a provincial Environmental Assessment Registration Document for construction and operation of a gold mine in Goldboro, Guysborough County. This site is approximately 86 km east of the Beaver Dam Mine Site, and 100 km east of the Touquoy Mine Site. Based on the project description available in the 2018 EARD, the proposed Project would involve operation of surface and underground mine facility producing 575 tonnes per day, 24 hours/day, 7 days/week, within a project footprint of approximately 126 ha. An on-site concentrator and tailings facility would be built as well. The proposed Project timeline involved production commencing in 2020, with project completion occurring in 2029, pending approval. On September 19th, 2018, the Minister released a decision, indicating that additional information would be required before approval could be granted. The Minister released terms of reference for a Focus Report to be submitted by the Proponent. The proponent withdrew their Environmental Assessment Registration Document on September 16, 2019.

The Goldboro area has been an active and productive mining area around the turn of the century from 1893-1910. There are historic mine workings as well as contamination throughout the area due to this history of mining.

Spatial overlap with the following RAAs: Mi'kmaq of Nova Scotia

8.4.3.2.4 Sheet Harbour Quarry (Future)

On January 31st, 2019, Dexter Construction registered an Environmental Registration Document with Nova Scotia Environment. The Minister released a decision on November 8th, 2019, approving the proposed undertaking. It is unknown whether the project has commenced. The Project is located in the community of Mushaboom, Halifax, County, Nova Scotia, approximately 26 km south of the Beaver Dam Mine Site, 6.6 km south of the community of Sheet Harbour, and 4 km southwest of the Port of Sheet Harbour. The total infrastructure footprint of the project is approximately 85 ha.

The purpose of the undertaking is to meet local and regional aggregate demand for projects carried out by Dexter Construction in the Sheet Harbour regional area. There is future potential for aggregate material to be sold offshore using the Port of Sheet Harbour as a shipping point. This quarry will replace existing smaller quarries in the region that are nearly exhausted and will be reclaimed. The extractable reserves in the quarry as designed is anticipated to be 50 plus years with production commencing at approximately 50,000 tonnes per year and increasing to 500,000 tonnes per year by Year 16 depending on markets.

Site activities will include the drilling, blasting, crushing, stockpiling, and transporting by trucks of aggregate for sale or for use in projects that are contracted to Dexter Construction. The operation will consist of a lay down area for the portable crushing equipment and screens, various aggregate stockpiles, and weigh scales, as well as the physical features of the site such as the quarry floor and active working faces, and site settling pond(s).

Assuming the mitigation, monitoring, and progressive reclamation measures specified in this report are implemented, and the quarry is operated according to provincial guidelines and approvals, no significant adverse residual environmental or socio-economic effects are likely. Effects are expected to be of small spatial magnitude, low frequency, short duration, and/or limited geographical extent. Operation of the quarry will result in economic benefits, including employment and an economic source of quality aggregates to local demand markets.

Environmental effects will include the loss of some habitat within the proposed quarry property area. The property has been the subject of past forestry- activities.

Localized impacts on air quality can be expected through the formation of airborne particulate matter. These impacts are readily controlled through standard mitigation measures (e.g., dust suppression) and follow-up monitoring as necessary to ensure compliance with the Pit and Quarry Guidelines at the property boundaries.

Spatial overlap with the following RAAs: Air, Mi'kmaq of Nova Scotia

8.4.3.2.5 Black Point Quarry (Future)

On March 4th, 2014, Black Point Aggregates Inc. submitted a Provincial Environmental Assessment Registration Document and federal EIS for the operation of a granite quarry in Guysborough County. It is located 180 km east of the Beaver Dam Mine Site and 143km northeast of the Touquoy Mine Site. On April 26, 2016 federal and provincial approval was granted for this project to proceed. On March 29th, 2018, the Minister authorized an extension for the commencement of work. The Proponent must commence work on or before April 26th, 2020 unless granted an extension by the Minister. It is uncertain whether an extension was sought, or has been granted by the minister; so this Project will remain in this list as reasonably foreseeable in an effort to be conservatively inclusive.

Spatial overlap with the following RAAs: Mi'kmaq of Nova Scotia

8.4.3.2.6 Bearpaw Pipeline (Future)

On March 30th, 2016, Bear Paw Pipeline Corporation Inc. submitted a provincial Environmental Assessment Registration Document for the construction and operation of a 62.5 km high pressure steel natural gas pipeline from Goldboro to the future location of the Bead Head LNG liquefied natural gas export facility in Richmond County, Nova Scotia. The project will include a compressor facility to deliver natural gas pressure to Bear Had LNG. On November 2nd, 2016, the Proponent submitted an addendum to the Registration Document. The Minister granted approval to this project on December 22nd, 2016. The western extent of this proposed pipeline in in Goldboro, approximately 86 km east of the Beaver Dam Mine Site, and approximately 100 km northeast of the Touquoy Mine Site. The proposed pipeline route runs northeast across Guysborough County towards the Strait of Canso.

Spatial overlap with the following RAAs: Mi'kmaq of Nova Scotia

8.4.3.2.7 Goldboro LNG Facility (Future)

In September 2013, Pieridae Energy (Canada) Ltd. submitted a provincial Environmental Assessment Registration Document for the construction and operation of a Natural Gas Liquefaction Plant and Marine Terminal in Goldboro, Guysborough County. The Project received ministerial approval on March 21, 2014, and an extension for the commencement of work on October 24, 2017. The proponent must commence work on or before March 21, 2019, unless granted an extension by the Minister. This site is approximately 86 km east of the Beaver Dam Mine Site, and 100 km east of the Touquoy Mine Site.

Associated with this project, Pieridae Energy (Canad) Ltd. submitted a provincial Environmental Assessment Registration Document for the Realignment of Marine Drive (Highway 316) project on March 10, 2021. The purpose of this project is to permanently re-align approximately 3.5 km of the existing Marine Drive (Highway 316) around the proposed Goldboro LNG Project site. This project is pending a decision from the Minister.

Spatial overlap with the following RAAs: Mi'kmaq of Nova Scotia

8.4.3.2.8 Canso Spaceport Facility (Future)

Maritime Launch Services Ltd. (MLS) has proposed to construct and operate a private commercial space launch site near the communities of Little Dover, Hazel Hill, and Canso, within the Municipality of the District of Guysborough (MODG) of Nova Scotia. The purpose of the Project is to establish a commercially-controlled, commercially-managed, launch site that would provide launch site options in North America, in support of the growing commercial space transportation industry. The site location is approximately 140 km northeast of the Beaver Dam Mine Site and 155 km northeast of the Touquoy Mine Site.

The Project will be situated on a portion of Crown Land designated by Property Identification Number (PID) 35096320 and consist of three components; the Launch Control Center (LCC), the Horizontal Integration Facility (HIF), and the Vertical Launch Area (VLA) connected by a transportation route. Access to the Project site is expected to coincide, in part, with the access road to the Sable Wind Farm, owned and operated by the MODG, in partnership with Nova Scotia Power.

A provincial EA was registered in June of 2018 for the proposed undertaking. The Minister released a decision in August 2018 requesting additional information. A focus report was submitted on March 11th, 2019, and Minister issued an Approval for the Project on June 4, 2019.

Spatial overlap with the following RAAs: Mi'kmaq of Nova Scotia

8.4.3.2.9 Waste Dangerous and Non-Dangerous Goods Temporary Storage Facility (Future)

On August 7 2019, Envirosystems Incorporated (Envirosystems) registered an environmental assessment for the Waste Dangerous and Non-Dangerous Goods Temporary Storage Facility at 11 Brownlow Avenue in Burnside, NS. The Minister decided additional information was required to make a decision on this Project. On 11 February 2020, the Minister decided to approve the undertaking. The project lies approximately 63 km southwest of the Touquoy Mine Site and 78 km southwest of the Beaver Dam Mine Site. The Project involves construction and operation of a new waste dangerous and non-dangerous goods temporary storage facility (Storage Facility) at their existing site at 11 Brown Avenue, a fully permitted Used Oil Collection and Storage operation (Approval No. 2001-024626-R10). The existing site is approximately 20,940 square metres (m^2) in size with the proposed facility occupying roughly 1.55% of the site.

Spatial overlap with the following RAAs: Mi'kmaq of Nova Scotia

8.4.3.2.10 Liquid Asphalt Storage Facility (Future)

On 1 May 2020, General Liquids Canada and the municipal Group of Companies registered an environmental assessment document for a proposed Liquid Asphalt Storage Facility Project. This facility is proposed to be located on Pleasant Street in Dartmouth, which is approximately 61 km southwest of the Touquoy Mine Site and 76 km southwest of the Beaver Dam Mine Site. This facility would allow transferring, storage and preparation of liquid asphalt for shipment. On 22 June 2020, the Minister decided to approve the undertaking, subject to a number of conditions.

Spatial overlap with the following RAAs: Mi'kmaq of Nova Scotia

8.4.3.2.11 Highway 102 Aerotech Connector Road Project (potential Future)

On 20 September 2019, Nova Scotia Transportation and Infrastructure Renewal submitted a provincial Environmental Assessment Registration Document for the construction of a connector road from Highway 102 Aerotech Interchange (Exit 5A) to Trunk 2 in Wellington. This 5km connector road is designed as a four-lane road. According to the registration document, the project may commence in 2020 and is expected to take 5 years to complete. The Minister of Environment approved this undertaking on January 5, 2021. The project lies approximately 52 km southwest of the Touquoy Mine Site and 68 km southwest of the Beaver Dam Mine Site.

Spatial overlap with the following RAAs: Mi'kmaq of Nova Scotia

8.4.4 Confirmation of Valued Components to be Carried Forward Cumulative Effects Assessment

The three steps listed above include identification of the valued components, determination of spatial and temporal boundaries, and identification of past, present and future physical activities or projects relevant to the selected VCs based on identified RAAs for each VC. This exercise allowed for the identification of pathways for potential cumulative effects per VC based on:

- The extent of predicted Project effects on each VC;
- Potential extent of other Projects' impacts based on publicly available or published data;
- The timeframe of Project impacts;
- The timeframe of other Projects potential impacts, based on publicly available or published data; and,
- Types of potential cumulative effects (additive, synergistic, compensatory and masking).

This fourth step takes these confirmed pathways and potential intersections with other Projects, and then identifies which VCs will be brought forward to the CEA, based on the following criteria:

- level of concern noted during engagement;
- current state of the VC (health/status/condition);
- potential for significant cumulative effects with other projects as identified for each VC; and
- uncertainty in predictions of cumulative effects especially project knowledge and data limitations.

As described in Table 8.4-2 the following VCs warrant further assessment:

- Physical Environment:
  - Air;
  - Noise;
  - Light; and
  - Surface Water Quality and Quantity.
- Biophysical Environment:
  - Fish and Fish Habitat; and
  - Species of Conservation Interest and Species at Risk.
- Socio-Economic Environment:
  - Mi'kmaq of Nova Scotia.

Noise and light VCs associated with the defined Beaver Dam Project do not trigger evaluation of cumulative effects based on confirmed Project Areas and VC spatial boundaries (RAAs) and locations of other identified projects. However, due to the proposed interactions of the Fifteen Mile Stream Project with the Project and Cochrane Hill Gold Project, as well as forestry trucking activities, relating to the use of the Beaver Dam Haul Road for transportation of gold concentrate from the Project, the noise and light VCs are carried forward to evaluation for cumulative effects herein only in consideration of the plan to use the Beaver Dam Haul Road for transportation of gold concentrate to the Touquoy Mine Site. Trucks associated with the transportation of this concentrate have additive cumulative potential for increased dust, light intrusion into the forest, and noise when considered with the Beaver Dam Haul Road truck traffic, and also the truck traffic associated with the proposed Cochrane Hill Gold Project (additional transportation of gold concentrate using this Haul Road) and potential forestry traffic.

SAR/SOCI is being evaluated with regards to cumulative effects for rare species, including Avifauna. As such, cumulative effects to migratory birds more generally will be addressed through the effects assessment for Avifauna SAR.

Table 8.4-2: Selection of Valued Components for the Cumulative Effects Assessment

Project VC	Residual Adverse Effects	EIS Finding	Boundaries		Criteria for Determining Whether Further Assessment Is Required			Carried Forward to Cumulative Effects Assessment		
			Spatial – Geographical Extent of Residual Effects	Temporal - Timeframe Associated with Residual Effects	Level of Concern Noted During Engagement	Current State of The VC (Health/Status/ Condition)	Potential for Cumulative Effects: Screening Evaluation Summary	Uncertainty in Prediction of Cumulative Effects	Yes/No	Rationale
Noise	Increased ambient noise	Not Significant	Residual effects related to ambient noise levels are not anticipated to extend outside the LAA	Residual effects to ambient noise levels may occur throughout the duration of the project including Construction, Operation and Active Closure	Medium. Local residents and Mi'kmaq are concerned with potential noise from the mine. Noise along the Beaver Dam Haul Road is a concern for the Millbrook First Nation and local residents.	Good. Project noise is predicted to be in compliance with the Pit and Quarry Guideline nighttime guideline of 55 dBA at the proposed property boundaries for the Beaver Dam Mine Site, the Haul Road and the Touquoy Mine Site.	No. It is likely that forestry operations will occasionally coincide with those of the Beaver Dam Mine Project within the RAA and cause increased ambient noise levels, compared to the levels that these operations produce individually. However, such additive periods are likely to be limited in duration and frequency and are not expected to be significant. The NSSA AMP overlaps with the Noise RAA, however with the exception of annual helicopter deposition of limestone over a several week period, the project does not generate noise. No other projects were identified within the RAA for noise. Cumulative effects of transportation of gold concentrate from Fifteen Mile Stream Gold Project, the Cochrane Hill Gold Project and forestry activity, together with the Project, is possible (trucking on Beaver Dam Haul Road)	Moderate. The principal assumption behind the potential of significant cumulative effects is that local forestry practices will not change in any substantial, meaningful way throughout the Project. This assumption is considered as having a moderate uncertainty. No data was available to confirm this statement.	Yes.	The predicted cumulative effects are not anticipated to be significant and the residual effects of the Project are anticipated to revert back to baseline conditions upon completion of the project. However, due to potential for cumulative effects of trucking on the Beaver Dam Haul Road, further evaluation is warranted specific to this location only.
Air	Increased ambient dust	Not Significant	Residual effects related to air quality are not anticipated to extend outside the LAA.	Residual effects to ambient air quality levels may occur throughout the duration of the project including Construction, Operation, and Active Closure	Medium to high. Concerns were specifically expressed by the Mi'kmaq relating to atmospheric environment include potential dust from mining operations at the Beaver Dam Mine Site and Touquoy Mine Site for traditional practices Dust along the Beaver Dam Haul Road is a concern for the Millbrook First Nation and local residents.	Good. Concentrations of all parameters are predicted to be in compliance with appropriate regulatory criteria at the proposed property boundaries for the Beaver Dam Mine Site and Haul Road. Compliance will be reached through the application of chemical dust suppressants along the Haul Road (proposed 80% dust suppression). There are no predicted impacts from the Project at the Touquoy Mine Site.	No. It is likely that forestry operations will occasionally coincide with those of the Beaver Dam Project and cause increased ambient dust levels, compared to the levels that these operations produce individually. However, such additive periods are likely to be limited in duration and frequency and are not expected to be significant. Cumulative effects of transportation of gold concentrate from Fifteen Mile Stream Gold Project, the Cochrane Hill Gold Project and forestry activity, together with the Project, is possible (trucking on Beaver Dam Haul Road)	Moderate. The principal assumption behind the potential of significant cumulative effects is that local forestry practices will not change in any way throughout the Project. This assumption is considered as having a moderate uncertainty. No data was available to confirm this statement.	Yes.	Further assessment is required to determine if there is the possibility of significant residual cumulative effects to Air at the Beaver Dam Mine Site. Also, due to potential for cumulative effects of trucking on the Beaver Dam Haul Road, further evaluation is warranted specific to this location.
Light	Increased ambient light	Not Significant	Residual effects related to ambient light levels are not anticipated to extend outside the RAA.	Residual effects to ambient light levels may occur throughout the duration of the project including Construction, Operation and Active Closure.	Medium. Local residents and Mi'kmaq are concerned with potential light from the Beaver Dam Mine Site Light intrusion into the forest along the Beaver Dam Haul Road is a concern for the Millbrook First Nation and local residents.	Good. The RAA is a rural area and is mostly wooded. Ambient nighttime light conditions would be minimal and typical of an undeveloped rural area. There are no predicted impacts from the Project at the Touquoy Mine Site	No. It is likely that forestry operations will occasionally coincide with those of the Beaver Dam Mine Project and cause increased ambient light levels, compared to the levels that these operations produce individually. However, such additive periods are likely to be limited in duration and frequency and are not expected to be significant. Cumulative effects of transportation of gold concentrate from Fifteen Mile Stream Gold Project, the Cochrane Hill Gold Project and forestry activity, together with the Project, is possible (trucking on Beaver Dam Haul Road)	Moderate. The principal assumption behind the potential of significant cumulative effects is that local forestry practices will not change in any way throughout the Project. This assumption is considered as having a moderate uncertainty. No data was available to confirm this statement.	Yes.	The predicted cumulative effects are not anticipated to be significant and the residual effects of the Project are anticipated to revert back to baseline conditions upon completion of the project. However, due to potential for cumulative effects of trucking on the Beaver Dam Haul Road, further evaluation is warranted specific to this location only.
GHG	Increased greenhouse gas emissions	Not significant	Residual effects related to GHG emissions are anticipated to extend throughout the RAA (the Province of Nova Scotia)	Residual effects to GHGs may occur throughout the duration of the project including Construction, Operation and Active Closure.	Limited concern has been noted specific to greenhouse gas emissions associated with the Project	Good. The total GHG emissions from Nova Scotia were identified to be 17,000 kilotonnes CO_2e during 2018, which achieved the legislated reduction goal of 10% below 1990 levels by 2020	No. All phases from this project would represent approximately 0.128% of the total GHG emissions for Nova Scotia. It is therefore considered that the proposed project contributes very little to the overall cumulative effects of regional industry to GHG emissions.	Low. Although there is some uncertainty in levels of GHG emissions, there is good confidence in the fact that the Beaver Dam Mine will only contribute a small percentage for Nova Scotia.	No.	As the predicted cumulative effects are not anticipated to be significant and given the small contribution of the Beaver Dam Project to total GHG emissions, the effects with and without the project are very similar. Therefore, no further assessment is warranted.

Table 8.4-2: Selection of Valued Components for the Cumulative Effects Assessment (continued)

Project VC	Residual Adverse Effects	EIS Finding	Boundaries		Criteria for Determining Whether Further Assessment Is Required			Carried Forward to Cumulative Effects Assessment		
			Spatial – Geographical Extent of Residual Effects	Temporal - Timeframe Associated with Residual Effects	Level of Concern Noted During Engagement	Current State of The VC (Health/Status/ Condition)	Potential for Cumulative Effects: Screening Evaluation Summary	Uncertainty in Prediction of Cumulative Effects	Yes/No	Rationale
Geology, Soil and Sediment Quality	Erosion, soil and sediment quality, (i.e. flora and fauna/habitat, etc.)	Not Significant	Residual effects related to erosion, soil and sediment quality are not anticipated outside of the Beaver Dam Study Area.	Residual effects to Geology, Soil and Sediment Quality may occur throughout the duration of the project including Construction, Operation and Active Closure.	Medium. Concerns were expressed relating to potential ARD, suspended solids and mobilization of historical tails from the Beaver Dam Mine Site, which may affect receiving water and its fish habitat.	Good. Based on a number of conservative assumptions, the results indicate that there is very low potential for acidic conditions to occur during operations. During closure phase, there is potential for acidic conditions to occur, however, through mitigation these conditions can be mitigated. Historical tailings present at Beaver Dam Mine Site will be delineated, tested and managed on site before new mining activities commence. Options for disposal on-site or off-site are being considered in conjunction with regulatory consultation.	No. Potential cumulative effects related to sediment release are not anticipated. Historic Beaver Dam mining operations, forestry, haul road usage and the NSSA AMP are the only activities identified within the RAA for Soil, Sediment and Geology. Effects of historic tailings will be mitigated during construction including "working in the dry" and effective water management. Effects of forestry on sediment transport are expected to be minimal, providing forestry operators adhere to Provincial Wildlife Habitat and Watercourse Protection Regulations. Furthermore, FMS Mine Site erosion and sedimentation control measures will have a localized compensatory effect of any sediment release from local forestry activities. Therefore, it is unlikely that other projects would interact with this VC.	Low. Based on the residual effects being confined to the Beaver Dam Mine Site and Haul Road, with proper mitigation, it is unlikely that other projects would interact with this VC. This assumption is considered as having a low uncertainty.	No.	As the predicted cumulative effects are not anticipated to be significant with only two projects overlapping spatially with the Project, and the residual effects of the Project are anticipated to limited to the Beaver Dam Mine Site and Haul Road, no further assessment is warranted.
Groundwater Quality and Quantity	Disturbance to groundwater quality and quantity	Not Significant	The potential for residual groundwater quality effects are limited to the PA.	Residual effects to groundwater quality and quantity may occur throughout the duration of the project including Construction, Operation and Active Closure.	Medium. Concerns were expressed regarding groundwater drawdown and potential effects on surface water and potential impacts to potable wells at the Beaver Lake IR. The nearest potable well is 5km south of the Beaver Dam Mine Site (drilled well Beaver Lake IR).	Good. Maximum radius of influence (groundwater drawdown) is predicted at 1000 m (to the south) from the pit during operations, and less that this during closure, when the pit is re-filling with water. The nearest potable well is 5 km south of the Project. Groundwater seepage has been predicted through modelling efforts and these seepage rates have been included in operational and closure surface water modelling efforts to understand potential effect of groundwater seepage on surrounding surface water features for both the Beaver Dam Mine Site and the Touquoy Mine Site.	No. Historic mining activities within the PA, haul road usage, forestry and the NSSA AMP are the only projects within the RAA for groundwater quantity and quality. Potential cumulative effects on groundwater are not anticipated at the mine site because of the lack of other activities affecting this VC at this location. Furthermore, the potential groundwater seepage at the Touquoy site has been evaluated as part of the surface water VC.	Low. Uncertainty will be addressed through the monitoring and follow-up programs established for the Project.	No.	The predicted cumulative effects are not anticipated to be significant due to the spatial boundaries of the residual effects (zone of influence for groundwater interactions). Therefore, no further assessment is warranted.
Surface Water Quality and Quantity	Change in Water Quality and Quantity Habitat Loss and disturbance	Not Significant	The potential for residual surface water quality and quantity effects are limited to the PA and LAA.	Residual effects to surface water quality and quantity may occur throughout the duration of the project including Construction, Operation and Active Closure phases, along with the Post Closure phase when water monitoring and possible treatment is on-going.	Moderate to high. Key issues raised during stakeholder engagement was the concern about effect on water quality and quantity in downstream receiving environments and associated potential effect on fish.	Moderate. All mine contact water during operations will be directed to the North Settling Pond for treatment as required prior to release. Discharge water will meet MDMER at the end of pipe. There is a 100 m modelled mixing zone from the water discharge point within Cameron Flowage/Killag River at which point, water quality will meet CCME/Tier I, background and/or Site Specific Criteria. During closure, a cover planned for the PAG stockpile to improve water quality.	Yes. Historic mining activities within the PA, timber harvesting, Haul Road usage and the NSSA Acid Mitigation Projects are located within the RAA for surface water. Cumulative impacts based on forestry are expected to be low, providing forestry operators adhere to Wildlife Habitat and Watercourse Protection legislation. There is potential for cumulative effects between the Project and NSSA Acid Mitigation Project. The Project will adhere to all applicable water quality guidelines. However, the use of the Touquoy processing plant and deposition of tails into the exhausted pit at Touquoy extends the temporal scale of potential effects to surface water. Deposition of tails into the exhausted pit must be considered for cumulative effects. Also, the Project may require an extension to the use of Scraggy Lake as one of the sources of fresh water to process concentrate. The cumulative effect of the combined projects could mean a reduction in the streamflow from Scraggy Lake to the Fish River system. In addition, subsequent deposition of tails into the exhausted Touquoy Pit will result in release of discharge into the Moose River once the pit has filled.	Low. Uncertainty will be addressed through refinement of modelling, and the monitoring and follow-up programs established for the Project.	Yes	Further assessment is required to determine if there is the possibility of significant residual cumulative effects to Surface Water Quality and Quantity at both the FMS Mine Site and the Touquoy Mine Site.

Table 8.4-2: Selection of Valued Components for the Cumulative Effects Assessment (continued)

Project VC	Residual Adverse Effects	EIS Finding	Boundaries		Criteria for Determining Whether Further Assessment Is Required			Carried Forward to Cumulative Effects Assessment		
			Spatial – Geographical Extent of Residual Effects	Temporal - Timeframe Associated with Residual Effects	Level of Concern Noted During Engagement	Current State of The VC (Health/Status/ Condition)	Potential for Cumulative Effects: Screening Evaluation Summary	Uncertainty in Prediction of Cumulative Effects	Yes/No	Rationale
Wetlands	Habitat loss and disturbance	Not Significant	The potential for residual effects to wetlands are limited to the PA and LAA. No change in footprint at the Touquoy Mine Site is required for the Project.	Residual effects to wetlands may occur throughout the duration of the Project including Construction, Operation and Active Closure.	Low-moderate. Key issues raised during stakeholder engagement was the concern about wetlands being impacted at the Project and future compensation, and potential reduction in habitat, water quality and flood control due to loss of wetlands.	Good. Wetlands within the PA generally offer high quality wildlife habitat and water quality and quantity functions. 95% of all wetlands assessed were determined to provide moderate-high plant community integrity with a diversity of species generally composed of native species characteristic of the wetland type. Wetlands within the PA, have experienced disturbance from historic mining activity and timber harvesting in adjacent uplands.	No. The loss of wetlands from the PA results in a direct loss of 31.8 ha of wetlands which will require compensation under the Nova Scotia Wetland Conservation Policy. A cumulative wetland loss assessment exercise was carried out in Section 6.8.7.2, which determined that there was no expected significant effect on wetland loss within the LAA. Within the RAA, other activities are limited to historic mining and forestry. Effects of historic tailings will be mitigated. Effects of forestry on sediment transport are expected to be minimal, providing forestry operators adhere to Provincial Wildlife Habitat and Watercourse Protection Regulations and the Nova Scotia Wetland Conservation Policy. No additional wetland impacts are proposed at the Touquoy Mine Site.	A moderate level of uncertainty exists in the potential effect of Project changes to local hydrology and resultant impacts to wetlands. Little to no uncertainty exists related to direct wetland impacts. The potential cumulative effects (loss of wetlands within the Project footprint) is based on the planned footprint of the Project which is unlikely to change.	No.	The predicted cumulative effects are not anticipated to be significant due to the limited spatial boundaries of the residual effects (LAA) and the magnitude of these effects (Moderate). Therefore, no further assessment is warranted
Fish and Fish Habitat	Habitat loss and disturbance Decreased water quality and quantity	Not Significant	The potential for adverse residual effects to fish and fish habitat is limited to the PA and LAA.	Residual effects to fish and fish habitat may occur throughout the duration of the project including Construction, Operation and Active Closure along with the Post Closure phase when water monitoring and possible treatment is on-going.	Moderate to High. Key issues raised during public and Mi'kmaq engagement relating to fish and fish habitat include potential impacts to the Nova Scotia Southern Uplands population of Atlantic Salmon; based on proximity of the Project to the Killag River, and Acid Mitigation Projects being completed by the Nova Scotia Salmon Association, and potential indirect effects from wetland alteration or changes to surface water and groundwater quality and quantity on fish and fish habitat.	Moderate. Habitat quality within the areas proposed for direct impact do not provide suitable habitat for coldwater species and comprise anthropogenically altered habitat within the proposed open pit. High temperatures and low pH are limiting factors to fish habitat quality. Suitable habitat for a variety of species including Atlantic Salmon is present within the Killag River, immediately downstream of the proposed Project.	Yes. Within the RAA, other activities are limited to historic mining and forestry, and the ongoing Acid Mitigation Project operated by the Nova Scotia Salmon Association. Effects of historic tailings will be mitigated. Effects of forestry on sediment transport are expected to be minimal, providing forestry operators adhere to Provincial Wildlife Habitat and Watercourse Protection Regulations. Potential interaction between the Project and the NSSA works require further evaluation of cumulative effects. Site infrastructure has been micro-sited for fish habitat avoidance wherever practicable Development of the Beaver Dam Pit and associated mine infrastructure will require direct impact to fish habitat. A Fish Habitat Offset Plan has been developed to facilitate compensation for direct and indirect impacts to fish habitat (Appendix J.3)	Moderate. The uncertainty of cumulative effects to fish habitat will correspond with the level of detailed information available from the Nova Scotia Salmon Association. The uncertainty as to the Project effects on fish and fish habitat would be addressed through monitoring and follow-up programs established for the Project.	Yes.	Although the potential for significant cumulative effects to fish and fish habitat is not anticipated given appropriate mitigation, the VC was carried forward due to the concern expressed relating to fish and fish habitat including the proximity to the Killag River, and its population of southern uplands Atlantic Salmon.
Habitat and Flora	Habitat loss and disturbance	Not Significant	The potential for adverse residual effects to habitat and flora is limited to the PA and LAA. No change in footprint at the Touquoy Mine Site is required for the Project.	Residual effects to habitat and flora may occur throughout the duration of the Project including Construction, Operation and Active Closure phases.	Low-moderate. Concerns were raised during public and Mi'kmaq engagement relating to habitat and flora include potential effect on biodiversity and loss of habitat associated within the PA.	Moderate. Ecosites are predominantly poor to medium nutrient regimes with acidic soils and dominated by mixedwood and conifer forest stands. Historical mining and disturbances from timber harvesting have affected the habitat and flora communities with the PA.	No. Projects which lie within the RAA for Habitat and Flora include current and proposed mining activities at Touquoy Gold Project, historic mining at the Beaver Dam Mine Project and Dufferin Gold Mine, future mining activities at Fifteen Mile Stream, Nova Scotia Salmon Association's Acid Mitigation project (3 components), along with various regional forestry activities. Project effects on Habitat and Flora for the Beaver Dam Mine Site are limited to the LAA, which does not overlap the LAA for the proposed Project. While spatial boundaries for potential residual effects for the Dufferin Project were not available, it is expected that effects to habitat and flora would occur on a similar spatial scale to the proposed Project (2km buffer of the Study Area). Provided this is a reasonable assumption, project effects to Habitat and Flora would not overlap spatially. The Dufferin Project is not expected to overlap temporally with the proposed Project either, as the Proponent for the Dufferin Project has declared bankruptcy. The lime dosing stations operated by the Nova Scotia Salmon Association are not expected to have a significant interaction with terrestrial flora and habitat; however, the potential interaction between the terrestrial liming and flora is unknown. Any interaction between terrestrial liming and rare flora will be discussed in the cumulative effects assessment for SAR and SOCI. Forestry activities within the RAA could result in a cumulative impact to habitat and flora.	Moderate uncertainty. The generalized disturbance of the landscape by forestry on crown land is well documented in the NSL&F Forest Inventory. However, timber harvesting on private land, and potential effects of terrestrial liming on flora has a moderate level of uncertainty.	No.	Overall, the generalized disturbance of the landscape by forestry activities, past, present and future are the main source of cumulative effects of habitats throughout the area. Without the Project, the loss of habitat in the Beaver Dam Mine Site during the construction and operation phases would be avoided, however the current observed generalized disturbance of the landscape would be unaffected. Any potential significant cumulative effect based on habitat fragmentation will be discussed in the context of SAR and SOCI.

Table 8.4-2: Selection of Valued Components for the Cumulative Effects Assessment (continued)

Project VC	Residual Adverse Effects	EIS Finding	Boundaries		Criteria for Determining Whether Further Assessment Is Required			Carried Forward to Cumulative Effects Assessment		
			Spatial – Geographical Extent of Residual Effects	Temporal - Timeframe Associated with Residual Effects	Level of Concern Noted During Engagement	Current State of The VC (Health/Status/ Condition)	Potential for Cumulative Effects: Screening Evaluation Summary	Uncertainty in Prediction of Cumulative Effects	Yes/No	Rationale
Terrestrial Fauna	Habitat loss and disturbance	Not Significant	The potential for adverse residual effects terrestrial fauna occurs within the LAA and possibly may extend into the RAA when considering habitat fragmentation.	Residual effects to terrestrial fauna may occur throughout the duration of the Project including Construction, Operation and Active Closure.	Low. Concerns raised during public and Mi'kmaq engagement relating to terrestrial fauna include potential for direct mortality and indirect effects of other VCs, such as dust, noise and light, as well as potential effects on avifauna associated with loss of habitat from construction of the Project.	Moderate. The PA was evaluated for bat hibernacula potential through both desktop and field evaluations. A single abandoned mine opening was identified as a potential bat hibernaculum, however no bat species were observed, nor evidence found that indicates any usage of the PA by priority bat species. Three set of moose tracks were observed incidentally and during targeted moose surveys between 2015 and 2021. One female snapping turtle and nest was observed within the Beaver Dam Mine Site. Three snapping turtles were observed incidentally along the Haul Road and at the Touquoy Mine Site.	No. Projects which lie within the RAA for Terrestrial Fauna include current and proposed mining activities at Touquoy Gold Project, historic mining at the Beaver Dam Mine Project and Dufferin Gold Mine, future mining activities at Fifteen Mile Stream, Nova Scotia Salmon Association's Acid Mitigation project (3 components), along with various regional forestry activities. Project effects on Terrestrial Fauna from the Fifteen Mile Stream Gold Project are limited to the LAA, which does not overlap the LAA for the proposed Project. While spatial boundaries for potential residual effects for the Dufferin Project were not available, it is expected that effects to habitat and flora would occur on a similar spatial scale to the proposed Project (2km buffer of the Study Area). Provided this is a reasonable assumption, project effects to Terrestrial Fauna would not overlap spatially, and given the proponents bankruptcy declaration, the projects are not likely to overlap temporally. No significant cumulative effect is expected from the Nova Scotia Salmon Associations' Acid Mitigation Project on terrestrial fauna. Although both the Beaver Dam Project and the Touquoy Gold Project will cause the loss and disturbance of habitats within the PA, these effects are relatively small given the fact that most of the affected areas are already disturbed.	Low. The main assumption behind this assessment is that the overall patterns of land use in the region will remain unchanged in the foreseeable future.	No.	As the potential cumulative effects are not anticipated to be significant and loss of habitat will be restored during the reclamation stage no further assessment is warranted. SAR/SOCI is being evaluated with regards to cumulative effects for rare species, including Mainland Moose and Snapping Turtle. As such, cumulative effects to terrestrial fauna more generally will be addressed through the effects assessment for Mainland Moose and Snapping Turtle.
Avifauna	Habitat loss and disturbance Decreased surface water quality (Touquoy Mine Site)	Not Significant	The potential for adverse residual effects to avifauna is limited to the PA and LAA.	Residual effects to avifauna may occur throughout the duration of the Project including Construction, Operation and Active Closure.	Low. Concerns raised during public and Mi'kmaq engagement relating to avifauna include potential for direct mortality and indirect effects of other VCs, such as dust, noise and light, as well as potential effects on avifauna associated with loss of habitat from construction of the Project.	Good. Abundance and diversity of avian species observed was moderate to high based on observer experience in the geographic area. The common species assemblage of forest birds was observed, along with many priority species.	No. Projects which lie within the RAA for Avifauna include current and proposed mining activities at Touquoy Gold Project, historic mining at the Beaver Dam Mine Project and Dufferin Gold Mine, future mining activities at Fifteen Mile Stream, Nova Scotia Salmon Association's Acid Mitigation project (3 components), along with various regional forestry activities. Project effects on Avifauna from the Fifteen Mile Stream Gold Project are limited to the LAA, which does not overlap the LAA for the proposed Project. While spatial boundaries for potential residual effects for the Dufferin Project were not available, it is expected that effects to habitat and flora would occur on a similar spatial scale to the proposed Project (2km buffer of the Study Area). Provided this is a reasonable assumption, project effects to Avifauna would not overlap spatially. The temporal scale of the Dufferin project is not expected to overlap either, as the Proponent has declared bankruptcy. The lime dosing stations operated by the Nova Scotia Salmon Association are not expected to result in any negative effects to avifauna, nor is the terrestrial liming activities as liming typically occurs in the fall outside of the active nesting season. Within the RAA, there is some potential additive cumulative effects with respect to habitat loss on the broad scale. Overall habitat loss and potential additive cumulative effects will be addressed in SAR-SOCI cumulative effects. Although both the Beaver Dam Project and the Touquoy Gold Project will cause the loss and disturbance of habitats within the PA, these effects are relatively small given the fact that most of the affected areas are already disturbed.	Low. The main assumption behind this assessment is that the overall patterns of land use in the region will remain unchanged in the foreseeable future.	No.	The predicted cumulative effects are not anticipated to be significant and loss of habitat will be restored during the reclamation stage. As such, the VC was not carried forward to the Cumulative Effects Assessment. SAR/SOCI is being evaluated with regards to cumulative effects for rare species, including Avifauna. As such, cumulative effects to avifauna more generally will be addressed through the effects assessment for Avifauna SAR.

Table 8.4-2: Selection of Valued Components for the Cumulative Effects Assessment (continued)

Project VC	Residual Adverse Effects	EIS Finding	Boundaries		Criteria for Determining Whether Further Assessment Is Required			Carried Forward to Cumulative Effects Assessment		
			Spatial – Geographical Extent of Residual Effects	Temporal - Timeframe Associated with Residual Effects	Level of Concern Noted During Engagement	Current State of The VC (Health/Status/ Condition)	Potential for Cumulative Effects: Screening Evaluation Summary	Uncertainty in Prediction of Cumulative Effects	Yes/No	Rationale
Species of Conservation Interest (SOCI) and Species at Risk (SAR)	Habitat loss and disturbance	Not Significant	The potential for adverse residual effects to SOCI and SAR is limited to the PA and LAA, with the exception of Moose, which is evaluated at the RAA level relating to potential habitat fragmentation.	Residual effects to avifauna may occur throughout the duration of the Project including Construction, Operation and Active Closure.	High. Key issues raised during public and Mi'kmaq engagement relating to SAR and SOCI include potential direct effects on priority flora and fauna, particularly Atlantic Salmon, associated with construction of the Project and potential indirect effects associated with changes to other VCs, such as air, wetlands, surface water and groundwater.	Good. Evidence of Mainland Moose and Snapping Turtle was recorded within the Beaver Dam Mine Site. Thirty-two priority avifauna species were recorded, including nine SAR. Six priority vascular species were recorded. No SAR were observed. Eleven priority lichen species were recorded, including three SAR. Three priority fish species were observed. No SAR were observed. Direct habitat loss is expected as a result of the Project. Direct priority vascular plant loss includes one observation of southern twayblade. Direct priority lichen loss includes two observations of blue felt lichen, six observations of salted shell lichen three observations of slender monk's hood lichen and one observation of eastern candlewax lichen.	Yes. Projects overlapping the RAA for SAR fish, flora, terrestrial fauna and avifauna, and potential interactions therein, are discussed in respective VCs above.	Low. The main assumption behind this assessment is that the overall patterns of land use in the region will remain unchanged in the foreseeable future.	Yes.	Although, the potential for significant cumulative effects to SOCI and SAR is not anticipated, the VC was carried forward due to the concern expressed by the Mi'kmaq of Nova Scotia and the Nova Scotia Salmon Association relating to SAR and SOCI, and as required by the per the EIS guidelines (See 8.3.1). Concerns included the potential direct effects on rare flora, fish, and terrestrial fauna associated with construction of the Project and the potential indirect effects associated with changes to other VCs, such as wetlands, surface water and groundwater.
Mi'kmaq of Nova Scotia	Loss of plant specimens Habitat loss Sensory Disturbance Visual Change Aesthetics effect Loss of Access	Not Significant	The potential for adverse residual effects to Mi'kmaq of Nova Scotia are limited to the PA and LAA.	Residual effects to Mi'kmaq of Nova Scotia may occur throughout the duration of the project including Construction, Operation and Active Closure.	High. Key issues raised during public and Mi'kmaq engagement relating to Mi'kmaq of Nova Scotia include concerns related to pathways of adverse effects, primarily related to access and resources and harvesting, from Project activities during construction and operation.	Moderate. The nearest Mi'kmaw community is the Beaver Lake IR 17, located approximately 5km southwest of the Beaver Dam Mine Site; followed by the Sheet Harbour IR, located approximately 21km southeast of the Beaver Dam Mine Site.	Yes. Potential significant adverse cumulative effects to surface water, could cause effects on the use of surface water bodies and the fish inhabiting them by the Mi'kmaq of Nova Scotia. There is also the potential for cumulative effects on habitats, flora, terrestrial fauna and birds to lead to effects on current use of land and resources for traditional purposes.	Moderate. Effects are linked to a number of VCs and therefore can be more difficult to predict.	Yes.	Further assessment is required to determine if there is the possibility of significant residual cumulative effects to Mi'kmaq of Nova Scotia.
Physical and Cultural Heritage	Loss of archaeological features	Not significant	The potential for adverse residual effects to Physical and Cultural Heritage are limited to the PA	Residual effect to Physical and Cultural Heritage are anticipated to occur through the Construction phase.	Low. Concern was noted during Mi'kmaq engagement regarding areas of elevated potential for Mi'kmaq resources (near Crusher Lake, Killag River and Cameron Flowage).	Good. Thirteen sites/areas with elevated archaeological potential were identified with the Beaver Dam Mine Site. Most sites are associated with historical mining activities and Euro-Canadian archaeological resources. Three sites were identified as having elevated potential for historic Mi'kmaw archeological resources. Three sites will be impacted by the Project. No direct or indirect impacts to Mi'kmaq archaeological features are expected. Additional shovel tests were completed within Site 6 and Areas 2 and 3 in 2020. No Pre-contact Mi'kmaq archaeological resources were encountered, and CRM Group recommends these areas be cleared of requirements for further investigation.	No. While other archaeological features may be present in the LAA or RAA, there is no pathway for disturbance of these features outside of the PA.	Low. The expected disturbance to archeological features is assessed and well understood. Chance find protocols for archaeological resources will be implemented as part of the Project Environmental Protection Plan (EPP). Personnel will receive the appropriate level of EPP training to properly implement the chance find protocol.	No	As the potential cumulative effects are not anticipated to be significant no further assessment is warranted.
Socio-Economic Conditions	Disturbance to recreational usage of site.	Not Significant	Positive residual effects are expected to occur through the RAA.	Residual effects to socio-economic conditions may occur throughout the duration of the project including Construction, Operation and Active Closure.	Medium. Concern about volumes of truck traffic in context of safety on public roadways and recreational access to the areas surrounding the Project to fish, hunt and for ATV access and throughflow access.	Good. The area sees public use for access to hunting, fishing and ATV activity. Between 2014-2018, 93 jobs were created for exploration. An estimated 289 jobs will be created during construction and operation.	No. Disturbance to recreational usage is restricted to the PA so, with proposed mitigation and bypass roads, no cumulative effects are anticipated. The overall effect of the Project on Socio-economic Conditions is positive.	Low. Prediction made on the assumption that the local road usage will not change, with proposed mitigation measures in place.	No.	As the overall potential effect of the Project on Socio-economic Conditions is positive, no further assessment is warranted.

8.5 Cumulative Effects Assessment of the Valued Components

Using appropriate data and information is critical to the analysis of cumulative effects. Exhaustive baseline studies have been completed to characterize the environment within the PAA, LAA and RAA for the Project. Baseline information for all VC's is described in detail in Section 6 of the EIS, and for the reader, has also been summarized in the subsequent sections for those VC's that have been carried forward for the cumulative effects assessment. Baseline information provided for each valued component is limited by the evaluation methods and frequency of surveys. It is representative of the current status of the Project footprint. However, there are limitations to this data collection and analysis.

The following VCs have been carried forward for cumulative effects assessment based on the parameters and screening tools described in the previous sections:

- Noise (Beaver Dam Haul Road component of the Beaver Dam Mine Project only- qualitative);
- Air;
- Light (Beaver Dam Haul Road component of the Beaver Dam Mine Project only- qualitative);
- Surface Water;
- Fish and fish habitat;
- Species at Risk (SAR) and Species of Conservation Interest (SOCI); and
- Mi'kmaq of Nova Scotia.

Data and information for the other projects considered in the cumulative effects section is provided from public sources of information only. Data is collected from environmental assessment websites (both federal and provincial) and review of publicly available documents. There are significant limitations in this approach. Environmental assessments do not follow a standard methodology so often the data available is not in a format that can be directly comparable to the data available for the Project, or the same level of data analysis was not completed (air dispersion modelling for example, or quantitative predictive water quality modelling). Past projects can be devoid of published information (historical tailings for example) limiting the ability to quantitatively evaluate the potential cumulative impact of this project with the Project. Furthermore, projects that do not require environmental assessment (timber harvesting, or the NSSA Acid Mitigation Project, for example) have very limited data available for review and inclusion in these cumulative effects analyses. The EIS team has attempted to avoid sweeping qualitative statements and conclusions and has acknowledged data limitations where necessary in this section and in some instances, these data limitations limit conclusions.

8.5.1 Noise Cumulative Effects Assessment

8.5.1.1 Baseline Conditions

8.5.1.1.1 Baseline Noise Levels

Ambient noise has been sampled at several representative locations. Noise data was recorded in A-weighted decibels (dBA) and presented as equivalent continuous noise level (Leq) averaged over a time period and compared to Nova Scotia Environment criteria by time of day. Sound level measurements for all sample locations, except for Location #1 at the Beaver Dam Mine Site, met NSE Pit and Quarry criteria for all time intervals.

At the measurement locations around the Beaver Dam Mine Site, based on the 2014 values, the average value is 33 dBA ±. The dominant noise sources noted are natural, including birds, the movement of leaves, and possibly the odd vehicle on a logging road. The measurement locations at Beaver Dam Mines Road and Mooseland Road would be mostly from natural sources. Mooseland Road measurements are comparable to the Beaver Dam Mine Site. It is located on a little used gravel road. The Beaver Dam Mines Road is elevated and is near a paved highway with regular traffic. This road also passes through Beaver Dam IR and ambient sound will be the same as at the measured location.

Potential Noise interactions and effects for Construction and Operations are quantitatively assessed by acoustic modelling. The technical reports documenting the updated approach and inputs for Noise modelling (Construction, Operations) are provided in Appendix B.1 and Appendix B.2, and are summarized in this section.

The updated noise analysis results include all identified worst-case human receptor locations (R1 to R9, Figure 6.1-3). Specific non-residential locations of traditional land use and recreation have not been identified for inclusion in the analysis; however, it is understood that traditional and recreational uses such as hunting may occur in areas close to the Project Area.

In summary, an updated acoustical model was undertaken to provide an order of magnitude estimation of the estimated noise from the crushing operations at the Beaver Dam Mine Site and haul truck travel along the Haul Road. The noise sources and topography were input into an industry standard acoustic model. Computer Aided Noise Abatement Acoustical Modeling Software (Cadna A), version 4.6, is based on the ISO 9613-2 standard "Acoustics - Attenuation of Sound During Propagation Outdoors - Part 2: General Method of Calculation." The Cadna A model is the industry standard for environmental noise modeling in Canada. The nearest receptor considered in the preliminary acoustical model included Beaver Lake IR 17, located approximately 5 km from the Mine Site and 3 km from the nearest point of the Haul Road.

To predict the future worst-case noise impacts from the Project activities, representative octave band noise data was used, measured from processing equipment similar to what is noted to be required for the Project. This data was obtained from the Department of Environment Food and Rural Affairs (DEFRA) "Update of Noise Database for Prediction of Noise on Construction and Open Sites, 2005 and 2006". The United States Department of Transportation, Federal Highway Administration (FHWA) document "FHWA Roadway Construction Noise Model User's Guide, 2006" was used as a supplemental document to obtain sound level data for equipment not listed by DEFRA.

8.5.1.1.2 Regional baseline Noise conditions

The relatively steady ambient noise of the surrounding area is a conglomeration of distant noise sources including wind in trees, bird and animal noise, rainfall, distant aircraft, logging activities, traffic and all-terrain vehicle use. The acoustic monitoring completed in the vicinity of the Beaver Dam Mine Site and Haul Road is considered representative of the local baseline conditions.

8.5.1.2 Analysis of Effects

8.5.1.2.1 Residual Effects of Proposed Project

The predicted residual environmental effects of Project development and production of noise are assessed to be adverse, but not significant within the PA. During construction, operations and active closure phases, the noise levels defined in the Pit and Quarry Guidelines will be met at the property boundary for both the Beaver Dam Mine Site and Haul Road, while baseline noise levels are met at the RAA boundary.

8.5.1.2.2 Effects of Other Projects in the Area

The RAA for noise, and projects which fall within this RAA are shown on Figure 8.5-1. The NSSA Acid Mitigation Project has a spatial and temporal overlap with the Projects' RAA for noise. However, this project is not being discussed in the context of cumulative noise, because aside from several days per year of helicopter flights for terrestrial liming, the NSSA work does not generate additional sources of considerable noise.

Current Regional Forestry Operations

The local forestry industry has the potential to have cumulative effects on noise levels due to timber harvesting and trucking of timber. Anthropogenic sources of noise have been excluded from noise modelling calculations. Data is publicly unavailable to quantify the level of noise expected from timber harvesting and trucking due to regional forestry operations. However, the baseline forestry activity on the Haul Road has been considered in this cumulative effects assessment (Section 8.5.1.2.2.3). However, noise associated with timber harvesting is likely to be relatively seasonal and sporadic, and not likely to affect regional noise levels in any significant or sustained manner.

Touquoy Mine Site

The Noise Impact Study (Appendix B.2) shows that the predicted levels for sound propagation from the Touquoy Mine Site for the Project will be below the Pit and Quarry Guidelines noise thresholds (day/evening/night) at the property boundaries. As indicated in the EARD, the maximum sound generated at the processing plant is 80 dBA, which attenuates to the background of 40 dBA over a distance of 500 m.

The Touquoy Mine Site is in production. The primary effect of the continued use of the Touquoy Mine Site is the continued generation of noise due to haul truck traffic on the site, processing of Beaver Dam ore. There are no new or additional effects from noise anticipated to be caused by the processing of ore and the management of tailings (exhausted pit) from the Project, as no new construction or disturbance is required at the Touquoy Mine Site related to the processing of Beaver Dam ore.

Beaver Dam Haul Road Use by the Project, the Fifteen Mile Stream Project, Cochrane Hill Gold Project and Regional Forestry

Trucks from other projects and forestry operations on the Haul Road have the potential to increase the cumulative effect of noise at the receptors. Noise levels due to cumulative effects of trucks on the Haul Road were assessed, and the predicted noise levels remain within the applicable NSEL sound level limits at all identified residential receptors. Details of this assessment are provided in Appendix B.2 and summarized below.

A cumulative effects analysis has been conducted to determine the potential effects of truck traffic from the proposed Fifteen Mile Stream Gold Project, Cochrane Hill Gold Project and Forestry operations that may use the Haul Road concurrently with trucks from the Beaver Dam Mine Site. Truck traffic volumes used in the direct (i.e., Project only) and cumulative effects analysis are summarized in Table 8.5-1.

Truck traffic from the Project will operate on the Haul Road 16 hours per day, during day and evening time periods only (7:00 AM to 11:00 PM). It is assumed that trucks originating from the other projects and industries will operate during the same hours for the purposes of the cumulative effects analysis.

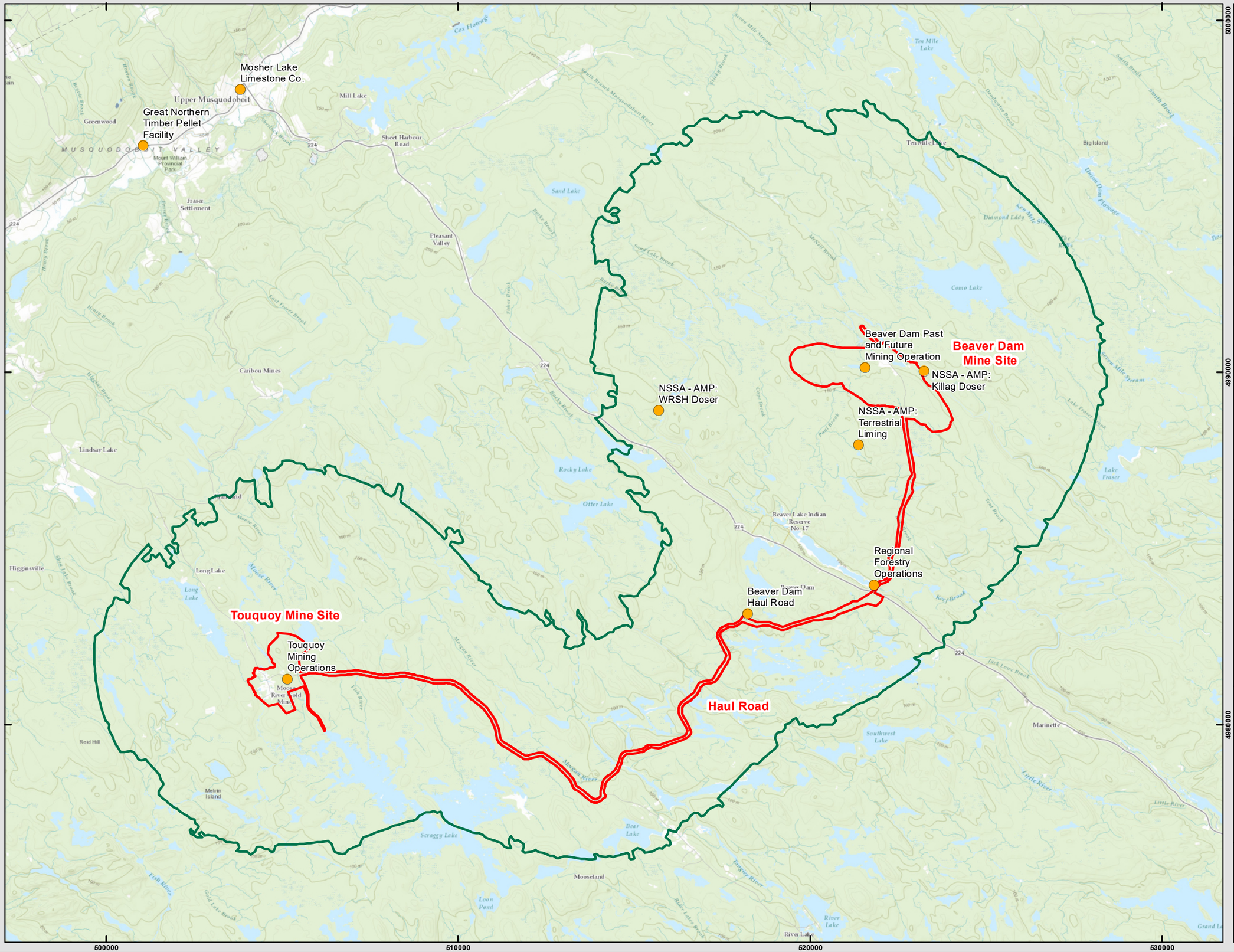


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FIGURE 8.5-1

Beaver Dam Mine Project

Cumulative Effects Assessment: Noise

- Projects Evaluated in the Cumulative Effects Assessment
- Regional Assessment
- Project Area

Note: Forestry operations occur throughout the RAA and are not displayed on this figure



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 1.25 2.5 5 km

1:100,000 Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed By: KR

Date: 2021-04-29

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

McCallum Environmental Ltd.

Document Name: BD_EIS_Figure8-4-X_CEA_Noise

In addition to the heavy truck traffic summarized above, it is estimated 3/4-ton service trucks would make up to approximately 20 round trips per day on the haul roads. Noise emissions from these service trucks have also been included in the cumulative effects noise model.

Table 8.5-1 shows the predicted cumulative effects of truck traffic for noise during the Operation Phase of the Project are within the applicable sound level limits at all of the identified residential receptors and the property boundary for the Beaver Dam Mine Site and Haul Road, including noise emissions from equipment and activities at the Beaver Dam Mine Site, Touquoy Mine Site, and Haul Road.

Table 8.5-1: Operation Phase Predicted Cumulative Effects

Receptor ID	Receptor Description	Noise Level (dBA) (Day/Evening/Night)	Sound Level Limit [(a)] (dBA) (Day/Evening/Night)	Compliance
R1	9 Beaver Dam Mine Road (Marlborough Property)	50 / 50 / 27	65 / 60 / 55	Yes
R2	4112 Highway 224 (Beaver Lake IR 17)	31 / 31 / 28	65 / 60 / 55	Yes
R3	4115 Highway 224 (Cottage on Crown Land)	33 / 33 / 28	65 / 60 / 55	Yes
R4	3492 Highway 224 (Hobbs Property)	56 / 56 / 27	65 / 60 / 55	Yes
R5	3379 Highway 224 (McLeod Property)	51 / 51 / 27	65 / 60 / 55	Yes
R6	3373 Highway 224 (Smith Property)	51 / 51 / 27	65 / 60 / 55	Yes
R7	Tangier River (Deepwood Estates Property)	55 / 55 / 20	65 / 60 / 55	Yes
R8	Tanger River (Musqudoboit Lumber Co. Ltd. Property/John Dickson Lease)	44 / 44 / 20	65 / 60 / 55	Yes
R9	5579 Mooseland Road (Lloy Property)	52 / 52 / 27	65 / 60 / 55	Yes

Notes: Truck traffic used in the noise assessment and related modelling has been adjusted to a 16-hour shift, including the nighttime hour of 6:00 AM to 7:00 AM
(a) NSEL 1999.

Overall, the findings summarized in the Noise Impact Study, and the EIS for Beaver Dam Mine Project will remain valid, and the cumulative effects of noise along the Haul Road are predicted to remain within the guideline limits specified by Nova Scotia Environment and Labour (NSEL) at all of the identified receptors, and with consistent conclusions relating to the property boundary along the Haul Road. Based on those predictions, noise levels at all nearby residential receptors are anticipated to be within the NSEL noise level limits with the additional vehicles included in the assessment. Speed limits would be implemented as a part of each of these projects will mitigate the potential increase in ambient noise from the associated trucking operations.

8.5.1.2.3 Cumulative Effects on Noise Levels

It is likely that forestry operations will occasionally coincide with activities at the Beaver Dam Mine Site and cause greater disturbance to noise levels that these operations produce individually. However, such additive periods are likely to be limited in duration and frequency and are not expected to be significant. This cannot be quantified for the purpose of this CEA due to a lack of available data relating to forestry activities and future plans for harvesting. The principal assumption behind this assessment is that local forestry practices are not expected to change in any important way during the life of the Project. Data to support the quantification of timber harvesting is limited, particularly related to noise levels.

The gold concentrate transportation and processing activities associated with the Fifteen Mile Stream Gold Project and the Cochrane Hill Gold Project overlap in both time and space with the Project. Therefore, the potential effects from the transportation

and processing from the three projects, along with forestry activities on the Beaver Dam Haul Road, have the potential to act in an additive and cumulative nature. The additive cumulative effects on noise from transportation to the Touquoy Mine Site from the cumulative projects are not expected to be significant, provided mitigation measures for noise are implemented.

The processing of Beaver Dam ore and deposition of tails is not expected to affect noise levels at the Touquoy Mine Site in any noticeable way. This will be confirmed through monitoring.

8.5.1.3 Mitigation

Standard mitigation measures for noise generated by the Project at the Beaver Dam Mine Site, Haul Road and Touquoy Mine site are presented in Section 6.1.8, and mitigation measure associated with use of the Beaver Dam Haul Road are described in the Beaver Dam Mine Project EIS. As no pathway for significant cumulative effects are identified, no additional mitigation measures are warranted.

8.5.1.4 Residual Cumulative Effects and Significance Assessment

A significant adverse effect to noise at the Beaver Dam Mine Project is defined as having high magnitude (i.e., an exceedance of the maximum noise or vibration limits), occurring beyond the PA and LAA, of long-term to permeant duration, occurring at regular intervals or be continuous throughout the Project, and be only partially reversible to irreversible. The cumulative effects to noise are predicted to be low, diverging from existing conditions but in compliance with appropriate guidelines; these effects do not extend into the RAA, are long-term, and are considered reversible. The overall residual cumulative effects on noise is assessed as not likely to have significant adverse effects after mitigation measures have been implemented. Thus, predicted residual environmental effects of Project development and production on Noise are assessed to be not significant (Table 8.5-2).

Table 8.5-2: Residual Cumulative Environmental Effects for Noise

Residual Adverse Cumulative Effects (After Mitigation)	Significance Levels						Overall Significance of Residual Adverse Effects (and Rationale)
	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	
Cumulative increased noise levels (Noise from construction, operation, reclamation, and operation of mining, haul trucks, forestry activities and haul road usage)	L Noise levels are expected to be less than or equal to appropriate guidelines or threshold values at the Beaver Dam Mine Site and Haul Road property boundary. Additive cumulative effects may occur when forestry operations occasionally coincide with Project activities and hauling ore from FMS and Cochrane Hill to Touquoy Mine Site for processing	LAA The cumulative effects causing increased background noise levels will not extend beyond the LAA.	A VC is expected to be affected by timing, with sporadic nature of timber harvesting.	LT Effects may extend beyond 8 years.	R Additive periods of potential effects from the Project and forestry operations are likely to be limited in frequency. However, cumulative effects to baseline noise levels from the use of the Beaver Dam Haul Road by Beaver Dam, Fifteen Mile Stream and Cochrane Hill Gold Projects will occur regularly throughout the operational phase of the Project.	R VC will recover to baseline conditions once operations have stopped.	Low Adverse Effect (Not Significant) Effects are limited to the LAA based on Project interactions and usage of the Beaver Dam Haul Road by various activities. Furthermore, the VC is anticipated to recover to baseline conditions once the operation of the mine has stopped. Effects would be confirmed through monitoring.

Legend (refer to Section 5.11, Table 5.11-1 for definitions)

Magnitude		Geographic Extent		Timing		Duration		Frequency		Reversibility	
N	Negligible	PA	Project Area	N/A	Not Applicable	ST	Short-Term	O	Once	R	Reversible
L	Low	LAA	Local Assessment Area	A	Applicable	MT	Medium-Term	S	Sporadic	PR	Partially reversible
M	Moderate	RAA	Regional Assessment Area			LT	Long-Term	R	Regular	IR	Irreversible
H	High					P	Permanent	C	Continuous		

8.5.1.5 Follow-up and Monitoring Programs

No additional follow-up or monitoring beyond that presented in Section 6.1.10 is warranted.

8.5.2 Air Cumulative Effects Assessment

8.5.2.1 Baseline Conditions

8.5.2.1.1 Baseline Air Quality Monitoring Program

Preliminary baseline particulate monitoring was undertaken for TSP and PM_{10}. Baseline air quality measurements were obtained from nine locations near the Beaver Dam Mine Site and along the proposed Haul Road, five locations on the Touquoy Mine Site, two locations near the proposed Fifteen Mille Stream Gold Project, and two locations near the proposed Cochrane Hill Gold Project.

Baseline TSP concentrations ranged from 1.7 to 41.7 micrograms per cubic metre (µg/m³), with the highest value obtained at Location #2 during monitoring in June 2008. Results for PM_{10} concentrations ranged from 7.1 to 13.1 µg/m³, with the highest value also obtained at Location #2 during monitoring in June 2008. This monitoring station was located in a recently clear-cut area, which may have contributed to higher particulate levels in comparison to the other locations. This area was resampled in 2014 (AN#2). The 2014 results for that area were 4.6 µg/m³. All samples collected were below the NSAQS for TSP, there is no NSAQS for PM_{10}.

The data obtained as part of the baseline program reported herein provides a preliminary snapshot of air quality in the area of the Beaver Dam Mine Site and Haul Road, and a general understanding of local air quality. Due to a lack of other sources of data for ambient TSP, the background concentration for TSP is based on the maximum measured 24-hour TSP concentration (there are insufficient data to provide a meaningful 90th percentile value), and the average of all the TSP measurements. There is uncertainty in how representative these values might be for background, but they represent the best available data at this time.

To support the effects assessment of the Air VC, air dispersion modelling was performed. Emission rates from the Project-related sources were calculated using USEPA AP-42 (5th Edition) emission factors for the Beaver Dam Mine Site and Haul Road dust emissions, and MOBILE6.2 (M6.2) for Haul Road vehicle emissions. There is currently no guidance on the use of models in Nova Scotia, and therefore the O.Reg. 419/05 requirements were used as a framework. The version of the air dispersion model used in this project is currently accepted in Ontario, and AERMOD is used across Canada and throughout the United States as a regulatory model of choice. AERMOD is an advanced steady state plume model that has the ability to incorporate building cavity downwash, actual source parameters, emission rates, terrain and historical meteorological information to predict ground level concentrations (GLCs) at specified locations.

Air compounds evaluated included TSP, PM_{10}, $PM_{2.5}$, NO_X, SO_2 and VOC.

Haul Road emissions calculations assume that the roads are unpaved, and a dust management plan (targeting 80-90 %percent dust suppression efficiency). This will be achieved through the implementation of a fugitive dust control plan that includes the use of dust suppressant (Section 6.2.8 and Appendix C.3).

The Beaver Dam Mine Site mining, crushing, and transfer operations will primarily operate from adjacent to the open pit. Although vehicle traffic is also expected, it was assumed that most of these operations also occur adjacent to the open pit. Therefore, the Beaver Dam Mine Site emissions were modelled using as an open pit source such that all emissions from mining operations were summed and attributed to the pit source. As discussed in Project Description (Section 2) the Beaver Dam Mine site may not rely

on a primary crusher if the ore can be broken using jawbreaker and other mining equipment. For the purposes of this air assessment, a conservative assessment approach has been applied and assumed that a primary crusher would be in use.

The Touquoy Mine Site consists of crushers and mining sources as volume sources. These sources were previously modelled in AERMOD for an Emissions Summary and Dispersion Modelling Assessment (CRA 2007a). As the Beaver Dam Mine Site will use the Touquoy Mine Site for its refining capabilities, the crushing and mining operations remained unchanged.

8.5.2.1.2 Regional ambient air quality

Ambient air quality in Nova Scotia is monitored using a network of 10 sites operated by NSE and Environment and Climate Change Canada (ECCC) through the NAPS. Common air pollutants monitored at these stations include the following:

- SO_2;
- $PM_{2.5}$;
- ozone (O_3); and
- oxides of nitrogen (NO_2, NO, and total NO_X).

Data collected at these stations is used by NSE to report the Air Quality Index (AQI) and by ECCC to report the Air Quality Health Index (AQHI). There are currently no permanent air monitoring stations within the vicinity of the PA. The Beaver Dam Mine Site is located in a relatively undeveloped rural region of Nova Scotia with infrequent industrial operations that would affect air quality. As the NAPS monitoring stations are typically located in areas with local industry, measured concentrations of indicators are likely lower at the Beaver Dam Mine Site than at NAPS stations.

The nearest representative stations which report concentrations for the air quality parameters assessed include:

- Lake Major, Nova Scotia (Station ID 030120) – $PM_{2.5}$, NO_2, and SO_2;
- Port Hawkesbury, Nova Scotia (Station ID 030201) – $PM_{2.5}$, NO_2, and SO_2;
- Aylesford Mountain, Nova Scotia (Station ID 030701) – $PM_{2.5}$, and NO_2; and
- Pictou, Nova Scotia (Station ID 030901) – $PM_{2.5}$, and NO_2.

VOCs are not measured at these stations. PM_{10} are not measured in many areas in Canada. Of the locations which do measure PM_{10}, most are in British Columbia urban centres, four are in Manitoba cities, one is in Regina, Saskatchewan, and four are in the Northwest Territories. In terms of locations that are somewhat comparable to the Project site (human habitation, regional activities that may generate airborne particulate, etc.), Norman Wells, NWT Regional Office (Station ID 129102) appears the most appropriate location that has recent data available (Appendix C.1).

8.5.2.2 Analysis of Effects

8.5.2.2.1 Residual Effects of Proposed Project

The Project will result primarily in the generation and airborne transport of fugitive dust particles and exhaust emissions from equipment. Fugitive dust typically refers to small particles of geological or other origin that are moved into the atmosphere from non-ducted, open sources. Fugitive dust sources can originate from both stationary and mobile sources such as open fields, open

burning, agricultural activity, construction sites, logging road traffic, vehicle traffic on paved and unpaved roads, aggregate pits and storage piles, as well as open pit mines.

Airborne particulate matter will be generated during construction and operation of the proposed Haul Road. Sources of project-related particulate matter would include upgrading the existing road to be suitable for the mine traffic, and truck traffic hauling ore from Beaver Dam Mine to the Touquoy Mine Site for processing. Dust can be generated from mine haul truck tires interacting with gravel surfaced Mine Haul Roads and Beaver Dam Haul Roads. Dust is also generated during the truck loading and dumping activities. Dust is not expected from uncovered trucks because the ore material is of a size that is unlikely to generate dust. Dust can be tracked across asphalt roads and re-entrained by traffic or by the wind.

Results of air dispersion modelling for maximum predicted concentrations of emitted particulate species from the Beaver Dam Mine Site are presented in Table 6.2-7 in Section 6.2.7. This table summarizes the particulate size fraction considered, the averaging period, the assessment criteria against which the results are compared, the maximum predicted concentration from the modelling, the ambient background concentration, the combined effect (the modelled concentration from the site added to the assumed existing background concentration for that averaging period), and the percentage of the assessment criteria for the site modelling results alone and the cumulative effects.

For this site, maximum predicted concentrations occurred at the property boundary. Predicted concentrations for all indicator compounds and averaging periods were lower than existing background concentrations, and well below relevant assessment criteria.

Results of air dispersion modelling for maximum predicted concentrations of emitted particulate species from the Haul Road are presented in Table 6.2-10 in Section 6.2.7. This table summarizes the particulate size fraction considered (i.e., TSP, PM_{10} and $PM_{2.5}$), the averaging period, the assessment criteria against which the results are compared, the maximum predicted concentration from the modelling, the ambient background concentration, the combined effect (the modelled concentration from the site added to the assumed existing background concentration for that averaging period), and the percentage of the assessment criteria for the site modelling results alone and the cumulative effects.

For this site, maximum predicted concentrations occurred within 30 m of the road, and predicted concentrations decreased, with increasing distance from the road. The maximum predicted concentrations for all compounds occurred in close proximity to the road, in areas that are not continuously occupied. Maximum predicted concentrations presented occur at 30 m from the road and decrease rapidly with distance.

Maximum predicted concentrations of emitted particulate species from the Touquoy Mine Site are presented in Table 6.2-13 in Section 6.2.7. This table summarizes the particulate size fraction considered, the averaging period, the assessment criteria against which the results are compared, the maximum predicted concentration from the modelling, the ambient background concentration, the cumulative effect (the modelled concentration from the site added to the assumed existing background concentration for that averaging period), and the percentage of the assessment criteria for the site modelling results alone and the cumulative effects.

For this site, maximum predicted concentrations occurred at the property boundary. Predicted concentrations for all indicator compounds and averaging periods were lower than existing background concentrations, and well below relevant assessment criteria.

Modelling of sources at the Beaver Dam Mine Site and the Touquoy Mine Site showed maximum predicted concentrations at their respective fencelines well below applicable air quality criteria, which are unlikely to cause adverse effects. The Haul Road between

the proposed Beaver Dam and the Touquoy Mine Sites is the source primarily responsible for the maximum predicted concentrations at both the gridded receptors and the sensitive receptors identified for this assessment.

Maximum predicted $PM_{2.5}$ concentrations did not exceed the CAAQS for either the 24-hour or annual averaging periods at any of the sensitive receptor locations, based on Project alone predictions, or Project plus background. PM_{10} was predicted to exceed the Ontario Interim 24-hour guideline at Deepwood Estates up to 2% of the time without background) and up to 57% of the time with background concentration included. PM_{10} was also predicted to exceed the Ontario Interim 24-hour guideline at 9 Beaver Dam Mines Road up to 13% of the time with background concentration included but met the guideline without background. TSP was predicted to exceed the 24-hour Nova Scotia Air Quality Standard up to 0.3% of the time with background included at the Deepwood Estates receptor. There is uncertainty in the presented background concentrations of both PM_{10} and TSP. The Deepwood Estate property, the most impacted, has been acquired by AMNS so there will be no permanent or seasonal resident at this property. In addition, this property will likely be used as part of the monitoring to confirm impact predictions and assess the effectiveness of the mitigations.

8.5.2.2.2 Effects of Other Projects in the Area

The RAA for air, and other projects which fall within this RAA are shown on Figure 8.5-2. The NSSA Acid Mitigation Project has a spatial and temporal overlap with the Projects' RAA for air. However, this project is not being discussed in the context of cumulative air impacts, because aside from several days per year of helicopter flights for terrestrial liming, the NSSA work does not generate air emissions. The Gaetz Brook Wind Power Project is within the RAA for Air; however, this project is not anticipated to generate emissions. The existing Touquoy project lies within he RAA for air; however, it is an integral component of the Beaver Dam Project and air emissions from the Touquoy project are considered in the modelling for the Beaver Dam Project. As a result, this project is not being described further in the cumulative effects assessment for Air.

Current Regional Forestry Operations

The local forestry industry has the potential to have cumulative effects on air quality. As the forestry industry is ongoing in the region and has been for many decades, its effects on air quality are already accounted for in the local baseline conditions. The largest effect noted from the baseline data was the measurement of the highest suspended particulate concentrations from a monitoring station located in a recently clear-cut area. As a result of the expected inclusion of forestry contributions to air quality in baseline data, no additional analysis for cumulative effects of this industry related to air is necessary.

Beaver Dam Haul Road Use by the Project, Fifteen Mile Stream Project, Cochrane Hill Gold Project and Regional Forestry

During the operation phase of the Project and the Cochrane Hill Gold Project, gold concentrate from each surface mine will be transported to the Touquoy processing site for final processing into gold doré bar. The proposed haul route for each of these projects is proposed to overlap with the Beaver Dam Haul Road west of the Highway 224, along with potential trucking activity associated with the forest industry. Eleven round-trips are proposed to carry gold concentrate from each of the Cochrane Hill and the FMS Projects per day (totaling 22 vehicle round-trips per day or 11 1-way trips), plus 190 round-trips per day (or 95 1-way trips) between Beaver Dam Mine Site and Touquoy Mine Site. This could be further compounded by forestry truck activity (approximately 7 return trips per day plus 20 round trip service trucks). The total number of trucks for cumulative effects assessment is 288 trucks round trip (Appendix C.1). Mitigation measures proposed in the Beaver Dam Mine Project EIS will result in an 80 to 90% targeted dust suppression efficiency.

The modelled particulate concentration results of the Cumulative Haul Road emissions scenario for the four road sections modelled (Figure 3 in Appendix C.1) are summarized in Table 7A for the 80% road dust mitigation scenario. All predicted Cumulative maximum concentrations are well below the air quality assessment criteria with background added, as shown in Table 7A in Appendix C.1. The maximum particulate deposition along the Haul Road for the Cumulative truck traffic scenario ranged from 78.9 to 81.6 g/m^2/year. Table 7B in Appendix C.1 summarizes the predicted maximum concentrations of the gaseous species (NO_2, SO_2 and VOCs). There are no exceedances of the air quality criteria for NO_2 and SO_2. There are no criteria applicable for total VOCs. The predicted concentrations of VOCs as presented in Table 7B show that the VOC concentrations are very low (less than 1 microgram per cubic metre) and are provided for reference only.

The maximum concentrations for all contaminants occur at 30 m from the Haul Road centerline, which is the project boundary for the Haul Road. Figures 4A to 4E in Appendix C.1 show the 30 km haul road contour plots for TSP, PM_{10} and $PM_{2.5}$ modelled for the 80% dust mitigation scenario. As shown on these figures, there are no exceedances of the applicable criteria along the haul road.

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FIGURE 8.5-2

Beaver Dam Mine Project

Cumulative Effects Assessment: Air

Projects Evaluated in the Cumulative Effects Assessment

Air Regional Assessment Area

Project Area

Note: Forestry operations occur throughout the RAA and are not displayed on this figure



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 4.25 8.5 17 km

1:330,000 Scale when printed @ 11" x 17"

Drawn By: EP Date: 2021-04-25

Reviewed By: KR

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Document Name: BD_EIS_Figure8-4-X_CEA_Light

Beaver Dam Mine Site

Touquoy Mine Site

Haul Road

Mosher Lake Limestone Co.

Great Northern Timber Pellet Facility

Fifteen Mile Stream Forestry Operations

Fifteen Mile Stream Past Mining Operations

Beaver Dam Past and Future Mining Operation

NSSA - AMP: Killag Doser

NSSA - AMP: WRSH Doser

NSSA - AMP: Terrestrial Liming

Regional Forestry Operations

Beaver Dam Haul Road

Touquoy Mining Operations

Taylor Lumber Co. Ltd. mill

National Gypsum quarry

ScoZinc Ltd mine

Cook's Brook Sand and Gravel Pit

Murchyville Gypsum Mine

Dufferin Gold Mine

Great Northern Timber Wood Chipping and Shipping

Port of Sheet Harbour

Sheet Harbour Quarry

Tangier Gold Mine

Gaetz Brook Wind Farm

Lake Major Dam Replacement

Liquid Asphalt Storage

460000 470000 480000 490000 500000 510000 520000 530000 540000 550000 560000 570000

5020000 5010000 5000000 4990000 4980000 4970000 4960000 4950000

Sheet Harbour Quarry (Future)

On January 31, 2019, Dexter Construction Company Limited submitted an Environmental Assessment Registration Document for the Sheet Harbour Aggregate Quarry Project, located approximately 26 km southeast of the Beaver Dam Mine Site, and 35 km southeast of the Touquoy Mine Site. According to the EARD, Project activities will result in release of dust and exhaust type emissions through construction, operation, and reclamation phases of this proposed quarry. Mitigation measures proposed include wet suppression of unpaved surfaces, equipment maintenance, and the use of low-sulphur fuel. Assuming appropriate mitigation measures are employed, the EARD indicates that the effect of the Project on air quality are minor. The EARD does not predict air quality concentrations from the project, nor does it predict the spatial extent of this potential dust deposition.

The spatial boundaries used to make this determination are not provided in the EARD. However, the Projects' effects on air is not expected to spatially overlap with the proposed Beaver Dam Project, based on the distance between the two sites. The EARD was determined to provide insufficient information for the Minister to grant approval to the Project. On March 22, 2019, the Minister requested submission of additional information. The Minister approved this undertaking on November 8, 2019, but it is unclear in the public records whether operation has commenced. As such, there is additional uncertainty in the potential temporal overlap between this project and the Project.

Great Northern Timber Pellet Facility (Present)

The Great Northern Timber Pellet Facility is located approximately 22 km northwest of the Beaver Dam Mine Site, and 16 km north of the Touquoy Mine Site. This facility produces chips for pulp and paper, MDF, and biomass, in addition to selling whole birch logs.

Data to support conclusions about residual effects of this project on Air quality is unavailable, however it is not expected that this project would result in a significant additive effect to Air quality with the Project. Neither of these projects triggered provincial or federal environmental assessment processes. As such, no air dispersion modelling was completed for either of these activities, and neither is expected to result in cumulative effects with the Project. There is some uncertainty in this conclusion, however, due to lack of available data.

Murchyville Gypsum Mine (Past)

This small gypsum mine is located approximately 36 km west of the Beaver Dam Mine Site and 18 km west of the Touquoy mine Site. As a small extraction mine with no processing of materials on site (beyond crushing), air emissions are not expected to be generated at this location. This project is not currently operational; therefore, there is no expectation of cumulative effects to Air between the Murchyville Gypsum Mine and the Project.

Dufferin Gold Mine (Historic and Proposed)

The Dufferin Gold Mine is located approximately 26 km southeast of the Beaver Dam Mine Site, and 43 km west of the Touquoy Mine Site. The footprint of this mine is approximately 375 m by 150 m. A bulk sampling program and associated milling was completed in 2018, but in 2019 the proponent (Resources Capital Gold Corporation) filed a Notice of intention to make a proposal under the Bankruptcy and Insolvency Act so future plans for this Project are uncertain. As such, the potential temporal overlap of this project and the Beaver Dam Project are unknown. Should the project proceed and overlap with the beaver Dam Project temporally, the potential spatial overlap of effects to Air needs to be considered. Details associated with the effects of the Dufferin project on air are limited. Considering the Beaver Dam Project is able to mitigate residual effects on Air and meet applicable guidelines within the Property boundary, the relatively small size of the proposed operation at the Dufferin site, and the distance

between the two (26 km), a spatial or temporal overlap between these projects is unlikely. Therefore, there is little potential for cumulative effects on air quality.

Tangier Gold Mine (Historic and Proposed)

The Tangier Gold Mine is located approximately 28 km south of the Beaver Dam Mine Site, and 27 km southwest of the Touquoy Mine. The footprint of this mine is approximately 500 m by 150 m, as measured on Google Earth. The Tangier Gold Mine was purchased by Resource Capital Gold Corp and plans are being developed for re-opening the mine. However, according to a press release dated January 29th, 2019, the proponent had filed a Notice of Intention to make a proposal under the Bankruptcy and Insolvency Act. The planned activities are limited to mining as no processing is planned at this site. Processing would take place at the Dufferin Gold Mine (Resource Capital Gold Corp. 2017). The potential temporal overlap of this project and the Project are unknown. Should the project proceed and overlap with the Project temporally, the potential spatial overlap of effects to Air needs to be considered. Details associated with the effects of the project on air are limited. Considering the Beaver Dam Project is able to mitigate residual effects on Air and meet appropriate air quality guidelines within the property boundary, the relatively small size of the proposed operation at the Tangier site, and the distance between the two (28 km), a spatial or temporal overlap between these projects is unlikely. Therefore, there is little potential for cumulative effects on air quality.

Taylor Lumber Co. Ltd. Mill (Present)

Taylor Lumber Co. Ltd. has operated a mill in Middle Musquodoboit since 1945. This site, located approximately 30 km west of the Beaver Dam Mine Site and 17 km northwest of the Touquoy Mine Site, includes a saw mill, a finishing plant, a pallet plant, a power plant, a dry-kiln, and a chipping plant. The power plant is a co-generation facility that burns biomass produced from their operation that provides power to their operation as well as to homes and businesses within a 30 km radius (Taylor Lumber, 2017).

It is possible that the Taylor Lumber Mill may result in an additive cumulative effect to Air quality, however the extent of the residual impact of the lumber bill on Air quality is unknown. No additional information is available to predict potential cumulative effects in a quantitative manner. Given that the Project is able to meet applicable air quality guidelines at the property boundary, the likelihood of a cumulative effects on air quality is low.

Mosher Lake Limestone Co. (Present)

Mosher Limestone processing facility is located approximately 21 km northwest of the Beaver Dam Mine Site and 16 km north of the Touquoy Mine Site. As such, the project lies within the RAA for Air for the Project, and there is a potential spatial overlap of residual effects. Mosher Limestone processes and sells limestone products in Nova Scotia and Atlantic Canada. Products include pelletized limestone, powdered limestone, granular limestone, powdered gypsum, pelletized gypsum, and traction sand. The processing facility crushes, packages and ships product. While very little data is publicly available, the Moser Lake Limestone Quarry is expected to generate dust and exhaust type emissions similar to other construction projects. This site has the potential for an additive cumulative effect on air quality with the Project, though it is expected to be minor given the distance between the two projects. No additional information is available to predict potential cumulative effects in a quantitative manner. This project did not trigger an environmental assessment and no publicly available data was found to provide air quality results associated with this project.

Fifteen Mile Stream Past and Proposed Mining Operations (proposed)

The Fifteen Mile Stream Gold Project is located approximately 17 km northwest of the Beaver Dam Mine Site, and 37 km northwest of the Touquoy Mine site. Residual effects on air quality from operation of the proposed Fifteen Mile Stream Mine Project include dust from onsite activities, vehicle travel, material handling and crushing of ore prior to transportation to the Touquoy Mine Site for processing. Residual effects are expected to be adverse, but not significant, and limited to the LAA, which represents a 1.5 km buffer of the PA. These effects will be mitigated through equipment maintenance, dust suppression, enforcement of speed limits, stabilization of stockpile slopes, covering of haul trucks and minimizing blasting events. There is no spatial overlap of residual effects between the FMS and Beaver Dam Gold Projects, as such, there is no expectation of additive cumulative effects. There is little uncertainty in this determination, given the clear definition of the spatial and temporal extent of residual impacts to Air presented in the EIS for the Fifteen Mile Stream Project.

ScoZinc Ltd. Mine (Past and Future)

ScoZinc is a proposed future (and past) zinc mine located approximately 50 km west of the Beaver Dam Mine Site, and 32 km west of the Touquoy Mine Site. While this Project is not currently in operation, it has an approved EARD and is expected to commence operation in the near future, so a temporal overlap of the Projects is possible. The ScoZinc Mine is expected to generate emissions related to trucking primarily. The spatial extent of impacts of the ScoZinc Mine on air quality has been defined as a 5 km zone of influence surrounding the Project. As such, there is no expectation for spatial overlap of residual effects between the ScoZinc Mine and the Beaver Dam Project, and no pathway for cumulative effects.

Cooks Brook Sand and Gravel Pit (Present)

This sand and gravel pit is located 47 km west of the Beaver Dam Mine Site and 29 km west of the Touquoy Mine Site. The primary operation at this facility is extraction and crushing of sand and gravel; air emissions are not expected to be generated at this location. Given that the spatial extent of residual effects of the Project on Air quality are limited to the LAA, there is no expectation of additive cumulative effects of these two facilities, given the distance between the sites.

Port of Sheet Harbour and Great Northern Timber Wood Chipping and Shipping (Present)

The Port of Sheet Harbour is a deep water port located 23 km southeast of the Beaver Dam Mine Site and 35 km southeast of the Touquoy Mine Site on the coast of the Atlantic Ocean. The terminal consists of a 152 m wharf with a minimum draft of 10 m and is capable of handling ships of up to 214 m (Port of Sheet Harbour, 2017).

At this same location, Great Northern Timber owns and operates a chipping and ship loading facility in Sheet Harbour, approximately 25 km southeast of the Beaver Dam Mine Site. Great Northern Timber procures wood chips and roundwood fibre from industrial landowners, sawmills, Crown lands, Private land contractors and Private woodlot management organizations in Nova Scotia, Prince Edward Island, New Brunswick and Quebec.

Data to support conclusions about residual effects of these projects on Air quality is unavailable, however it is not expected that either of these projects would result in a significant additive effect to Air quality with the Project. Neither of these projects triggered provincial or federal environmental assessment processes. As such, no air dispersion modelling was completed for either of these activities, and neither is expected to result in cumulative effects with the Project. There is some uncertainty in this conclusion, however, due to lack of available data.

8.5.2.2.3 Cumulative Effects on Ambient Air Quality

It is likely that forestry operations will occasionally coincide with those of the Project and cause greater disturbance to air quality that these operations produce individually. However, such additive periods are likely to be limited in duration and frequency and are not expected to be significant.

The gold processing and transportation activities associated with the Fifteen Mile Stream Mine Project, the Cochrane Hill Gold Project and the Project overlap in both time and space, with additional consideration to potential forestry activities that could also overlap spatially and temporally. Therefore, effects from the transportation and processing of gold from the three projects and forestry activities have the potential to act in an additive and cumulative nature. The operation of Beaver Dam Mine Project, the Project and the Cochrane Hill Gold Project are proposed roughly to occur during the same timeframe, with all three mines operating at the same time from 2023 to 2027. During this time all three projects will use the portion of the Beaver Dam Haul Roads west of the Highway 224 to transport gold concentrate to the Touquoy Mine Site resulting in potential additive cumulative effects to air quality through increased ambient dust levels along the Beaver Dam Haul Road. The addition of trucking from the two projects and forestry activity will not result in a significant cumulative effect (Appendix C.1).

The principal assumptions behind this assessment is that local forestry practices will not change in any important way during the Project, the Fifteen Mile Stream Project or the Cochrane Hill Gold Project. Limitations related to data availability do not allow us to make meaningful conclusions related to cumulative effects and project interactions for many of the projects listed throughout Section 8.5.2.2.2, however, given the limited spatial scale of the individual project effects, the mitigation measures proposed, and the distance between the projects, it is unlikely that any cumulative effects would be significant.

8.5.2.3 Mitigation

As the cumulative effects are not anticipated to be significant, additional mitigative measures (beyond those proposed to mitigate Project related effects, Section 6.2.7) for cumulative effects to air are not warranted.

8.5.2.4 Residual Cumulative Effects and Significance Assessment

Significant residual effects for the Air VC Are defined as having high magnitude (i.e., an **exceedance** applicable criteria), occur beyond the LAA, be of long-term to permeant duration, occur at regular intervals or be continuous throughout the Project, and be only partially reversible to irreversible, as described in Section 6.2.

The residual cumulative effects on the atmospheric environment are considered to be adverse but not significant (Table 8.5-3).

Table 8.5-3: Residual Cumulative Environmental Effects for Air

Residual Adverse Cumulative Effects (After Mitigation)	Significance Levels						Overall Significance of Residual Adverse Effects (and Rationale)
	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	
Increased cumulative dust during operation of the Project (Dust from mining and haul trucks)	M Possible exceedance of guidelines or threshold values when forestry operations occasionally coincide with hauling from the Project to the Touquoy Processing Facility along with ore or concentrate from Fifteen Mile Stream and Cochrane Hill Projects.	LAA The cumulative effects causing increased background air concentrations will not extend beyond the LAA.	A VC will be affected by timing – drier periods will increase fugitive dust emissions relative to wetter times of the year.	LT Effects may extend beyond 7 years.	R Additive periods of potential effects from the Project and forestry operations are likely to be limited in frequency. However, cumulative effects to ambient dust levels from the use of the Beaver Dam Haul Road by the Project, the Fifteen Mile and Cochrane Hill Gold Projects will occur regularly throughout the operational phase of the Project.	R VC will recover to baseline conditions once operations have stopped.	Moderate Adverse Effect (Not Significant) Effects are limited to the LAA where there are limited sensitive receptors, and the use of the Beaver Dam Haul Road. Furthermore, the VC is anticipated to recover to baseline conditions once the operation Project has been completed. Effects would be confirmed through monitoring.

Legend (refer to Section 5.11, Table 5.11-1 for definitions)

Magnitude		Geographic Extent		Timing		Duration		Frequency		Reversibility	
N	Negligible	PA	Project Area	N/A	Not Applicable	ST	Short-Term	O	Once	R	Reversible
L	Low	LAA	Local Assessment Area	A	Applicable	MT	Medium-Term	S	Sporadic	IR	Irreversible
M	Moderate	RAA	Regional Assessment Area			LT	Long-Term	R	Regular		
H	High					P	Permanent	C	Continuous		

8.5.2.5 Follow-up and Monitoring Programs

No additional follow-up or monitoring beyond that presented in Section 6.2.10 is warranted.

8.5.3 Light Cumulative Effects Assessment

8.5.3.1 Baseline Conditions

8.5.3.1.1 Baseline Light Levels

As part of the 2007 Focus Report, a background light study was conducted at the Touquoy Mine Site. At all locations where baseline measurements were taken at the Touquoy Mine Site, ambient light measurements were under exposed, indicating ambient light levels were too low (<0.01 lux) to be measured (CRA, 2007). The Touquoy baseline conditions fell under the classification for rural areas, small villages, or relatively dark urban areas: “E2 Low District Brightness Areas”.

The conditions around Beaver Dam Mine Site, Haul Road, and surrounding area are similar to that of the background conditions for Touquoy Mine Site 2007 Focus Report, due to its remote, rural and mostly wooded, location. Ambient nighttime light conditions are minimal and typical of an undeveloped rural area. The largest artificial light sources in the Project Area are from the nearest residences, the Beaver Lake IR, and the occasional all-terrain vehicle. As such additional on-site light monitoring was not required to support the light impact assessment. The Beaver Dam Mine Site, Haul Road and surrounding area also fall under the classification for rural areas, small villages, or relatively dark urban areas: “E2 Low District Brightness Areas”.

A light impact assessment (Appendix D.1) was completed for the Beaver Dam Mine Project and included 9 points of reception (Section 6.3). For the purposes of this assessment, "pre-curfew" was assumed to be before 11 PM, and included road activity, and "post-curfew" was between 11 PM and 7 AM and included only overnight activities at the Beaver Dam Mine Site. The assessment of light impacts along the Haul Road was completed by considering a “worst case” scenario when two trucks are closest to each receptor and shining light towards the receptor. Because receptors along the Haul Road are not located on any road bends, with limited line of site to the travelling trucks, the assessed light impacts to these receptors were likely overestimated (Appendix D.1).

The calculated light levels at all receptors are below the limits recommended by the ILP guidelines during both pre- and post-curfew conditions (i.e., between 11 pm and 7 am and before 11 pm; Table 6.3-6 and Figure 6.3-2). The assessment considers worst-case operating conditions, for example, if all mobile equipment was in use at the same time and illuminating towards the receptors and the potential for light from both the Beaver Dam Mine Site and the Haul Road trucks to affect a receptor in a cumulative way.

The calculated light levels from the Haul Road are also below the limits recommended by the ILP guidelines (Table 6.3-6 and Figure 6.3-2).

Ambient night-time (post-curfew) light levels at the Beaver Dam Mine Site are predicted to meet the 1 lux guideline within 1.6 km from the site and as such not anticipated to affect the Beaver Lake IR or other receptors. The Beaver Lake IR 17 is located approximately 5 km southwest of the Beaver Dam Mine Site and is separated from the Beaver Dam Mine Site by forest and two topographic ridges.

Distance to Sky Glow dissipation is summarized in Table 6.3-7 along with total luminous flux from the Beaver Dam Mine and Haul Road, and distance to the 5.0 lux and 1.0 lux assessment criteria. Table 6.3-7 shows the distance to a maximum 0.1 lux illuminance level which is considered as background light level for this assessment. Figure 6.3-2 shows the Light shed map depicting these

distances. The light shed map (Figure 6.3-2) shows that the light levels from the Beaver Dam Mine Site reach maximum 5 Lux at a distance of 719 m from the source, maximum 1 Lux light level at distance of 1,607 m from the source and maximum 0.1 Lux (background level) at a distance of 5,082 m from the source. Table 6.3-7 and Figure 6.3-2 also show that during Pre-Curfew conditions when the Haul Road is in operation, when two trucks pass the same point simultaneously, the ambient light may be 5 lux or more out to a maximum distance of 39 m from the Haul Road (on an instantaneous basis, this will not be a continuous light level, it will occur only where two trucks are passing each other, and only for the brief period they are both affecting the same receptor). At a distance of 279 m, the light under these same conditions will be less than 0.1 lux (or less than background) (Appendix D.1).

8.5.3.1.2 Residual Effects of Proposed Project

The predicted residual environmental effects of Project development and production of light are assessed to be adverse, but not significant. The calculated light levels at all receptors are below the limits recommended by the ILP guidelines during both pre- and post-curfew conditions. The calculated light levels at all receptors from the Haul Road are also below the limits recommended by the ILP guidelines.

The resulting area of illumination elevated above background conditions (sky glow) from the Beaver Dam Mine Site will be seen within 5,082 m. This encompasses receptors R1, R2, R3, and R4 (Figure 6.3-2). The predicted illuminance levels represent the worst-case operating conditions of the Beaver Dam Mine Site. The assessment considers when all of the mobile equipment at the mine would be in use at the same time, illuminating towards receptors. The areas surrounding the site are wooded with varying topography and inhibit the spread of light. It was conservatively assumed for screening purposes that 50% of the light will not reach the receptors due to directionality and line of sight obstructions. The amount of light blocked by the surrounding woodland and topographic changes, however, will likely be much greater than this (>90%), especially during the seasons when deciduous trees are leaf on (Appendix D.1). It is therefore not expected that the illumination will cause any significant visual impact, due to a combination of distance and the screening effects of topography and vegetative cover.

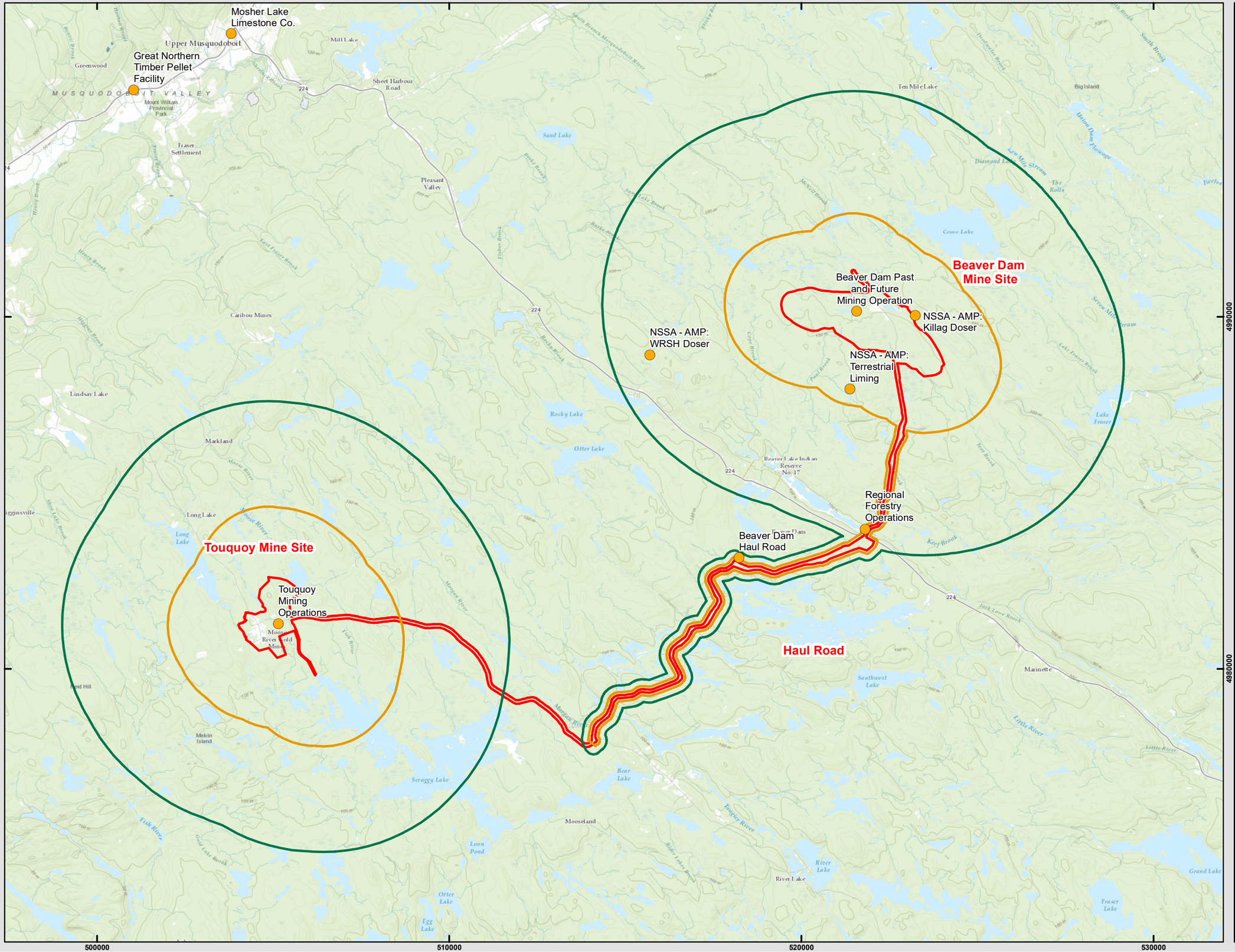
Beaver Dam ore will be trucked to the operating Touquoy Mine Site for processing. The primary effect of the continued use of the Touquoy Mine Site is the continued lighting of facilities and vehicular traffic during the processing of FMS concentrate. There are no new or additional effects from light anticipated to be caused by the processing of concentrate and the management of tailings from the Project and are therefore not further evaluated in this cumulative effects assessment.

8.5.3.1.3 Effects of Other Projects in the Area

The RAA for light, and projects which fall within this RAA are shown on Figure 8.5-3. The NSSA Acid Mitigation Project has a spatial and temporal overlap with the Projects' RAA for light. However, this project is not being discussed in the context of cumulative light impacts, because aside from several days per year of helicopter flights for terrestrial liming during daytime, the NSSA work does not generate light.

<u>Current Regional Forestry Operations</u>

The local forestry industry has the potential to have cumulative effects on light. As the forestry industry is ongoing in the region and has been for many decades, its effects on light are already accounted for in the local baseline conditions. Impacts on light associated with timber harvesting would be limited to temporary increases in light based on transportation to timber, and cannot be quantified in a meaningful with publicly available data.



Prepared For:

Atlantic Gold

FIGURE 8.5-3

Beaver Dam Mine Project

Cumulative Effects Assessment: Light

- Projects Evaluated in the Cumulative Effects Assessment
- Light local Assessment
- Light Regional Assessment
- Project Area

Note: Forestry operations occur throughout the RAA and are not displayed on this figure

Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 1.25 2.5 5 km

1:100,000 Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed By: KR

Date: 5/10/2021

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Beaver Dam Haul Road Use by the Fifteen Mile Stream Project, Cochrane Hill Gold Project and Regional Forestry

During the operation phase of the Project, ore will be transported to the Touquoy Mine Site for processing. The Fifteen Mile Stream and Cochrane Hill Gold Projects plan to also transport gold concentrate from each surface mine to the Touquoy processing site for final processing into gold doré bar. The proposed haul route for each of these projects is proposed to overlap with the Beaver Dam Haul Road west of the Highway 224, along with potential trucking activity associated with the forest industry. Eleven round-trips are proposed to carry gold concentrate from each of the Cochrane Hill and the FMS Projects per day (totaling 22 vehicle round-trips per day or 11 1-way trips), plus 190 round-trips per day (or 95 1-way trips) between Beaver Dam Mine Site and Touquoy Mine Site. The total number of trucks for cumulative effects assessment is 288 trucks round trip (Appendix C.1).

The assessment of light impacts along the Beaver Dam Haul Road was completed by considering a "worst case" scenario when two trucks are closest to each receptor and shining light towards the receptor. Because receptors along the Beaver Dam Haul Road are not located on any road bends, with limited line of site to the travelling trucks, the assessed light impacts to these receptors were likely overestimated.

The 22 additional vehicle round trips along this Haul Road are not anticipated to change the assessment presented. The worst-case would still occur when two trucks are close to a single receptor and shining lights toward that receptor. As the road is only 2 lanes, only two trucks could approach a receptor at one time (one from each direction). During daylight hours, the truck lights are insignificant compared to ambient light levels, in the dawn, dusk and evening hours (until 11 PM when curfew is implemented), potential light impacts will be as presented in Section 6.3.

Within the Beaver Dam Mine Project EIS, the calculated light levels at all receptors from the Haul Road are also below the limits recommended by the ILP guidelines, as a result of road traffic. This will be unchanged with the additional vehicles from Fifteen Mile Stream and Cochrane Hill and with consideration of baseline forestry activity (Appendix D.1).

8.5.3.1.4 Cumulative Effects on Light

It is likely that forestry operations will occasionally coincide with those of the Beaver Dam Mine Project and cause localized elevated light levels relative to what these operations produce individually, especially along the Beaver Dam Haul Road. However, such additive periods are likely to be limited in duration and frequency and are not expected to be significant. There are no available data to quantify timber harvesting accurately on crown land or on private land. This is a substantial data limitation, which prevents us from making any more meaningful conclusions related to cumulative effects on light from the Project, in the context of a resource driven landscape with unknown amounts of timber harvesting. Based on the current understanding of proposed lumbering operations, it has been assumed that forestry operations may add 7 truck trips per day plus service vehicles (20 trips per day), but it clear that forestry will not be a significant source of traffic on the Haul Road.

The gold concentrate processing and transportation activities associated with the Beaver Dam Mine Project, the Project and the Cochrane Hill Gold Project overlap in both time and space. Therefore, the potential effects from the transportation from the three projects have the potential to act in an additive and cumulative nature. The operation of Beaver Dam Mine Project (2023 to 2027), the Project (2023 to 2029) and the Cochrane Hill Gold Project (2025 to 2030) are proposed roughly to occur during the same timeframe, with all three mines likely operating at the same time from 2025 to 2027. During this time all three projects will use the portion of the Beaver Dam Haul Road west of the Highway 224 to transport gold concentrate to the Touquoy Mine Site resulting in potential additive cumulative effects to light levels from trucking along the Haul Road. Given the limitations of traffic on the Beaver Dam Haul Road (2 lanes, only 2 trucks can be in one place at one time), the increase in volume of traffic will not result in a cumulative impact on light levels, particularly related to light levels at reception points.

The principal assumptions behind this assessment is that local forestry practices will not change in any important way during the Project, the Beaver Dam Mine Project or the Cochrane Hill Gold Project. These assumptions are considered to have a low uncertainty.

8.5.3.2 Mitigation

As the cumulative effects are not anticipated to be significant, additional mitigative measures (beyond those proposed to mitigate Project related effects, Section 6.3.7) for cumulative effects to light are not warranted.

8.5.3.3 Residual Cumulative Effects and Significance Assessment

For the purpose of this assessment, the threshold of determination of significant effects from light at the Beaver Dam Mine Site was determined to be 1 lux light trespass into windows at the nearest receptor. This was determined as a result of the baseline environmental light classification of E2 at the Beaver Dam Mine Project.

The residual cumulative effects on the atmospheric environment are considered to be adverse but not significant (Table 8.5-4).

Table 8.5-4: Residual Cumulative Environmental Effects for Light

Residual Adverse Cumulative Effects (After Mitigation)	Significance Levels						Overall Significance of Residual Adverse Effects (and Rationale)
	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	
Increased light levels during operation of the Project (operational light levels and light from transportation of gold concentrate and use of the Beaver Dam Haul Road by other projects)	L Less than or equal to appropriate guidelines or threshold values.	LAA The cumulative effects causing increased background light concentrations will not extend beyond the LAA. Exception to this is the cumulative light along the Beaver Dam Haul Road which is outside of the Project LAA but described herein.	N/A VC is not expected to be affected by timing.	LT Effects may extend beyond 8 years.	R Additive periods of potential effects from the Project and forestry operations are likely to be limited in frequency. However, cumulative effects to ambient light levels from the use of the Beaver Dam Haul Road Use by Fifteen Mile Stream and Cochrane Hill Gold Projects will occur regularly throughout the operational phase of the Project.	R VC will recover to baseline conditions once operations have stopped.	Low Adverse Effect (Not Significant) Effects are limited to the LAA where there are limited sensitive receptors, and the use of the Beaver Dam Haul Road. Furthermore, the VC is anticipated to recover to baseline conditions once the operation of the Beaver Dam Mine SIte has been completed.

Legend (refer to Section 5.11, Table 5.11-1 for definitions)

Magnitude		Geographic Extent		Timing		Duration		Frequency		Reversibility	
N	Negligible	PA	Project Area	N/A	Not Applicable	ST	Short-Term	O	Once	R	Reversible
L	Low	LAA	Local Assessment Area	A	Applicable	MT	Medium-Term	S	Sporadic	PR	partially reversible
M	Moderate	RAA	Regional Assessment Area			LT	Long-Term	R	Regular	IR	Irreversible
H	High					P	Permanent	C	Continuous		

8.5.3.4 Follow-up and Monitoring Programs

No additional follow-up or monitoring beyond that presented in Section 6.3.10 is warranted.

8.5.4 Surface Water Quality and Quantity Cumulative Effects Assessment

8.5.4.1.1 Baseline conditions

Surface Water Features

Beaver Dam Mine Site and Haul Road

The Beaver Dam Mine Site lies within the West River Sheet Harbour (WRSH) drainage basin, which is directly east of the Musquodoboit River Valley system. The watershed occupies an area of roughly 576 square kilometers (km^2), a moderately sized watershed in the Province. The area is characterized by rolling till plains, drumlin fields, extensive rockland, and numerous freshwater lakes, streams, bogs and wetlands having relatively low relief, hummocky type terrain. This inland area is somewhat removed from the immediate climatic influence of the Atlantic Ocean and is characterized by warmer summers and cooler winters.

The Killag River and Cameron Flowage is the main mapped linear watercourses of the Beaver Dam Mine Site, and Crusher Lake and Mud Lake are the major mapped lakes. The complex system of streams, lakes, bogs, and wetlands is a direct result of the underlying bedrock geology of greywacke and slate found in the region. The basin ultimately drains to the south via the West River Sheet Harbour, and discharge peaks are likely attenuated to a large extent by the numerous lakes and wetlands through which runoff is routed. The West River Sheet Harbour and Tangier River Secondary boundary runs through the center of the Project Area (Section 6.7.3) along the proposed Haul Road. Elevations within the catchment vary from approximately 135 to 165 meters above sea level (masl) in the headwater areas and gradually decrease to sea level at the final outlet located at Sheet Harbour. The headwaters of the drainage basin are located along the topographic divide separating the Musquodoboit River Valley to the northwest.

An inventory of surface water features was undertaken to identify water features may be impacted directly or indirectly by the proposed mine and Haul Road construction and operations. Initially three waterbodies (Crusher Lake, Mud Lake, and an unnamed waterbody in the southwest section of the Project Area) were identified through a desktop review of available mapping as requiring characterization of baseline conditions. During the 2019 field evaluations, 10 additional watercourses were identified within the Beaver Dam Mine Site, totaling 24 watercourses within the mine area. Three additional watercourses outside of the Beaver Dam Mine Site were also delineated (WC-23 [Outlet to Cope Brook], WC-26 [Outlet to Killag], and WC-27 [Outlet of Mud Lake]), due to potential impacts to fish and fish habitat within the LAA (Section 6.9). New watercourses are described in Section 6.7.3 and shown in Figures 6.7-1 and 6.7-2.

Most watercourses within the Beaver Dam Mine Site are first order streams originating within headwater wetland habitat inside of the PA. Many streams across the Beaver Dam Mine Site are generally small with minimal pool/riffle structure and consist of mucky organic substrate. While most are generally perennial in nature, many have intermittent patches, which go dry during prolonged rainless periods when percolation depletes all flow (Alberta Transportation 2009).

Tertiary basins potentially affected by the Project including four within the Beaver Dam Mine Site and six along the Haul Road footprint; were identified as a result of baseline characterizations studies, are listed below and shown on Figure 6.7-4).

The four tertiary basins constituting the PA and LAA identified for the Project:

- Portion of Killag River (1EM-2-D);
- Tent Brook (1EM-2-F);
- Paul Brook (1EM-2-H); and
- Cope Brook (1EM-2-J).

The six tertiary basins affected along the Haul Road:

- Tent Brook (1EM-2-F);
- Keef Brook (1EM-2-G);
- Jack Lowe Brook (1EM-2-N);
- Little River (1EM-2-P);
- Portion of Sandy Pond (1EL-2-C); and
- Portion of Morgan River (1EL-2-H).

Touquoy Mine Site

The Touquoy Mine Site is an active Mine Site that commenced operation on October 11, 2017 and is subject to an Industrial Approval to operate issued by NSE. A Class I Environmental Assessment under the *Nova Scotia Environment Act* and Environmental Assessment Regulations for the Project was reviewed and approved in 2008, subject to Approval conditions. The use of the Touquoy Mine Site for the processing of Beaver Dam Mine ore and deposition of the associated tailings will occur after ore extraction from the Touquoy open pit has ceased. As such, the baseline conditions for the Touquoy Mine Site for the Project operations will be the conditions expected near the end of the Touquoy ore processing operations.

Existing conditions with respect to surface water for the watershed was based on the available data collected as part of the 2007 submission (CRA), 2013 LiDAR (Leading Edge), and Water Management Plan (Stantec 2017a) for operation, the Reclamation Plan (Stantec 2017b) for reclamation and closure, and the 2017 surface water quality/quantity monitoring reports (Stantec 2018b).

The existing Touquoy Mine Site is part of the Moose River drainage basin, which is directly east of the Musquodoboit River Valley system. As described in the Environmental Assessment Registration Document (CRA 2007b), the Moose River watershed can be characterized by rolling till plains, drumlin fields, extensive rock land, and numerous freshwater lakes, streams, bogs and wetlands in the headwaters and the relatively low relief hummocky terrain. Forests are predominantly coniferous of red and black spruce (CRA 2007b). Local ground surface elevations at the Touquoy Mine Site range from 102 to 145 masl. The Touquoy Mine Site is approximately 10 kilometers (km) northwest of the Tangier Grand Lake Wilderness Area. This protected area consists of 16,000 ha of predominantly coniferous forest and has abundant lakes, wetlands, and waterways. The waterbodies within the Wilderness Area are contained within a separate watershed from that of the Touquoy Mine Site, which lies in the Fish River Watershed.

The Moose River drainage basin ultimately drains to the south via Moose River, and runoff through the catchment to Moose River is likely attenuated by the many lakes and wetlands in the catchment thus reducing the peak flow. The catchment area of Moose River is 3,904 ha at surface water monitoring station TQ-SW-2 draining from topographical highs of 180 to 110 masl in elevation (CGVD 2013) at the banks of Moose River. Moose River flows south approximately 2.3 km downstream of SW-2 where it joins the

Fish River. Watercourse No. 4 has a catchment area of 136.3 ha at surface water monitoring station TQ-SW-3 and flows south between the existing open pit and Tailings management Facility (TMF) to Moose River and eventually to the Fish River.

Surface Water Quality

The Killag River, Crusher Lake, Mud Lake, Tent Brook and Cope Brook (Beaver Dam Mine Site area), and Moose River (existing Touquoy Mine) constitute the primary focus of the Project baseline surface water characterization studies, as well as subsequent effects assessment, as these watercourses will receive direct discharge and/or catchment areas have potential to be impacted by Project water management activities.

The Project is in a highly mineralized region and the geology contributes to naturally elevated concentrations of many water quality parameters in the area, including iron, arsenic and aluminum. The occurrence of naturally elevated concentrations in surface waters is commonly observed in regions of planned/proposed mining activities, all over the world (e.g., "Golden Triangle" of northwestern British Columbia, Canada). In such regions, naturally elevated concentrations of certain water quality parameters generally occur where exposure of rock or other geologic materials to oxygen and water results in natural weathering processes, including chemical oxidation and leaching of solid-phase constituents (e.g., metals), which are then transported to surface waters.

Natural exceedances of water quality guidelines in baseline conditions are not a Project effect and, for these parameters, generic water quality guidelines (WQG) such as Canadian Council of Ministers of the Environment Water Quality Guidelines for the Protection of Freshwater Aquatic life (CCME FAL), do not necessarily apply. That is, WQG generally represent generic criteria that are developed by governments or international organizations to identify the concentrations of parameters in the receiving environment that are not expected to cause an adverse effect on various receptors or uses (e.g., aquatic life, wildlife, livestock/agriculture, drinking water. As WQG are intended to apply universally, they do not necessarily account for site-specific factors including the presence/absence of specific species in the receiving environment, or naturally occurring elevated existing water quality due to mineralization of the watershed.

To support baseline characterization for the Project, and subsequent effects assessment, site-specific water quality objectives (SSWQO) have been developed for arsenic (As). SSWQOs are site-specific criteria developed by proponents as part of ESIAs or permit applications in many jurisdictions, for example Canada, on a site-by-site basis to replace the generic WQG guidelines of the receiving environment; take instead, site-specific water quality. Here, arsenic is naturally elevated in Project area-streams and, in this instance, CCME FAL is not appropriate.

Baseline surface water monitoring was conducted at 19 locations around the Beaver Dam Mine Site and 29 locations along the Haul Road and 13 locations at the Touquoy Mine site, to obtain water quality data. The purpose of this program was to establish a baseline for comparison of surface water quality and quantity before site activities for the Beaver Dam Mine site commence.

At the Beaver Dam Mine Site, most nutrients were below or slightly above detectable concentrations, but below available water quality guidelines, indicating little to no influence from agricultural operations in the area. The watersheds have been logged extensively, yet turbidity is low, indicating generally little long-term impacts and a lack of silt in the soils and/or little erosion from logging practices. The existing Haul Roads at the in and around the Beaver Dam Mine Site have been used to haul timber as well; however, measured TSS levels were low, which may be attributable to limited use, existing road conditions and allowable speeds.

Along the Haul Road, similar to as described for the Beaver Dam Mine Site Area, most nutrients were below or slightly above detectable concentrations, but below available water quality guidelines, indicating little to no influence from agricultural operations in the area. The watersheds have been logged extensively, yet turbidity is low, indicating generally little long-term impacts and a

lack of silt in the soils and/or little erosion from logging practices. Metal concentrations were typically below detectable levels and/or available water quality guidelines.

Based on a review of the 2017 baseline surface water quality results (Stantec 2018a), surface water at the monitoring stations upstream and downstream of the Touquoy Mine Site had elevated baseline concentrations of arsenic, aluminum, cadmium, copper, iron, lead, manganese, and zinc that exceeded NSE Tier 1 EQS. In addition, cobalt, manganese, silver and mercury exceeded the Canadian Council of Ministers of the Environment (CCME 2018) guideline for the protection of freshwater aquatic life. These exceedances are considered to be naturally occurring, or the result of historical anthropogenic (i.e., non-Project related) activities, varying seasonally and representing baseline conditions at the Touquoy Mine Site.

Surface Water Quantity

FMS Mine Site

The average monthly temperature at the site ranges from a low of -6.2°C in January to a high of 18.5°C in July. The lowest average total monthly precipitation occurs in June (94.8 mm), while the highest occurs in November (137.1 mm). Snowfall was converted to snowmelt using the degree-day method. The rainfall plus snowmelt values were taken from this analysis for use in the water balance and predictive water quality assessments. Rainfall plus snowmelt depths peaked in March due to the rising temperature depleting the snow pack, creating a greater volume of available water for discharge. The lowest rainfall plus snowmelt occurred in June to August.

The total contributing drainage area to the Killag River downstream of the site, which includes the Project Site and Mud Lake and Crusher Lake, is approximately 3,933.5 ha.

Touquoy Mine Site

Scraggy Lake is part of the Moose River drainage system. It has an area of 6.4 km^2 (Stantec 2018c) and forms two major basins which are separated by islands and peninsulas. Scraggy Lake is the freshwater make-up supply for the active Touquoy mill process. Water flows into Scraggy Lake from approximately twenty-two inlets consisting of mapped watercourses or adjacent waterbodies. Water flows out of Scraggy Lake over the Fish River Dam and into the Fish River. The Fish River drains Square Lake located north of the existing Touquoy waste rock area to Scraggy Lake. Both lakes are part of the Fish River Watershed which flows west and then south into Lake Charlotte, eventually emptying into the Atlantic Ocean at Ship Harbour.

As per the Reclamation Plan for Touquoy (Stantec 2017b), Moose River is proposed as a second point of final discharge under closure of the exhausted Touquoy open pit. At SW-2, Moose River is a 3rd order watercourse with an approximately 12.5 m bankfull width as measured in the 2017 hydrometric program. The substrate was noted in the 2017 hydrometric monitoring report (Atlantis 2017) as characteristically muddy consisting predominantly of cobbles and small boulders, silt/sand with gravel.

Baseline flow in Moose River and Scraggy Lake at the end of Touquoy operations will be similar to the existing conditions prior to the development of the Touquoy Gold Project. The flow conditions in Moose River are represented by a stage-discharge curve derived based on an annual hydrometric monitoring program at stations SW-2, HM-1, and SW-11. Baseline flow statistics on Moose River were generated based on a regional analysis of thirteen representative ECCC (ECCC 2018) hydrometric stations, prorated to the Moose River catchment area at TQ-SW-2. The record of daily average flow for each station was fitted to the Log Pearson Type III distribution and prorated to the site based on catchment area. The log relationship of catchment area and flow was graphically plotted to establish a relationship between the catchment area and the average spring flow (April), summer flow (June/July/August), and low flow (July).

Surface water in Moose River is based a statistical analysis of regional flow records. As presented on Figure 6.7-6, strong linear trends exist between the average monthly flow rates of the selected monitoring stations and drainage area for April, August, and June to August with a correlation coefficient (R^2) of 0.98, 0.93, and 0.96, respectively. From these regional relationships, the average April and August flows for SW-2 in Moose River (catchment area of 39.03 km^2) are estimated to be 2.42 m^3/s and 0.45 m^3/s, respectively. Results of the analysis indicated that generally the peak and low flow events occur in April and August, respectively.

8.5.4.2 Analysis of Effects

8.5.4.2.1 Residual Effects of Proposed Project

Beaver Dam Mine Site Water Quantity Summary

A water balance analysis was conducted to assess the hydrologic impact of mine development on the surrounding water features. The water balance was calculated for five assessment points where the site will discharge or impact flows in the natural environment, including the Killag River, Mud Lake (outlet to WC-27), Crusher Lake (outlet to WC-5), Tent Brook and Cope Brook systems.

Mine site development will increase the Killag River catchment area, and decrease the Mud Lake, Tent Brook and Cope Brook catchments due to the placement of mine features in their baseline drainage areas. Surface runoff from mine features will be directed to settling ponds for treatment prior to being released into the Killag River and Tent Brook systems. The north settling pond will receive and treat runoff from the waste rock, low-grade ore and topsoil stockpiles, the crusher pad, administrative building area and site roads. Surface water and groundwater collected in the pit sump will also be dewatered to the north settling pond. The east settling pond will receive runoff from the till stockpiles, part of the organic stockpile and site roads. The north and east settling ponds discharge to the Killag River. The south settling pond will receive runoff from another other part of the organic stockpile and a topsoil stockpile. The south settling pond discharges to WC-19 of the Tent Brook system.

As part of the site reclamation plan, the pit will be filled with water from groundwater inflows, direct precipitation, and site contact water. Water will no longer be pumped from the pit to the north settling pond, and the north settling pond discharge will be re-directed into the pit. Once the pit is filled, the north settling pond will be decommissioned and site runoff will be diverted directly into the pit (Figure 6.7-14). Overflow from the pit will be directed to the Killag River through an engineered outfall in the east pit wall and existing outlet channel (WC-13). The capacity of the pit is approximately 16,000,000 m^3. During PC conditions an additional 8.6 ha will be routed to Mud Lake, reducing the impact to the Mud Lake drainage area to from a 18.3% decrease between baseline and EOM conditions to a 13.7% decrease between baseline and PC conditions. The impact to the drainage area of the Tent Brook and Cope Brook assessment points remain the same as in EOM conditions.

Beaver Dam Mine Site Water Quality Summary

During EOM conditions site water from the waste rock, low grade ore stockpiles and the pit will be routed through the North Settling Pond prior to discharge into the Killag River. Additionally, clean water from the site will be diverted and discharged directly to Mud Lake. There will also be clean discharge from the eastern till stockpiles to the Killag River. During PC conditions, site water from the waste rock stockpiles will be routed through the pit prior to discharge into the Killag River.

In summary, under the EOM scenarios, predicted mass balance near-field mixing zone and far-field mixing zone chemical concentrations in the base case are consistently below selected water quality benchmarks. The initial analysis assumed no treatment of mine contact water in the north settling pond and only analyzed the results from a mass balance (dilution) calculation

at the extent of the predicted mixing zone. The results indicated that, while concentrations for some parameters are anticipated to increase above baseline levels, at the near-field mixing zone there are no exceedances of either CCME, NSE Tier 1 criteria. As water quality criteria are defined by national and international entities as protective of the receiving environment and all water users, there are no anticipated effects to surface waters are a result of discharges from the Project to the Killag River.

However, in the EOM upper case scenario, nitrite is predicted to exceed CCME regulatory guidelines in three months of the year. Note, modelling for the Project is conservative, and based on the principles of mass balance. That is, while mass and water balance models (including GoldSim) provide capabilities for simulating mass and water balances, these processes do not represent complete reaction paths and water quality predictions are expected to be further governed by in situ processes. This included equilibrium reactions, sorption reactions and solubility limits which, together, would generally service to reduce concentrations of many quality parameters predicted by the mass balance. In particular, nitrite is known to be unstable in oxygenated environments (such as the Killag River), oxidizing to Nitrate and/or bio-assimilated. Thus, it is likely that nitrite concentrations have been overestimated for the Killag River, in both base case and upper-case scenarios. However, in response to IR2, potential nitrite removal technologies have been identified and evaluated for the Project (Appendix F.2 [Water Treatment Assessment Operation] of Appendix P.4 Mine Water Management Plan).

During PC conditions the pit lake discharges into the Killag River directly. Predictions were generated for the PC at near-field mixing zone assessment point and PC far-field mixing zone assessment point. The initial analysis assumed no treatment of mine contact water in the pit lake and only analyzed the results from a mass balance (dilution) calculation at the extent of the predicted mixing zone. There is contingency for an interception trench during PC if there are potential impacts from the PAG pile on groundwater. Water from the interception trench will be directed to the pit and/or treated

At the near-field and far field mixing zones the results from the analysis concluded that during base case scenario, while concentrations for some parameters are anticipated to increase above baseline levels, there are no exceedances of either CCME, NSE Tier 1 criteria. As water quality criteria are defined by national and international entities as protective of the receiving environment and all water users, there are no anticipated effects to surface waters are a result of discharges from the Project to the Killag River. However, results from the upper-case scenario suggest there is potential for a slight exceedance of the CCME guideline for cobalt and zinc in July and August, which is within range of natural variability. If monitoring data deviates from impact predictions, then water treatment will be undertaken.

Under the PC scenarios, there is little difference between predicted chemical concentrations at near-field mixing zone (pit lake discharge) and far-field mixing zone locations for each assessment each case. The results for the mass balance assessment during the base case PC scenarios the chemical concentrations are consistently below selected water quality benchmarks. In upper case PC scenarios, cobalt and zinc concentrations are predicted to exceed selected water quality benchmarks at both locations without during the months of July and August. An aquatic ecological risk assessment is provided in (Appendix G.2). If monitoring data deviates from impact predictions, then water treatment will be undertaken. Results for cobalt and zinc, are further discussed below.

- **Cobalt**, the predicted PC cobalt concentration at the near-field location marginally exceeds the Federal Environmental Quality Guideline (FEQG; 0.78 µg/L) in the upper case (0.8 and 0.85 µg/L in July and August; Table 6.7-35). The concentrations are up to 1.1 times the FEQG. A similar situation occurs with the PC far field location, wherein cobalt concentrations are predicted to range between 0.8 to 0.84 µg/L in July and August (upper case; Table 6.7-39). Additional water quality modelling was conducted to confirm hardness levels in the receiving environment, following effluent release. his modelling indicates that hardness in the near field receiving environment is predicted to increase to 11.4 mg/L $CaCO_3$ in the PC upper case. These hardness levels are also predicted for the far field location. The FEQG considers hardness as a modifying factor, and was derived for water hardness values ranging between 52 to 396 mg/L. The FEQG of 0.78 µg/L

represents the guideline value using a water hardness of 52 mg/L. Given that the water hardness in the near field receiving environment is predicted to be below this range, there is some uncertainty associated with the use of this guideline value. However, the SSD model developed by Environment Canada in this guideline setting approach is very conservative, and the data used in the assessment do not fit the selected model of the SSD in the lower quartile of the dataset well (see Figure 1; ECCC, 2017). This results in the estimated HC5 value being considerably lower than it should be, relative to the toxicity dataset. This indicates that the selected guideline is over predicting toxicity of cobalt, and hence, the marginal exceedances predicted are unlikely to pose a risk in the receiving environment. In addition, Dissolved Organic Carbon (DOC) is an additional modifying factor for cobalt toxicity (Stubblefield et al., 2020). This factor was not considered in the development of the FEQG, and would assist in mitigating potential for toxicity, based values that cobalt is largely non-detect in the baseline data, at a detection limit of 0.4 µg/L (Table 6.7-12). The predicted concentrations have been added to a mean value which may be biased high due to the non-detect samples. For additional context, it is interesting to note that Stubblefield et al. (2020) published two water quality guidelines for cobalt recently as follows:

  - European-based approach and EC_{10} values and a species sensitivity distribution (SSD), yielding a median hazardous concentration for 5% of the organisms (HC5, 50%) of 1.8 µg/L; and
  - A US EPA-style approach, using EC_{20} values in a SSD to derive a final chronic value (FCV) of 7.13 µg/L (note: this approach is more relaxed than typical Canadian approaches for deriving water quality standards, and hence, it is not recommended to use this value).

Neither of these approaches used hardness, or other water quality factors as modifiers. Based on the marginal degree of exceedance, the presence of elevated DOC concentrations, and increased hardness levels associated with the release of effluent, cobalt is considered unlikely to pose a risk to aquatic life.

- **Zinc**: The predicted concentrations do not exceed the new CCME guideline for zinc (7 µg/L) in the EOM scenarios for near field or far field. Additionally, predicted concentrations do not exceed the CCME guideline for zinc in the PC scenarios for near or far field in the base case, but do in the upper case. In the near field PC scenario, upper case predicted exceedances from the pit are 7.09 and 7.39 µg/L in July and August, respectively (Table 6.7-35). In the far field PC scenario, upper case predicted exceedances are 7.05 and 7.35 µg/L in July and August, respectively (Table 6.7-39). The Lowest observed effect concentration (LOEC) listed in the CCME (2018) fact sheet is 9.89 µg/L (11-week study; development; Chironomid sp.; normalized to 50 mg/L $CaCO_3$ and Dissolved Organic Carbon (DOC) of 0.5 mg/L). The predicted concentrations are within the range of background (<5 to 7.8 µg/L; based on sample size N=15). The waters of the Killag River are soft (<10 mg/L $CaCO_3$), but the DOC is reasonably high (ranging from 7 to 20 mg/L; mean of 12.2 mg/L, based on 2019 and 2020 data), and would be expected to provide adequate protection, for several of the months where predictions indicate elevated levels. Additional water quality modelling was conducted to confirm hardness levels in the receiving environment, following effluent release. This modelling indicates in the PC base case, hardness in the near field receiving environment is predicted to increase to 11.4 mg/L $CaCO_3$ in the PC upper case. These hardness levels are also predicted for the far field location. Based on these hardness levels, and accounting for site specific pH and DOC, the zinc guideline changes to 33 µg/L (based on an assumed mean hardness: 11.4 mg/L; mean pH: 5.43; mean DOC: 12.2 mg/L). None of the predicted concentrations exceed this guideline value, and hence, predicted zinc concentrations are considered to have a low potential for toxicity.

The site will be monitored during construction and operations. The outcomes from the modelling will inform updates to water quality model to refine PC predictions. The principals of adaptive management will be applied if the outcomes from modelling differ from those predicted.

In response to IR2 issued by Canadian Environmental Assessment Agency and Nova Scotia Environment, and as a result of ongoing water quality, water quantity and geochemical studies for the Project, water treatment for both EOM and PC is planned

for the Project. Details for water management and evaluation of water treatment alternatives are presented (F.1 [Water Treatment Assessment Post-closure of Appendix P.4 Mine Water Management Plan, Appendix]). Note, the treatment system will be designed to ensure that all site effluent water meets MDMER and will reflect assimilation capacity of the receiving environment, such that any potential effects to the Surface Water Quality VC, and downstream water users, will be fully mitigated.

Touquoy Surface Water Quality

Based on the water balance model results (Appendix A of Appendix P.4 [Mne Water Management Plan]), no water will be discharged from the exhausted Touquoy open pit until the pit reaches the spillway elevation in Year 12. This allows for many years of water treatment in the pit as a batch reactor with the objective of adjusting the pH to precipitate metals, potentially improving discharge criteria toward MDMER discharge criteria. As an additional benefit of the slow filling of the pit over time, the residence time and exposure to the atmosphere will increase, thus enhancing the natural UV degradation of cyanide and improving water quality in the pit lake.

The water quality in the Touquoy open pit will be monitored during the pit filling and as the pit level approaches the spillway elevation. The water quality will be compared to the MDMER discharge limits and will be treated as required to meet these limits. The MDMER discharge limits will decrease from the existing limits to those presented in Table 6.7-15 effective June 2, 2021. The discharge from the Touquoy Mine Site is anticipated to occur after this period, and therefore the lower MDMER limits will apply.

The water quality model of Moose River predicts the effluent concentrations under normal discharge from the Touquoy open pit combined with the groundwater seepage contributions in Moose River under the same climate conditions. Moose River will primarily be driven by climatic conditions, and April flows were selected in the modelling to represent a worst-case dilution ratio between the effluent discharge from the Touquoy open pit and Moose River. This results in conservatively higher estimates of mass loadings to the receiving environment from the Project.

It is important to note that the NS Tier 1 guideline of 5 µg/L (which is based on the CCME guideline), is for free cyanide. This guideline is not a relevant guideline to compare Total cyanide, SAD or even WAD forms of cyanide to, as it is based on the free ion, as opposed to bound forms of cyanide, which have far lower toxic potential. Based on the receiving environment predictions, WAD cyanide is approximately half of the Total Cyanide predicted concentration (0.0032 mg/L WAD, compared to 0.0074 mg/L Total). This implies that the half of the Total Cyanide prediction would be SAD, and hence, less likely to dissociate in the receiving environment (mean pH in receiving environment is 6.05). Predicted WAD concentrations in the receiving environment are below the NS Tier 1 guideline, indicating acceptable levels of risk to aquatic life. Based on this, risk to aquatic life are predicted to be low.

Predicted cobalt levels in the receiving environment (0.0011 mg/L) marginally exceed the new FEQG for cobalt (0.00078 mg/L), but are less than the NS Tier 1 cobalt value of 0.01 mg/L. The FEQG considers hardness as a modifying factor, but the SSD model developed by Environment Canada in this guideline setting approach is very conservative, and the data used in the assessment do not fit the selected model of the SSD in the lower quartile of the dataset well (Figure 1; ECCC, 2017). This results in the estimated HC5 value being considerably lower than it should be, relative to the toxicity dataset. This indicates that the selected guideline is over predicting toxicity of cobalt, and hence, the marginal exceedance is not considered to represent a concern, with respect to toxicity to aquatic species. Cobalt concentrations are predicted to decrease to 0.0010 mg/L by 120 m from the effluent discharge point (Appendix F.8, Table 10 [Project Assimilative Capacity Study of Moose River - Touquoy Open Pit Discharge]), which is 0.1 ppb above the guideline. Risks to aquatic life at this concentration are anticipated to be low (Appendix G.2).

Touquoy Surface Water Quantity

The use of the exhausted Touquoy facility for tailings storage will result in the accelerated filling of the pit from that of the Touquoy reclamation plan.

Based on a three-dimensional model of the Touquoy ore body presented in the water and tailings management plan (Appendix F.7 [Touquoy Integrated Water and Tailings Management Plan]), the total storage capacity of the exhausted open pit at the maximum surface water elevation of 108 m CGVD2013 is estimated at 8.962 Mm^3. The water balance model predicted the amount of water and tailings stored in the pit until the pit was filled to 108 m CGVD2013. Based on results of the water balance model and the derived elevation storage relationship, tailings will be deposited in the open pit for a total of 41 months reaching an elevation in the pit of 93.2 m CGVD2013. This amounts to approximately 14.8 m of water cover above the tailings, assuming the spillway invert elevation of 108 m CGVD2013. The water balance model simulated that it would take an additional 100 months or a total of 141 months from commencement of operation to fill the pit to the spillway invert elevation.

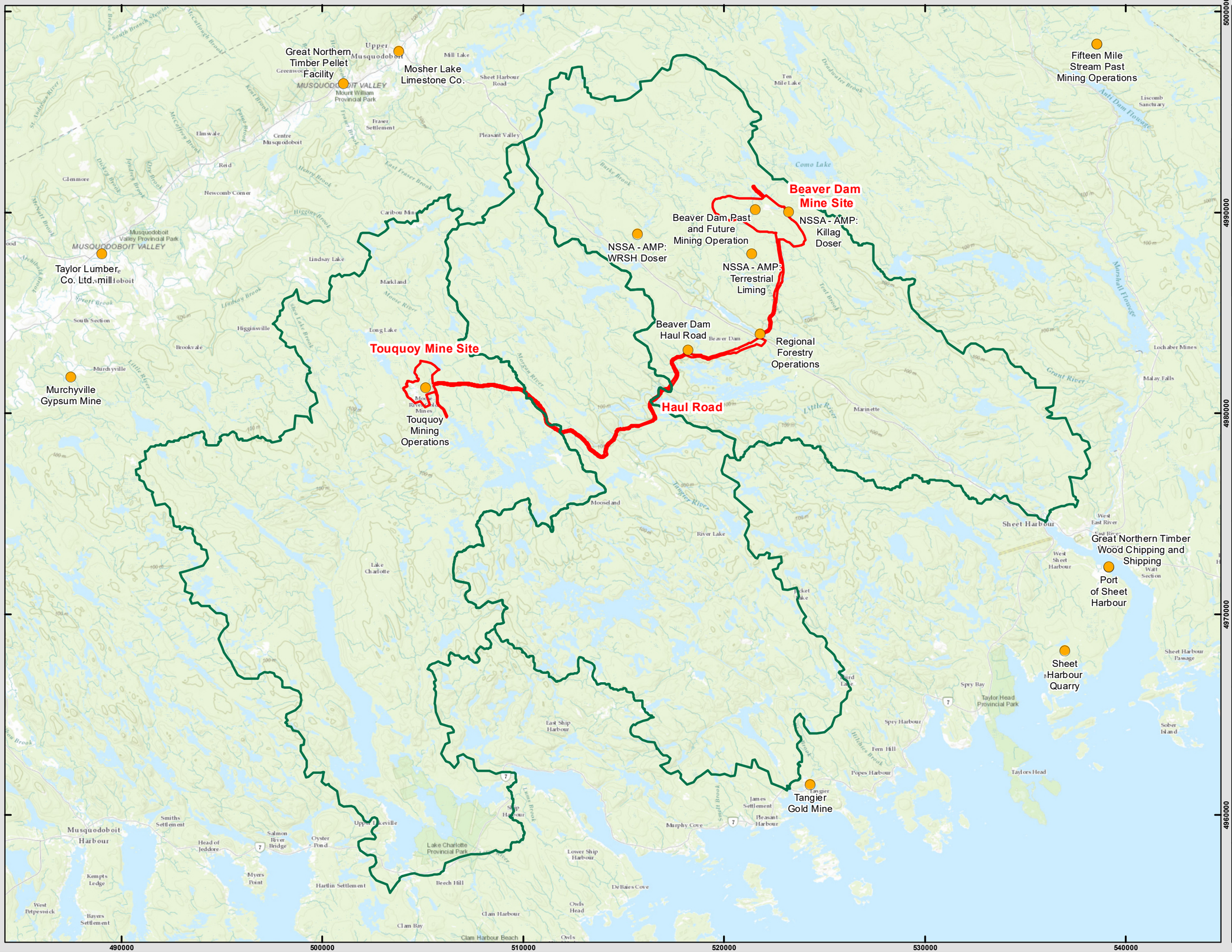
Initially, process water will be reclaimed at a rate of 8,960 m^3/d from the existing Touquoy TMF until surplus water storage in the pond is depleted. Based on results of the water balance model under climate normal conditions, three to five months of process water surplus will be available depending on the month of start-up. Subsequently, process water will be reclaimed from the exhausted Touquoy open pit at the same rate, recirculated as a closed loop through the mill facility during the remaining period of processing Beaver Dam ore at the Touquoy facility. As the current practice at Touquoy, this water management strategy reduces the quantity of mine contact water or the at the site and a lower demand on freshwater supplies.

8.5.4.2.2 Effects of Other Projects in the Area

The RAA for surface water quality and quantity, and projects which fall within this RAA are shown on Figure 8.5-4. There is direct spatial overlap between the Project and historic mining operations in the Beaver Dam Haul Road, Touquoy Mine Site, regional forestry operations and the NSSA AMP. Any potential cumulative effects from these projects related to surface water would be based on potential impacts to water quality from mobilization of historic tailings. The potential impact of this interaction will be mitigated by implementation of the Historical Tailings Management Plan (Appendix E.9). As such, these historic operations are not carried through the CEA process.

Regional forestry operations

The local forestry industry has the potential to have cumulative effects on surface water. As the forestry industry is ongoing in the region and has been for many decades, its effects on surface water quantity and quality are already accounted for in the local baseline conditions. Furthermore, in Nova Scotia forestry operations are regulated under the *Wildlife Habitat and Watercourse Protection* regulations, which imposes various restrictions on timber harvesting with the purpose of limiting impact of forestry on aquatic habitats. Presuming forestry operators adhere to these regulations, the likelihood of a cumulative effect on surface water from timber harvesting and the Project is limited.



Prepared For:

Atlantic Gold

FIGURE 8.5-4

Beaver Dam Mine Project

Cumulative Effects Assessment: Surface Water Quality and Quantity & Fish and Fish Habitat

- Projects Evaluated in the Cumulative Effects Assessment
- Project Area
- Aquatic Regional Assessment Area

Note: Forestry operations occur throughout the RAA and are not displayed on this figure

Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 2.5 5 10 km

1:175,000 Scale when printed @ 11" x 17"

Drawn By: EP
Date: 2021-02-28
Reviewed By: KR

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

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Document Name: BD_EIS_Figure8-4-X_CEA_SW_Fish

NSSA Acid Mitigation Project

The NSSA AMP operates three main components. Two lime dosing stations are located on the West River Sheet Harbour and on the Killag River, downstream of Cameron Flowage. Neither of these components have direct spatial overlap with the Proposed Project, although the dosing station on the Killag River is approximately 650 m southeast of the proposed pit. Despite its close proximity to the proposed Project; the spatial extent of direct and indirect impacts to fish and fish habitat does not extend to this portion of the Killag River, as specified in Section 6.9.7.1.6.

Terrestrial liming has occurred within the Paul Brook, Keef Brook and Tent Lake watersheds. According to Rotteveel (2018), terrestrial liming occurred in MacGregor Brook and Colwell Brook during the fall of 2016, with some expected 'blowout' from helicopter liming affecting Cope Brook as well. The upper portion of the Killag River (above the lime dosing station) and Brandon lake Brook were used as control sites for this study. On September 25, 2019, MEL and AMNS met with the NSSA and ASF to discuss the second round of information requests related to the Project. During that meeting, it was stated that the NSSA would be commencing terrestrial lime application in the Tent Lake watershed; but indicated that terrestrial liming would not occur in proximity to the proposed organics stockpile until 2020. Of the three watersheds where terrestrial liming is known, or expected to have occurred, the Project only has a spatial overlap with the Tent Lake watershed (1EM-2-F) and the Keef Brook watershed (1EM-2-G). According to Rotteveel (2018), acidification of Nova Scotia's freshwater ecosystems has resulted in decreased habitat quality for Southern Uplands Atlantic Salmon, due in part to the mobilization of aluminum which has been mobilized due to low pH.

The residual effect of the NSSA AMP on surface water quality, is a positive due to reduction of the effect of historic acidification on water quality within the treated catchment areas of the West River Sheet Harbour watershed. This Project is defined as having direct spatial and temporal overlap with the Beaver Dam Project specifically within the Tent Brook watershed (Project effects related to low magnitude flow reductions), and to a lesser extent, the Keef Brook watershed (Project effects related to Haul Road construction).

Touquoy Gold Project

The effects of the Touquoy Gold Project on surface water include (based on CRA 2007a and GHD 2017b):

- Reduced water quality from sedimentation/siltation, deposition of fines during construction, operation and decommissioning;
- Introduction of contaminants (e.g., nitrate) from blasting operations and pit dewatering;
- Effluent released into Scraggy Lake from the tailings and polishing ponds;
- Water withdrawal from Scraggy Lake; and
- Potential impact to surface water quality from spills of hazardous materials stored on site during mine construction and operation.

Given the implementation of mitigation measures to control erosion and sedimentation, significant adverse effects from operation of the Touquoy Gold Project are not anticipated on surface water resources. The Touquoy Gold Project currently holds an Industrial Approval for water withdrawal, permitting withdrawal of up to 720 m^3 per day, to a maximum of 262,800 m^3 annually from Scraggy Lake (Approval #2017-103502-01). Treated effluent is released form the polishing pond into Scraggy Lake, with monitoring completed under the EEMP to ensure compliance with MDMER.

The discharge of treated mine effluent is controlled by MDMER regulations. The effluent must meet the limits put in place to protect the aquatic environment and the effects monitoring program will ensure that operational discharges are compliant. Therefore, no significant adverse effects on surface water resources from tailings effluent on Scraggy Lake are expected. Water monitoring

completed under the EEMP for release of water to Scraggy Lake, and authorization for water withdrawal, it Is not expected that the Touquoy Gold Project results in a significant adverse effect to aquatic resources in Scraggy Lake.

Touquoy Gold Project and Beaver Dam Mine Project- deposition of tailings in Touquoy exhausted pit

The Proponent proposes the operation and closure of a tailings management facility in the exhausted Touquoy pit developed for the Touquoy Project. Tailings from the processing of ore or ore concentrates from four deposits at the Touquoy mill are proposed to be disposed of in the Touquoy pit. These include the processing of lower grades of ore stockpiled for the Touquoy Project, processing of ore transported from the Beaver Dam Mine Project (the Project), and processing of ore concentrates from the Fifteen Mile Stream Gold Project and Cochrane Hill Gold Project.

The total capacity of the expanded Touquoy pit at the proposed spillway elevation of 108.0 m is 11.83 million cubic metres (Mm^3). This is sufficient to store tailings using subaqueous deposition. Considering subaqueous deposition, the exhausted Touquoy pit can accommodate the estimated total deposited volume of 7.91 Mm^3 based on an average tailings density of 1.3 tonnes per cubic metre (t/m^3) from the four projects (Appendix F.10).

Modelling conducted for the Beaver Dam Mine Project simulates the filling of the Touquoy pit with tailings, which are assumed to have a hydraulic conductivity of 1×10^{-6} m/s (Appendix F.6). The volumes of tailings disposed of in the Touquoy pit are the only important difference between the groundwater models prepared for the Beaver Dam, Fifteen Mile Stream, and Cochrane Hill projects.

In addition to the deposition of tailings from the Beaver Dam, Fifteen Mile Stream, and Cochrane Hill projects, an expansion of the Touquoy open pit is proposed to extract additional high-grade ore. Groundwater modelling was conducted to assess the dewatering of the expanded open pit (Appendix F.6). This model forms the basis of the modelling for the cumulative effects, following the scenarios generally described in Appendix F.6.

The cumulative effects of the various projects on groundwater are simulated through the deposition of tailings in the expanded Touquoy open pit. The processed tailings were assumed to share the same source terms for the prediction of downstream groundwater quality effects. These source terms are based on the geochemical testing conducted on the Touquoy tailings (Appendix E.3).

Cumulative Conclusions (Water Quality) (provided in Appendix E.3):

- The water quality modelling considered the pore water quality in the tailings and the pit floor/ walls, the dilution from surface runoff, direct precipitation in the pit and the water quality of the mixture based on the geochemistry of the individual water quality parameters using source terms presented by Lorax (as described in Appendix E.3). The geochemical source term predictions of pore water quality of pit walls/floor had elevated metal (e.g., arsenic, cobalt, copper), ammonia, nitrate and cyanide concentrations thus reducing pit lake water quality at the time of discharge.
- The updated water quality modelling presented in Section 3 of Appendix E.3 shows that the pit lake is simulated to reach the spillway elevation in March of Year 9 of the operation of the expanded Touquoy pit for tailings disposal. The corresponding water quality model predicted elevated concentrations of arsenic, cobalt, copper, nitrate, nitrite as summarized in Table 4.1 not considering planned water treatment.
- Water quality that is predicted to exceed the MDMER discharge limits will be treated prior to discharge. The pit lake will be treated to meet MDMER discharge limits for an existing mine prior to discharge to Moose River. As the pit lake is simulated to take about 10 years to fill from commencement of tailings deposition in the exhausted Touquoy pit, the final water treatment design will be fully developed during operation and pit filling.
- As presented in the assimilative capacity study of Moose River by Stantec (Appendix F.8), the effluent concentrations under normal discharge from the filled exhausted Touquoy pit, combined with the groundwater seepage contributions in Moose

River under the same climate conditions are predicted. Moose River will primarily be driven by climatic conditions, with April flows representing a worst-case dilution ratio between the effluent discharge from the exhausted Touquoy pit and Moose River. Based on results of the assimilative capacity model (Appendix F.8), once mixed with the background water quality in Moose River, the concentration 100 m downstream of SW-2 is predicted to be 0.0238 mg/L for arsenic and 0.184 for aluminum. Although the simulated arsenic concentration is above the NSE Tier 1 and CCME guidelines of 0.005 mg/L, the background levels at SW-2 also exceed the guidelines at 0.018 mg/L. The aluminum concentration is predicted below the 75th percentile receiver quality in Moose River.

- An assessment of the potential environmental effects of elevated arsenic in the downstream environment in Moose River are presented in Appendix G.2 and the cumulative effects of operating the four projects are not likely to result in adverse arsenic concentrations for the existing aquatic environment.
- Groundwater seepage discharging to Moose River will be consistent between scenarios and therefore groundwater quality predictions are also consistent with the Beaver Dam project.

Cumulative Conclusions (Water Quantity) (provided in Appendix F.10):

- The potential effect of the addition of tailings from Touquoy, FMS, Beaver Dam and Cochrane Hill Projects to the Touquoy Pit has been outlined in Appendix F.10. Tailings will be deposited in the exhausted Touquoy pit for a total of 47 months reaching an elevation in the pit of 94.0 m CGVD2013. As presented in the Touquoy Gold Mine Project Reclamation Plan (Stantec 2017), the inflow of groundwater, surface runoff and precipitation into the pit will naturally create a lake upon closure of the site. The water balance model simulated that it would take an additional 48 months or a total of 95 months from commencement of tailings deposition in the exhausted Touquoy pit to fill the pit to the spillway invert elevation.
- The proposed Touquoy pit extension and subsequent tailings deposition from all four deposits has been evaluated (Appendix F.10). Based on results of the water balance model, process water can be reclaimed from the TMF for approximately three to seven months depending on the climatic conditions and with no water discharged to the effluent treatment plant during this time to maintain the reservoir supply. When the TMF pond volume is no longer adequate for process water supply, process water will be reclaimed from the Touquoy pit as a closed loop, with the exception of freshwater make-up from Scraggy Lake.
- Water supply in the Touquoy pit is adequate for operation of the Project under normal and wet climate conditions, considering the 5.8% fresh water make-up from Scraggy Lake. Should operation commence under dry climate conditions, there will be little water available in the TMF for reclaim and insufficient time to store water in the Touquoy pit prior to start-up. The water balance simulated a water deficit under dry climate conditions that would require takings exceeding the permitted water volume from Scraggy Lake for Touquoy operation. Therefore, under dry climate conditions or based on the operational requirements of pumping infrastructure, start-up water in the Touquoy pit may be supplied from Scraggy lake (subject to provincial permitting) and/or effluent from the effluent treatment plant.
- As mill production rates are simulated to remain consistent throughout the processing of ores from all projects, the existing Touquoy reclaim water lines and tailings slurry lines are anticipated to be adequate both in capacity and length for continued ore processing. Additional lift booster pumps may be required to reclaim water from the Touquoy pit. Methods for tailings deposition in the Touquoy pit will differ during cold and mild climatic conditions and the tailings deposition progress should be monitored and updated as more information becomes available.

8.5.4.2.3 Cumulative Effects on the Surface Water Quality and Quantity

The use of the Touquoy processing plant and waste disposal systems by the Beaver Dam Mine Project (2023 to 2027), the Project (2023 to 2029), and the Cochrane Hill Gold Project (2025-2030) extends the period in which effects to the surrounding surface

water (both Scraggy Lake and the Moose River) may occur by up to 8+ years. Water withdrawal from Scraggy Lake may be required to be extended for the life of the Beaver Dam, FMS and Cochrane Hill Projects. An extension to the existing approval will be requested by the Proponent. Incremental effects to surface water quantity at Scraggy Lake is not expected, due to the extended withdrawal period and small daily operational water withdrawal needs in comparison to the large size of the lake. Water will also be recycled from the exhausted Touquoy pit when sufficient supply is available. However, with the application of the mitigation measures proposed for the operation of the site for both projects, the residual effects of both projects are predicted to be not significant.

The cumulative effect of the combined projects could mean a reduction in the streamflow from Scraggy Lake to the Fish River system; however, assuming that the rate of withdrawal is consistent with current needs of the project, then it has been shown that the withdrawal from Scraggy Lake is sustainable given the current level of inputs to the watershed. The cumulative effects of the three projects using the Touquoy processing facilities and the Touquoy Gold Project itself are therefore also expected to be not significant. There is some uncertainty as to the effects assessments for these projects. These would be addressed through the monitoring and follow-up programs established for the Project (Section 6.6.9).

No surface water will be discharged from the exhausted Touquoy pit to Moose River until the pit reaches the spillway elevation in Year 10 of the Project. Water withdrawal from Scraggy Lake will require to be extended to process ore associated with the Project. As the pre-development and post-development catchment areas draining to the ultimate discharge location at Moose River are similar, Moose River is capable of handling the resultant flow. No cumulative effects to surface water quantity in the Moose River are predicted. Modelling for the cumulative scenario (all four projects tailings deposition into the exhausted pit) predict water levels in the pit will reach the spillway elevated in 10 years.

The use of the Touquoy processing plant and waste disposal systems by the proposed extension of the Touquoy pit and deposition of these tailings into the exhausted pit, the Beaver Dam Mine Project, the Fifteen Mile Stream Project, and the Cochrane Hill Gold Project have been modelled (Appendix F.10) and predict the same conclusions relating to surface water quality in the receiving environments (Moose River) as that described in Section 6.7 for the Project. The potential effects of these projects to surface water quality in the receiving environment will be mitigated by a commitment to treat effluent to MDMER discharge limits and water quality objectives prior to release and a commitment to acceptable water quality in the receiving environment that is protective of aquatic health.

8.5.4.3 Mitigation

The effects of each project with the potential to result in a cumulative effect to surface water all require a suite of mitigation to ensure compliance with MDMER, and water quality objectives. Through monitoring and aquatic effects assessment, there is no expectation that these projects will result in a cumulative adverse effect to fish and aquatic species. As the potential effects are limited to the area surrounding the Project's LAA, no mitigation measures beyond those already presented to mitigate Project effects (Section 6.6.7) are warranted.

8.5.4.4 Residual Cumulative Effects and Significance Assessment

The thresholds for the determination of significant effects to surface water quality and quantity are thoroughly defined in Section 6.7, but it includes an effect to water quantity or quality that is high magnitude, regional geographic extent and medium to long term duration, and be partially reversible or irreversible. Overall, the residual cumulative effects are considered to be not significant (Table 8.5-5).

Table 8.5-5: Residual Cumulative Environmental Effects for Surface Water

Residual Adverse Cumulative Effects (After Mitigation)	Significance Levels						Overall Significance of Residual Adverse Effects (and Rationale)
	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	
Potential for residual cumulative effects to all surface water systems within each RAA (Touquoy Mine Site and Beaver Dam Mine Site).	L With mitigation strategies, predicted receiver concentrations are predicted to be greater than guidelines and increase by greater than 10% over baseline levels, but remains well within the observed range of natural variation (25th to 75th percentile baseline water quality).	LAA Cumulative effects are confined to the LAA.	A Cumulative effect would be more significant during low flow conditions and/or sensitive spawning windows.	LT Effects may extend beyond 7 years.	R Effects will occur at regular intervals throughout operations.	PR Mitigation cannot guarantee a return to baseline conditions.	Minor Adverse Effect (Not Significant) Given implementation of proposed mitigation methods, no significant adverse cumulative effect is expected.

Legend (refer to Section 5.11, Table 5.11-1 for definitions)

Magnitude		Geographic Extent		Timing		Duration		Frequency		Reversibility	
N	Negligible	PA	Project Area	N/A	Not Applicable	ST	Short-Term	O	Once	R	Reversible
L	Low	LAA	Local Assessment Area	A	Applicable	MT	Medium-Term	S	Sporadic	PR	Partially reversible
M	Moderate	RAA	Regional Assessment Area			LT	Long-Term	R	Regular	IR	Irreversible
H	High					P	Permanent	C	Continuous		

8.5.4.5 Follow-up and Monitoring Programs

No additional follow-up or monitoring beyond that presented in Section 6.6.9 is warranted.

8.5.5 Fish and Fish Habitat Cumulative Effects Assessment

In response to NSE-IR-123, the Proponent has determined that an ecosystem-based approach to the spatial boundary determination is the most appropriate to identify cumulative effects to fish and fish habitat. The spatial boundary determination is based on the VC geographic range and the zone of influence (ZOI) for that VC. The ZOI sets a spatial limit beyond which the residual effects of the Project on a VC are not detectable. For all aquatic VCs, the secondary watershed boundary (West River Sheet Harbour, 1-EM-2) has been selected as the appropriate spatial boundary (ZOI, or regional assessment area) for the Beaver Dam Mine Site (plus the Tangier River and Fish River-Lake Charlotte secondary watersheds for the Haul Road and Touquoy Mine Site). Based on the pathways of effects to fish and fish habitat, the spatial boundary for the CEA followed the ecosystem-based approach. This approach is supported by the CEA methodology guidance document (CEAA 2016).

While the Southern Upland (SU) Atlantic Salmon range encompasses the entire southern coast of Nova Scotia, from Canso through to Cape Split in the Bay of Fundy, Gibson et al. (2009a,b) state that they have very "precise homing to natal streams [which] restricts gene flow among fish at different spawning locations". They continue to state that "this can lead to local adaptation and dissimilarities in life-history characteristics among fish inhabiting geographically distinct or environmentally distinct rivers". Given that salmon return to natal rivers, the probability of a Project in one watershed or natal stream affecting a population in another natal stream is very low. Fish from each natal stream would experience the same effects in the marine environment, but effects to salmon from inland projects do not have a pathway of effect from one watershed to the next.

The determination of the secondary watersheds as the appropriate scale for the CEA (rather than the entire SU Atlantic Salmon range) is supported by the CEA methodology in another manner. The CEA methodology states that "adopting a large spatial area may lead to misinterpreting the incremental cumulative effects of the project as being insignificant relative to everything else that is affecting the VC in that region, i.e., negligible. If the Regional Assessment Area (RAA) were to be expanded to incorporate the entire range of the SU Atlantic salmon, it would necessitate inclusion of all marine effects, which present substantial threats to the recovery of the Atlantic salmon, negating the incremental effects of land-based Projects.

The salmon's return to natal streams and the incremental cumulative effect of the project being insignificant relative to everything else when adopting a large spatial area (i.e., negligible effect) justifies the determination of the secondary watershed as the appropriate spatial boundary for the CEA of fish and fish habitat. Therefore, the CEA focuses on identifying cumulative effects of projects within the defined RAA.

8.5.5.1 Baseline conditions

8.5.5.1.1 Fish Habitat

Beaver Dam Mine Site

Watercourses, waterbodies and wetlands within the PA are known to support various life stages of 12 species of fish. Within the Beaver Dam Mine Site, the quality of the habitat is generally limited by low pH in small, first order streams. The majority of habitat proposed for direct alteration is limited to an anthropogenic, shallow open water wetland complex (3.7 ha of open water), created in the 1980's to support mining activities. Indirect effects to fish habitat are anticipated; primarily related to flow reduction. The Beaver Dam Mine Site is located adjacent to Cameron Flowage/Killag River, a tributary to the West River Sheet Harbour. Both the West River and the Killag River are known to support Southern Uplands Atlantic Salmon. Historic effects of acid rain have reduced

habitat quality for Atlantic Salmon; as a result, the Nova Scotia Salmon Association has implemented a three-pronged Acid Mitigation project, which includes two lime dosing stations and a terrestrial liming program. Preferred Atlantic Salmon habitat within and in proximity to the Beaver Dam Mine Site is confined to the main bodies of the Killag River/Cameron Flowage.

Development of the Beaver Dam Pit and associated mine infrastructure will result in direct loss of fish habitat within the proposed pit and associated site infrastructure. Smaller impacts are expected within watercourses intersected by the Haul Road, to facilitate upgrades to the existing road and associated culverts. A Fish Habitat Offset Plan and Habitat Bank: Preliminary Design (Offset Plan; Appendix: J.3) has been developed to compensate for loss of fish habitat. Site infrastructure has been micro-sited for fish habitat avoidance wherever practicable. A *Fisheries Act* Authorization will be required for the Project.

Touquoy Mine Site

Moose River, which runs along the western extent of the Touquoy Mine Site, was determined to provide habitat for Atlantic salmon and brook trout during surveys conducted in 2005 as part of the Environmental Assessment (CRA, 2007a). Atlantic salmon (juveniles) were observed and suitable rearing and potential spawning habitat is available for the species. It was presumed that the Atlantic salmon observed were landlocked due to their proximity to a known landlocked population within Scraggy Lake. American Eel, White Sucker, and various forage fish species were also observed in Moose River. Although not observed, surveys determined that there is good adult and juvenile Brook Trout feeding habitat, fair rearing habitat, and potential spawning habitat available within Moose River (CRA, 2007a).

8.5.5.1.2 Fish Species

Beaver Dam Mine Site

A desktop review was conducted for fish species within major watercourses and waterbodies within the SA. The West River Sheet Harbour, contiguous with the Killag River, is known to support Atlantic salmon, brook trout, American eel, brown bullhead, yellow perch, lake chub, creek chub, banded killifish, ninespine stickleback, golden shiner, and white sucker (Halfyard, 2007; NSFA, 2016). The Morgan River located near the south end of the Haul Road within the Tangier River secondary watershed, is known to support white sucker, brook trout, white perch, yellow perch, banded killifish, rainbow trout, American eel, golden shiner, sticklebacks, alewife, northern redbelly dace, and brown bullhead (Alexander, Kerekes, & Sabean, 1986).

A portion of the Haul Road lies within the Tangier River secondary watershed. Fish species known to occur within this watershed include white sucker, brook trout, white perch, yellow perch, banded killifish, rainbow trout, golden shiner, stickleback sp., alewife, northern redbelly dace, and brown bullhead (Alexander et al, 1986). Nova Scotia Fisheries & Aquaculture (2019) have also recorded common shiner and smallmouth bass in this watershed. Atlantic salmon are considered extirpated from the Tangier River (DFO, 2009).

Fish surveys were completed throughout the PA within the Beaver Dam Mine Site and Haul Road through 2015-2020. Methods employed include electrofishing, minnow traps, eel pots, fyke nets and eDNA (using a non-species-specific primer called eFish). During 2015-2017, 145 individuals representing 10 species were identified within the Beaver Dam Mine Site and Haul Road – 84 individuals across nine species were captured within the Beaver Da Mine Site, while 61 individuals representing seven species were identified in watercourse along the Haul Road. In 2019-2020, the level of fishing effort was increased within the Beaver Dam Mine site, and a total of 1732 individuals representing 11 species were identified. Species identified during all surveys include Atlantic Salmon, American Eel, Banded Killifish, Brook Trout, Brown Bullhead, Creek Chub, Golden Shiner, Lake Chub, Ninespine Stickleback, Northern redbelly Dace, White Sucker and Yellow Perch. Atlantic Salmon was identified only within the Killag River, downstream of the NSSA lime dosing station.

Touquoy Mine Site

Fish observed from 2006 electrofishing surveys of Moose River as part of the EARD include; American Eel, White Sucker, and various forage fish (CRA 2007a). Further aquatic baseline studies completed by Stantec Consulting Ltd. In 2017 and 2018 confirmed presence of alewife, American eel, Atlantic salmon, banded killifish, brown bullhead, brook trout, golden shiner, lake chub, lake trout, white perch, white sucker and yellow perch.

8.5.5.2 Analysis of Effects

8.5.5.2.1 Residual Effects of Proposed Project

The development of the proposed open pit within the Beaver Dam Mine Site will require direct impact to open water wetland habitat within wetlands 59 and 56, along with several small tributaries to support construction of associated mine infrastructure. Direct impacts to fish bearing habitats are expected along the Haul Road to allow for widening of the existing Haul Road and construction of an ATV Bypass Road. For the most part, this involves upgrades to an existing road and culverts (many of which are improperly installed based on current watercourse crossing standards), though one section of the Haul Road will require new construction. The Project is expected to result in indirect effects to fish habitat, primarily through reduction in flows from groundwater interaction and collection of surface water to allow for treatment prior to release. Indirect impacts to fish habitat is described in detail in Section 6.9.7.1.2.

The impacted area includes open water wetland habitat within the proposed open pit. This habitat was anthropogenically formed by construction of a berm during the 1980's to support historic mine activity. Other habitats propose for direct impact within the Mine Site includes small, first order streams, which are typically limited in habitat quality by low pH and/or high summer temperatures. The pit development and associated fish habitat loss is considered an unavoidable impact of the Project development. The development of site infrastructure, primarily the pit is anticipated to result in a total direct impact area of 4.18 ha of fish habitat. Extensive work has been completed to revise the site infrastructure layout to avoid direct impacts to fish habitat. Direct impact to fish habitat is described in Section 6.9.7.1.1. Further to the efforts to avoid impacts to fish habitat, mitigation measures are described in Section 6.9.8.1. Mortality is anticipated to be low, given the implementation of appropriate mitigation measures, such as a fish rescue prior to the completion of construction. The fish rescue plan is outlined in Section 6.9.8.2.2. Finally, an offset plan has been developed to compensate for both direct and indirect impacts to fish habitat, as required under the *Fisheries Act* (described in Section 6.9.8.3, attached in Appendix J.3).

Indirect effects to fish habitat have been evaluated through a series of pathways, including water quality effects, groundwater interactions, blasting and surface water interactions. Through this evaluation, it was determined that effects to fish habitat are of low magnitude; and not anticipated to require authorization under the *Fisheries Act*, with the exception of reduction in surface flow in four watercourses. The detailed evaluation of indirect impacts to fish is outlined in Section 6.9.7.1.2.

Based on reduced flow comparisons to DFO framework for ecological flow, it was determined that reductions in four watercourses would have a moderate probability of detectable impacts to ecosystems that support fisheries. Flow reduction is anticipated due to drainage area and/or baseflow reductions in Crusher Lake Outflow (WC-5), South Tributary (WC-23), West Tributary (WC-26), and Mud Lake Outflow (WC-27). Although the actual area of reduced wetted channel due to the flow reductions is quantified at 322.41 m^2 we have quantified a much larger area as potentially altered. Through discussion with DFO the entire area below 30% MAD (approximately 7,728.88 m^2) is considered potentially altered due to uncertainty associated with extreme low flow and physicochemical habitat parameters. The amount of this habitat considered harmfully altered with be determined with DFO during the fisheries authorization process and is expected to be reduced or require less offsetting given that the habitats are expected to maintain the ability to support the existing fish communities.

Direct and potential indirect impacts to fish habitat are expected to require authorization under the *Fisheries Act*, and both are incorporated into the draft Fish Habitat Offset Plan (Appendix J.3).

The maximum expected spatial extent of direct and indirect effects to fish and fish habitat is shown on Figure 6.9-5. This includes direct impacts to fish habitat within the Beaver Dam Mine Site and Haul Road, and indirect impacts to watercourses 5, 23, 26 and 27 related to flow reduction. Water quality modelling shows compliance with all applicable guidelines at the North Settling Pond effluent release point within the 100 m mixing zone.

8.5.5.2.2 Effects of Other Projects in the Area

The RAA for fish and fish habitat, and projects which fall within this RAA are shown on Figure 8.5-4. There is direct spatial overlap between the Project and historic mining operations in the Beaver Dam Mine Site and the Touquoy Mine Site. Any potential cumulative effects from these projects related to surface water would be based on potential impacts to water quality from mobilization of historic tailings. The potential impact of this interaction will be mitigated by implementation of a Historical Tailings Management Plan (Appendix E.9). As such, these historic operations are not carried through the CEA process. Additional overlapping projects include regional timber harvesting, Haul Road usage, and the NSSA Acid Mitigation Project (specifically the terrestrial liming component of their project). Timber harvesting is not expected to result in adverse cumulative effects to fish and fish habitat, provided timber harvesters adhere to the Watercourse and Wildlife Habitat Protection Regulations.

Regional Forestry Operations

Forestry operations have been ongoing through the region for many decades. As such, the effects of these operations are included in the baseline conditions. Forestry operators are obliged to follow provincial *Wildlife Habitat and Watercourse Protection* regulations, which provide restrictions to timber harvesting with the purpose of protecting wildlife habitat and water quality. Presuming forestry operators adhere to these regulations, the potential for cumulative impacts occurring where the Project and forestry operations overlap is minimal.

Touquoy Gold Project and Beaver Dam Mine Project- deposition of tailings in Touquoy exhausted pit

The deposition of tailings from the Project, the proposed use of the exhausted pit for Touquoy tailings deposition, the FMS Project and the Cochrane Hill Gold Project at the Touquoy Mine Site has potential to affect water quality in the receiving environment (Moose River), and ultimately the fish and other aquatic organisms which inhabit it. The effect of tailings deposition on surface water quality in the receiving environment is described in Section 6.7, and the potential cumulative effect thereof is discussed in Section 8.5.4. Overall, the residual effect of tailings deposition in the Touquoy Pit, and the potential cumulative effect is expected to be minimal, considering that treatment to meet MDMER and water quality objectives will be implemented where necessary.

NSSA Acid Mitigation Project

The NSSA AMP operates three main components. Two lime dosing stations are located on the West River Sheet Harbour and on the Killag River, downstream of Cameron Flowage. Neither of these components have direct spatial overlap with the Proposed Project, although the dosing station on the Killag River is approximately 650 m southeast of the proposed pit. Despite its close proximity to the proposed Project; the spatial extent of direct and indirect impacts to fish and fish habitat does not extend to this portion of the Killag River, as specified in Section 6.9.7.1.6.

Terrestrial liming has occurred within the Paul Brook, Keef Brook and Tent Lake watersheds. According to Rotteveel (2018), terrestrial liming occurred in MacGregor Brook and Colwell Brook during the fall of 2016, with some expected 'blowout' from

helicopter liming affecting Cope Brook as well. The upper portion of the Killag River (above the lime dosing station) and Brandon lake Brook were used as control sites for this study. On September 25, 2019, MEL and AMNS met with the NSSA and ASF to discuss the second round of information requests related to the Project. During that meeting, it was stated that the NSSA would be commencing terrestrial lime application in the Tent Lake watershed; but indicated that terrestrial liming would not occur in proximity to the proposed organics stockpile until 2020. Of the three watersheds where terrestrial liming is known, or expected to have occurred, the Project only has a spatial overlap with the Tent Lake watershed (1EM-2-F) and the Keef Brook watershed (1EM-2-G). According to Rotteveel (2018), acidification of Nova Scotia's freshwater ecosystems has resulted in decreased habitat quality for Southern Uplands Atlantic Salmon, due in part to the mobilization of aluminum which has been mobilized due to low pH.

The residual effect of the NSSA AMP on fish and fish habitat, particularly Atlantic salmon, is a positive due to reduction of the effect of historic acidification on water quality within the treated catchment areas of the West River Sheet Harbour watershed. This Project is defined as having direct spatial and temporal overlap with the Beaver Dam Project specifically within the Tent Brook watershed (Project effects related to low magnitude flow reductions), and to a lesser extent, the Keef Brook watershed (Project effects related to Haul Road construction).

8.5.5.2.3 Cumulative Effects on the Fish and Fish Habitat

Residual effects on fish and fish habitat within the Beaver Dam Study Area are primarily related to loss of fish habitat from the development of the pit and other infrastructure. The key mitigation measures associated with this loss of fish habitat involve the fish rescue and offsetting for loss of fish habitat.

Spatial and temporal overlap of other projects within the RAA for fish and fish habitat is limited to the NSSA AMP; specifically terrestrial liming within Tent Brook and Keef Brook Watersheds. Given the proximity of the Project to the Killag Dosing station, a summary of water quality effects is provided herein. The downstream extent of impact to Cameron Flowage/Killag River is defined as the 100 m mixing zone of the effluent release location from the North Settling Pond, upstream of the Killag River Dosing Station (no spatial or temporal overlap of effects). The results of the predictive water quality assessment demonstrate the need for treatment of the mine effluent water prior to discharge to the Killag River. Nitrite (EOM) and cobalt and zinc (PC) have the potential to exceed CCME, background or site-specific guidelines within the Killag River at the near-field mixing zone locations and far-field mixing zone location. Treatment will occur, as required, prior to discharge into the receiving environment to ensure discharge meets MDMER regulations and concentrations in the Killag River do not exceed CCME or site-specific guidelines.

The Killag lime dosing station was installed to mitigate the effects of historic acidification within the Killag River, and to improve the quality of fish habitat within the Killag River, particularly for Atlantic salmon. As part of the predictive water quality modelling, the effect of the Project on pH in the receiving environment was evaluated. pH cannot be predicted with certainty by mass-balance models as used in the predictive water quality evaluation. That is, while modelling for the Project is conservative, mass balances modelling processes/predictions do not represent complete reaction paths and thus for non-conservative parameters (such as pH) water quality predictions are expected to be further governed by in situ processes. Note, discharges from the project will be subject to the MDMER such that effluent concentrations must be within pH range of 6.0 to 9.5, which is protective of aquatic life. Therefore, there are no effects to Surface Water Quality as a result of Project effluent discharges; and no expected negative cumulative impact of the Project on pH in the Killag River.

The Project is expected to have a direct spatial overlap within the Keef Brook Watershed, and the Tent Brook watershed. The spatial scale of terrestrial liming within each of these watersheds is unknown; therefore, it was assumed that the entire catchment areas are treated with lime in an effort to be conservatively inclusive. Impacts of the Project to fish habitat within the Keef Brook watershed are limited to upgrading the existing Haul Road and associated watercourse crossings. Upgrading the Haul Road is

expected to result in direct impacts to fish habitat (420.2 m^2, in WC J and WL76) to allow for culvert installation, which has been incorporated in the draft Fish Habitat Offset Plan (Appendix J.3). Of the watercourse crossings located within the Keef Brook watershed, five are currently acting as barriers to fish passage, so upgrading Haul Road infrastructure is expected to result in improvements to fish passage in watercourses E, F, G, J and K. Provided mitigation measures for watercourse crossings are adhered to (as will be required under provincial watercourse permits), no indirect effects are expected to fish habitat within this tertiary watershed. Furthermore, it is unknown whether terrestrial liming within this system is ongoing, based on results published by Rotteveel (2018) and communication from DFO (2019). Terrestrial liming was selected as a treatment within several catchment areas in this watershed due to the long-lasting effects of helicopter-based liming; which essentially acts as a 'slow-release' of lime through the soil into the watercourses. While the benefits of liming may continue to occur through the temporal scale of the Project; activities within this watershed are not expected to have any type of cumulative interaction with terrestrial liming which has already occurred.

Within the Tent Brook tertiary watershed, Project interactions include construction of an organics stockpile, ATV bypass road, crusher pad, and topsoil stockpile. The ATV bypass road will remain in place through post-construction, while the crusher pad, topsoil stockpile and organics stockpile will be reclaimed in the active reclamation stage of the Post Closure phase of the Project. Upgrading Haul Road infrastructure is expected to result in direct impacts to 535 m^2 of fish habitat in Wetlands 64 and 66, and will result in fish passage improvements in watercourses A and B. Direct impacts to fish habitat have been incorporated into the Offsetting Plan (Appendix J.3). Provided mitigation measures for watercourse crossings are adhered to, no indirect impacts in watercourses within the Tent Brook watershed are expected based on upgrades to the Haul Road.

To identify potential indirect effects to fish and fish habitat within Tent Brook watershed, an updated Water Balance Assessment is provided. Based on the results of the water balance, collection of contact water is expected to result in a 1.1% reduction in flow at EOM, and a 1.2% reduction at PC. As a result, a low magnitude of effect is expected to fish habitat within the Tent Brook watershed, as this change has been determined to fall within natural variation. Furthermore, water quality effects are not expected within the Tent Brook watershed; as all site contact water will be collected in the South Settling Pond prior to release. The primary purpose of the south settling pond is to reduce the TSS levels to acceptable limits, and control stormwater runoff. Effects to the downstream environment are not expected.

Data related to the NSSA terrestrial liming program inputs, objectives, and results were not available with sufficient detail to allow interpretation of interacting effects between terrestrial liming and direct and indirect effects within the Tent Brook or Keef Brook watersheds. AMNS requested further detail from the NSSA; however, NSSA did not provide a response (Appendix A.4b). Therefore, the evaluation of cumulative effects within the Tent Brook and Keef Brook watersheds are qualitative in nature. Direct impacts to fish habitat within each of these watersheds is limited to construction of the Haul Road and associated watercourse crossings. These impacts range from negligible to high, based on the area of impact within each individual crossing. Given implementation of mitigation measures including Offsetting, these effects are determined to be not significant, especially considering the improvements to fish passage which will be provided. The indirect effects of the Project on fish habitat within the Tent Brook watersheds are limited to low magnitude effects to flow reduction in the Tent Brook watershed, and no indirect effects are expected within the Keef Brook watershed. The Project related effects to fish habitat within these two watersheds are adverse and not significant; given that the residual effects of the terrestrial liming are positive (magnitude and significance are unknown); it is likely that any cumulative effect to fish habitat would be classified as a compensatory interaction, with a non-significant residual cumulative effect.

The deposition of tailings from the proposed Fifteen Mile Stream Project and the existing Touquoy Gold Project in the Touquoy Pit overlap the current Project both spatially and temporally. As discussed, with appropriate mitigation to ensure compliance with

MDMER criteria and water quality objectives, the potential for residual cumulative effect on fish and fish habitat is expected to be minimal.

There is some uncertainty as to the Project effects on fish and fish habitat. This uncertainty is addressed through the monitoring and follow-up programs established for the Project (Section 6.9.10). No significant cumulative effects on fish habitat beyond the effects assessed for the Project are anticipated.

8.5.5.3 Mitigation

No mitigation measures beyond those proposed in Section 6.9.8 are warranted.

8.5.5.4 Residual Cumulative Effects and Significance Assessment

A significant adverse effect from the Project on fish and fish habitat is defined as an effect that results in an unmitigated or uncompensated net loss of fish habitat as defined under the *Fisheries Act*, and its associated no-net loss policy. The screening of project effects, mitigation measures, and the subsequent fish and fish habitat results are assessed in aggregate to determine whether the residual impacts are “Not Significant” or “Significant” according to the following definitions:

Significant Residual Effect: residual effects have high magnitude, be of potential regional geographic extent and of medium to long term duration, occur at any frequency and only be partially reversible to irreversible.

Not Significant Residual Effect: is defined as: negligible to moderate magnitude, are restricted to the PA or near-field receiving environment, are of sporadic or short-term duration, occur at any frequency or are reversible to partially reversible.

A residual cumulative effect would be determined using the same determination provided in section 6.9; however, the evaluation of a significant residual cumulative effect would be based on the RAA spatial boundary, considering the interacting and overlapping project interactions within the RAA.

Within the RAA for fish and fish habitat, the Project effects overlap spatially and temporally with other Projects only within the Tent Brook and Keef Brook Watersheds. Within these watersheds, direct impacts are proposed to allow for construction of the Haul Road, and indirect effects are predicted for a minor level of flow reduction to the Tent Brook watershed (<2%). The predicted residual cumulative effects on fish and fish habitat are assessed to be adverse, but not significant (Table 8.5-6).

8.5.5.5 Follow-up and Monitoring Programs

No additional follow-up or monitoring beyond that presented in Section 6.9.10 is warranted.

Table 8.5-6: Residual Cumulative Environmental Effects for Fish and Fish Habitat

Residual Adverse Cumulative Effects (After Mitigation)	Significance Levels						Overall Significance of Residual Adverse Effects (and Rationale)
	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	
Cumulative disturbance to fish and fish habitat within the RAA.	L Differing from the existing environment/ baseline conditions, within natural variation	LAA Potential adverse cumulative effect to fish habitat outside of the PA.	A Cumulative effect would be more significant during sensitive spawning windows.	P Effect is expected to be permanent.	C Effects will occur on a continuous basis throughout operations and closure.	IR Effects of flow reduction and direct impacts from Haul road crossings are expected to be irreversible.	Low Adverse Effect (Not Significant) Fish habitat offsetting is anticipated to compensate for lost fish habitat from the Project itself. No other pathway for residual effects from surrounding projects has been identified.

Legend (refer to Section 5.11, Table 5.11-1 for definitions)

Magnitude		Geographic Extent		Timing		Duration		Frequency		Reversibility	
N	Negligible	PA	Project Area	N/A	Not Applicable	ST	Short-Term	O	Once	R	Reversible
L	Low	LAA	Local Assessment Area	A	Applicable	MT	Medium-Term	S	Sporadic	PR	Partially reversible
M	Moderate	RAA	Regional Assessment Area			LT	Long-Term	R	Regular	IR	Irreversible
H	High					P	Permanent	C	Continuous		

8.5.6 Species of Conservation Interest and Species at Risk Cumulative Effects Assessment

8.5.6.1 Baseline conditions

8.5.6.1.1 Priority Fish Species

A desktop evaluation for priority fish species revealed that four priority species have been identified within 5 km of the SA. These include Atlantic salmon (*Salmo salar*), American eel (*Anguilla rostrata*), alewife *(Alosa pseudoharengus*) and brook trout (S*alvelinus fontinalis*) (ACCDC 2021). Priority fish species identified as having an elevated potential to be located within the PA, based on habitat preferences, and broad geographic range, include American eel, Atlantic salmon, brook trout, brook stickleback (*Culaea inconstans*), and landlocked rainbow smelt *(Osmerus mordax*).

Within and in proximity to the Beaver Dam Mine Site and Haul Road, three priority species (Atlantic Salmon, American Eel and Brook Trout) were identified during electrofishing and fish collection. Atlantic Salmon were only identified within the Killag River in the 2020 fish sampling program, downstream of the NSSA lime doser, which is considered to provide suitable spawning and rearing habitat for Atlantic Salmon.

From 2015-2017, adult American Eel were confirmed in watercourses along the Haul Road including WC-N, WC-V, and WC-AH. Juvenile Eel were also observed in WC-N and WC-AH. During the 2019-2020 field program, adult American Eel were confirmed in Mud Lake/WC27, Cameron Flowage, WC13, and the Killag River. Juvenile Eel were also observed in WC13. Based on the wide distribution of American Eel within the province, their generalist habitat preference, and capacity to migrate over barriers, all hydrologically connected watercourses within the PA are believed to be potentially accessible to the American Eel, even if habitat provision in those watercourses is determined to be low.

From 2015-2017, juvenile Brook Trout were captured in WC5 (north of Crusher Lake), WC12, and WC13 within the Beaver Dam Mine Site. Along the Haul Road, juvenile Brook Trout were confirmed in WC-N and WC-V. One individual adult Brook Trout was captured in WC-AH. During the 2019-2020 field program, adult Brook Trout were captured within Crusher Lake, WC5 Reach B, Mud Lake/WC27, Cameron Flowage, WC13, and WC23. Juvenile Brook Trout (young of the year and parr) were also documented in WC13, WL59, Crusher Lake, WC5, and the Killag River. Potential brook trout spawning habitat was identified within four watercourses within the Beaver Dam Mine Site (Watercourses 5, 12, 13, and 14), and 11 watercourses along the Haul Road (Watercourses E, K, L, N, S, T, V, Z, AE, AF, and AH). Suitable rearing areas were also identified within these watercourses, along with WC23 in the Beaver Dam Mine Site, and Watercourses I, H, P, Q, and AG within the Haul Road.

According to the Nova Scotia Salmon Association (pers. comm. 2016), rainbow smelt and brook stickleback are not known to be present within the West River Sheet Harbour or Tangier River systems. Therefore, the likelihood of these species being present within the PA is very low. Alewife has been historically documented within the Tangier River secondary watershed, and may use watercourses within the Haul Road as migration corridors to upstream spawning areas. The likelihood of alewife being present within the Beaver Dam Mine Site and Haul Road watercourses within the West River Sheet Harbour watershed is considered low.

Moose River, within the Touquoy Mine Site, provides habitat for Atlantic Salmon and Brook Trout. Good juvenile and rearing habitat and potential spawning habitat is available for Atlantic Salmon. Several juvenile Atlantic Salmon were observed, however, these species were believed to be from the landlocked population known to Scraggy Lake. Good adult and juvenile Brook Trout feeding habitat, fair rearing habitat, and potential spawning habitat is available within Moose River (CRA 2007a).

The Nova Scotia Department of Agriculture and Fisheries conducted a fisheries resource study in Scraggy Lake in July of 1975. Fish captured included; brook trout and American eel. Atlantic Salmon smolts were recorded during creel census in 1979. Fingerling landlocked Atlantic Salmon and Brook Trout were stocked in Scraggy Lake between 1998-2000 and 1994-1996, respectively (CRA 2007a). Additional fish community and fish habitat assessments were completed under the EEM to support MDMER regulations under the *Fisheries Act*. These baseline aquatic environment surveys were completed by Stantec Consulting Ltd. in 2017 and 2018. According to the 2017 report, fish surveys completed in Scraggy Lake identified a total of 1,091 individual fish, representing 12 species of fish. Priority species observed include American Eel, Atlantic salmon, Brook Trout, and Lake Trout.

8.5.6.1.2 Priority Vascular Flora and Lichens

Priority Vascular Flora Species

A comprehensive list of species identified is provided in Appendix K.1 and discussed in Section 6.10.4.3. No SAR vascular plant species were observed. A total of six plants are priority species (SOCI), based on provincial status ranks (S3 and S3S4), including weigand's sedge, lesser rattlesnake plantain, southern twayblade, Appalachian polypody, highbush blueberry and Nova Scotia agalinis. Micro-siting of infrastructure has been completed to avoid priority flora species, wherever practicable, and has reduced the direct impact of the Project on flora and lichens. One occurrence of a southern twayblade, within Wetland 161, is expected to be impacted by the proposed Haul Road alignment. No priority vascular flora are anticipated to be directly impacted within the Beaver Dam Mine Site.

Southern twayblade (*Listera australis*, syn. *Neottia bifolia*) is a small inconspicuous member of the orchid family (Orchidaceae), which has been found in eight locations (wetlands 80, 115, 129, 137, 135, 147, and 161, and in upland habitat north of Wetland 136) within the PA. This species belongs to the Atlantic Coastal Plain Flora community and its primary habitat is shaded sphagnum mosses in bogs or coniferous treed swamps. Within the PA, it was typically found in clusters of 5-10 individual plants at the base of small sphagnum hummocks in treed swamps. Its distribution is scattered throughout Nova Scotia and it is considered vulnerable by the ACCDC (S3).

Surveys of the Touquoy site did not detect any plant species of special status within surveyed area (CRA 2007a). During follow up evaluation for wetland alteration permitting in 2015, a single black ash (NSESA Threatened) was identified in Wetland 2, within the (at the time) proposed TMF. Through consultation with NSE and the Mi'kmaq of Nova Scotia, this tree was harvested prior to construction of the TMF. No other Priority species of vascular flora were identified in the Touquoy Study Area.

Priority Lichen Species

Eleven priority lichen species were observed within the broader LSA as described in Section 6.10.4.4. Of the eleven species, three SAR and eight SOCI species were observed, as provided in Table 6.13-7. Of the three SAR identified, two are located within the PA. Blue felt lichen was observed in the Beaver Dam Mine Site and Haul Road and in the broader Lichen Study Area, while frosted glass whiskers was identified within the Beaver Dam Mine Site. Boreal felt lichen was identified in the LSA originally by the Project Team, but not within the PA. However, upon return in 2016 and 2017, the three observed locations of the boreal felt lichen were no longer present.

While micro-sitting infrastructure has avoided occurrences of priority lichen wherever practicable, the Project is expected to result in direct impacts to two blue felt lichen (*Pectenia plumbea*) occurrences and 10 SOCI lichen occurrences: six salted shell lichen *(Coccocarpia palmicola*), three slender monk's hood lichen (*Hypogymnia vittata*) and one eastern candlewax lichen (*Ahtiana aurescens*) within the Beaver Dam Mine Site. No priority lichens are anticipated to be directly impacted along the Haul Road. Locations of all priority lichen species documented within the LSA and the proposed Haul Road are provided in Figure 6.13-2.

Lichen surveys conducted in the Touquoy Mine Site in 2004 and 2005 as part of the EARD process found the presence of blue felt lichen (*Pectenia plumbea* syn. *Degelia plumbea*). An additional lichen survey in 2007 found seven additional SOCI including; salted shell lichen (*Coccocarpia palmicola*), corrugated shingles lichen (*Fuscopannaria ahlneri*), powdered fringe lichen (*Heterodermia speciosa*), blistered jellyskin lichen (*Leptogium corticola*), blue-gray moss shingle lichen (*Moelleropsis nebulosa*), naked kidney lichen (*Nephroma bellum*), and peppered moon lichen (*Sticta fuliginosa*) (CRA 2007a). These lichens were observed in the northern, southern and south eastern portions of the Project Area. Both locations of blue felt lichen have not been directly impacted by infrastructure from the Touquoy Project, however, direct impacts to corrugated shingles lichen and blue-gray moss shingle lichen have occurred.

8.5.6.1.3 Priority Terrestrial Fauna

Priority Mammal Species

Through all targeted surveys and incidental observations, evidence of a single mammalian priority species was observed. Within the PA, mainland moose tracks were observed within the Beaver Dam Mine Site in disturbed, roadside habitat north of Wetland 56 on May 24th, 2015 during a targeted PGI survey. Moose tracks were observed incidentally-in two locations on September 9th, 2014. One set of tracks was observed in Wetland 210 and a second set of tracks was observed adjacent to Wetland 206, just beyond the Beaver Dam Mine Site. No signs of mainland moose were observed during any survey within Haul Road. Mainland moose are not particularly affected by habitat fragmentation based on habitat preference; however, increased access into a site (construction of new roads) may increase poaching levels. As such, low-level habitat fragmentation can indirectly affect mainland moose.

Eighteen AMOs within the Beaver Dam Mine Site were evaluated for their potential to provide bat hibernacula on September 18, 2014. Of the eighteen AMOs evaluated at the site, all were either in-filled, contained a concrete cap blocking access, or were flooded, with the exception of one (BED-1-003), which was identified during the desktop evaluation as a potential bat hibernaculum. The BED-1-003 AMO was determined to be inaccessible to bats, as described further in Section 6.13.3.4. No bat hibernacula were identified within the Haul Road. According to the ACCDC reports, no known bat hibernaculum are present within 5 km of the Haul Road or Beaver Dam Mine Site. No bats, or evidence thereof, were observed incidentally during biophysical surveys, particularly bird surveys which are conducted when bats are more active.

Mainland moose tracks were observed within the Touquoy Mine Site in a bog during field surveys to support the Touquoy Gold Project EARD in 2006. Moose are known to the Tangier Grand Lake Wilderness Area (CRA, 2007a). In addition to the information above, a Post-Construction Moose Monitoring Program for Mainland Moose has been underway in lands surrounding the Touquoy Mine Site during each winter and spring since 2017. Surveys are ongoing throughout 2021 and include a combination of winter tracking surveys and spring pellet group inventory surveys. Surveys are completed on foot along transects surrounding the Touquoy Mine Site throughout a diversity of habitat types. During surveys, moose observations are recorded including a description of moose sign observed, a GPS location and a microhabitat assessment. To date, three observations of Mainland Moose Sign (scat and tracks) were documented during 2017, and two sightings of moose were encountered during 2018 surveys. No signs of the animal were observed during surveys in 2019, however, an incidental observation of a moose on a road near the mine was reported by an Atlantic Gold staff member. No moose were observed in 2020; 2021 surveys are ongoing. Annual reports have been provided to NSL&F as per the Touquoy Gold Project Environmental Assessment Approval conditions.

No suitable bat hibernacula were found within the Touquoy Mine Site during environmental screening to support the Touquoy Gold Project EA (CRA, 2007a).

Priority Herpetofauna Species

One female snapping turtle (SARA/COSEWIC, Special Concern; NSESA, Vulnerable; S3) and nest was observed by DFO within the Beaver Dam Mine Site on June 27, 2019. The observation was on a rocky, man-made berm east of Wetland 59 (historic settling pond; Figure 6.13-1. Previously, there were only incidental observations, outside field surveys, of this species; one on June 26, 2016 where the Mooseland Road section of the Haul Road crosses Fish River, during bird surveys (near PC45), and two adjacent to the Touquoy Mine Site in the scope of the EIS (Figure 6.13-1).

Potential suitable habitat for snapping turtles has been observed in Wetlands 8, 10, 14, 17, 29, 44, 56, 59, 61, 64, 66, 68, 69, 159, 168, 171, and 207 within the Beaver Dam Mine Site and the Haul Road. These wetlands are identified as potentially providing hibernacula for snapping turtles where open water is present (i.e., standing water to a depth exceeding 0.5 m).

Targeted turtle surveys within the Beaver Dam Mine Site did not reveal any sightings of wood turtles, painted turtle or suitable nesting habitat. No opportunistic observations of wood turtles, painted turtle or suitable nesting habitat were documented during any wetland or watercourse surveys throughout the PA.

No wood turtle or suitable habitat were observed within the Touquoy Mine Site during Wood Turtle habitat surveys conducted in 2004 (CRA 2007a). No snapping turtles were recorded within the Touquoy Mine Site during the EARD process. A WMMP was implemented upon commencement of operations of the Touquoy Mine Site. Under this Plan, wildlife sightings, particularly turtles, were reported to the site Environmental Technicians. Between 19 June 2017 and 2 July 2020, sixteen observations of snapping turtles were recorded by Atlantic Gold staff and contractors at various locations throughout the Touquoy Project Area, typically in close proximity to the Moose River (AMNS, Pers. Comm., 2021).

Priority Invertebrates

A review of data provided by the Maritime Butterfly Atlas confirmed that one monarch butterfly was observed in squares 20NQ17, 20NQ18, 20NQ19, 20NQ28, and 20NQ29. This 10 km x 10 km survey grid covers Mud Lake and Crusher Lake, extending north to Beaver Lake, and east to Smith Lake and Rocky Lake. As the monarch has been recorded in this survey square, it is possible that it uses the Beaver Dam Mine Site, at least periodically, such as during migration. Monarch butterflies rely on milkweed as a host plant for their larvae; as such, it is a key indicator for presence of the monarch. Surveys for vascular plants were conducted throughout the PA, and staff were instructed to identify any suitable habitat for monarchs based on presence of milkweed. No milkweed was documented during surveys for vascular flora, or opportunistically during any other surveys.

No other targeted surveys were completed for invertebrates; however, no opportunistic observations of priority invertebrate species were recorded. No other priority invertebrate species were identified during the desktop review.

Aquatic benthic invertebrates were surveyed during the aquatic surveys. No priority invertebrate (terrestrial and aquatic) species were observed within the Touquoy Mine Site during environmental screening to support the Touquoy Environmental Assessment (CRA, 2007).

8.5.6.1.4 Priority Avifauna

Across all survey seasons completed within the PA, a total of 32 priority species were observed either during dedicated survey periods or incidentally, including 23 SOCI and nine SAR. All avifauna SAR observed were as expected based on habitat and geographic range. The presence of wetlands, forested uplands, watercourses, clearings and fragmented habitats (resulting in edge habitats) provided suitable habitat for many of the priority bird species in Nova Scotia.

During all breeding bird surveys, evidence of breeding behavior was recorded for all species, with particular attention towards SAR and SOCI. Breeding evidence was recorded in accordance with guidance provided by Bird Studies Canada (2016), which defines behavior in terms of possible, probable, and confirmed breeders. Any species observed during breeding season singing in suitable habitat is identified as a possible breeder. Signs of probable breeding observed are agitation and established territories. Evidence of confirmed breeders observed includes distraction displays, feeding young or carrying food, nests with young, or recently fledged young. Canada warbler is identified as a probable breeder, while olive-sided flycatcher and common nighthawk are identified as possible breeders. Breeding evidence for other SAR was not observed. Nine SOCI are identified as possible breeders, while five show evidence of probable breeding. One SOCI species (Swainson's thrush) was recorded as a confirmed breeder.

The 2005 breeding bird surveys of the Touquoy Mine Site found ten priority species. They are as follows; pine grosbeak, willow flycatcher, yellow-bellied flycatcher, barn swallow, boreal chickadee, ruby-crowned kinglet, rusty blackbird, bay-breasted warbler, Swainson's thrush, and pine siskin.

8.5.6.2 Analysis of Effects

8.5.6.2.1 Residual Effects of Proposed Project

Priority Fish Species

The geographic extent, timing, duration, frequency, reversibility, and magnitude of direct and indirect impacts to priority fish species remains the same as is with non-priority specific fish and fish habitat, however, the level of scrutiny and analysis undertaken to determine the magnitude of each effect was substantially higher for priority species, particularly Atlantic salmon. Direct impacts are proposed in several habitats known to support brook trout and American eel. The residual effects to these species is reflected in Section 6.9.9.

The Project is expected to result in direct impact to fish habitat within the Beaver Dam Mine Site and Haul Road to facilitate infrastructure development. Specific habitats proposed for direct impact have been identified as providing suitable habitat for American eel and brook trout; however no direct impacts are proposed in habitats known or expected to support Atlantic salmon. Indirect effects to fish and fish habitat are predicted occur in watercourses 5, 23, 26 and 27 due to flow reduction, incorporating both daily and monthly flow estimates. Extensive work has been completed to predict indirect effects to fish and fish habitat in Cameron Flowage/Killag River due to the presence of Atlantic salmon downstream within the Killag River. This modelling is presented in Section 6.9.7.1.6. Through this evaluation, it was determined that no harmful alteration disruption or destruction to fish or fish habitat is expected within Cameron Flowage/Killag River.

Along the Haul Road, it is expected that direct impact to fish habitat can be minimized through proper planning, micro-sighting of the upgraded road footprint, and installation of culverts in accordance with the Nova Scotia Watercourse Alteration Standard (2015). All direct impacts to fish habitat proposed for construction of the Beaver Dam Mine Site and Haul Road are quantified and accounted for in the draft Fish Offset Plan (Appendix J.3).

The mitigation sequence was used to avoid, mitigate, and offset impacts to fish and fish habitat, with an emphasis on mitigating impacts to priority fish species. Project infrastructure was redesigned to avoid direct impacts to fish habitat relative to the 2019 EIS, however direct impacts to fish habitat within the proposed pit was determined an unavoidable impact of the Project. Indirect impacts to fish habitat were reduced through re-evaluating the site water balance Mitigation measures include collection and treatment of surface water, and development of a plan to supplement baseflow in Cameron Flowage if required. The details of this plan are outlined in the Mine Water Management Plan (Appendix P.4), and described in Section 6.9.7.

Project activities are not expected to result in significant adverse effect to fish and fish habitat in general, or specifically to priority fish species, with appropriate mitigation measures in place (including obtaining a *Fisheries Act* authorization and implementing the Offset Plan).

The Touquoy Mine Site is currently operational. Potential impacts to surface water quality and quantity as a result of the storage of Beaver Dam tailings in the exhausted Touquoy open pit mine were examined in Section 6.7.8. There are no direct or indirect effects to priority fish or fish habitat anticipated to be caused by the processing of ore and the management of tailings (exhausted pit) from the Beaver Dam Mine Project.

Priority Vascular Flora and Lichens

Clearing and grubbing will occur during the construction phase of the Project and is limited to the Beaver Dam Mine Site and Haul Road where infrastructure is proposed. No additional clearing and grubbing are required at Touquoy Mine Site to support the Project. Clearing and grubbing requires full vegetative removal which will directly affect vascular and non-vascular individuals, and to flora communities at the full or partial forest stand level. One priority vascular species, an occurrence of southern twayblade, is expected to be directly impacted by the proposed Haul Road alignment. No priority vascular flora are anticipated to be directly impacted within the Beaver Dam Mine Site. No SAR vascular flora were observed within the PA.

Translocation of SAR lichen species is proposed for occurrences directly and indirectly impacted by the Project, as described below. Blue felt lichen populations expected to be directly and indirectly (within 60 m of Project infrastructure) impacted by the Project are proposed to be translocated, as described in the Lichen SAR Translocation and Monitoring Plan (Appendix Q). Furthermore, this plan includes a monitoring component to monitor all SAR lichen transplants and occurrences proposed to be indirectly impacted by the Project. Monitoring is proposed to occur for the duration of operations and to be continued post-closure (timeline to be determined).

Heavy machinery operation and vehicle activity will occur within the Beaver Dam Mine Site and Haul Road during the construction phase and throughout the PA during the operation and closure phases. Both heavy machinery operation and vehicle activity can cause impacts to vascular and non-vascular flora from edge effects, dust, erosion, invasive species transportation and accidents (e.g. spills). Due to their non-vascular physiology, lichens are especially sensitive to changing environmental conditions, particularly air quality and edge effects (Boudreault et al. 2008; COSEWIC 2002). The impact of edge effects (depth of influence) on lichen has been well studied (Moen & Jonsson, 2002). The dept of influence on lichen species can range from 60-240 m (Esseen & Renhorn, 1997; Gauslaa et al., 2018; Haughian & Harpre, 2020) and is highly species and context dependant.

Studies, such as Neitlich et al. (2017), Naeth and Wilkinson (2008), Loppi and Frati (2005) and Farmer (1993), present the primary drivers of atmospheric contamination to lichen from mine operations: sulfur dioxide and nitrous oxide emissions, metal mobilization and dust generation. The Project is predicted to result in localized particulate and metal mobilization through dust generation during construction and operations (i.e., mining and hauling ore; Appendix C.1). Deposition of dust on flora can temporarily reduce evapotranspiration, photosynthesis and can bioaccumulate within tissue, which may reduce overall growth rates, especially for non-vascular flora such as lichen (Degtjarenko, 2016; Naeth and Wilkinson 2008; Farmer, 1993). The Haul Road is expected to the be largest source of particulate emissions within the PA. While dust deposition-related impacts to lichens were assessed for Project only truck traffic, the modelled deposition rates have been reviewed under the cumulative truck traffic scenario and did not result in changes to predicted effects.

Potential indirect impacts to vascular plants and lichens surrounding Project infrastructure will be reduced through best management strategies and mitigation measures. No SAR vascular flora will be directly impacted by the Project. Mitigations for the two blue felt lichen occurrences that are expected to be directly impacted and for additional Lichen SAR where indirect impacts

are anticipated is proposed in the draft Lichen Mitigation and Monitoring Plan (Appendix P.6) and Section 6.10.8. As a result, no lichen SAR will be directly impacted by the Project. Through the implementation of mitigations, the magnitude for residual environmental effects to flora is assessed as moderate, primarily as a result of direct loss of habitat area.

Priority Terrestrial Fauna

Clearing and grubbing is limited to the Beaver Dam Mine Site and Haul Road during the construction phase. Clearing and grubbing are not required at the Touquoy Mine Site. Clearing and grubbing will result in habitat loss for priority fauna. Best management practices will be used to limit unnecessary loss of habitat, and infrastructure layout has been planned to limit unnecessary clearing and grubbing. Grubbed material will be stockpiled and used for remedial efforts during the closure phase of the Project. Clearing and grubbing is expected to have a low magnitude of impact on priority fauna. This is based on the lack of direct impact to fauna SAR and the recognition that the loss of habitat within the PA is expected to be temporary in nature (considering reclamation of habitat following operations). Clearing and grubbing can reduce cover for priority turtle species (e.g. snapping turtle), indirectly affect water quality, and can isolate populations (ECCC 2016c). Regarding Mainland Moose, it is documented that habitat loss and fragmentation caused by clearing and grubbing interferes with the long-term population viability and is a serious threat to the species (NSDNR 2007).

Fragmentation of a particular species' habitat implies a loss of habitat, reduced patch size, and/or increasing distance between patches. While Project activities are expected to result in increased habitat fragmentation and a decrease in habitat quality (e.g., sensory disturbance), the level of new fragmentation associated with the Beaver Dam Mine Site is anticipated to be low, given the current level of disturbance within the PA. The Beaver Dam Mine Site infrastructure footprint is situated primarily on an area of high existing disturbance and is expected to only have fringe effects on the interior forest availability. There will be minimal isolation of habitat that is currently contiguous. Undisturbed, unfragmented habitat is present in the LAA and RAA, and the larger tracts are maintained around the PA, particularly to the north. The RAA is generally remote, with a moderate network of roads and forestry activity, though large tracts of forest landscape undisturbed by roads still exist in this region (NSDNR 2015b). A total of 72,663 ha of predicted interior forest has been identified within the RAA. The maximum Project edge effect as discussed in Section 6.10.7.1.1, will affect 237 ha of interior forest habitat, which accounts for 0.3% of predicted interior forest in the RAA.

Sensory disturbance to terrestrial fauna would result from rock blasting (weekly during operation), clearing and grubbing, infrastructure construction during the construction phase and, overall increased traffic, mining activities and trucking during operations within the PA. Changes to ambient noise and light levels and the presence of periodic vibrations have the potential to adversely affect fauna by influencing circadian patterns, seasonal patterns, movement and distribution, and community interactions and composition (Pauwels, 2018). The Environment Code of Practice for Metal Mines (Environment Canada, 2012) has established parameters for ambient noise levels for wildlife. These parameters indicate that ambient noise observed above 55 dBA during the day and 45 dBA at night can affect wildlife. Noise may simply act as a sensory disturbance resulting in avoidance (Ware et al. 2015), however, noise can also affect fauna behavioral patterns (Patthey et al. 2008), stress levels (Knight and Swaddle, 2011), affect communication and hunting success (Barber et al. 2009). Combined, these effects can negatively impact the overall population health of a particular species (Ware et al. 2015). Studies, some specific to ungulates, have found that sound levels of 46-68 dBA can elicited responses and have observed impacts on mammals (Maier et al. 1998; and Flydal et al, 2001; Drolet et al., 2016; Shannon et al. 2016). Elevated noise above background concentrations around the PA may cause avoidance by terrestrial fauna within 400 m (S, W, E) to 1,000 m (N) of the Beaver Dam Mine Site, <500 m on either side of the Haul Road and within 850 m the Touquoy Mine Site property boundaries, based on the most conservative guideline (45 dBA) identified for potential broad wildlife effects (Appendix B.1; Environment Canada, 2012).

Light effects on terrestrial fauna include changes to circadian patterns, seasonal patterns, movement and distribution, and community interactions and composition (Pauwels, 2018). Artificial light can also disrupt habitat connectivity and indirectly create habitat fragmentation (Bliss-Ketchum et al. 2016). However, there is limited data is available for larger mammalian species. While effects of light on wildlife are documented, it is still an emerging area of research and artificial lighting thresholds (e.g., duration, intensity, spectrum, etc.) for fauna are not well defined. Light levels from the Project have been modeled in the Light Impact Assessment (Appendix D.1). While the calculated light levels at the sensitive receptors are below the guidelines recommended by the Institution of Lighting Professionals (ILP) guidelines, nighttime light propagation from the Project may still cause sensory disturbance to fauna. Project-related changes in ambient light levels are likely to result in localized avoidance of the Beaver Dam Mine Site and Haul Road and directly surrounding areas by some species. The impact distance will also be dependent on the type of lighting used. These distances have been considered in the delineation of the RAA. Light impacts from trucks on the Haul Road are expected to be insignificant compared to baseline daylight illuminance and will be blocked by the surrounding natural buffers and topography. The impacts of Haul Road lighting on fauna is expected to be less than that of noise. No permanent lighting will be installed on the Haul Road. There are no new or additional effects from light anticipated at the Touquoy Mine Site, with the exception of temporal increase of the life span as a result of the Project.

Mainland moose are likely to be less significantly affected by sensory disturbance due to their ability to easily travel to avoid this disturbance. Hibernating snapping turtles, on the other hand, are unable to easily escape sensory disturbance easily during hibernation. As such, practices should be implemented to reduce blasting near wetlands with suitable snapping turtle hibernacula during hibernation. Hibernation generally occurs from October through March, depending on seasonal temperatures (i.e., hibernation can start later in a warm fall and end sooner in an early spring, and vice versa).

Construction of the Haul Road will involve a combination of new road construction (4.0 km) and upgrades to the existing logging road. The majority of the proposed Haul Road (30 km) follows an existing road corridor, used by local residences and lumber trucks. Vehicle traffic volumes will increase throughout the PA during the construction, operation, and closure phases. Vehicle and haul truck activity can cause impacts to priority fauna from wildlife vehicle collisions, dust, noise, and accidents (e.g. spills). Mitigation measures such as spill preparedness, emergency response measures, and best management practices (e.g. noise/dust control, speed limits) will minimize the likelihood of a negative impact.

Direct mortality of priority fauna species could result from Project activities, particularly due to the increase in traffic during construction and operation of the facility. Increased traffic poses a risk to wildlife such as the mainland moose and snapping turtle along the entire length of the Haul Road between the Beaver Dam Mine Site and the Touquoy Mine Site. Indirect mortality to these species could also occur from exposure to contaminants or spills from unplanned incidents.

Through the implementation of mitigations, overall, the magnitude of the Project's effect on priority fauna species is determined to be low. A low magnitude of effect on priority species is defined as an effect which results in no direct loss of SAR individuals, and loss of habitat for those species is mitigated in the long term through reclamation planning. Table 6.11-7 presents a habitat loss by observed fauna species (or species group) based on the habitat analysis described in Section 6.10.3.5. Based on the definitions of magnitude of impact, it is anticipated that all impacts to habitat types used by observed SAR terrestrial fauna (i.e., mainland moose and snapping turtle) will be low, in comparison to habitat availability within the LAA.

Priority Avifauna

The geographic extent, timing, duration, frequency, and reversibility of the effects of clearing and grubbing to priority birds remains the same as is with non-priority specific birds. Clearing and grubbing is limited to the Beaver Dam Mine Site and portions of the Haul Road during the construction phase. No clearing and grubbing is required at the Touquoy Mine Site. Clearing and grubbing will result in habitat loss for avifauna.

Avian usage of the PA during construction and operation of the Beaver Dam Mine will largely be driven by changes to habitat, resulting in localized avoidance of the PA by some species. Habitat connectivity is critical for maintaining biodiversity and healthy species populations and interior forests are often an important feature that supports this movement (NSDNR, 2015b). While Project activities are expected to result in increased habitat fragmentation and a decrease in habitat quality (e.g., sensory disturbance), the level of new fragmentation associated with the Beaver Dam Mine Site is anticipated to be low, given the current level of disturbance within the PA. The Beaver Dam Mine Site infrastructure footprint is situated primarily on an area of high existing disturbance and is expected to only have fringe effects on the interior forest availability. There will be minimal isolation of habitat that is currently contiguous, limited to the patch of potential interior forest west of the NAG waste rock stick pile (Figure 6.10-6). Undisturbed, unfragmented habitat is present in the LAA and RAA, and the larger tracts are maintained around the PA, particularly to the north. The LAA is covered with a network of roads, historical mining and forestry activities, and forestry trails creating a largely disturbed forest landscape. Section 6.10, Figure 6.10-5 shows the extent of the simulated existing disturbance and edge effect largely covering the majority of the LAA. As presented in Section 6.10, the Project will affect 237 ha of interior forest habitat, which accounts for 9% of the predicted interior forest area within the respective LAA (Section 6.10, Figure 6.10-5).

The effect of the Project on avifauna can largely be attributed to sensory disturbance, specialty noise and light. Sensory disturbance would result from rock blasting, clearing and grubbing, infrastructure construction, lighting and operations, internal mine traffic and traffic along the Haul Road during operations. Artificial noise and light, especially at night, have been shown to influence avian migration and behavior pattens, which could affect individual fitness and reproductive success (Da Silva et al. 2014). The Environment Code of Practice for Metal Mines (Environment Canada, 2012) has established parameters for ambient noise levels for wildlife. These parameters indicate that ambient noise observed above 55 dBA during the day and 45 dBA at night can affect wildlife. A literature review conducted by Shannon et al. (2016) found that avifauna have the potential to exhibit changes in song characteristics, reproduction, abundance, stress levels, and species richness at levels greater than 45 dBA, on average. Impacts can also differ between acute and chronic noise sources. Elevated noise above background concentrations around the PA may cause avifauna avoidance within 400 m (S, W, E) to 1,000 m (N) of the Beaver Dam Mine Site, <500 m on either side of the Haul Road and within 850 m the Touquoy Mine Site property boundaries, based on the most conservative guideline (45 dBA) identified for potential broad wildlife effects (Appendix B.1 and B.2; Environment Canada, 2012). These ranges of noise distribution are due to changes in local topography. Avifauna within these approximate ranges of noise distribution surrounding the PA have the potential to be affected by noise during the day and overnight. However, it should be noted that noise effects are rarely isolated from other disturbances and impacts likely coincide with habitat suitability changes that accompany increased noise levels (Shannon et al, 2016).

Light can impact avifauna by potentially causing disorientation or by causing attraction or avoidance (Langcore and Rich, 2004). Avifauna may be attracted to or disoriented by open pit lighting at night, particularly during migration periods, leading to mortality (Jones and Francis 2003). While effects of light on wildlife are documented, it is still an emerging area of research and artificial lighting thresholds (e.g., duration, intensity, spectrum, etc.) for wildlife are not well defined. Light levels from the Project have been modeled in the Light Impact Assessment (Appendix D.1). While the calculated light levels at the sensitive receptors are below the guidelines recommended by the Institute of Lighting Engineers (ILE) guidelines, nighttime light propagation from the Project may still cause sensory disturbance to avifauna. Project-related changes in ambient light levels are likely to result in localized avoidance of the Beaver Dam Mine Site and Haul Road and directly surrounding areas by some species. The impact distance will also be dependent on the type of lighting used. These distances have been considered in the delineation of the RAA. Light impacts from trucks on the Haul Road are expected to be insignificant compared to baseline daylight illuminance and will be blocked by the surrounding natural buffers and topography. The impacts of Haul Road lighting on fauna is expected to be less than that of noise. No permanent lighting will be installed on the Haul Road. There are no new or additional effects from light anticipated at the Touquoy Mine Site, with the exception of temporal increase of the life span as a result of the Project.

Some priority species may avoid the PA in favor of undisturbed habitat in the surrounding landscape. Other priority species are anticipated to be attracted to the mine infrastructure and newly created habitat. The common nighthawk, for instance, is a crepuscular insectivore which nests on exposed gravel and disturbed areas. Lighting of buildings at dawn and dusk can create a foraging opportunity where insects are attracted to the lights. Barn swallows commonly nest in the eaves of built structures and bank swallows can nest in vertical slopes in sandy or silty soil, even in areas with high activity levels. These species of swallows have similar feeding habits as the common nighthawk. As such, Project activities may increase habitat suitability for both these species.

Direct mortality of avifauna species could result from Project activities, particularly due to the increase in traffic during construction and operation of the facility. Increased traffic poses a risk to avifauna along the length of the Haul Road between the Beaver Dam Mine Site and the Touquoy Mine Site. Vehicle and haul truck activity can cause impacts to priority avifauna from wildlife vehicle collisions, dust, noise, and accidents (e.g. spills). Wildlife vehicle collisions can directly affect priority fauna and noise can indirectly affect priority fauna by encouraging avoidance behaviour. Mitigation measures such as spill preparedness, emergency response measures, and best management practices (e.g. noise/dust control, speed limits) will minimize the likelihood of a negative impact.

Overall, the magnitude of the Project's effect on priority fauna species is determined to be low. A low magnitude of effect on priority species is defined as an effect which results in no direct loss of SAR individuals, and loss of habitat for those species is mitigated in the long term through reclamation planning. With appropriate mitigations, best management practices and operational monitoring (Appendix A of Appendix P.7 draft Wildlife Mitigation and Monitoring Plan), no direct mortality of priority bird species is anticipated, with the exception of the low potential for a bird strike with a haul truck. Best management practices include the avoidance of clearing and grubbing during the breeding season for migratory birds where practical. Table 6.12-11 presents a habitat loss by observed avifauna functional groups based on the habitat analysis described in Section 6.10.3.5. Based on the definitions of magnitude of impact, it is anticipated that all impacts to habitat types used by observed SAR avifauna will be low, in comparison to habitat availability within the LAA.

8.5.6.2.2 Effects of Other Projects in the Area

For SAR and SOCI, the RAAs align with taxa specific RAAs defined previously. There is direct spatial overlap between the Project and historic mining operations in the Beaver Dam and Touquoy Mine Sites (Figure 8.5-5). Any potential cumulative effects from these projects related to SAR and SOCI would be based on potential impacts to water quality from mobilization of historic tailings. The remediation of historic tailings is expected to result in a positive effect of the Project. The potential impact of this interaction will be mitigated by implementation of the dHistorical Tailings Management Plan (Appendix E.9). As such, these historic operations are not carried through the CEA process.

Current Regional Forestry Operations

Habitat throughout the region exhibits fragmented conditions related to current and historic timber harvesting activity. This has led to habitat fragmentation and an increase in young regenerating stands to the detriment of older undisturbed forest, and the species which rely on these forests.

The existing roads that service the regional forestry industry contribute to the disturbance and risk of collision to species such as Moose. Timber harvesting is expected to have direct and indirect impacts to priority avifauna. According to Freedman, Woodley & Loo (1994), the effects of timber harvesting on birds is reflective of the physical and botanical changes in the structure of the forest in a given landscape. Habitat preferences for avifauna vary quite widely, so the effects of timber harvesting can result in creation of habitat for some species, while negatively affecting habitat for others. As described previously, this can be particularly important for species relying on old forest conditions, which is not supported in a landscape with abundant timber harvesting activity.

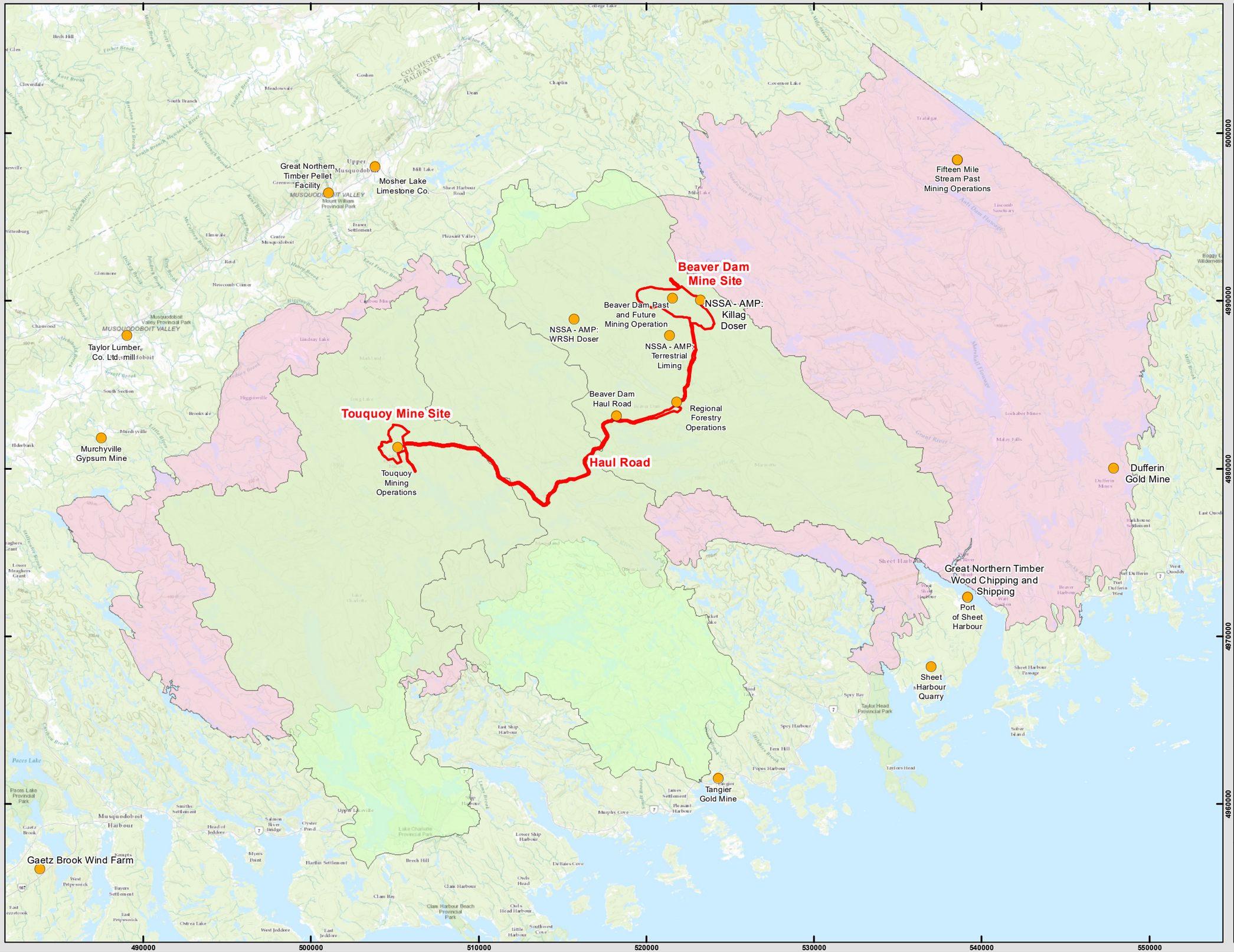
Prepared For:

Atlantic Gold

FIGURE 8.5-5

Beaver Dam Mine Project

Cumulative Effects Assessment: Species of Conservation Interest and Species at Risk



- Projects Evaluated in the Cumulative Effects Assessment
- Project Area
- Aquatic Regional Assessment Area
- Terrestrial Fauna, Avifauna, and Flora Regional Assessment Area

Note: Forestry operations occur throughout the RAA and are not displayed on this figure



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 2.5 5 10 km

1:210,000 Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed By: KR

Date: 2021-02-28

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

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Document Name: BD_EIS_Figure8-4-X_CEA_SAR_SOCI

Generally speaking, the removal of trees for timber harvesting is anticipated to have a negative effect on priority avifauna species. The extent of the impact of timber harvesting on priority avifauna within the LAA is not well documented in literature. The likelihood that timber harvesting would have an adverse residual effect on priority fish species is moderate, presuming forestry operators adhere to provincial Wildlife Habitat and Watercourse Protection regulations. These regulations also provide stipulations to reduce the effect of habitat fragmentation on terrestrial and avifauna, by requiring stream buffers (to act as corridors) and patches of live trees, protection of Moose shelter patches, allowing for passage of wild species across clear-cut landscapes. As such, while habitat loss and fragmentation do occur as a result of timber harvesting, some level of habitat connectivity is provided by these regulations and provincial oversight and integrated resource management processes.

Touquoy Gold Project

Some loss of Mainland Moose habitat, although limited to the Touquoy Project footprint, has occurred through the construction of the Touquoy Mine Site. Snapping Turtles have been observed in the riparian zone of the Moose River, and the Moose River is known to support priority fish species such as Atlantic Salmon and Brook Trout. The construction of this facility has resulted in some loss of habitat for avifauna, including priority species. The Touquoy Project has resulted in the loss of a single Black Ash to allow construction of the TMF. While the Touquoy Gold Project is discussed in terms of a cumulative effects assessment, the extension of the operation of this facility is also tied directly to the FMS Project. As such, the effects assessment of the temporal extension of the Touquoy Gold Project is presented herein. The effects of the Touquoy Gold Project are similar in nature to the effects of the addition of the FMS Project to the Touquoy facility, with the primary difference related to the temporal extension of effects.

Potential impacts to priority species include direct mortality (vehicles), alteration or loss of habitat, disturbance of reproductive or feeding activities (generally due to noise or site activity), increased predation (natural predators, vehicle collision or hunting/trapping) due to improved access and traffic or disruption of migration patterns and habitat fragmentation. Accidental events could result in similar impacts. Vehicle use on-site could result in accidental mortality of Mainland Moose and Snapping Turtles. As few moose are in the area, it is unlikely that encounters will occur; however, the importance of individual moose within this area is recognized. As collisions can be avoided by ensuring on-site vehicle speeds are under 50 km/hr, speed limits below this level will be enforced year-round.

A WMMP has been implemented at the Touquoy Mine Site, requiring reporting of wildlife, particularly turtles and Mainland Moose observations to the site Environmental Technicians. No additional clearing or grubbing is required at the Touquoy Mine Site to facilitate deposition of FMS tailings, so additional habitat loss is not an important factor in assessing cumulative effects to SAR/SOCI at the Touquoy Mine Site. Aside from trucking of gold concentrate and deposition of tailings, the effects of the FMS Project and the Touquoy facility do not overlap spatially or temporally, reducing potential cumulative effects to SAR and SOCI.

Fifteen Mile Stream Mine Project

Some loss of interior forest is expected to occur to support development of the Fifteen Mile Stream (FMS) Project. Project activities are expected to result in increased habitat fragmentation and a decrease in habitat quality for those species, including mainland moose and several bird species, which rely especially on interior forest conditions. The decrease in habitat quality for species relying on interior forest condition is based on increased activity and sensory disturbance, along with increased physical fragmentation and direct habitat loss. The loss of interior forest has been determined to represent approximately 0.49% of predicted interior forest within the RAA (AMNS, 2020).

Twenty-two (six of which are SAR) priority avifauna species were observed within the Beaver Dam Mine Site and proposed Project infrastructure and a direct loss of their habitat is expected. The six SAR avifauna species are common nighthawk, Canada warbler,

rusty blackbird, olive-sided flycatcher, evening grosbeak, and eastern wood-peewee. A cumulative effects modelling exercise was completed within the FMS EIS, to understand the effects of cumulative wetland loss on several Species at Risk. This exercise is described in Section 6.7.5.2 of the FMS EIS (AMNS, 2021c). Through the cumulative effects modelling completed regarding wetland loss and species at risk, it was determined that the FMS Project will result in a 5.2% loss of wetland area in the LAA, and a 1.2% loss of wetland area in the RAA. Specific to Species at Risk, habitat suitability across the entire RAA was not modelled for specific species. The FMS Project is predicted to result in a 2.5% loss of modelled wetland habitat for mainland moose, along with a 5.5% loss of suitable modelled wetland habitat for olive-sided flycatcher, and a 0.3% loss of suitable modelled wetland habitat for the rusty blackbird, within the Projects' LAA. This demonstrated that large amounts of equivalent habitat is available to these mobile species in close proximity to the FMS Project; therefore, there is no predicted significant adverse effect from the Project on wetland habitat for the selected species.

The FMS Project is expected to result in loss of habitat for brook trout to support development of Project components including the diversion and realignment of Seloam Brook. Within the Beaver Dam Mine Site, four locations with a total of 11 thalli of blue felt lichen are expected to be directly impacted by the construction of the TMF (3) and WRSA (1). An additional four individuals representing three lichen SOCI are expected to be impacted, along with four individuals of three species of SOCI vascular flora.

Project interactions for the FMS Mine are detailed in the respective VC chapters. The Projects' effects on SAR and SOCI were determined to be adverse, but not significant. The RAA associated with the proposed Beaver Dam Haul Route overlaps the FMS Project both spatially and temporally due to trucking of gold concentrate to the Touquoy Mine Site, which is described below. As a result, there is some potential additive cumulative effect to priority species due to habitat fragmentation and sensory disturbance, especially given the concurrent timelines of the Beaver Dam Mine Project and the Project.

Beaver Dam Haul Road Use by the FMS Project and Cochrane Hill Gold Project

As stated above, during the operation phase of Project and the Cochrane Hill Gold Project, gold concentrate from each surface mine will be transported to the Touquoy Mine Site for final processing into gold doré bar. The proposed haul route for each project is proposed to overlap with the Beaver Dam Haul Road west of the Highway 224, which will be constructed to transport ore from Beaver Dam Mine Site to the Touquoy Mine Site. It is expected that the FMS Mine Site and the Cochrane Hill Mine Site will each transport 11 round-trip truckloads of gold concentrate to Touquoy Mine Site per day for final processing. This accounts for a total of 44 single trip trucks per day from both projects, in addition to the 95 single-trip trucks (190 two-way trips) using the road to transport Beaver Dam ore, and average of 14 single-trips per day anticipated from timber harvesting operations. The total number of trucks for cumulative effects assessment is 288 trucks round trip (Appendix C1).

The trucking operations associated with the Project and Cochrane Hill Gold Project along the Beaver Dam Haul Road west of Highway 224 has the potential to increase the potential impact SAR and SOCI from wildlife vehicle collisions, dust, noise, and accidents (e.g. spills) due to cumulative truck traffic from these projects. The pathway for effects of this activity to SAR and SOCI involves disturbance through increased air, noise and light, potential physical interaction with trucks, and habitat disturbance from construction of the haul road. The incremental effects related to disturbance are expected to be similar with respect to impact to SAR and SOCI. Adherence to provincial and federal guidance, along with mitigation measures presented in the Beaver Dam Mine Project EIS will limit the effects to priority species from trucking on the Beaver Dam Haul Road.

NSSA Acid Mitigation Project

One or more component of the Acid Mitigation Project overlap the RAA for priority fish species (Terrestrial liming component in the Tent Lake and Keef Brook watersheds), priority flora fauna and avifauna. The NSSA AMP operates three main components. Two lime dosing stations are located on the West River Sheet Harbour and on the Killag River, downstream of Cameron Flowage.

Neither of these components have direct spatial overlap with the Proposed Project, although the dosing station on the Killag River is approximately 650 m southeast of the proposed pit. Despite its close proximity to the proposed Project; the spatial extent of direct and indirect impacts to fish and fish habitat does not extend to this portion of the Killag River, as specified in Section 6.9.7.1.6.

Terrestrial liming has occurred within the Paul Brook, Keef Brook and Tent Lake watersheds. According to Rotteveel (2018), terrestrial liming occurred in MacGregor Brook and Colwell Brook during the fall of 2016, with some expected 'blowout' from helicopter liming affecting Cope Brook as well. The upper portion of the Killag River (above the lime dosing station) and Brandon lake Brook were used as control sites for this study. On September 25, 2019, MEL and AMNS met with the NSSA and ASF to discuss the second round of information requests related to the Project. During that meeting, it was stated that the NSSA would be commencing terrestrial lime application in the Tent Lake watershed; but indicated that terrestrial liming would not occur in proximity to the proposed organics stockpile until 2020. Of the three watersheds where terrestrial liming is known, or expected to have occurred, the Project only has a spatial overlap with the Tent Lake watershed (1EM-2-F) and the Keef Brook watershed (1EM-2-G). According to Rotteveel (2018), acidification of Nova Scotia's freshwater ecosystems has resulted in decreased habitat quality for Southern Uplands Atlantic Salmon, due in part to the mobilization of aluminum which has been mobilized due to low pH.

The residual effect of the NSSA AMP on fish and fish habitat, particularly Atlantic salmon, is a positive due to reduction of the effect of historic acidification on water quality within the treated catchment areas of the West River Sheet Harbour watershed. This Project is defined as having direct spatial and temporal overlap with the Beaver Dam Project specifically within the Tent Brook watershed (Project effects related to low magnitude flow reductions), and to a lesser extent, the Keef Brook watershed (Project effects related to Haul Road construction). The residual effects of the NSSA AMP on other taxa of rare species are unknown.

<u>Dufferin Gold Mine</u>

The Environmental Assessment Registration Document for this project is not currently publicly available. As such, a thorough cumulative effects assessment for the Dufferin Gold Mine is limited to the Project's description on the companies' website and a review of satellite images in Google Earth, along with MEL biologists' experience with SAR and SOCI in that region of the Province.

According to the proponents' website, "The Dufferin Mine is a high-grade underground gold mine and fully permitted mill in Nova Scotia, Canada, with historic and recent production, a planned near-term restart, and potential for extensive expansion. The mine has a 300 tpd gravity and flotation mill and, with certain upgrades and refurbishment, all necessary infrastructure in place to conduct full-scale gold mining operations" (Resource Capital Gold Corp, 2019).

"The Company has completed refurbishment of the major mill components and is performing test milling. As part of the test milling process, the Company produced its first gold on the project in early March 2017. RCG is preparing to begin trial mining of an initial approximately 15,000 tonnes in order to confirm mineralization grade and prepare for a full restart of the mine and mill. The project comprises 1,684 ha, accessible by gravel road 25 km from Sheet Harbour in southeastern Nova Scotia, about 135 km northeast of Halifax " (Resource Capital Gold Corp, 2019).

The Dufferin deposit consists of mineralized gold in quartz veins, mined by underground shafts, rather than an open pit. Milling operations continued through 2017, and according to a press release dated January 29th, 2018, the bulk sampling program was completed with favorable results. A press release dated January 29th, 2019 indicated, however, that the company has filed a Notice of Interest to make a proposal under the Bankruptcy and Insolvency Act. According to the press release, "The initial NOI period will allow RCG to evaluate, with its partners, all available legal recourses and financial alternatives that may allow the Company to resume its operational production efforts as soon as possible and continue as a going concern" (Resource Capital Gold Corp, 2019).

Given this most recent press release, the future development of the Dufferin Project is uncertain. In its current state, the shaft, plant site and access road has resulted in some habitat fragmentation which could impact habitat quality for SAR and SOCI at a localized level. Given the uncertainty moving forward, it is unknown whether the Dufferin Project will overlap temporally with the FMS Project. The Dufferin Project Area is located more than 26km southeast of the Beaver Dam Mine Site, though there is potential for an additive cumulative effect between the projects, based on habitat fragmentation if the Project were to proceed.

8.5.6.2.3 Cumulative Effects on the Species of Conservation Interest and Species at Risk

Cumulative effects to SAR and SOCI are specific to each species, meaning that cumulative effects are only considered for species on which the Project has adverse residual effects and for which adverse effects from other identified projects in the area are expected.

Priority Fish

Residual effects on priority fish and fish habitat within the Beaver Dam Study Area are primarily related to loss of fish habitat from the development of the pit and other infrastructure. The key mitigation measures associated with this loss of fish habitat involve the fish rescue and offsetting for loss of fish habitat.

Spatial and temporal overlap of other projects within the RAA for fish and fish habitat is presented in Section 8.5.5.2.3.

The Killag lime dosing station was installed to mitigate the effects of historic acidification within the Killag River, and to improve the quality of fish habitat within the Killag River, particularly for Atlantic salmon. As part of the predictive water quality modelling, the effect of the Project on pH in the receiving environment was evaluated. pH cannot be predicted with certainty by mass-balance models as used in the predictive water quality evaluation. That is, while modelling for the Project is conservative, mass balances modelling processes/predictions do not represent complete reaction paths and thus for non-conservative parameters (such as pH) water quality predictions are expected to be further governed by in situ processes. Note, discharges from the project will be subject to the MDMER such that effluent concentrations must be within pH range of 6.0 to 9.5, which is protective of aquatic life. Therefore, there are no effects to Surface Water Quality as a result of Project effluent discharges; and no expected negative cumulative impact of the Project on pH in the Killag River.

The Project is expected to have a direct spatial overlap within the Keef Brook Watershed, and the Tent Brook watershed. The spatial scale of terrestrial liming within each of these watersheds is unknown; therefore, it was assumed that the entire catchment areas are treated with lime in an effort to be conservatively inclusive. Impacts of the Project to fish habitat within the Keef Brook watershed are limited to upgrading the existing Haul Road and associated watercourse crossings. Upgrading the Haul Road is expected to result in direct impacts to fish habitat (420.2 m^2, in WC J and WL76) to allow for culvert installation, which has been incorporated in the Offsetting Plan (Appendix J.3). Of the watercourse crossings located within the Keef Brook watershed, five are currently acting as barriers to fish passage, so upgrading Haul Road infrastructure is expected to result in improvements to fish passage in watercourses E, F, G, J and K. Provided mitigation measures for watercourse crossings are adhered to (as will be required under provincial watercourse permits), no indirect effects are expected to fish habitat within this tertiary watershed. Furthermore, it is unknown whether terrestrial liming within this system is ongoing, based on results published by Rotteveel (2018) and communication from DFO (2019). Terrestrial liming was selected as a treatment within several catchment areas in this watershed due to the long-lasting effects of helicopter-based liming; which essentially acts as a 'slow-release' of lime through the soil into the watercourses. While the benefits of liming may continue to occur through the temporal scale of the Project; activities within this watershed are not expected to have any type of cumulative interaction with terrestrial liming which has already occurred.

Within the Tent Brook tertiary watershed, Project interactions include construction of an organics stockpile, ATV bypass road, crusher pad, and topsoil stockpile. The ATV bypass road will remain in place through post-construction, while the crusher pad, topsoil stockpile and organics stockpile will be reclaimed in the active reclamation stage of the Post Closure phase of the Project. Upgrading Haul Road infrastructure is expected to result in direct impacts to 535 m^2 of fish habitat in Wetlands 64 and 66, and will result in fish passage improvements in watercourses A and B. Direct impacts to fish habitat have been incorporated into the Offsetting Plan (Appendix J.3). Provided mitigation measures for watercourse crossings are adhered to, no indirect impacts in watercourses within the Tent Brook watershed are expected based on upgrades to the Haul Road.

To identify potential indirect effects to fish and fish habitat within Tent Brook watershed, an updated Water Balance Assessment is provided (within the Mine Water Management Plan, Appendix Q1). Based on the results of the water balance, collection of contact water is expected to result in a 1.1% reduction in flow at EOM, and a 1.2% reduction at PC. As a result, a low magnitude of effect is expected to fish habitat within the Tent Brook watershed, as this change has been determined to fall within natural variation. Furthermore, water quality effects are not expected within the Tent Brook watershed; as all site contact water will be collected in the South Settling Pond prior to release. The primary purpose of the south settling pond is to reduce the TSS levels to acceptable limits, and control stormwater runoff. Effects to the downstream environment are not expected.

Data related to the NSSA terrestrial liming program inputs, objectives, and results were not available with sufficient detail to allow interpretation of interacting effects between terrestrial liming and direct and indirect effects within the Tent Brook or Keef Brook watersheds. AMNS requested further detail from the NSSA; however, NSSA did not provide a response. Therefore, the evaluation of cumulative effects within the Tent Brook and Keef Brook watersheds are qualitative in nature. Direct impacts to fish habitat within each of these watersheds is limited to construction of the Haul Road and associated watercourse crossings. These impacts range from negligible to high, based on the area of impact within each individual crossing. Given implementation of mitigation measures including Offsetting, these effects are determined to be not significant, especially considering the improvements to fish passage which will be provided. The indirect effects of the Project on fish habitat within the Keef Brook and Tent Brook watersheds are limited to low magnitude effects to flow reduction in the Tent Brook watershed. The Project related effects to fish habitat within these two watersheds are adverse and not significant; given that the residual effects of the terrestrial liming are positive (magnitude and significance are unknown); it is likely that any cumulative effect to fish habitat would be classified as a compensatory interaction, with a non-significant residual cumulative effect.

The deposition of tailings from the proposed Fifteen Mile Stream Project and the existing Touquoy Gold Project in the Touquoy Pit overlap the current Project both spatially and temporally. As discussed, with appropriate mitigation to ensure compliance with MDMER criteria and water quality objectives, the potential for residual cumulative effect on fish and fish habitat is expected to be minimal.

There is limited uncertainty as to the Project effects on priority fish species. Follow-up monitoring programs established for the Project (i.e. monitoring the effectiveness of fish habitat offsetting measures) will be used to address any uncertainty (Section 6.9.10). Surface water quality and quantity monitoring completed within he AEMP will identify any potential indirect cumulative effects to fish and fish habitat.

Priority Vascular Flora and Lichens

Projects which overlap the RAA for priority vascular flora and lichens include historic mining operations at both FMS and Touquoy Mine Sites, current operations of the Touquoy Mine Site, the FMS Project, cumulative use of the Haul Road west of the Highway 224 by the FMS Mine Project and the Cochrane Hill Mine Project, regional forestry operations, the Dufferin Gold Mine, and the NSSA Acid Mitigation Projects. No significant adverse effects to priority vascular flora and lichens are anticipated as a result of the Touquoy Gold Project or FMS Project.

Residual effects to priority vascular flora and lichens as a result of the timber harvesting, historic mining operations, the Dufferin Gold Project and the NSSA Acid Mitigation Projects are largely unknown, and little information is available, with the exception of the general understanding that habitat loss or change from these projects results in potential loss of priority flora and lichen species. The general habitat disturbances from historic and ongoing forestry activities, and these projects listed above, are likely to have had some effect on species that prefer undisturbed habitat and especially those sensitive to edge effects, such as priority lichens.

The NSSA Acid Mitigation Projects, specifically the terrestrial liming component in the Tent Lake and Keef Brook watersheds, may have an adverse effect on priority lichen. As one of the main factors affecting epiphytic lichen occurrences is the pH of the host tree on which it is growing (Marmor & Randlane, 2007), aerial lime dosing may cause a shift in lichen community and result in alteration in cell tissue pH which can impact lichen health and richness (Naeth and Wilkinson 2008; Farmer, 1991). The level and spatial extent of impact will depend on the specifics of the project, such as weather conditions at time of dosing, elevation of lime release, concentration, etc. Aerial liming impacts will be considered during the implementation of the Lichen SAR translocation and Monitoring Plan, specifically when selecting transplant recipient sites.

The Air Emission Assessment Technical Report (Appendix C.1) presents Project only and cumulative dust deposition rates along the Haul Road. While the cumulative use of the Haul Road west of the Highway 224 by the FMS Mine Project and the Cochrane Hill Mine Project does increase deposition rates, these rates have been reviewed with respect to lichen impacts and it was found that they did not result in changes to predicted effects. As a result, no additional monitoring or mitigations are recommended.

There is a significant level of uncertainty as to the cumulative effects, especially as to the effects from past disturbances and other projects in the region. However, given the small footprint of the Project on the regional scale there is some confidence that the Project's effects on priority flora contributes only a small portion to the total cumulative effects, and that any additive cumulative effects would be negligible.

Priority Terrestrial Fauna

Projects which overlap within the RAA for priority terrestrial fauna include historic mining operations at both FMS and Touquoy Mine Sites, current operations of the Touquoy Mine Site, the FMS Project, cumulative use of the Haul Road west of the Highway 224 by the FMS Mine Project and the Cochrane Hill Mine Project, regional forestry operations, the Dufferin Gold Mine, and the NSSA Acid Mitigation Projects. No significant adverse effects to priority terrestrial fauna are anticipated as a result of the Touquoy Gold Project or FMS Project.

The Beaver Dam Mine Project will result in the loss of 10 ha of mainland moose wetland habitat. The additional wetland impacts from the FMS Mine Project will result in a loss of 26 ha of this habitat, resulting in a cumulative loss of 36 ha of mainland moose wetland habitat within the terrestrial fauna RAA, as a result of these Projects. This habitat loss represents 0.03% of the total RAA area. Large amounts of equivalent mainland moose habitat are still available within the RAA and abundant intact area exists between these projects to maintain unimpeded movement.

Residual effects to priority terrestrial fauna as a result of the timber harvesting, historic mining operations, the Dufferin Gold Project and the NSSA Acid Mitigation Projects are largely unknown, and little information is available, with the exception of the general understanding that these projects can result in habitat loss or change for priority fauna species. Given the distance between the Dufferin Gold Project and all components of the PA, a spatial overlap in effects is unlikely. Given the current state of the Dufferin Gold Project (detailed in Section 85.6.2.2.6), it is unlikely that there will be a temporal overlap with the current proposal.

The general habitat disturbances and fragmentation from historic and ongoing forestry activities are likely to have had some effect on priority species that prefer undisturbed habitat and interior forest. Specifically, timber harvesting, the Project, the FMS Project

and the Touquoy Gold Project are expected to have an adverse effect on the mainland moose. A Mainland Moose Management Plan will be developed as part of the Project's Wildlife Management Plan (Appendix Q) to help mitigate these effects. The effects are the result of loss of habitat and from the risk of collision with vehicles. Habitat loss and disturbance, and traffic from other activities in the region contribute to the resulting cumulative effects.

Similar cumulative effects are expected for the snapping turtle, which have been observed at the Beaver Dam Mine Site and along roadsides near the Touquoy Mine Site during nesting season. Increasing traffic levels will increase risk of collisions to snapping turtles. A Wildlife Management Plan has been implemented at the Touquoy Mine Site and has been developed for the Beaver Dam Mine Site (Appendix P.7) to reduce potential impact to wildlife, specifically turtles. No other specific project causing loss of habitat for this species has been identified.

There is a significant level of uncertainty as to the cumulative effects on priority terrestrial fauna. Given the small footprint of the Project on the regional scale there is some confidence that the Project's effects on priority terrestrial fauna contributes only a small portion to the total cumulative effects, and that there is low potential for significant additive cumulative effects.

Priority Avifauna

Projects which overlap within the RAA for priority avifauna include historic mining operations at both FMS and Touquoy Mine Sites, current operations of the Touquoy Mine Site, the FMS Project, cumulative use of the Haul Road west of the Highway 224 by the FMS Mine Project and the Cochrane Hill Mine Project, regional forestry operations, the Dufferin Gold Mine, and the NSSA Acid Mitigation Projects. No significant adverse effects to priority terrestrial fauna are anticipated as a result of the Touquoy Gold Project or FMS Project.

The Beaver Dam Mine Project will result in the loss of a total of 35 ha of SAR avifauna wetland habitat for Canada warbler, olive-sided flycatcher and rusty blackbird. The additional wetland impacts from the FMS Mine Project will result in a loss of 72 ha of this habitat, resulting in a cumulative loss of 107 ha of Canada warbler, olive-sided flycatcher and rusty blackbird wetland habitat within the avifauna RAA, as a result of these Projects. This habitat loss represents 0.07% of the total RAA area. Large amounts of equivalent habitat is still available within the RAA and abundant intact area exists between these projects to maintain unimpeded movement.

Residual effects to priority terrestrial fauna as a result of the timber harvesting, historic mining operations, the Dufferin Gold Project and the NSSA Acid Mitigation Projects are largely unknown, and little information is available, with the exception of the general understanding that these projects can result in habitat loss or change for priority avifauna species. Given the distance between the Dufferin Gold Project and all components of the PA, a spatial overlap in effects is unlikely. Given the current state of the Dufferin Gold Project (detailed in Section 8.4.3.1.13), it is unlikely that there will be a temporal overlap with the current proposal.

The general habitat disturbances and fragmentation from historic and ongoing forestry activities are likely to have had some effect on priority species that prefer undisturbed habitat and interior forest. The cumulative effects to priority birds are therefore driven by habitat loss and disturbance and are essentially the same as those noted for birds in general. Overall, the generalized disturbance of the landscape by proposed and active gold projects, and forestry activities (past, present and future) are the main source of cumulative effects to priority birds throughout the area. A Landbird Mitigation and Monitoring Plan has been developed for the Project (Appendix P.6) to help mitigate effects to avifauna SAR during operations. The largest adverse effects expected would be to species preferring undisturbed and unfragmented habitats, although the impact to interior forest from the Beaver Dam Mine Project and FMS Project have been determined to be low.

There is a moderate level of uncertainty as to the cumulative effects on priority avifauna. The main assumption behind this assessment is that the overall patterns of land use in the region will remain unchanged in the foreseeable future and that the Project will be approved and carried out during the anticipated timelines. Considering the temporal scale and small footprint of the Project on the regional scale, there is some confidence that the Project's effects on priority avifauna contributes only a small portion to the total cumulative effects, and that there is low potential for significant additive cumulative effects.

8.5.6.3 Mitigation

No specific mitigations are recommended to reduce cumulative effect, other than those presented in Sections 6.8 to 6.13 (Fish and Wetlands, Fish Habitat, Habitat and Flora, Terrestrial Fauna, Avifauna and SAR/SOCI, respectively). The Touquoy Gold Project and FMS Gold Projects will adhere to their own mitigation measures as outlined in their Approval and EIS, respectively. The mitigation of the effects originating from regional forestry and land management practices falls outside the scope of the Proponent's authority and responsibility.

8.5.6.4 Residual Cumulative Effects and Significance Assessment

A significant adverse effect from the Project on SAR and SOCI is defined as an effect that is likely to cause a permanent, unmitigated alteration to habitat that supports a species' distribution, or alteration of critical habitat. Sedentary species such as vascular and non-vascular flora do not have the opportunity to move to avoid direct or indirect impact. For these species, the loss of an individual or individuals of a SAR species that is important in the context of the province, or that species' overall abundance or distribution, may be considered significant, if appropriate mitigation measures are not implemented.

Within the Project, the FMS Gold Project, the Touquoy Gold Project and the use of the Beaver Dam Haul Road by all three projects, there is no expectation of significant cumulative effects to SAR or SOCI. The NSSA AMP has a partial spatial and temporal overlap with the Project where terrestrial liming is ongoing within the Tent Brook and Keef Brook watersheds. The effects of this project on fish and fish habitat is anticipated to be positive, and there is no predicted adverse cumulative effect on fish and fish habitat when combined with residual effects of the Project. Based on lour limited understanding of the details of the NSSA AMP, particularly related to the potential effects to priority species, we anticipate the potential cumulative effects as not significant; however available information was limited for this assessment, and therefore, there is some uncertainty in this conclusion.

The alteration of the disturbance of habitats throughout the region from historic and current land use is likely to have affected the local distribution and abundance of various species, especially those associated with undisturbed mature habitats. However, the overall footprint of mining activities in the area, including the Beaver Dam and Touquoy Mine Sites, is quite small in relation to the VCs respective RAAs. As such, no significant residual cumulative effects are anticipated (Table 8.5-7).

8.5.6.5 Follow-up and Monitoring Programs

No additional monitoring beyond that indicated for the Project in Section 6.12.10 is proposed.

Table 8.5-7: Residual Cumulative Environmental Effects for SOCI and SAR

Residual Adverse Cumulative Effects (After Mitigation)	Significance Levels						Overall Significance of Residual Adverse Effects (and Rationale)
	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	
Cumulative loss, alteration and the disturbance of habitats throughout the RAA relating to SOCI and SAR.	L The maximum cumulative Project edge effect will affect 512 ha of interior forest habitat in consideration of the Beaver Dam and FMS Projects, which accounts for 0.7% of predicted interior forest in the RAA. There is limited additional development pressures from other projects in the RAA, as demonstrated by the few projects identified within this evaluation.	RAA Loss of habitat used by priority species has occurred on a regional scale.	A Cumulative effect would be more significant during sensitive period for each priority species.	LT Effects may extend beyond 7 years.	S The loss of habitat associated with the Beaver Dam Mine Site will occur once. However, the potential future loss of habitat associated with the Beaver Dam Project and other regional projects in the future could occur throughout the lifetime of the Project.	PR Reclamation cannot guarantee a return to baseline conditions.	Low Adverse Effect (Not Significant) The small proportion of regional habitat that supports priority species that would be lost as a result of this Project will be restored during the reclamation stage of Closure Phase. There is limited additional development pressure from projects in the RAA.

Legend (refer to Section 5.11, Table 5.11-1 for definitions)

Magnitude		Geographic Extent		Timing		Duration		Frequency		Reversibility	
N	Negligible	PA	Project Area	N/A	Not Applicable	ST	Short-Term	O	Once	R	Reversible
L	Low	LAA	Local Assessment Area	A	Applicable	MT	Medium-Term	S	Sporadic	PR	Partially reversible
M	Moderate	RAA	Regional Assessment Area			LT	Long-Term	R	Regular	IR	Irreversible
H	High					P	Permanent	C	Continuous		

8.5.7 Mi'kmaq of Nova Scotia Cumulative Effects Assessment

8.5.7.1 Baseline conditions

There are 13 Mi'kmaq communities in Nova Scotia, with two First Nation (Mi'kmaq) reserves in the vicinity of the Project: Beaver Lake IR 17 (49.4 ha) is located approximately 5 km southwest from the Beaver Dam Mine Site, and Sheet Harbour IR 36 (32.7 ha) is located 20 km south of the Project. Both these reserves belong to the Millbrook First Nation which is located in Truro, Nova Scotia, 54 km northwest of the Beaver Dam Mine Site. The 2017 Census reports 21 and 25 Mi'kmaw residents at Beaver Lake and Sheet Harbour, respectively (Statistics Canada 2017, 2017a).

Beaver Lake: established in 1867 and approximately 49.4 ha in size is situated along Hwy 224. The estimated population on reserve is 21 with a total of five homes and four small cottages/camps.

Sheet Harbour: set aside under Millbrook administration in 1960 and approximately 32.7 ha along Hwy 7, the estimated population on reserve is 25 with a total of nine homes, two trailers, a community hall and a convenience/gas bar.

The Sipekne'katik First Nation, located in Indian Brook, Nova Scotia, is located approximately 61 km west of the Project. The Pictou Landing First Nation (PLFN), located north of the town of New Glasgow, is located 66 km north of the Project.

Mi'kmaq rights are communal rights and therefore shared amongst all members of the Mi'kmaq Nation in Nova Scotia. Community profiles of the 13 Mi'kmaw First Nations in Nova Scotia have been included in Table 6.14-1 (Stantec 2018c, CBU 2020).

8.5.7.1.1 Historic Mi'kmaq Land and Resource Use

Mi'kmaq traditional use of the land in Nova Scotia involved semi-permanent and permanent settlements. Summer villages of the Mi'kmaq were usually located on the banks of streams or rivers. The most important factor in the choice of a site was the proximity of the site to a navigable body of water. Sites around the mouths of rivers with heavy spawning runs were highly favourable for use, as well as smaller rivers running back into a system of lakes (Appendix M.1).

Beaver Dam lies within Eskikewa'kik or the "skin dressing territory". This particular district spans from Halifax County across to Guysborough County. Various authors and historians have differed in their description of how far this territory expands, but all have agreed that Beaver Dam lies within this district (Appendix M.1).

Although little historical information has been written about Mi'kmaq inhabiting these areas in large numbers, there is some documentation that suggests that they mainly inhabited Halifax and Port Mulgrave. Bernard Hoffman has noted that there were seven main sites within Eskikewa'kik; including sites at Ship Harbour, Spry Bay Harbour and Liscomb Harbour near the study area (Appendix M.1).

Mi'kmaq cultures hunted land and marine mammals and fish for sustenance and some trading until the late sixteenth century, when traditional activities began to change in response to contact with the Europeans. Settlements, although not permanent, were located near major waterways and harbours, providing accessibility to trade with the Europeans. The Mi'kmaq traveled inland through minor streams and rivers, either by canoe or on foot (Appendix M.1).

More details outlining historic land and resource use by the Mi'kmaq of Nova Scotia are presented in Section 6.14.

8.5.7.1.2 Current Mi'kmaq Land and Resource Use

Drawing from information provided through the MEKS, the TLRUS (MFC 2019), direct information gathered from engagement activities between AMNS and the Millbrook First Nation and Sipekne'katik First Nation, and the KMKNO, and the Project team's knowledge of the Beaver Dam Mine Site and the Haul Road, the following summary of current Mi'kmaq land and resource use has been prepared as a basis from which to understand and evaluate Project interactions and potential effects of the Project on the Mi'kmaq of Nova Scotia. The description and analysis in this section has been tailored to Millbrook First Nation, unless specific mention of information relating to a different Mi'kmaq community is noted. Information was requested from all Mi'kmaq communities in Nova Scotia through the MEKS and direct engagement with KMKNO and Sipekne'katik First Nation; however, the TLRUS (MFC 2019) prepared for Millbrook First Nation and information received directly from the Millbrook First Nation community informs AMNS's specific understanding of traditional and current use. Some generalized information, especially relating to traditional use, was available through the MEKS and is presented herein. The baseline information provided in the MEKS is generally consistent with that baseline data collected by the Millbrook First Nation through the TLRUS (MFC 2019).

The following key aspects were considered and requested from the Mi'kmaw communities during collection of baseline data (either through direct engagement or the completion of the MEKS and TLRUS):

- General information about Mi'kmaq of Nova Scotia populations;
- General description of baseline conditions within the Beaver Dam Mine Site and Haul Road and surrounding landscape to support an understanding of the current experience of the traditional practice for the Mi'kmaq of Nova Scotia;
- Sites or areas that are used by the Mi'kmaq of Nova Scotia either for permanent residences or on a seasonal/temporary basis and the number of people that use each site/area identified;
- Drinking water sources (permanent, seasonal, periodic, or occasional);
- Consumption of country foods (also known as traditional foods) including food that is trapped, fished, hunted, harvested, or grown for subsistence or medicinal purposes, outside of the commercial food chain;
- Which country foods are consumed by which groups, how frequently, and where these country foods are harvested;
- How are different subpopulations of the Mi'kmaq communities using the land;
- How often is the right practiced or exercised and timing/seasonality of the practice; the context in which the right is practiced;
- Commercial activities (e.g. fishing, trapping, hunting, forestry, outfitting) and the frequency, duration and timing of these activities including maps and data sets; and
- Recreational uses and the frequency, duration and timing of these activities.

Baseline information that was shared and available for the Project is described in this section. This summary of current use is specific to the Millbrook First Nation, through the completion of the TLRUS (MFC 2019), supported by conclusion of the MEKS. This report describes Millbrook traditional land and resource use in the regional and local study areas through careful documentation of harvesting and occupancy locations, as well as the presentation of qualitative information relating to participants' relationships with these locations (MFC 2019).

It is important to note that some limitations relating to baseline information are present and thus, evaluation of Project interactions and potential effects to the Millbrook First Nation and more broadly the Mi'kmaq of Nova Scotia, are provided with some limitations on specific analysis:

- **Drinking Water Sources:** No surface drinking water sources were identified through the MEKS or TLRUS, and direct engagement activities with the communities. As a result, no analysis of specific surface water drinking water sources is completed. However, a discussion of impact to drinking water at the Cameron Flowage/Killag River (the discharge location from the Project) is included as it is considered the reasonable worst case predicted water quality conditions stemming from the Project.
- **Residences (Permanent or Seasonal):** No specific detail relating to location of seasonal or temporary camps/cottages/residences were provided to AMNS. The MEKS did not provide any information relating to seasonal or permanent residences, with the exception of the Beaver Lake IR. The TLRUS identified several Millbrook camp locations, but no specific locations were provided. Thus, no analysis of specific Millbrook residential receptors has been included in this Project EIS. Conclusions relating to Project impacts at the Beaver Dam Mine Site and Haul Road property boundaries have been provided for each VC in Table 6.14-4 and these conclusions can support analysis of camps/cottages that have been identified in a more generalized way surrounding, and in close proximity to, the Beaver Dam Mine Site and Haul Road.
- **Ceremonial/Spiritual Activities and Sites:** General or specific information about sacred sites was not provided in the MEKS or TLRUS.

Additional information relating to strengthening AMNS understanding of current Millbrook and more broadly, Mi'kmaq, land use was requested as documented in detail in Section 4.0 and summarized herein. AMNS will continue to work with the Millbrook First Nation and the Mi'kmaq of Nova Scotia to identify any outstanding traditional and current use information related to the Project.

The Mi'kmaq of Nova Scotia have established Aboriginal and Treaty rights. This includes traditional rights to hunt, gather and fish, as well as treaty-protected rights to hunt and gather, and to fish for a "moderate livelihood", which may take place throughout the year. According to the TLRUS (MFC 2019), the LAA is used by the Millbrook First Nation for the following purposes:

- Hunting deer, bear, rabbit and grouse for sustenance;
- Trapping rabbits, bobcat, beaver, coyotes, musrat, mink, otter, weasel and other small fur bearing animals for pelts and food;
- Gathering/harvesting various plants for medicinal and sustenance purposes;
- Gathering/harvesting fallen wood and birchbark for handicrafts and cultural items;
- Fishing for trout and other freshwater species; and
- Modern-day camps for recreational purposes.

The TLRUS (MFC 2019) states that local residents of the Beaver Dam, Sheet Harbour and Millbrook IRs frequently use the area (range of use from weekly to yearly, depending on availability of species) for hunting (deer, bear, rabbit, grouse, porcupine) and rely on the wild harvest as an important food and dietary source. Equally, community members harvest berries when in season, and a number of plants that are also used for sustenance, as well as traditional medicines. The seasonal and recreational use of animals and plants important to the Millbrook community members supports the continuity of traditional practices and is very important to the maintenance of their culture and the practice of their rights. Millbrook harvesting activities and practices are culturally important as they ensure the sharing and maintenance of cultural values and their practice. Millbrook First Nation community members use plants and animals harvested in the area for traditional sustenance purposes, health-related medicinal purposes, and spiritual and cultural purposes.

Additionally, the MEKS (CCM 2016) provided the following information related to current Mi'kmaq land and resource use sites, species of significance to Mi'kmaq, and Mi'kmaw communities, with the current Mi'kmaq land and resource uses categorized and identified as:

- Kill/hunting: trout, eel, bear, rabbit, deer, porcupine, partridge, coyote, mink, muskrat, weasels, raccoon, fox, otter and beaver;
- Burial/birth: potential burial sites recorded within the MEKS study area on the western side of the Beaver Dam Mine Road but not within the PA;
- Ceremonial: none identified;
- Gathering: wild fruit, berries, water, food plant, specialty wood, logs, feathers, quills; and
- Habitation: anchored boat, travel route, overnight site.

Species of significance to the Mi'kmaq are associated with three categories; these are listed below with the number of occurrences in the study area based on field work completed by CMM in summer 2016:

- Medicinal: 49 species present;
- Food/beverage: 27 species present; and
- Craft/art: 11 species present.

An overview of the Millbrook First Nation local fisheries activity within the identified LAA was provided in the TLRUS (MFC 2019). Additional information relating to the local Mi'kmaq fisheries was also reported in the MEKS and through direct engagement with the Mi'kmaq of Nova Scotia which supports the conclusions presented in the TLRUS (MFC 2019).

Fishing is generally for sustenance/subsistence, as well as for recreational purposes. Trout is the key fish species described in the TLRUS (MFC 2019) with additional species including brook and rainbow trout, sea trout, American eel, Atlantic salmon, herring, mackerel, gaspereau, various groundfish species, smelt, striped bass and sucker. Shellfish harvesting within the LAA include clams, lobster, mussels, snowcrab, and scallop (MFC 2019). Fishing is practiced across the LAA in most major rivers and lakes, as documented in the TLRUS and MEKS. Within the Beaver Dam Mine Site, there is documentation of trout fishing within Cameron Flowage/Killag River and possibly Mud Lake and Crusher Lake (MFC 2019). Within the 4km footprint of new construction for the Haul Road, there are no documented rivers or lakes that support the Mi'kmaq fisheries. However, adjacent to this new construction corridor and along the road footprint proposed for upgrades to construct the Haul Road, fishing locations are common, and Millbrook First Nation use of these lakes (and rivers) is well documented from the Beaver Dam Mine Site to the Mooseland Road (MFC 2019). AMNS acknowledges documented fish harvesting by Millbrook First Nation within the area directly surrounding the Project and the broader LAA.

There are a number of activities associated with the harvest and use of plants, animals and fish within the PA and in the LAA that relate to historical traditions and customs of the Mi'kmaq that are still practiced today. As described, the TLRUS (MFC 2019), the MEKS and residents of the Beaver Lake IR identify trapping and hunting activities, plant and berry gathering, and fishing in, near and surrounding the PA for purposes of sustenance, spiritual and cultural practice. The TLRUS (MFC 2019) described the frequency of use within the LAA which can be summarized as regular: weekly to annually across all seasons. This means the area was, and still is, an important resource area for the Millbrook First Nation community members and by extension, all Mi'kmaq of Nova Scotia, and any Project activities may have potential impacts on the ability of the Mi'kmaq of Nova Scotia to access certain areas to practice their rights where species with important cultural relevance may be found. Wild meat was traditionally a staple of the Millbrook First Nation diet, and a few of the harvesters interviewed for the TLRUS (MFC 2019) indicated they rely mainly on this food source and they share their food with other community members, rather than purchase their meat at a local supermarket.

Some Mi'kmaq community members have camps on Crown land where they go to enjoy peaceful recreational and traditional activities with family and community members. There are five camps documented within 1 km of the Haul Road and multiple other camp locations throughout the LAA (MFC 2019). The Millbrook community is concerned that noise and activity from the Beaver Dam Mine Site and the Haul Road will negatively impact their ability to enjoy the remoteness and quiet of the area, as well as impact wildlife patterns and their hunting practices.

The evidence presented above shows Mi'kmaw occupancy and land/resource use in the PA, LAA and wider region of Eskikewa'kik – are changing, and more limited but uninterrupted use from pre-contact times to today.

In summary, both those aspects, the economic and cultural motivations for traditional land and resource uses, feed into a third impetus: the need to express, affirm and exercise their Aboriginal rights to live their cultural heritage within Mi'kma'ki, and their Treaty rights to continue harvesting the resources of their traditional territory.

8.5.7.2 Analysis of Effects

8.5.7.2.1 Residual Effects of Proposed Project

The predicted residual environmental effects of the Project on the Mi'kmaq of Nova Scotia are assessed to be adverse, but not significant following implementation of applicable mitigation measures (Table 6.14-8). Potential residual effects to the Mi'kmaq of Nova Scotia's physical health from Project-related changes to the environment (e.g., changes to country foods, water, and soils) are anticipated to be not significant. Potential pathways of effects on human health associated with consumption of or contact with country foods, water and soils will be minimized by implementing mitigation measures such as dust control, water management infrastructure and processes and water treatment (if required). Mitigation measures to reduce atmospheric emissions will be implemented to minimize potential related effects on human health, and the residual risk to human health from inhalation of Project-related dust and airborne contaminants is considered low.

Mitigation measures and conclusions relating to impacts to traditional practices and socio-economic, mental and social well-being will continue to be evaluated directly with Millbrook First Nation and the Mi'kmaq of Nova Scotia throughout the environmental assessment process, and throughout the lifecycle of the Project. AMNS has reviewed with Millbrook First Nation and the Mi'kmaq of Nova Scotia the proposed mitigation measure of a multi-use bypass road to access to lands surrounding the Haul Road and north of the Beaver Dam Mine Site, as well as the availability and proposed suitability of nearby Crown land as partial mitigation for loss of access during the eight years that the mine will be limiting access to the Beaver Dam Mine Site and Haul Road. Feedback on the summary of impacts and proposed mitigation measures is expected once Millbrook First Nation community meetings can be safely and effectively completed, given COVID restrictions. Mitigations and monitoring can be adjusted at the permitting stage as necessary.

8.5.7.2.2 Effects of Other Projects in the Area

The Project is located in a rural area, with a rural community of residents, and the presence of regional forestry activities. The RAA for the Mi'kmaq of Nova Scotia is spatially large, based on historical migration patterns and movements of the Mi'kmaq and territorial boundaries of the *Eskikewa'kik (Skin Dressing Territory).* This RAA allows for impacts that may be felt locally from the Project to be contextualized within the geographical setting of *Eskikewa'kik* land and resource use.

There are 37 identified projects within the RAA for the Mi'kmaq of Nova Scotia (Figure 8.5-6). Cumulative effects on the Mi'kmaq of Nova Scotia are indirect and will be caused by effects to other VCs from the Project and other projects that have been shown to act cumulatively with overlapping effects within the RAA.

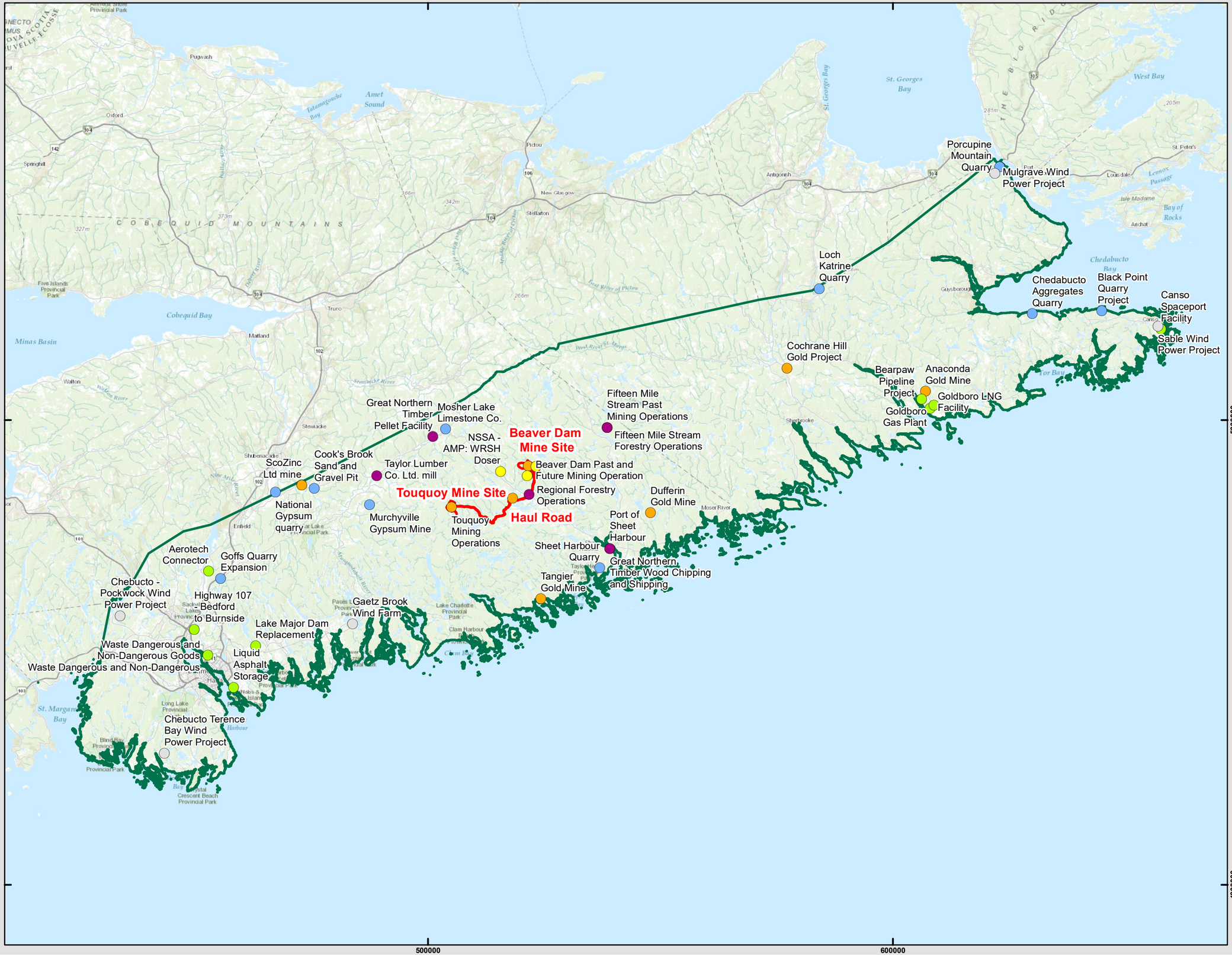

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FIGURE 8..5-6A

Beaver Dam Mine Project

Cumulative Effects Assessment: Mi'kmaq of Nova Scotia

Category

- Forestry and Associated
- Mining
- Other
- Other Industries
- Pits and Quarries
- Wind Power Projects

- Project Area
- Mi'kmaq Regional Assessment Area

Note: Forestry operations occur throughout the RAA and are not displayed on this figure



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 10 20 40 km

1:760,000 Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed By: KR

Date: 2/25/2021

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

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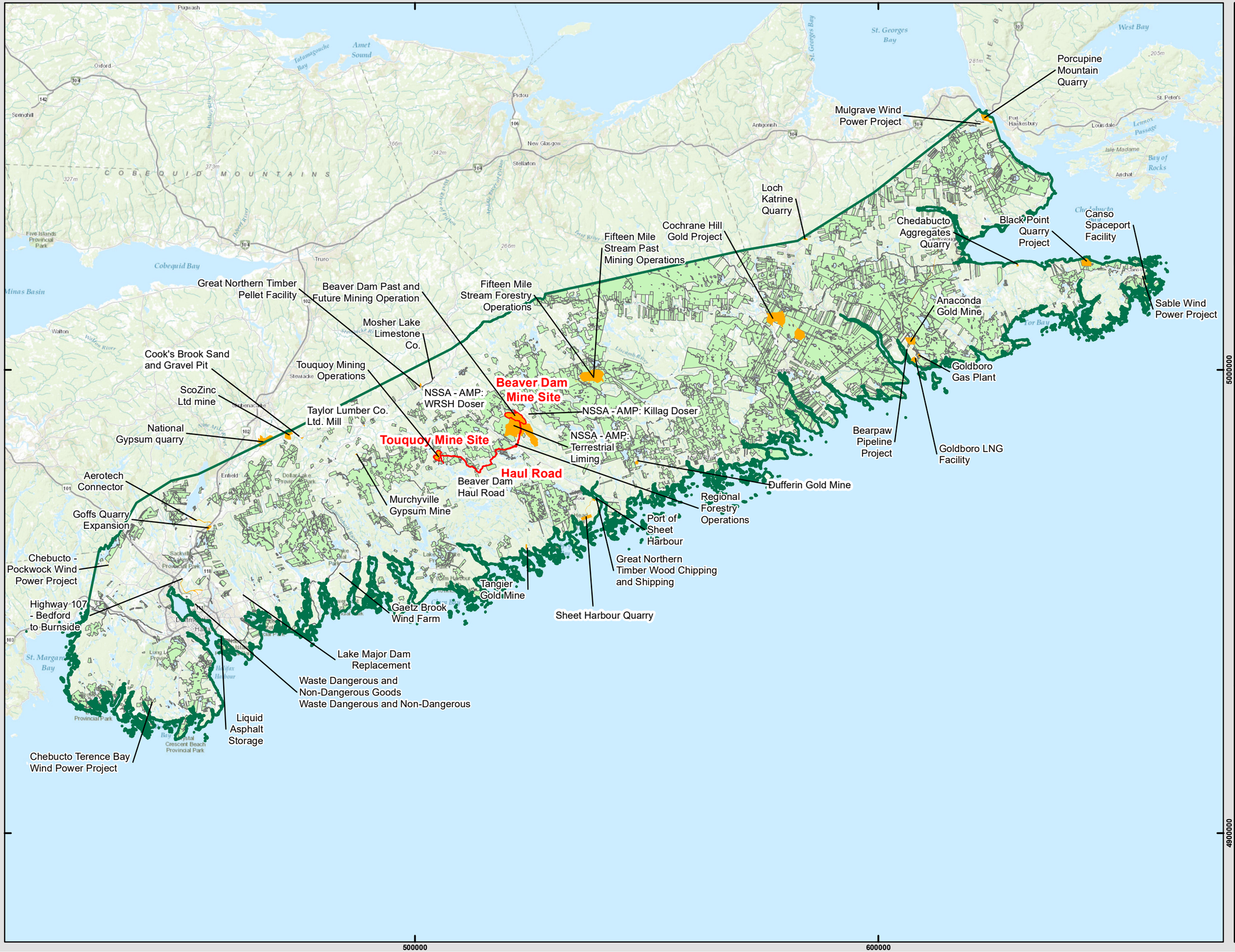
Document Name: BD_EIS_Figure8-4-X_CEA_Mikmaq_Categories



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Atlantic Gold

FIGURE 8.5-6B

Beaver Dam Mine Project

Cumulative Effects Assessment: Mi'kmaq of Nova Scotia

- Projects
- Crown Land
- Project
- Mi'kmaq Regional Assessment Area

Note: Forestry operations occur throughout the RAA and are not displayed on this figure



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 10 20 40 km

1:760,000 Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed By: KR

Date: 2/25/2021

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

McCallum Environmental Ltd.

Document Name: BD_EIS_Figure8-4-X_CEA_Mikmaq_Polygons

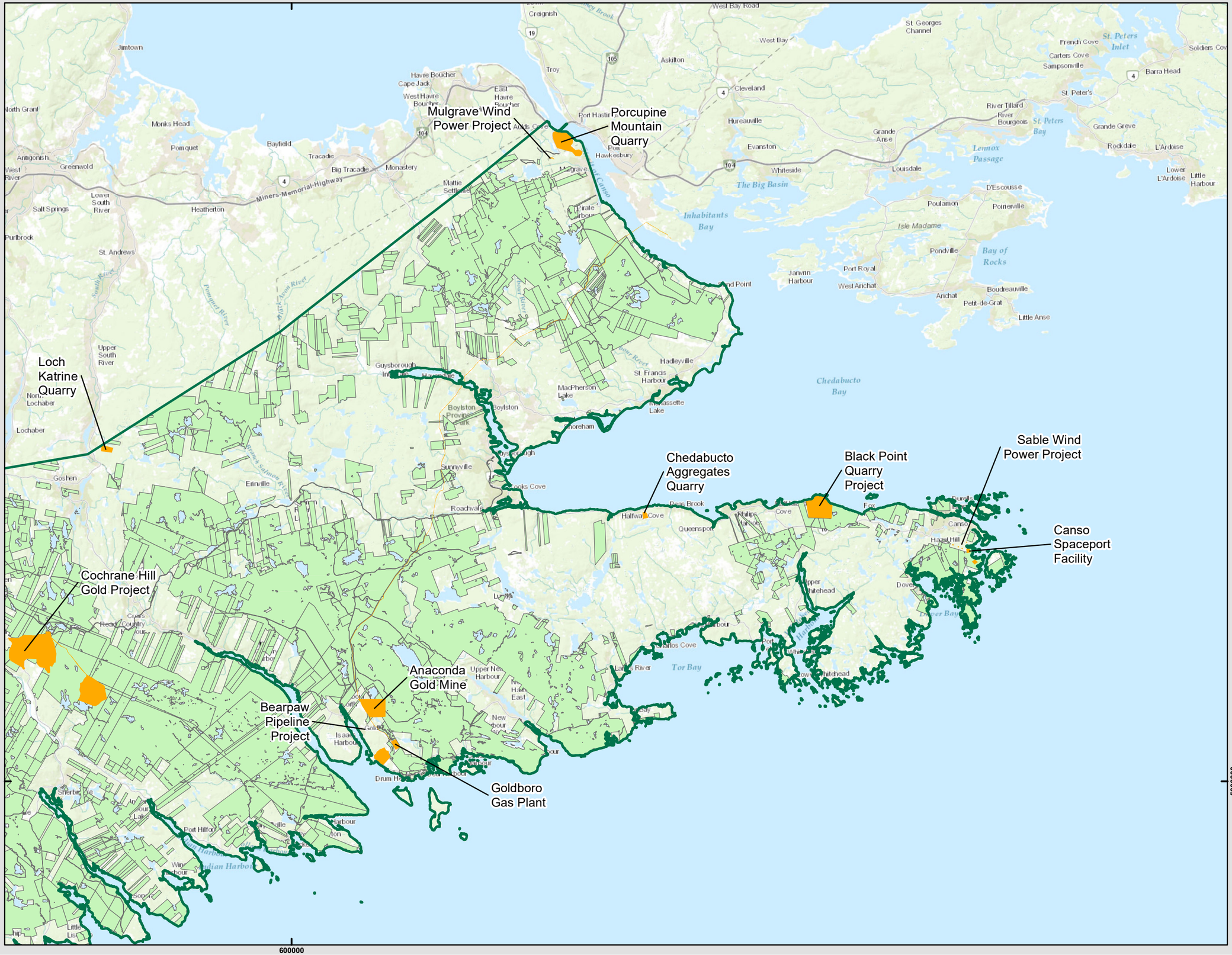

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FIGURE 8.5-6C

Beaver Dam Mine Project

Cumulative Effects Assessment: Access to Crown Land within the Mi'kmaq Regional Assessment Area Eastern

Projects

Crown Land

Mi'kmaq Regional Assessment Area

Note: Forestry operations occur throughout the RAA and are not displayed on this figure



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 4 8 16 km

1:300,753 Scale when printed @ 11" x 17"

Drawn By: EP

Reviewed By: KR

Date: 2/25/2021

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

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Document Name: BD_EIS_Figure8-4-X_CEA_Mikmaq_Polygons_East

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FIGURE 8.5-6D

Beaver Dam Mine Project

Cumulative Effects Assessment: Access to Crown Land within the Mi'kmaq Regional Assessment Area Central

Projects
Crown Land
Project
Mi'kmaq Regional Assessment Area

Note: Forestry operations occur throughout the RAA and are not displayed on this figure



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 3.75 7.5 15 km

1:300,000 Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed By: KR

Date: 2/25/2021

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

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Document Name: BD_EIS_Figure8-4-X_CEA_Mikmaq_Polygons_Central

500000

5000000

ScoZinc Ltd mine

Taylor Lumber Co. Ltd. mill

National Gypsum quarry

Cook's Brook Sand and Gravel Pit

Murchyville Gypsum Mine

Touquoy Mine Site

Aerotech Connector

Touquoy Mining Operations

Goffs Quarry Expansion

Chebucto - Pockwock Wind Power Project

Highway 107 - Bedford to Burnside

Waste Dangerous and Non-Dangerous Goods
Waste Dangerous and Non-Dangerous

Lake Major Dam Replacement

Gaetz Brook Wind Farm

Liquid Asphalt Storage

Chebucto Terence Bay Wind Power Project

400000

500000

Prepared For:

Atlantic Gold

FIGURE 8.5-6E

Beaver Dam Mine Project

Cumulative Effects Assessment: Access to Crown Land within the Mi'kmaq Regional Assessment Area Western

- Projects
- Crown Land
- Project
- Mi'kmaq Regional Assessment Area

Note: Forestry operations occur throughout the RAA and are not displayed on this figure



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 4.25 8.5 17 km

1:326,852 Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed By: KR

Date: 2/25/2021

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

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Document Name: BD_EIS_Figure8-4-X_CEA_Mikmaq_Polygons_West

The 37 projects can be categorized in five categories by activity:

- **Mining** including Fifteen Mile Stream Gold Project, Touquoy Gold Project, Cochrane Hill Gold Project, Beaver Dam Gold Project, Beaver Dam Haul Road use, Anaconda Gold Mine, Scozinc Mine, Tangier and Dufferin Gold Mines, and the Goldboro Gold Mine.
- **Pits and Quarries** including Cooks Sand and Gravel, National Gypsum, Murchyville Gypsum, Porcupine Mountain, Chedabucto Quarry, Black Point Quarry, Sheet Harbour Quarry, Goff's Quarry, Mosher Lake Limestone, and Loch Katrine Quarry.
- **Forestry and Associated** including forestry activities, Taylor Lumber Mill, Great Northern Timber Wood Chipping and Shipping, and Great Northern Timber Pellet Facility.
- **Wind Power Projects (WPP)** including Gaetz, Mulgrave, Chebucto/Pockwock, Sable, Terence Bay WPPs.
- **Infrastructure and other** including the Lake Major Dam Replacement, Port of Sheet Harbour, Highway 107 Bedford to Burnside Connector, Liquid Asphalt Storage, Waste Dangerous and Non Dangerous Goods Storage, Canso Spaceport Facility Goldbro LNG Facility, Goldboro Gas Plant, Bearpaw Pipeline, and the Highway 102 Aerotech connector.

8.5.7.2.3 Cumulative Effects on the Mi'kmaq of Nova Scotia

Cumulative effects on the Mi'kmaq of Nova Scotia are indirect and will be caused by effects to other VCs from the Project and other projects that have been shown to act cumulatively with overlapping effects within the RAA.

Assessment of the potential for cumulative effects to the Mi'kmaq of Nova Scotia is included in consideration of its socio-economic, socio-cultural, and/or traditional importance; in recognition of potential or established Aboriginal and Treaty rights; and due to the nature of potential Project-VC interactions, and cumulative-VC interactions of other projects in the RAA. Additionally, subparagraph 5(1)(c) of CEAA 2012 and the EIS Guidelines require assessment of potential effects to Indigenous Peoples including consideration of:

- Health and socio-economic conditions;
- Physical and cultural heritage, including any structure, site or thing that is of historical, archaeological, paleontological or architectural significance; and
- Current use of lands and resources for traditional purposes.

In order to evaluate the potential cumulative effect to the Mi'kmaq from the Project and other projects within the RAA, a summary of VC cumulative conclusions identified within Section 8 has been prepared and is presented in Table 8.5-8. These conclusions are then considered in the context of the broader categories of projects within the RAA provided in Section 8.5.7.2.2, and then finally reviewed to evaluate the potential effect to the health and socio-economic condition, physical and cultural heritage and current use of the lands for traditional purposes of the Mi'kmaq of Nova Scotia.

Table 8.5-8: Analysis of Cumulative Effect on the Mi'kmaq of Nova Scotia

Valued Component	Cumulative Effects Residual Effect Summary	Projects (by Category) within RAA and interaction with VC cumulative effects conclusions	Impact to the Mi'kmaq of Nova Scotia			Residual Effect
			Health/Socio	Physical/ Cultural	Traditional Use	
Noise	Additive periods of potential effects from the Project and forestry operations are likely to be limited in frequency. Additive cumulative effects may occur when forestry operations occasionally coincide with Project activities, and hauling ore from Beaver Dam, and FMS and Cochrane Hill concentrate to Touquoy for processing. Cumulative effects to baseline noise levels from the use of the Beaver Dam Haul Road by Beaver Dam, FMS and Cochrane Hill Gold Projects will occur regularly throughout the operational phase of the Project.	Within the noise RAA, forestry operations were considered in the cumulative effects assessment, and cumulative noise impacts along the BD Haul Road from truck traffic from the Project, Cochrane Hill Gold Project, the Beaver Dam Mine Project, and forestry activity. The NSSA AMP lies within the Noise RAA, but is not expected to produce noise on any consistent or substantial basis aside from occasional (annual) helicopter activity. There is no further cumulative impact from noise to the Mi'kmaq within the broader RAA. Individual projects as described in Section 8.5.7.2.2. contribute spatially isolated noise impacts within the RAA, but do not overlap with the Project.	Limited to cumulative effects described within Noise sub-section of Section 8. Specific to BD Haul Road and potential for additive (sporadic) Project + Forestry activities within the Beaer Dam Mine Site	No impact from noise to physical and cultural including any structure, site or thing that is of historical, archaeological, paleontological or architectural significance	Limited to cumulative effects described within Noise sub-section of Section 8. Noise impacts from other projects would be felt in isolation of the Project and its cumulative effects	No additional residual effect beyond that defined in the subsection of Section 8 dedicated to the Noise VC.
Air	Additive periods of potential effects from the Project and forestry operations are likely to be limited in frequency. Elevated dust levels are possible when forestry operations coincide with hauling ore from the Beaver Dam Mine Site to the Touquoy Processing Facility along with concentrate from Fifteen Mile Stream and Cochrane Hill Projects. Cumulative effects to ambient dust levels from the use of the Beaver Dam Haul Road by the Project and Fifteen Mile Stream and Cochrane Hill Gold Project will occur regularly throughout the operational phase of the Project. These cumulative effects are not considered significant, and the Proponent has committed to 80% dust suppression along the Beaver Dam Haul Road to reduce dust levels.	Within the air RAA, fifteen projects were considered in the cumulative effects assessment. These projects were determined to have spatial and temporal overlap with the Project interactions, and were carried through the evaluation of cumulative effects. There is no further cumulative impact from air to the Mi'kmaq within the broader RAA. Individual projects as described in Section 8.5.7.2.2. contribute spatially isolated air impacts within the RAA, but do not overlap with the Project.	Limited to cumulative effects described within Air sub-section of Section 8. Specific to BD Haul Road and potential for additive (sporadic) Project + Forestry activities within the Beaver Dam Mine Site	No impact from air to physical and cultural including any structure, site or thing that is of historical, archaeological, paleontological or architectural significance	Limited to cumulative effects described within Air sub-section of Section 8. Air impacts from other projects would be felt in isolation of the Project and its cumulative effects	No additional residual effect beyond that defined in the subsection of Section 8 dedicated to the Air VC.
Light	Additive periods of potential effects from the Project and forestry operations are likely to be limited in frequency. However, cumulative effects to ambient light levels from the use of the Beaver Dam Haul Road Use by Fifteen Mile Stream, Cochrane Hill Gold Projects and forestry activities will occur regularly throughout the operational phase of the Project, although maximum light levels are limited by two trucks passing by at a single occurrence in space and time.	Within the light RAA, only forestry operations were considered in the cumulative effects assessment, and cumulative light impacts along the BD Haul Road from truck traffic from the Project, Cochrane Hill Gold Project, the Beaver Dam Mine Project, and forestry activity. The NSSA AMP lies within the Light RAA, however light production is not involved in the acid mitigation project, so it was not carried through the evaluation of cumulative effects to light. There is no further cumulative impact from light to the Mi'kmaq within the broader RAA. Individual projects as described in Section 8.5.7.2.2. contribute spatially isolated light impacts within the RAA, but do not overlap with the Project.	Limited to cumulative effects described within Light sub-section of Section 8. Specific to BD Haul Road and potential for additive (sporadic) Project + Forestry activities within the Beaver Dam Mine Site	No impact from light to physical and cultural including any structure, site or thing that is of historical, archaeological, paleontological or architectural significance	Limited to cumulative effects described within Light sub-section of Section 8. Light impacts from other projects would be felt in isolation of the Project and its cumulative effects	No additional residual effect beyond that defined in the subsection of Section 8 dedicated to the Light VC.
Surface Water	Additive periods of potential effects from the Project and forestry operations are likely to be limited in frequency and limited in scale, assuming forestry activities are well managed. The Beaver Dam Mine Project and the Fifteen Mile Stream Gold Project and Cochrane Hill Gold Project interaction cumulatively at the Touquoy Mine Site with the deposition of tailings into the exhausted pit and the resulting effect to the Moose River. With water treatment, this residual effect is considered low magnitude. The presence of historical tailings at Beaver Dam Mine Site has an additive effect with the Project, resulting in a positive residual effect through improvement of water quality with property management and disposal of historical tailings during Project development.	Within the surface water RAA, forestry operations and the NSSA AMP were considered in the cumulative effects assessment; along with the Touquoy Mine Project. There is no further cumulative impact of surface water to the Mi'kmaq within the broader RAA. Individual projects as described in Section 8.5.7.2.2. contribute spatially isolated surface water impacts within the RAA, but do not overlap with the Project.	Limited to cumulative effects described within Surface Water sub-section of Section 8. Recreational swimming within Cameron Flowage has been evaluated from Project water quality. Adverse health effects from recreational water use (swimming) are not anticipated. Swimming in Moose River has been discounted due to low water levels.	No impact from surface water to physical and cultural including any structure, site or thing that is of historical, archaeological, paleontological or architectural significance	Limited to cumulative effects described within Surface Water sub-section of Section 8.	No additional residual effect beyond that defined in the subsection of Section 8 dedicated to the Surface Water VC.

Valued Component	Cumulative Effects Residual Effect Summary	Projects (by Category) within RAA and interaction with VC cumulative effects conclusions	Impact to the Mi'kmaq of Nova Scotia			Residual Effect
			Health/Socio	Physical/ Cultural	Traditional Use	
Fish and Fish Habitat	Additive periods of potential effects from the Project and forestry operations are likely to be limited in frequency and limited in scale, assuming forestry activities are well managed. The NSSA AMP is expected to provide a positive residual impact to fish and fish habitat. Water quality will meet CCME Freshwater Aquatic Guidelines with necessary water treatment and thus will not impact fish and fish habitat in the receiving environment (Anti-Dam Flowage) The Fifteen Mile Stream Project and the Project interaction cumulatively at the Touquoy Mine Site with the deposition of tailings into the exhausted pit and the resulting effect to the Moose River. With water treatment, this residual effect is considered low magnitude and the effect to Mi'kmaq consumption of country foods (fish) has been concluded to be low.	Within the fish RAA, forestry operations and the NSSA AMP were considered in the cumulative effects assessment; along with the Touquoy Mine Project. There is no further cumulative impact of surface water to the Mi'kmaq within the broader RAA. Individual projects as described in Section 8.5.7.2.2. contribute spatially isolated surface water impacts within the RAA, but do not overlap with the Project.	Limited to cumulative effects described within Surface Water sub-section of Section 8. It is unlikely that effluent releases will result in levels of metals in country foods (fish) that would be harmful to human health.	No impact from fish to physical and cultural including any structure, site or thing that is of historical, archaeological, paleontological or architectural significance	Limited to cumulative effects described within Fish sub-section of Section 8. Fishing activities to support Mi'kmaq traditional uses and commercial fisheries are not expected to be affected by the Project or its cumulative impact with identified projects as described in the Fish sub-section of Section 8.	No additional residual effect beyond that defined in the subsection of Section 8 dedicated to the Fish VC.

The cumulative effect of all projects within the RAA combined result in a loss of potential access to lands for traditional or spiritual purposes. The total area of the identified projects in the RAA was calculated in order to quantify the area of land (for the purposes of this exercise, limited to crown land only) which may be lost for traditional purposes. The total estimated project footprint was calculated for each individual project, using publicly available study area boundaries where available, property boundaries, and aerial photo interpretation of project infrastructure if a study area boundary was not publicly available. As the calculations were based on each project's study area or property boundary rather than actual infrastructure, this method is considered an overestimate of land lost to traditional purposes. Furthermore, all projects were considered, regardless of the temporal nature of a project's implementation (past, present or future). As such, this exercise presents a worst-case scenario, assuming all projects overlap temporally to limit access for the Mi'kmaq for their traditional practices.

Two projects have been excluded from this spatial land use exercise. The Nova Scotia Salmon Association's Acid Mitigation Project in the West River Sheet Harbour was not considered as removing land available for traditional or spiritual purposes. These habitats are still available, but work has been completed to mitigate the effects of acid rain on the watercourses. Secondly, timber harvesting was not considered as a loss of access to land for traditional purposes. Reliable, accurate data quantifying the area of timber harvesting which occurs on private land and crown land is not available. Timber harvesting changes the habitat type for some time, but it does not result in permanent change in the capacity of the forest to support habitats and species (i.e. natural succession will, in time, allow forest habitat to regenerate), and it does not result in loss of access to the land on any time frame, with the exception of during active cutting periods. As such, these two projects were not quantified for this cumulative effects assessment.

The total area of projects within the RAA, and the proportion of crown land is presented in Table 8.5-9 and 8.5-10. All projects quantified within the RAA account for 6,282 ha of total area, 3,148 ha of which is crown land. The loss of access to a maximum area of 3,148 ha from all identified projects in the RAA accounts for 0.32% of all land within the RAA, and 0.88% of available crown land within the RAA. The maximum project footprints used for this calculation are presented on Figure 8.5-6. Figure 8.5-7 shows the proportion of industrial development in the RAA, which accounts for less than 1% of the region (0.6%). The proposed Beaver Dam Mine Project, as well as all other AMNS projects, account for only 0.4% of the RAA (Figure 8.5-7).

Table 8.5-9: Cumulative Projects in the Regional Assessment Area

	Development Type	Industrial Developments	Area (ha)
Existing			
1	Mine	Touquoy Mine	219.99
2	Mine	Dufferin Gold Mine	46.41
3	Mine	Tangier Gold Mine	29.90
4	Mine	ScoZinc Ltd Mine	236.14
5	Quarry	Chedabucto Aggregates	22.55
6	Quarry	Black Point Quarry	371.53
7	Quarry	Porcupine Mountain Quarry	278.36
8	Quarry	Mosher Lake Limestone	3.44
9	Quarry	Murchyville Gypsum Mine	11.61
10	Quarry	Cook's Brook Sand Gravel	13.80
11	Quarry	National Gypsum Quarry	475.94
12	Quarry	Goff's Quarry Expansion	69.16
13	Quarry	Loch Katrine Quarry	47.51

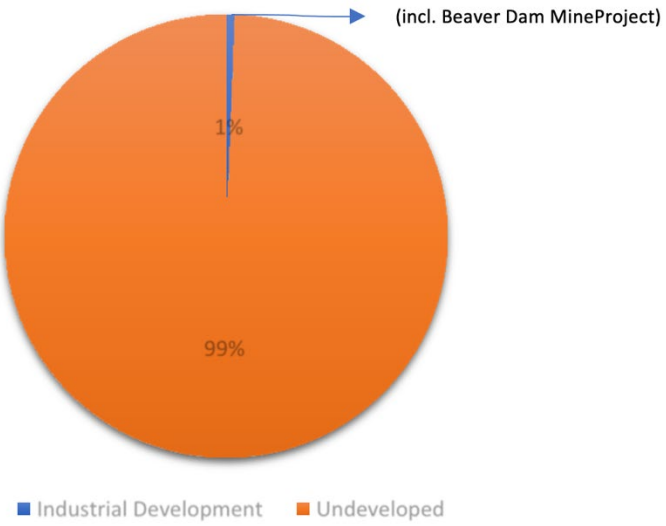
Table 8.5-9: Cumulative Projects in the Regional Assessment Area (continued)

	Development Type	Industrial Developments	Area (ha)
14	Wind	Chebucto Terence Bay Wind	1.39
15	Wind	Gaetz Brook Wind Farm	1.21
16	Wind	Chebucto Pockwock Wind	9.54
17	Wind	Sable Wind Power	5.91
18	Wind	Mulgrave Wind Power	3.80
19	Hydro	Lake Major Dam Replace	0.09
20	Timber Mill	Great Northern Timber (Sheet Harbour)	42.80
21	Timber Mill	Great Northern Timber (Musquodoboit)	37.83
22	Timber Mill	Taylor Lumber Co. Mill	7.42
23	Infrastructure	Port of Sheet Harbour	25.70
24	Infrastructure	Highway 107	110.68
25	Infrastructure	Liquid Asphalt Storage	1.13
26	Infrastructure	Waste Dangerous and Non Dangerous Goods	3.94
		Subtotal	*2,077.78*
Approved			
27	Quarry	Sheet Harbour Quarry	156.54
28	Oil and Gas	Goldboro LNG Facility	136.31
29	Oil and Gas	Goldboro Gas Plant	36.11
30	Infrastructure	Canso Spaceport Facility	21.82
		Subtotal	*350.78*
Proposed			
31	Mine	Beaver Dam Mine	470.65
32	Mine	Haul Road Study Area (including existing Mooseland Road Corridor)	295.97
33	Mine	Fifteen Mile Stream Study Area	1,139.60
34	Mine	Cochrane Hill Gold	1,410.22
35	Mine	Anaconda Gold Mine	283.54
36	Oil and Gas	Bearpaw Pipeline Project	183.06
37	Infrastructure	Aerotech Connector	70.66
		Subtotal	*3,853.70*
		Total	**6,282.22**

Table 8.5-10: Analysis of Cumulative Effect on Access to Crown Land within the Mi'kmaq of Nova Scotia Regional Assessment Area

	Total Area (ha)	Total Area of Crown Land
Regional Assessment Area	974,571	357,647
CEA Projects within Regional Assessment Area	6,282	3,148

Figure 8.5-7: Percent Regional Industrial Development in Regional Assessment Area



8.5.7.3 Mitigation

In part to mitigate the adverse effects on the use of surface waters and the fish that inhabit them for traditional purposes, the Proponent has committed to water treatment during operations and during post closure as required, at the Beaver Dam Mine Site. In order to mitigate the adverse effects of dust dispersion onto plants and berries for traditional purposes that inhabit the forests surrounding the Beaver Dam Mine Site and Haul Road, the Proponent has committed to the use of chemical dust suppressants as required to reduce dust by 80% on the Haul Road.

The Beaver Dam Mine Site and Haul Road will limit access to Millbrook First Nation and other Mi'kmaq of Nova Scotia for a period of eight years. The proposed property extents of the Beaver Dam Mine Site and Haul Road encompasses a 727-ha area, of which 123 ha is Crown land.

The Proponent has committed to the development of a multi-use bypass road parallel to the Haul Road. This bypass road will allow continued access for the Mi'kmaq of Nova Scotia and specifically, Millbrook First Nation community members, to lands and lakes used for traditional purposes to the south and north of the Beaver Dam Haul Road between Highway 224 and the Mooseland Road, to the east and west of the Beaver Dam Haul Road between Highway 224 and the Beaver Dam Mine Site, as well as access to the lands north of the Beaver Dam Mine Site.

Tracts of crown land are present in close proximity to the Project (Figure 6.14-7). These tracts of land are adjacent to the Project Area and, in most cases, overlap with areas with documented traditional use (MFC 2019). These areas of land are publicly owned, not limited by provincial or federal parks and protected areas, are all accessible and available with consideration of the mitigation measures described in CEAA 2-48. These areas are presented as potential suitable alternative areas for traditional practices to continue, during the eight-year temporal scale of the Project.

The Proponent is committed to engaging in fisheries offsetting plans, and wetland compensation activities for the fish habitat and wetland loss associated with the Project as required by the Fisheries Act Authorization Process and provincial wetland alteration process for the Project.

The mitigation of the effects on land use and resources for traditional purposes originating from regional forestry and land management practices falls outside the scope of the project Proponent's authority and responsibility.

8.5.7.4 Residual Cumulative Effects and Significance Assessment

A significant cumulative adverse residual effect on the Mi'kmaq of Nova Scotia is defined as an environmental effect that results in one or more of the following outcomes:

Long-term (greater than 20 years) or permanent loss of the availability of, or access to, land and resources currently relied on for traditional use practices; or if long-term or permanent loss is expected, no allowance for agreed-upon compensation with the affected Mi'kmaq community(s). A twenty-year temporal scale was chosen to represent a generational loss of access to an area.

Human health risk assessments are inherently conservative, and hence, development of a threshold of significance for human health is complicated, since risk estimates tend to be biased high, based on the degree of conservatism included in any given risk assessment. The threshold for a significant residual effect has been defined as a potential adverse effect to health, identified through the conclusions presented in the HHRA.

An unmitigated loss of a physical or cultural structure, site or thing that is of historical, archaeological, paleontological or architectural significance to the Mi'kmaq.

Short-term (less than 20 years) loss of availability of land and resources caused by displacement due to Project activities are not considered to be significant.

The significance of potential effects on potential or established Aboriginal or treaty rights is a matter of consideration by the Crown and Mi'kmaq representatives (Assembly of Nova Scotia Chiefs and the Governments of Canada and Nova Scotia).

Assuming that the proposed mitigation and compensation measures are applied for the Project, and that they achieve their objectives, the predicted residual cumulative effects on the Mi'kmaq of Nova Scotia are assessed to be adverse, but not significant (Table 8.5-11).

Historical and current land use with the region has affected the local habitats in ways that have affected the local distribution and abundance of several species of flora and fauna. However, the total area of crown land that has been limited by all projects identified within the RAA is only 0.88% of available crown land present within the RAA.

Table 8.5-11: Residual Cumulative Environmental Effects on the Mi'kmaq of Nova Scotia

Residual Adverse Cumulative Effects (After Mitigation and Compensation if required)	Significance Levels						Overall Significance of Residual Adverse Effects (and Rationale)
	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	
Effects to Mi'kmaq of Nova Scotia and their traditional land use as a result from impacts to air quality, noise, light, surface water, fish habitat, and human health, and cumulative limitations to land use for traditional purposes from multiple projects within the RAA.	L Mitigation and best management strategies reduce magnitude of impact. The loss of access to a maximum area of 6,282 ha from all identified projects in the RAA accounts for 0.64% of all land within the RAA, and 0.88% of available crown land within the RAA.	LAA Direct cumulative effects within PA, indirect cumulative effects within LAA. BD Haul Road cumulative effects within LAA for BD Haul Road.	A Seasonal windows applicable. Air dispersion affected by season and wind direction, noise and light effects will be limited by foliage when present on trees, effects to fish and fish habitat are more sensitive during spawning windows (spring and fall).	LT Effects will extend beyond 8+ years – will extend to eight years of limited access to the Beaver Dam Mine Site, less than the defined 20 years in the context of the Mi'kmaq of Nova Scotia VC significant threshold.	R VC interaction will occur regularly.	R VC interaction will recover to baseline after Project activities are completed.	Moderate Adverse Effect (Not Significant) Assuming that the proposed compensation measures are applied for the Project and that they achieve their objectives, the predicted residual cumulative effects on the Mi'kmaq of Nova Scotia with regards to impacts to air quality, noise, light, surface water, fish habitat, and human health, are assessed to be adverse, but not significant. Loss of access is limited to 0.88% of available crown land within the RAA.

Legend (refer to Section 5.11, Table 5.11-1 for definitions)

Magnitude		Geographic Extent		Timing		Duration		Frequency		Reversibility	
N	Negligible	PA	Project Area	N/A	Not Applicable	ST	Short-Term	O	Once	R	Reversible
L	Low	LAA	Local Assessment Area	A	Applicable	MT	Medium-Term	S	Sporadic	IR	Irreversible
M	Moderate	RAA	Regional Assessment Area			LT	Long-Term	R	Regular		
H	High					P	Permanent	C	Continuous		

8.5.7.5 Follow-up and Monitoring Programs

No additional monitoring is recommended, beyond that provided in each VC section and associated cumulative effects section. The monitoring and follow-up of the residual cumulative effects, primarily caused by past and ongoing forestry practices, falls outside the scope of the project Proponent's authority and responsibility.

Follow-up and monitoring of the site reclamation for the Beaver Dam Mine Site will be required. In addition, it is expected that the development of benefit agreement(s) and implementation of the overall Mi'kmaq engagement strategy with regards to the Project will include regular review of compliance and effects monitoring programs associated with other VCs, as well as monitoring of Project benefits to the Mi'kmaq of Nova Scotia.

8.6 Cumulative Effects Summary

A Cumulative Effects Assessment was carried out in order to meet the general requirements of the CEAA 2012, as well as the specific requirements laid out in the *Guidelines for the Preparation of an* Environmental *Impact Statement pursuant to the Canadian Environmental Assessment Act, 2012* and *Nova Scotia Registration Document pursuant to the Nova Scotia Environment Act – Beaver Dam Mine Project – Atlantic Gold Corporation*.

The VCs included in the Cumulative Effects Assessment into consideration were the following:

- Physical Environment:
  - Noise;
  - Air;
  - Light; and
  - Surface Water Quality and Quantity.
- Biophysical Environment:
  - Fish and Fish Habitat; and
  - Species of Conservation Interest and Species at Risk.
- Socio-Economic Environment:
  - Mi'kmaq of Nova Scotia.

Major industrial projects that have or are taking place within each VC's respective RAA were identified. Figure 8.5-6 identifies the complete suite of Projects which were considered in the Cumulative Effects Assessment.

The main conclusions of the Cumulative Effects Assessments are as follows:

- The cumulative effects to Noise, Air and Light are considered to be adverse but not significant. The primary pathway for cumulative effects for these VCs is through increased traffic along the Beaver Dam Haul Road. Logging trucks, and traffic from both the FMS and Cochrane Hill Projects will account for approximately 11.6% of the total proposed traffic rates. This is not expected to result in a significant cumulative effect to any of these three VCs, as described in Sections 8.5.1 to 8.5.3.
- The primary pathway for cumulative effects regarding surface water quantity and quality is through the addition of the Project, the proposed expansion of the Touquoy pit and subsequent disposal of Touquoy tailings in the exhausted pit, the Fifteen

Mile Stream Gold Project and Cochrane Hill Gold Project to the processing and waste disposal facilities at the Touquoy Mine Site. The cumulative effects of these combined projects on the receiving environments are adverse, but not significant, provided all mitigation measures are implemented.

- Cumulative effects to fish and fish habitat can occur directly (through direct loss of fish habitat, for instance), or indirectly through effects of projects on water quantity and quality. No significant cumulative effects to surface water quantity and quality is expected. Timber harvesting is a predominant land use within the fish and fish habitat RAA. It is expected that timber harvesting be carried out under the Wildlife and Watercourse Protection Regulations, reducing the potential cumulative effect on fish and fish habitat. Therefore, the primary pathway for cumulative effects to fish and fish habitat is through direct fish habitat loss. The Beaver Dam Project will result in approximately 4.18 ha of direct loss of fish habitat to allow for construction of the Open Pit and associated infrastructure. The Project is expected to result in an additional 322 m^2 of indirect impact to fish habitat based on flow reduction in local catchment areas. There is spatial and temporal overlap between the Project and terrestrial liming work being completed by the NSSA, however the NSSA AMP work is expected to result in a positive residual effect to fish and fish habitat, and will not lead to an adverse residual effect to fish and fish habitat when combined with the proposed Beaver Dam Project.
- Overall, the generalized disturbance of the landscape by forestry activities, past, present and future are the main source of cumulative effects of habitats, flora, terrestrial fauna and birds throughout the area. These cumulative effects also lead to effects on current use of land and resources for traditional purposes by the Mi'kmaq of Nova Scotia and to effects to priority species (SOCI and SAR). The maximum Project edge effect will affect 237 ha of interior forest habitat, which accounts for 0.3% of predicted interior forest in the RAA. There is limited additional development pressures from other projects in the RAA, as demonstrated by the few projects identified within this evaluation with small footprints of disturbance.
- The main pathways for cumulative effects to the Mi'kmaq of Nova Scotia are described as any adverse effect to the health and socioeconomic conditions, physical and cultural heritage, and current use of lands and resources for traditional purposes, as described in detail in Section 8.5.7. Cumulative effects of the Project on the Mi'kmaq of Nova Scotia, considering these three primary pathways, has been assessed as adverse, but not significant. The loss of access to a maximum area of 6,282 ha from all identified projects in the RAA accounts for 0.64% of all land within the RAA, and 0.88% of available crown land within the RAA. The largest regional impact to the landscape appears to be from regional forestry activities based only on aerial photography review. This impact could not be quantified herein due to a lack of publicly available data to support quantitative analysis.

Once the mitigation measures are taken into account, there are no significant residual cumulative effects anticipated for the VCs evaluated herein. The predicted residual cumulative effects on the Mi'kmaq of Nova Scotia with regards to indirect effects from impacts to water quality, wetland habitats, and road safety, are assessed to be adverse, but not significant.

Historical and current land use within the region has undeniably affected the local habitats in ways that have affected the local distribution and abundance of several species of flora terrestrial fauna and birds, including SOCI and SAR. However, the mitigation of the effects originating from regional forestry and land management practices falls outside the scope of the Project Proponent's authority and responsibility.

9 SUMMARY OF ENVIRONMENTAL EFFECTS ASSESSMENT MITIGATIONS AND ENVIRONMENTAL RESIDUAL EFFECTS

This section provides tables summarizing the following key information:

- Proposed mitigation measures to address the effects identified above as described in Section 6 of this EIS. AMNS acknowledges that responsibility for implementation of all mitigation measures proposed within this EIS during the Project phases (i.e., construction, operation, active closure, and post-closure) ultimately rests with AMNS; and
- Potential residual effects and the significance of the residual environmental effects for each Valued Components (VCs (Section 6) and the cumulative effects assessment (Section 8).

9.1 Summary of the Environmental Impact Statement

As described throughout the EIS, Project-environment interactions are expected to occur throughout the life of the Project during the construction, operations, active closure (i.e., decommissioning and reclamation), and post-closure phases. These interactions are expected and are typical of environmental impacts associated with mineral extraction projects in the region.

Given the considerations identified above and based on baseline studies completed for each of the identified VCs, the Project is not predicted to result in any significant adverse environmental effects after mitigation measures have been applied. Monitoring programs will proceed to gather pre-construction data for select VCs. This data will be used to refine mitigation measures and monitoring programs for the construction, operation, reclamation and decommissioning, and post-closure phases. Monitoring programs will continue throughout the life of the Project to verify baseline conditions and to determine the effects of the Project on the surrounding environment.

Key mitigation measures that will specifically mitigate the potential adverse residual effects are summarized in Table 9.1-1. Proposed mitigation measures are described in greater detail in the effects assessment for each individual VC in Section 6. A summary of the potential adverse residual effects associated with the Project, and their associated significance, and the Project's cumulative effects is summarized in Table 9.1-2 and Table 9.1-4.

AMNS acknowledges that responsibility for all mitigation commitments ultimately rest with AMNS.

Table 9.1-1: Summary of Key Mitigation Measures by Valued Component

Project Phase	Mitigation Measures	Corresponding EIS Section Number and/or Appendix
Noise		
C, O	Operations, infrastructure, and property boundaries for the Beaver Dam Mine have been updated to mitigate predicted noise levels at the property line. The following noise mitigation measures are incorporated into the current design of the Beaver Dam Mine: • The pit entrance/exit has been relocated to the west side of the pit, farther from the northeast property boundary. • No more than four drills will operate concurrently during any day, evening or nighttime hour. • Increase the height of the safety berm along the north boundary of the pit.	6.1.7.3.2
C, O	Restrict blasting to a specific and regular daytime schedule during weekdays. Specifically, lasting will not be undertaken on Sundays, statutory holidays, or any day between the hours of 1800 hours and 0800 hours (NSEL 1999).	6.1.8
C	Haul road construction will be restricted to the day and evening periods	6.1.8
O	If necessary, construct a large safety berm along the north boundary of the pit, dependent on how raw materials are processed at the Beaver Dam Mine Site	6.1.8
O	Operating hours for processing plants and trucking on the Haul Road will be limited to reduce nighttime noise levels	6.1.8
O	Maximum 4 drills will operate at the Beaver Dam Mine Site pit at any time during the Operation Phase of the Project.	6.1.8
C, O, CL	Implement preventative maintenance plans for all mobile and stationary equipment.	6.1.8
C	Noise-reduction as criteria in equipment selection.	6.1.8
C, O	Communicate general blasting schedule to the local community.	6.1.8
C	Consider the use of natural landforms when available as noise barriers when designing final site details and when placing fixed equipment.	6.1.8
O	Operating hours for processing plants and trucking on the Haul Road will be limited to reduce nighttime noise levels.	6.1.8
O	Regular check by site manager for excessive noise on site and in relation to sensitive receptors so that resolution can be timely.	6.1.8
C, O, CL	Implement preventative maintenance plans for all mobile and stationary equipment.	6.1.8
C	Noise-reduction as criteria in equipment selection.	6.1.8
C, O	Speed reduction.	6.1.8
C, O	Use equipment that meets appropriate noise emission standards for off-road diesel equipment.	6.1.8
C, O	Subcontractor agreements will include an obligation to comply with environmental protection including noise reduction.	6.1.8
C, O	Site design to reduce need for reversing and vehicle reversing alarms.	6.1.8
C, O	A procedure, including a response plan, will be available for public to be able to register complaints regarding noise concerns.	6.1.8

Table 9.1-1: Summary of Key Mitigation Measures by Valued Component (continued)

Project Phase	Mitigation Measures	Corresponding EIS Section Number and/or Appendix
Air		
C, O	Use wet suppression controls on unpaved surfaces.	6.2.8
C, O	Utilize paved surfaces where available.	6.2.8
C, O	Speed reduction.	6.2.8
O	Apply stabilized covers on inactive stockpiles.	6.2.8
O	Use mechanical sweeper on paved surfaces to prevent dust from remobilizing.	6.2.8
O	Apply dust suppressants, when and where practicable, to target 80 to 90% percent effectiveness.	6.2.8
O	Size haul vehicles appropriately to minimize trip frequency.	6.2.8
O	Implement appropriate dust suppression measures for crusher trains and associated activities/stockpiles.	6.2.8
O	Cover haul trucks to minimize dust during transportation between the mine site and the Touquoy facility.	6.2.8
O	Implement Dust Suppression Plan as part of the Fugitive Dust Control Plan (Appendix C.3).	6.2.8
O	A procedure, including a response plan, will be available for public to be able to register complaints regarding dust concerns.	6.2.8
CL	Stabilize slopes on inactive stockpiles to a safe and long-term angle of repose.	6.2.8
CL	Use soil and organics stockpiles for final capping and stabilization. Hydroseed as required.	6.2.8
Light		
C	Temporary lighting will be directly focused on work areas and shielded where practicable to avoid light trespass	6.3.8
C, O, CL	Use of only downward-facing lights on site infrastructure and Mine Site roads	6.3.8
	Install motion-sensing lights, where practicable	6.3.8
	Only use direct and focused light when needed for worker safety	6.3.8
	All floodlights will employ full horizontal cutoff, as appropriate	6.3.8
	Lighting not in use will be turned off, whenever practicable	6.3.8
	Site perimeter lighting will be directed to minimize light offsite light trespass	6.3.8
	Utilize efficient sources of light to reduce overall magnitude of light, wherever practicable	6.3.8
	A procedure, including a response plan, will be available for public to be able to register complaints regarding light concerns	6.3.8

Table 9.1-1: Summary of Key Mitigation Measures by Valued Component (continued)

Project Phase	Mitigation Measures	Corresponding EIS Section Number and/or Appendix
Greenhouse Gases		
C, O, CL	Limit engine idling where practicable.	6.4.8
C, O, CL	Implement fuel efficiencies where practicable.	6.4.8
C, O, CL	Implement preventative maintenance plans for all mobile and stationary equipment.	6.4.8
C, O, CL	Use renewable energy where reasonable (e.g., solar-powered lights).	6.4.8
Geology, Soils and Sediment		
C, O, CL	Use of the following routine controls, as needed: • Silt fences • Silt curtains • Riprap • Check dams • Settling ponds	6.5.8
C, O, CL	Segregate and manage waste rock with the potential for acid generation	6.5.8
C, O	Implement Erosion and Sediment Control Plan	6.5.8, Appendix C of Appendix P.4 (Mine Water Management Plan)
C, O	Secure overburden stockpiles using a combination of mulching, hydroseeding, and slope stabilization	6.5.8
C, O, CL	Limit exposed soil	6.5.8
CL	Use soil and organics stockpiles for final capping and stabilization. Hydroseed as required	6.5.8
Groundwater		
C	Conduct pre-construction well survey at Beaver Lake IR.	6.6.8
C, O	Use above ground fuel storage tanks that meet applicable regulatory standards.	6.6.8
C, O	Select appropriate type of explosive that will minimize nitrogen release to surface water and groundwater.	6.6.8
C, O, CL	Sub-aqueous deposition of mine tailings to reduce/prevent oxides and leaching.	6.6.8
CL	In the event of acid rock drainage and metal leaching, implement mitigative measures that will manage the source material and drainage effectively utilizing methods such as segregation and encapsulation.	6.6.8

Table 9.1-1: Summary of Key Mitigation Measures by Valued Component (continued)

Project Phase	Mitigation Measures	Corresponding EIS Section Number and/or Appendix
C	Based on evaluation of predicted aquatic risk, pump and treatment of groundwater (if required based on monitoring results) from installed groundwater wells at Beaver Dam Mine Site including those at Crusher Lake, Mud Lake, outlet from Mud Lake to the Killag, and Cameron Flowage, and existing groundwater wells at Touquoy between the open pit and the Moose River. The purpose of this groundwater treatment is to intersect groundwater seepage impacted with Constituents of Concern (COCs) above Tier II pathway specific guidelines or groundwater baseline/background prior to seepage discharging into surface water bodies.	6.6.8
C,O	Use blasting and pit construction techniques that minimize the potential for negatively interacting with the adjacent groundwater table and nearby surface water.	6.6.8
C,O	Implement water conservation program for onsite facilities.	6.6.8
C,O	Recycle site water for reuse wherever practical to reduce water withdrawal from lakes or streams.	6.6.8
C,O	Recycled water must meet acceptable water quality criteria for its intended use.	6.6.8
Surface Water		
C, O, CL	Use of the following structures, as needed: • Silt fences • Silt curtains • Riprap • Check dams	6.7.9, Appendix P.4 (Mine Water Management Plan)
C, O, CL	Limit exposed soil	6.7.9
C, O	Implement Erosion and Sediment Control Plan	6.7.9
O, CL	Segregate and manage waste rock with the potential for acid generation	6.7.9
O	Use adequately sized settling and containment ponds as required	6.7.9
O	Use flocculants and coagulants as required	6.7.9
C, O	Install perimeter ditches around site infrastructure	6.7.9
O	Provide appropriate settling time for suspended solids prior to discharge	6.7.9
O	Ensure pit water meets applicable regulatory quality criteria for discharge – otherwise treat water prior to discharge	6.7.9
O	Direct drainage ditches to designated settling ponds or other locations	6.7.9
C, O	Use above ground fuel storage tanks that meet applicable regulatory standards	6.7.9
C, O	Select appropriate type of explosive that will minimize nitrogen release to surface water and groundwater	6.7.9
C, O	Implement Surface Water Management Plan	6.7.9, Appendix P.4 (Mine Water Management Plan)

Table 9.1-1: Summary of Key Mitigation Measures by Valued Component (continued)

Project Phase	Mitigation Measures	Corresponding EIS Section Number and/or Appendix
C, O	Develop and implement an Emergency Response Spill Contingency Plan	6.7.9
C, O	Use clean, non-ore-bearing, non-watercourse derived and non-toxic materials for erosion control methods	6.7.9
C, O, CL	Sub-aqueous deposition of mine tailings to reduce/prevent oxides and leaching	6.7.9
CL	In the event of the potential for acid rock drainage and metal leaching, implement additional studies required to assess to actual risk and, as warranted, implement mitigative measures that will manage the source material and drainage effectively utilizing methods such as segregation and encapsulation	6.7.9
C, O, CL, PC	Minimize snow deposition into watercourses during snow removal activities	6.7.9
C	Construct drainage ditches and ponds to maintain natural flow directions when practical	6.7.9
O	Control release of settling ponds to mimic natural hydrograph, where practicable	6.7.9
O	Recycle site water for reuse wherever practical to reduce water withdrawal from lakes or streams	6.7.9
O	Recycled water must meet acceptable water quality criteria for its intended use	6.7.9
C	Mine infrastructure will be designed to minimize erosion during construction and operations, so as to preserve the stability of the ground surface surrounding mine infrastructure, SWM ditches, settling ponds and conveyance pathways, dykes, berms and any other Mine installations. The potential for scouring downstream of structures and the potential impacts of sudden changes in flow volume will also be considered. Short courses on erosion and sediment control design and inspection will be given to all managers and supervisors prior to mining or construction activities that may cause erosion or sediment movement and deposition. Environmental monitors will participate in a short course or seminar on inspection activities associated with erosion and sediment control. An 'Erosion Awareness and Identification' module will be a component of Mine specific training provided to all workers associated with earthwork mining activities. Principles for the ESCP for the Site include: 1. Fit the activity to the existing topography, soils, waterways, and natural vegetation of the site 2. Expose the smallest practical area of land for the shortest possible time 3. Apply erosion control practices as the primary method to prevent on-site damage 4. Apply sediment control practices as perimeter protection to prevent off-site damage 5. Implement a thorough maintenance plan during construction and operations	Appendix C draft Erosion and Sediment Control Plan of Appendix P.4 (Mine Water Management Plan)
C	To prevent discharge of sediment laden water from the Site during construction the first piece of site infrastructure to be constructed is to be the north settling pond. All site water will be directed towards the north settling pond (via an expanding network of surface water ditches or via pumping) prior to discharge until the east settling pond and south settling pond have been constructed. The north settling pond is to be constructed prior to any clearing or grubbing for other components of the Mine Site.	Appendix C draft Erosion and Sediment Control Plan of Appendix P.4 (Mine Water Management Plan)

Table 9.1-1: Summary of Key Mitigation Measures by Valued Component (continued)

Project Phase	Mitigation Measures	Corresponding EIS Section Number and/or Appendix
C	Following the development of the north settling pond, other aspects of the mine will be developed including the open pit, administrative areas, and haul road. Prior to the development of other aspects of the mine the associated mine water infrastructure components are to be developed as well. For example, prior to clearing, grubbing and development of the till and organics stockpile areas the east and south settling ponds must be developed first. The contact water ditch network is to be developed in conjunction with the stockpile and haul road development, starting at the downstream end and working upstream.	Appendix C draft Erosion and Sediment Control Plan of Appendix P.4 (Mine Water Management Plan)
O	Climate change impacts were accounted for in the design of mine water management infrastructure using Nova Scotia Environment climate change projections for the province.	Section 2.2 Mine Water Management Plan (Appendix P.4)
O	All site contact water will be collected into the north settling pond during construction and operations. The north pond will be connected to a robust water treatment system to ensure discharge water quality meets regulatory guidelines. An emergency spillway has been designed to direct excess runoff water into the open pit should an event larger than a 1:100 year storm event occur, to mitigate against the potential release of non-treated contact water from an extreme flood event.	Mine Water Management Plan (Appendix P.4, Appendix B Hydrologic Modelling Section 4)
O	All settling ponds include a filter berm to further improve the removal of TSS prior to discharge into the natural environment	Section 3.3 Mine Water Management Plan (Appendix P.4)
O	The settling ponds have been designed to control discharge for all storm events up to and including the 100-year design storm event over a minimum of duration of 24 hours. All ponds also include an emergency overflow spillway that has been designed to control the largest hurricane on record, Hurricane Beth	Section 3.3 Mine Water Management Plan (Appendix P.4)
O	Contact water ditches are proposed to be lined with impermeable membranes to mitigate against infiltration into the groundwater system	Section 6.1 Mine Water Management Plan (Appendix P.4)
O	Water treatment system used during dewatering of historical tailings (construction period) will remain on-site and connected to the north pond system to be used if it is identified, through on-going monitoring, that discharge water exceeds regulatory discharge requirements	Section 7.2 Mine Water Management Plan (Appendix P.4)
O	The proposed mine development is anticipated to increase streamflow volumes in the Killag River. AMNS will ensure post-development peak discharge does not exceed baseline peak discharge in the Killag River by providing peak flow attenuation through the settling ponds	Mine Water Management Plan Appendix A Water Balance Analysis Section 6 (Appendix P.4)
O	To further mitigate impacts to fish and fish habitat downstream of the settling ponds during more frequent events, all pond outlet structures (including the aeration lagoon) will be equipped with emergency shut-off valves that will be closed if any water quality parameter exceedances are triggered. The east, south and west settling ponds can contain the 10-year 24-hour rain event with no outflow, while the north settling pond can contain up to the 5-year 24-hour event with no outflow.	Mine Water Management Plan Appendix B Hydrologic Modelling Section 3 (Appendix P.4)

Table 9.1-1: Summary of Key Mitigation Measures by Valued Component (continued)

Project Phase	Mitigation Measures	Corresponding EIS Section Number and/or Appendix
O	If the nitrite or metal concentration objectives are exceeded in the east or south settling ponds, the impacted water will be pumped, or collected in a vacuum truck, and transported to the north settling pond for further treatment.	Mine Water Management Plan Appendix B Hydrologic Modelling Section 3 (Appendix P.4)
O	Each settling pond will maintain a permanent pool to the level of the first low flow orifice and will control the three design storms with a minimum detention time of 24 hours. There will be a minimum of 0.3 m of freeboard between the 100-year design event and the emergency spillway invert. Above the 100-year event, the emergency spillway is designed to pass Hurricane Beth	Mine Water Management Plan Appendix B Hydrologic Modelling Section 4 (Appendix P.4)
CL	The WBM predicts a decrease in streamflow at the Killag River DS assessment point while the pit is being filled with water in PC conditions. AMNS will implement a circular pumping system that uses water collected in the open pit, (including groundwater that is drawn from the Killag River), to mitigate against baseflow reduction in the Killag River caused by the open pit during low flow periods as described in the Baseflow Mitigation Assessment	Mine Water Management Plan Appendix H Baseflow Mitigation Assessment (Appendix P.4)
CL	The north settling pond will remain active during post closure and pit lake filling. The purpose will be to allow for the diversion of flow directly to the Killag River during low flow periods to augment flow volume to maintain environmental flows	Section 3.3 Mine Water Management Plan (Appendix P.4)
CL	The PAG waste rock pile will be capped with an impermeable liner and vegetated to reduce infiltration and seepage of contact water.	Section 3.3 Mine Water Management Plan (Appendix P.4)
CL	As part of the reclamation plan, the LGO stockpile will be removed and surface runoff from this area will be directed back toward Mud Lake to reduce the environmental impact to the lake	Section 3.3 Mine Water Management Plan (Appendix P.4)
CL	Based on the results from the Baseflow Mitigation Study, the discharge point of the Pit Lake has been set to re-establish ~99% of baseflow through this section of Cameron Flowage	Mine Water Management Plan Appendix H Baseflow Mitigation Assessment (Appendix P.4)
Wetlands		
C, O, CL	Complete pre-construction site meetings for all relevant staff/contractors related to working around wetlands and watercourses to minimize unauthorized disturbance, such as the introduction of invasive species	6.8.8.2
C, O, CL	Implement Erosion and Sediment Control Plan and measures to ensure site runoff is not directed towards wetlands to ensure habitat integrity and existing drainage patterns are maintained.	6.8.8.2, Appendix C draft Erosion and Sediment Control Plan of Appendix P.4 (Mine Water Management Plan)

Table 9.1-1: Summary of Key Mitigation Measures by Valued Component (continued)

Project Phase	Mitigation Measures	Corresponding EIS Section Number and/or Appendix
C, O, CL	Maintain pre-construction hydrological flows through wetland habitats and partially altered wetlands, wherever practicable	6.8.8.2
C, O, CL	Topsoil will be salvaged and stored for use in site restoration where practicable.	6.8.8.2
C, O, CL	Re-vegetate slopes adjacent to wetlands, using native seed mixes, to limit erosion and sediment release	6.8.8.2
C, O, CL	Implement the Preliminary Wetland Monitoring Plan, as refined through the permitting process.	6.8.8.2, Preliminary Wetland Compensation Plan (Appendix H.3)
C	Ensure all wetlands are visually delineated (e.g. flagged)	6.8.8.2
C	Complete detailed design of Haul Road and micro-siting of Beaver Dam Mine Site infrastructure to avoid or minimize impacts to wetlands	6.8.8.2
C	Implement construction methods that reduce the potential to drain or flood surrounding wetlands	6.8.8.2
C	Acquire and adhere to wetland alteration permits	6.8.8.2
C	Detailed culvert design of upgraded/replaced culverts to maintain current hydrology and necessary fish passage.	6.8.8.2, 6.9.8.2.3
C	Translocation of blue felt lichen and monitoring of lichen SAR where direct and indirect impacts are expected to occur as per the Lichen Mitigation and Monitoring Plan.	6.8.8.2, 6.10.8, 6.13.8.2, draft Lichen Mitigation and Monitoring Plan (Appendix P.6)
C	Complete work within Wetland 64 outside of the breeding season in consideration of greater yellowlegs observations and probable breeding habitat.	6.8.8.2, 6.13.8
C, O	Direct runoff through natural vegetation, wherever practicable	6.8.8.2
C, O	Minimize erosion of wetland soils by limiting flow velocities by means of hydraulic dissipation techniques	6.8.8.2
C, O	Minimize the rutting of wetland habitat by limiting the use of machinery within wetland habitat and use of swamp mats/corduroy bridges as required	6.8.8.2
C, O	Conduct vegetation management (cutting and clearing) in or near wetlands and watercourses in accordance with applicable guidelines	6.8.8.2
C, O	Employ measures to reduce the spread of invasive species (particularly by vehicles) into wetlands and retain habitat integrity Inspect vehicles regularly, particularly vehicles arriving from outside the PA. If necessary, cleaning will be undertaken at a designated cleaning station, away from wetlands and watercourses.	6.8.8.2

Table 9.1-1: Summary of Key Mitigation Measures by Valued Component (continued)

Project Phase	Mitigation Measures	Corresponding EIS Section Number and/or Appendix
CL	Compensate for permanent loss of wetland function through implementation of the Preliminary Wetland Compensation Plan, subject to NSE approval. The preliminary plan includes: On-the-ground restoration opportunities to meet a minimum 2:1 ratio and to be completed in a watershed near the Project area to the extent practicable; Wetland restoration opportunities within the Beaver Dam Mine Site will be considered where practicable; Other secondary forms of compensation that ECCC and NSE consider valuable to support the wetland conservation program in Nova Scotia; Collaboration with local community groups and the Mi'kmaq of Nova Scotia to the extent possible; and Inclusion of a conservation allowance in the Preliminary Wetland Compensation Plan to address restoration of equivalent habitat for wildlife SAR.	6.8.8.2, Preliminary Wetland Compensation Plan (Appendix H.3), draft Lichen Mitigation and Monitoring Plan (Appendix P.6)
CL	Review and consider alternatives to traditional hydroseeding methods to advance vegetation re-establishment and reclamation methods	6.8.8.2
Post-Closure	Follow monitoring requirements in wetland alteration permits and final Wetland Monitoring Plan (to be completed at permitting stage).	6.8.8.2, Preliminary Wetland Compensation Plan (Appendix H.3)
Fish and Fish Habitat		
C, O, CL	Complete site meetings with relevant staff/contractors to educate and confirm policies related to working around fish bearing surface water systems including schedule of construction activities to minimize unauthorized disturbance and limit vegetation clearing	6.9.8.2.3
C, O, CL	Implement a groundwater interceptor trench on the west side of the PAG stockpile, if necessary.	6.9.8.2.3
C, O, CL	Collect and treat all contact water, as required.	6.9.8.2.3
C, O, CL	Implement Erosion and Sediment Control Plan	6.9.8.2.3, Appendix C draft Erosion and Sediment Control Plan of Appendix P.4 (Mine Water Management Plan)
C, O, CL	Maintain pre-construction hydrological flows into and out of down-stream surface water habitats, to the extent practicable, to limit indirect impacts to fish habitat	6.9.8.2.3
C, O, CL	Complete offsetting for HADD including for permanent loss of fish habitat through fish habitat restoration activities, subject to DFO approval, as required under the *Fisheries Act*	6.9.8.2.3, 6.13.8
C, O, CL	Develop and implement the Aquatic Effects Monitoring Program (to be completed prior to the permitting stage) to identify and further mitigate any additional adverse impacts to fish and fish habitat	6.9.8.2.3
C, O, CL	Provide signage on fish habitat streams	6.9.8.2.3
C, O, CL	Complete micro siting of mine infrastructure to avoid or minimize fish habitat impact as necessary	6.9.8.2.3

Table 9.1-1: Summary of Key Mitigation Measures by Valued Component (continued)

Project Phase	Mitigation Measures	Corresponding EIS Section Number and/or Appendix
C, O, CL	Complete fish rescue within all fish bearing streams to be impacted by the Project, prior to commencement of mine development, with DFO approval if required	6.9.8.2.3
C, O, CL	Implement construction methods that reduce potential interaction with fish habitat and limit vegetation clearing around watercourses	6.9.8.2.3
C, O, CL	Complete culvert installations and upgrades in accordance with the NSE Watercourse Standard (2015) or as updated at time of construction. Limit vegetation clearing	6.9.8.2.3, 6.8.9.2
C, O, CL	Minimize the removal of vegetation upgradient of watercourses and stabilize shorelines or banks disturbed by any activity associated with Project activities	6.9.8.2.3
C, O, CL	Minimize the temporal extent of in-stream works as much as practicable	6.9.8.2.3
C, O, CL	Monitoring of standard mitigations will be supported by the Mine Water Management Plan and Aquatic Effects Monitoring Program (to be submitted as part of the Industrial Approval), both of which will be in place prior to construction activities to minimize possible disturbances of fish and fish habitat.	6.9.8.2.3, Appendix P.4 (Mine Water Management Plan)
C, O	Maintain 30 m riparian wetland and watercourse buffers, where practicable.	6.9.8.2.3
C, O	Use vegetated buffers and aquatic vegetation wherever practicable to provide shade to on-site ponds.	6.9.8.2.3
C, O	Install groundwater pumps to supplement baseflow in Cameron Flowage, if necessary	6.9.8.2.3
C, O	Follow DFO-advised Measures to avoid causing harm to fish and fish habitat pertaining to blasting (DFO 2019)	6.9.8.2.3
C, O	A detailed explosive management plan will be developed as part of the permitting process.	6.9.8.2.3
C, O	Use an emulsion-type explosive that will minimize nitrogen release to surface water and groundwater	6.9.8.2.3
C, O	Use clean, non-ore-bearing, non-watercourse derived and non-toxic materials for erosion control methods	6.9.8.2.3
C, O	Incorporate drainage structures, where necessary, to dissipate hydraulic energy and maintain flow velocities sufficiently low to prevent erosion of native soil material	6.9.8.2.3
C, O	Limit clearing within confirmed fish habitat outside of approved alteration areas to within approved areas.	6.9.8.2.3
C, O	Acquire and follow watercourse alteration permits	6.9.8.2.3, 6.7.9
C, O	Adhere to applicable timing windows, as directed by DFO, for construction where infilling has been approved in wetlands and watercourses where fish habitat is present	6.9.8.2.3
C, O	Locate fueling areas are a minimum of 30 m from waterbodies	6.9.8.2.3
C, O	Use and maintain properly sized screens on any water intakes or outlet pipes to prevent entrainment or impingement of fish (DFO, 2020)	6.9.8.2.3
C, O	Ensure that machinery arrives on site in a clean condition and is maintained and free of fluid leaks	6.9.8.2.3, 6.18

Table 9.1-1: Summary of Key Mitigation Measures by Valued Component (continued)

Project Phase	Mitigation Measures	Corresponding EIS Section Number and/or Appendix
C, O	Develop and implement Mine Water Management Plan	6.9.8.2.3, Appendix P.4 (Mine Water Management Plan)
Habitat and Flora		
C, O	Intact forest stands and wetlands will be avoided wherever practicable during detailed Project planning and design in favor of previously disturbed areas (e.g., stands disturbed by timber harvesting, roads, or other development).	6.10.8
C, O	Where natural, intact habitat cannot be avoided, maintain existing vegetation cover whenever practicable and minimize overall areas of disturbance.	6.10.8
C, O	A wetland alteration application will be submitted during Project planning and design to request an authorization to alter wetland habitat and to address loss of wetland function.	6.10.8
C, O	Compensation for permanent loss of wetland function will be completed through wetland restoration activities to support no net loss of wetland function, subject to NSE approval.	6.10.8, Preliminary Wetland Compensation Plan (Appendix H.3)
C, O	Topsoil will be salvaged and stored for use in site restoration where possible. Upland and wetland soils should be stockpiled separately.	6.10.8
C, O	Conduct vegetation management by cutting (e.g., no use of herbicides)	6.10.8
C, O	Implement Erosion and Sediment Control Plan and measures to ensure site runoff is not directed towards unaltered habitat where possible to ensure existing drainage patterns are maintained.	6.10.8, Appendix C of Appendix P.4 (Mine Water Management Plan)
C, O	Avoid frequent or unnecessary travel over erosion prone areas through communication with personnel and project planning	6.10.8
C, O	Monitor dust conditions and implement dust suppression mitigation (refer to air mitigation) when normal precipitation levels are not enough to suppress fugitive dust. In addition to water suppression, provincially approvable chemical dust suppressants will be used along the Haul Road. Implement Dust Control Plan.	6.10.8, Appendix C.3 (draft Fugitive Dust Control Plan)
C, O	Haul trucks will be equipped with spill kits and instructed on their use and spill prevention and appropriate site personnel will be trained in spill isolation, containment, and recovery.	6.10.8
C, O	Winter road maintenance will include conventional snow clearing and deposition of sand for traction control where necessary.	6.10.8
C, O	Employ measures to reduce the spread of invasive species (particularly by vehicles) and retain habitat integrity. Inspect vehicles regularly, particularly vehicles arriving from outside the PA. If necessary, cleaning will be undertaken at a designated cleaning station, away from wetlands and watercourses.	6.10.8
C, O	Confirm Potential Old Growth areas with NSLF and asses possible avoidance through the alternative Haul Road route, dependant on NSLF findings.	6.10.8

Table 9.1-1: Summary of Key Mitigation Measures by Valued Component (continued)

Project Phase	Mitigation Measures	Corresponding EIS Section Number and/or Appendix
C, O	Consider on-site opportunities for progressive reclamation during construction and operations to avoid viability issues with long-term stockpiling of organic material.	6.10.8
C, O	Translocation of blue felt lichen and monitoring of lichen SAR where direct and indirect impacts are expected to occur as per the draft Lichen Mitigation and Monitoring Plan.	6.8.8.2, 6.10.8, 6.13.8.2, draft Lichen Mitigation Monitoring Plan (Appendix P.6)
CL	Hydroseed areas that have erosion potential to return the area to pre-disturbance conditions in a timely fashion upon final reclamation	6.10.8
CL	Alternatives to traditional hydroseeding methods will be reviewed to advance vegetation re-establishment and reclamation methods. Consideration will be given to native species with Indigenous significance.	6.10.8
CL	Implement reclamation program within the Beaver Dam Mine Site to re-establish native vegetation communities	6.10.8
CL	Consider on-site opportunities for progressive reclamation during construction and operations to avoid viability issues with long-term stockpiling of organic material.	6.10.8
Terrestrial Fauna		
C, O	Provide wildlife awareness training to site personnel to reduce interactions between site personnel and wildlife.	6.11.8
C, O	Intact forest stands and wetlands will be avoided wherever practicable during detailed Project planning and design in favor of previously disturbed areas (e.g., stands disturbed by timber harvesting, roads, or other development). Micro-site Haul Road and mine infrastructure to avoid major fauna habitat.	6.11.8
C, O	Where natural, intact habitat cannot be avoided, maintain existing vegetation cover whenever practicable and minimize overall areas of disturbance.	6.11.8
C, O	Minimization of impact to old forest.	6.11.8, 6.10.8
C, O	For those species reliant on wetland habitat, a wetland alteration application will be submitted during Project planning and design to request an authorization to alter wetland habitat and to address loss of wetland function.	6.11.8, Preliminary Wetland Compensation Plan (Appendix H.3)
C, O	Compensation for permanent loss of wetland function will be completed through wetland restoration activities to support no net loss of wetland function, subject to NSE approval.	6.11.8, Preliminary Wetland Compensation Plan (Appendix H.3)
C, O	Habitat fragmentation will be reduced by limiting the area of new roads, favoring upgrading of existing roads where possible instead.	6.11.8
C, O	Site infrastructure will be fenced in, where practical, to reduce interactions between Project infrastructure and wildlife.	6.11.8
C, O	A speed limit of 40 km/hr within the Beaver Dam Mine Site and 70 km/hr along the Haul Road (or not exceeding posted speed limits) will be implemented to reduce likelihood of collisions with fauna.	6.11.8
C, O	Install signage where specific wildlife concerns have been identified. Vehicles will yield to wildlife on roads.	6.11.8

Table 9.1-1: Summary of Key Mitigation Measures by Valued Component (continued)

Project Phase	Mitigation Measures	Corresponding EIS Section Number and/or Appendix
C, O	Monitor and manage road conditions through dust suppression and traction control (sand on icy roads) to reduce potential for collisions with wildlife. Implement Dust Control Plan.	6.11.8, Appendix C.3 (draft Fugitive Dust Control Plan)
C, O	An un-vegetated buffer of 10 m along roadsides will be maintained, where possible, to improve visibility along roadsides and reduce the potential for collisions with wildlife.	6.11.8
C, O	Clearing and construction will be limited within wetlands that could support snapping turtles during winter hibernation period	6.11.8
C, O	Erosion and sediment control planning will be completed to ensure site runoff is not directed towards unaltered habitat. Implement Erosion and Sediment Control Plan.	6.11.8, Appendix C of Appendix P.4 (Mine Water Management Plan)
C, O	Culverts installed within wetlands and watercourses will provide an alternative crossing location to amphibians and reptiles, thereby reducing direct mortality of species attempting to cross a road. Upgrade culverts along the new and upgraded Haul Road sections to improve habitat connectivity.	6.11.8, 6.8.9.2
C, O	Implement Emergency Response and Spill Contingency Plans to protect fauna and their habitat from accidental spills	6.11.8, 6.18
C, O	Store hazardous and non-hazardous waste in designated locations, in appropriate containers to reduce potential for spills, and to prevent attracting wildlife (e.g., food waste in bear proof containers).	6.11.8, 6.18
C, O	Follow the Pit and Quarry Guidelines to reduce impact of noise and vibration on wildlife	6.11.8
C, O	Limit use of lights to the amount necessary to ensure safe operation within the PA, with the recognition that excessive lighting can be disruptive to wildlife. Install lights facing downward and wherever practicable using motion-sensing lights.	6.11.8, 6.3.8
C, O	Consider limiting use of lights that emit more blue shortwave light (e.g., LEDs, metal halides) which have greater impacts to wildlife at night, where practicable and considering operational safety.	6.11.8, 6.3.8
C, O	Restrict blasting to a specific and regular daytime schedule during weekdays to allow time for wildlife to recover from potential noise disturbance.	6.11.8
C, O	Implement draft Wildlife Management Plan	6.11.8, draft Wildlife Management Plan (Appendix P.7)
C, O	Site-specific measures to protect wildlife will be addressed in the EPP.	6.11.8

Table 9.1-1: Summary of Key Mitigation Measures by Valued Component (continued)

Project Phase	Mitigation Measures	Corresponding EIS Section Number and/or Appendix
C, O	The following actions will be implemented to reduce the potential for indirect impacts to adjacent undisturbed habitat: For species which rely on wetland habitat, maintain pre-construction hydrological flows into and out of downstream wetland habitats, to the extent possible (post alteration wetland monitoring may be required as a result of the provincial permitting process); In order to protect adjacent habitats from accidental spills, ensure that spill control and contingency planning is in effect, and its procedures fully communicated to staff; Vegetation management will be conducted by cutting (i.e., no use of herbicides); Ensure all development related activity (construction areas, access roads, etc.) are located within areas where biophysical field evaluations have been completed and approvals/written authorizations are in place as required; Erosion control materials shall be clean, non-ore-bearing, non-watercourse derived and non-toxic materials; Machinery and personnel will be instructed not to enter the habitats outside of approved Project footprint; and Slopes will be re-vegetated to stabilize them and limit erosion and sedimentation into adjacent habitats.	6.11.8
CL	Implement remediation plans to restore natural habitat and food source re-establishment to support fauna	6.11.8
CL	Install signage where specific wildlife concerns have been identified. Vehicles will yield to wildlife on roads.	6.11.8
Post-Closure	A deterrent system will be considered at the Touquoy Mine Site when the pit fills as tailing deposition will be present. This will deter wildlife from using the pit during and after filling which may have deleterious effects resulting from long-term exposure.	6.11.8
Avifauna		
C, O, CL	Conduct routine inspections as directed by regulators. Inspections are anticipated to be conducted daily by operators, and as required by qualified avian experts during construction, operation and active closure activities to identify and remove any trapped or injured avifauna	6.12.9, 6.13.8.4, SAR Landbird Mitigation and Monitoring Plan (Appendix A of Appendix P.7)
C	Avoid construction on native vegetation during the regional breeding season for migratory avifauna where practicable (beginning of April to end of August for migratory avifauna; ECCC 2015). Where this is not practicable, an avifauna nest mitigation plan will be developed	6.12.9
C	If a raptor nest is found within the forested areas to be cleared, a buffer zone appropriate to the species (as determined in consultation with NSL&F) would be placed around the nest	6.12.9
C	In instances where mature and interior forest cannot be avoided the following mitigation measures are proposed to identify and reduce indirect impacts to migratory avifauna that rely on this habitat throughout the PA: Grubbing and clearing activities will be avoided during nesting season if possible; The Project will limit further disruptions to interior forests by utilizing existing roads and disturbed sites where possible; Where possible, to avoid this habitat, adjustments will be made to infrastructure locations during detailed design phase; and Monitoring of the effectiveness of mitigation is recommended.	6.12.9
C, O	Limit the amount of exposed soil during nesting season	6.12.9

Table 9.1-1: Summary of Key Mitigation Measures by Valued Component (continued)

Project Phase	Mitigation Measures	Corresponding EIS Section Number and/or Appendix
C, O	Discourage ground-nesting or burrow-nesting species (such as common nighthawk and bank swallows), by limiting large piles or patches of bare soil during the breeding season, wherever practicable	6.12.9, 6.13.8.4, SAR Landbird Mitigation and Monitoring Plan (Appendix A of Appendix P.7)
C, O	Should any ground- or burrow-nesting species initiate breeding activities on stockpiles or exposed areas, AMNS will work with ECCC and NSE to develop buffer zones that incorporate adaptive management	6.12.9
C, O	Maintain speed limits on mine roads (max. 40 km/hr. within Beaver Dam Mine Site, 70 km/hr. along Haul Road) to minimize collisions with avifauna	6.12.9
C, O	Implement Dust Control Plan	6.12.9, Appendix C.3 (draft Fugitive Dust Control Plan)
C, O	Install downward-facing lights on site infrastructure and mine site haul roads. Wherever practicable, install motion-sensing lights to ensure lights are not turned on when they are not necessary	6.12.9, 6.3.8
C, O	Consider limiting use of lights that emit more blue shortwave light (e.g., LEDs, metal halides) which have greater impacts to wildlife at night, where practicable and considering operational safety.	6.12.9, 6.3.8
C, O	Conduct mobile refueling at least 30 m from any identified breeding locations	6.12.9
C, O	Monitor known nests around stockpiles and exposed areas from a distance with a spotting scope or binoculars to verify the effectiveness of an identified buffer until the nests are inactive	6.12.9
C, O	Conduct routine inspections of the open pit area to remove any trapped or injured avifauna. If identified, determine a plan for removal in consultation with an avian expert	6.12.9
C, O	Notify ECCC within 24 hours in the event of the mortality or injury of ten or more migratory avifauna in a single event or in the event of the mortality or injury of a migratory avifauna SAR	6.12.9, 6.13.8.4, SAR Landbird Mitigation and Monitoring Plan (Appendix A of Appendix P.7)
C, O	Mitigation measures will be applied to reduce the potential environmental impacts of the Project on migratory avifauna at the Touquoy Mine Site as per existing operational approvals. Audio and visual deterrents are currently being utilized at Touquoy Mine Site to dissuade avifauna from landing in the TMF.	6.12.9
CL	Continued monitoring, as described in the above section.	6.12.9

Table 9.1-1: Summary of Key Mitigation Measures by Valued Component (continued)

Project Phase	Mitigation Measures	Corresponding EIS Section Number and/or Appendix
Species of Conservation Interest and Species at Risk		
C, O, CL	Blue Felt Lichen • Complete further detailed design of Haul Road and micro siting of mine infrastructure to avoid priority lichen species. • Reduce disturbance through buffering of habitat - maintain 100m buffer, wherever practicable • Implement air quality monitoring and dust suppression plans • Flag host trees and setback areas • Implement dust suppression plan • Provide map of all priority vascular and non-vascular flora, and their setbacks, to site personnel during site orientation • Implement the SAR Lichen Mitigation and Monitoring Plan, developed in consultation with lichen specialists and regulators, for observations within and in close proximity to the PA • Wherever avoidance of SAR lichen species is not possible, the Project Team will implement the SAR Lichen Mitigation and Monitoring Plan, developed in consultation with lichen specialists and regulators. The two directly impacted blue felt lichen occurrences are proposed for translocation. • Where avoidance and translocation are not possible, the Project Team will collect specimens for submission to Frances Anderson or equivalent contact at time of construction (Lichen Specialist, Research Associate, and Nova Scotia Museum)	6.8.8.2, 6.10.8, 6.13.8.2 Lichen Mitigation and Monitoring Plan (Appendix P.6)
C, O, CL	Frosted Glass-whiskers • Complete further detailed design of Haul Road and micro siting of mine infrastructure to avoid priority lichen species • Complete further detailed design of Haul Road and micro siting of mine infrastructure to avoid priority lichen species. • Reduce disturbance through buffering of habitat - maintain 100m buffer, wherever practicable • Implement air quality monitoring and dust suppression plans • Flag host trees and setback areas • Implement dust suppression plan • Provide map of all priority vascular and non-vascular flora, and their setbacks, to site personnel during site orientation • Implement the SAR Lichen Mitigation and Monitoring Plan, developed in consultation with lichen specialists and regulators, for observations within and in close proximity to the PA • Wherever avoidance of SAR lichen species is not possible, the Project Team will implement the SAR Lichen Mitigation and Monitoring Plan, developed in consultation with lichen specialists and regulators. Where avoidance and transplantation are not possible, the Project Team will collect specimens for submission to Frances Anderson or equivalent contact at time of construction (Lichen Specialist, Research Associate, and Nova Scotia Museum)	6.8.8.2, 6.10.8, 6.13.8.2 Lichen Mitigation and Monitoring Plan (Appendix P.6)

Table 9.1-1: Summary of Key Mitigation Measures by Valued Component (continued)

Project Phase	Mitigation Measures	Corresponding EIS Section Number and/or Appendix
C, O, CL	Boreal Felt Lichen • Micro-siting of Project infrastructure has been completed to avoid observations and Boreal Felt Lichen Critical Habitat Areas • Continued detailed Project design to ensure no development occurs within the Boreal Felt Lichen Critical Habitat Areas • Implement air quality monitoring and dust suppression plans • Flag host tree and setback areas • Implement dust suppression plan • Provide map of all priority vascular and non-vascular flora, and their setbacks, to site personnel during site orientation • Implement the SAR Lichen Mitigation and Monitoring Plan, developed in consultation with lichen specialists and regulators.	6.8.9.2, 6.10.9, 6.13.9.2, Lichen Mitigation and Monitoring Plan (Appendix P.6)
C, O, CL	Atlantic Salmon • Complete further detailed surveys for wetland and watercourse alteration permitting • Complete further design phase micro siting of infrastructure and Haul Road to avoid or minimize impacts to fish and fish habitat • Complete fish rescue and relocation as anticipated for Wetland 59 prior to pit development • Adhere to approved timing windows for construction to minimize impact to eggs, larvae, and juvenile fish, wherever practicable • Limit direct alteration within the Beaver Dam Mine Site to first order streams that have limited potential to support spawning, wherever practicable • Limit access to the PA and prohibit staff fishing within the PA to avoid increased fishing pressures • Blasting activities will adhere to setback recommendations and other mitigation strategies advised by DFO for measures to avoid causing harm to fish and fish habitat • Implement accidental spill and contingency plans – e.g. use of spill kits and booms • Implement wetland and surface water quality monitoring programs • Implement downstream water quality and quantity monitoring program • Replace crushed, hung, or improperly installed culverts along the Haul Road that are impeding fish passage	6.13.8.1, 6.9.8.2.3

Table 9.1-1: Summary of Key Mitigation Measures by Valued Component (continued)

Project Phase	Mitigation Measures	Corresponding EIS Section Number and/or Appendix
C, O, CL	American Eel • Further detailed surveys for wetland and watercourse alteration permitting • Further design phase micro siting of infrastructure and Haul Road to avoid or minimize impacts to fish and fish habitat • Fish rescue and relocation is anticipated for Wetland 59 prior to pit development • Adherence to approved timing windows for construction to minimize impact to juvenile and adult eels. • Limit access to the PA and prohibit staff fishing within the PA to avoid increased fishing pressures • Blasting activities will adhere to setback recommendations and other mitigation strategies advised by DFO for measures to avoid causing harm to fish and fish habitat including aquatic species at risk. • Implementation of accidental spill and contingency plans – e.g. use of spill kits and booms • Implementation of wetland and surface water quality monitoring programs • Implementation of downstream water quality and quantity monitoring program • Replacement of crushed, hung, or improperly installed culverts along the Haul Road that are impeding fish passage	6.13.8.1, 6.9.8.2.3

Table 9.1-1: Summary of Key Mitigation Measures by Valued Component (continued)

Project Phase	Mitigation Measures	Corresponding EIS Section Number and/or Appendix
C, O, CL	<u>Snapping Turtle</u> • Include in the development and implementation of the draft Wildlife Management Plan • Implement wildlife observation reporting to appropriate site personnel during construction, operation, and decommissioning of Project • Safety and Environment orientation and training will include information on turtles and nesting season awareness training, particularly along the Haul Road. • If snapping turtle activity is occurring within and/or adjacent to the Beaver Dam Mine Site or Haul Road, additional turtle awareness and management program will be implemented to ensure all staff are well informed regarding the increased turtle activity, especially during breeding season • Complete further detailed design of Haul Road and micro siting of Beaver Dam Mine Site infrastructure to avoid aquatic habitat • Upgrade existing roads, wherever practicable, instead of building new roads • Replace crushed, hung, or improperly installed culverts, wherever practicable, to improve habitat connectivity (while maintaining existing hydrological conditions) • Reduce disturbance through buffering of habitat - a 30m buffer on aquatic habitat deemed suitable for snapping turtles, wherever practicable • Where avoidance of potential turtle hibernation habitat is not possible, construction in these habitats will be limited to the growing season when hibernating turtles are not likely to be impacted (Overwintering period - October through April), wherever practicable • Implement surface water quality monitoring program • Install turtle crossing signs near major watercourse crossings, or in areas where snapping turtles have been observed, in an effort to increase awareness and reduce vehicular collisions - preferably only seasonally when turtles are active • Vehicles will yield to wildlife on roads • Dust suppression to improve visibility during nesting and hatchling emergence • Vehicles will adhere to safe speed limits, particularly around blind corners • An un-vegetated buffer along roadsides will be maintained, where possible, to improve visibility along roadsides and reduce the potential for collisions with wildlife • If a turtle is found, report immediately to site Environmental Technician; if found on road, move away provided not actively nesting using proper moving technique • Use predator excluders on identified nests • Install fencing, where practicable, to prevent wildlife from accessing areas with increased risk of injuries to wild species - appropriate dimensions to address and eliminate accidental falls of species of varying size including turtles into the open pit	6.11.8, 6.13.8.3, draft Wildlife Monitoring and Management Plan (Appendix P.7), Appendix C.3 (draft Fugitive Dust Control Plan)

Table 9.1-1: Summary of Key Mitigation Measures by Valued Component (continued)

Project Phase	Mitigation Measures	Corresponding EIS Section Number and/or Appendix
C, O, CL	Mainland Moose • Include in the development and implementation of the Wildlife Management Plan. Implement Moose Management and Monitoring Program - including activities such as repeated winter track surveys and pellet group inventories, and collaboration with the Mi'kmaq of Nova Scotia to study Mainland Moose in a broader context • Implement wildlife observation reporting to appropriate site personnel during construction, operation, and decommissioning of Project • Vehicles will yield to wildlife on roads • Vehicles will adhere to safe speed limits, particularly around blind corners. • An un-vegetated buffer along roadsides will be maintained, where possible, to improve visibility along roadsides and reduce the potential for collisions with wildlife • Install fencing, where practicable, to prevent wildlife from accessing areas with increased risk of injuries to wild species - appropriate dimensions to address and eliminate accidental falls of species of varying size including deer and moose into the open pit • AMNS encourages the public to report mainland moose sightings to the province at https://novascotia.ca/natr/wildlife/sustainable/msform.asp.	6.11.8, 6.13.8.3, draft Wildlife Monitoring and Management Plan (Appendix P.7)
C, O, CL	Common nighthawk • Avoid clearing/grubbing activities during nesting season • If construction is required during the active nesting season, an avian specialist will monitor for nesting activity. If evidence of nesting is observed, the Proponent will consult with appropriate regulatory agencies to determine an appropriate spatial and temporal buffer, based on site and seasonal specific parameters at the time of the observation • Discourage ground- or burrow-nesting species by limiting the amount of exposed soil • Limit light use to direct and focused light when needed for worker safety • Implement noise management including use of mufflers on equipment and regular maintenance • Implement dust suppression plan • Implement the Landbird SAR Mitigation and Monitoring Plan and Wildlife Management Plan • All site workers shall comply with regulations outlined in the Migratory Bird Convention Act, which prohibits the disturbance of migratory birds, their nests and eggs. If any nest is identified, the Proponent Environmental Technician must be notified immediately, so steps can be taken to identify the species and determine appropriate mitigation or avoidance if required. Species identified of particular risk and several species of birds known to nest around active construction sites will be included in the Wildlife Sighting Report Card similar to those required at the Touquoy Mine Site	6.3.8, 6.10.8, 6.12.9, 6.13.8.4, SAR Landbird Mitigation and Monitoring Plan (Appendix A of Appendix P.7), draft Wildlife Monitoring and Management Plan (Appendix P.7), Appendix C.3 (draft Fugitive Dust Control Plan)

Table 9.1-1: Summary of Key Mitigation Measures by Valued Component (continued)

Project Phase	Mitigation Measures	Corresponding EIS Section Number and/or Appendix
C, O, CL	Canada Warbler • Avoid clearing/grubbing activities during nesting season • If construction is required during the active nesting season, an avian specialist will monitor for nesting activity. If evidence of nesting is observed, the Proponent will consult with appropriate regulatory agencies to determine an appropriate spatial and temporal buffer, based on site and seasonal specific parameters at the time of the observation • Limit light use to direct and focused light when needed for worker safety • Implement noise management including use of mufflers on equipment and regular maintenance • Implement dust suppression plan • Implement the Landbird SAR Mitigation and Monitoring Plan and Wildlife Management Plan • All site workers shall comply with regulations outlined in the Migratory Bird Convention Act, which prohibits the disturbance of migratory birds, their nests and eggs. If any nest is identified, the Proponent Environmental Technician must be notified immediately, so steps can be taken to identify the species and determine appropriate mitigation or avoidance if required. Species identified of particular risk and several species of birds known to nest around active construction sites will be included in the Wildlife Sighting Report Card similar to those required at the Touquoy Mine Site	6.3.8, 6.12.9, 6.13.8.4, SAR Landbird Mitigation and Monitoring Plan (Appendix A of Appendix P.7), draft Wildlife Monitoring and Management Plan (Appendix P.7), Appendix C.3 (draft Fugitive Dust Control Plan)
C, O, CL	Olive-sided Flycatcher • Avoid clearing/grubbing activities during nesting season • If construction is required during the active nesting season, an avian specialist will monitor for nesting activity. If evidence of nesting is observed, the Proponent will consult with appropriate regulatory agencies to determine an appropriate spatial and temporal buffer, based on site and seasonal specific parameters at the time of the observation • Limit light use to direct and focused light when needed for worker safety • Implement noise management including use of mufflers on equipment and regular maintenance • Implement dust suppression plan • Implement surface water quality monitoring program • Implement the Landbird SAR Mitigation and Monitoring Plan and Wildlife Management Plan • All site workers shall comply with regulations outlined in the Migratory Bird Convention Act, which prohibits the disturbance of migratory birds, their nests and eggs. If any nest is identified, the Proponent Environmental Technician must be notified immediately, so steps can be taken to identify the species and determine appropriate mitigation or avoidance if required. Species identified of particular risk and several species of birds known to nest around active construction sites will be included in the Wildlife Sighting Report Card similar to those required at the Touquoy Mine Site	6.3.8, 6.12.9, 6.13.8.4, SAR Landbird Mitigation and Monitoring Plan (Appendix A of Appendix P.7), draft Wildlife Monitoring and Management Plan (Appendix P.7), Appendix C.3 (draft Fugitive Dust Control Plan)

Table 9.1-1: Summary of Key Mitigation Measures by Valued Component (continued)

Project Phase	Mitigation Measures	Corresponding EIS Section Number and/or Appendix
C, O, CL	Eastern Wood-Pewee • Avoid clearing/grubbing activities during nesting season • If construction is required during the active nesting season, an avian specialist will monitor for nesting activity. If evidence of nesting is observed, the Proponent will consult with appropriate regulatory agencies to determine an appropriate spatial and temporal buffer, based on site and seasonal specific parameters at the time of the observation • Limit light use to direct and focused light when needed for worker safety • Implement noise management including use of mufflers on equipment and regular maintenance • Implement dust suppression plan • Implement the Landbird SAR Mitigation and Monitoring Plan and Wildlife Management Plan • All site workers shall comply with regulations outlined in the Migratory Bird Convention Act, which prohibits the disturbance of migratory birds, their nests and eggs. If any nest is identified, the Proponent Environmental Technician must be notified immediately, so steps can be taken to identify the species and determine appropriate mitigation or avoidance if required. Species identified of particular risk and several species of birds known to nest around active construction sites will be included in the Wildlife Sighting Report Card similar to those required at the Touquoy Mine Site	6.3.8, 6.12.9, 6.13.8.4, SAR Landbird Mitigation and Monitoring Plan (Appendix A of Appendix P.7), draft Wildlife Monitoring and Management Plan (Appendix P.7), Appendix C.3 (draft Fugitive Dust Control Plan)
C, O, CL	Chimney Swift • Avoid clearing/grubbing activities during nesting season • If construction is required during the active nesting season, an avian specialist will monitor for nesting activity. If evidence of nesting is observed, the Proponent will consult with appropriate regulatory agencies to determine an appropriate spatial and temporal buffer, based on site and seasonal specific parameters at the time of the observation • Limit light use to direct and focused light when needed for worker safety • Implement dust suppression plan • Implement noise management including use of mufflers on equipment and regular maintenance • Implement the Landbird SAR Mitigation and Monitoring Plan and Wildlife Management Plan • All site workers shall comply with regulations outlined in the Migratory Bird Convention Act, which prohibits the disturbance of migratory birds, their nests and eggs. If any nest is identified, the Proponent Environmental Technician must be notified immediately, so steps can be taken to identify the species and determine appropriate mitigation or avoidance if required. Species identified of particular risk and several species of birds known to nest around active construction sites will be included in the Wildlife Sighting Report Card similar to those required at the Touquoy Mine Site	6.3.8, 6.12.9, 6.13.8.4, SAR Landbird Mitigation and Monitoring Plan (Appendix A of Appendix P.7), draft Wildlife Monitoring and Management Plan (Appendix P.7), Appendix C.3 (draft Fugitive Dust Control Plan)

Table 9.1-1: Summary of Key Mitigation Measures by Valued Component (continued)

Project Phase	Mitigation Measures	Corresponding EIS Section Number and/or Appendix
C, O, CL	Rusty Blackbird • Avoid clearing/grubbing activities during nesting season • Complete further detailed design of Haul Road and micro siting of mine infrastructure to avoid major wetlands. Where wetlands cannot be avoided, total Project footprint within the wetland will be minimized to the extent practicable. • Implement wetland monitoring programs • If construction is required during the active nesting season, an avian specialist will monitor for nesting activity. If evidence of nesting is observed, the Proponent will consult with appropriate regulatory agencies to determine an appropriate spatial and temporal buffer, based on site and seasonal specific parameters at the time of the observation • Limit light use to direct and focused light when needed for worker safety • Implement dust suppression plans • Implement noise management including use of mufflers on equipment and regular maintenance • Implement the Landbird SAR Mitigation and Monitoring Plan and Wildlife Management Plan • All site workers shall comply with regulations outlined in the Migratory Bird Convention Act, which prohibits the disturbance of migratory birds, their nests and eggs. If any nest is identified, the Proponent Environmental Technician must be notified immediately, so steps can be taken to identify the species and determine appropriate mitigation or avoidance if required. Species identified of particular risk and several species of birds known to nest around active construction sites will be included in the Wildlife Sighting Report Card similar to those required at the Touquoy Mine Site	6.3.8, 6.8.8, 6.12.9, 6.13.8.4, SAR Landbird Mitigation and Monitoring Plan (Appendix A of Appendix P.7), draft Wildlife Monitoring and Management Plan (Appendix P.7), Appendix C.3 (draft Fugitive Dust Control Plan)
C, O, CL	Barn Swallow • Avoid clearing/grubbing activities during nesting season • If construction is required during the active nesting season, an avian specialist will monitor for nesting activity. If evidence of nesting is observed, the Proponent will consult with appropriate regulatory agencies to determine an appropriate spatial and temporal buffer, based on site and seasonal specific parameters at the time of the observation • Check abandoned structures on site for nests prior to any demolition • Limit light use to direct and focused light when needed for worker safety • Implement dust suppression plans • Implement noise management including use of mufflers on equipment and regular maintenance • Implement the Landbird SAR Mitigation and Monitoring Plan and Wildlife Management Plan • All site workers shall comply with regulations outlined in the Migratory Bird Convention Act, which prohibits the disturbance of migratory birds, their nests and eggs. If any nest is identified, the Proponent Environmental Technician must be notified immediately, so steps can be taken to identify the species and determine appropriate mitigation or avoidance if required. Species identified of particular risk and several species of birds known to nest around active construction sites will be included in the Wildlife Sighting Report Card similar to those required at the Touquoy Mine Site	6.3.8, 6.12.9, 6.13.8.4, SAR Landbird Mitigation and Monitoring Plan (Appendix A of Appendix P.7), draft Wildlife Monitoring and Management Plan (Appendix P.7), Appendix C.3 (draft Fugitive Dust Control Plan)

Table 9.1-1: Summary of Key Mitigation Measures by Valued Component (continued)

Project Phase	Mitigation Measures	Corresponding EIS Section Number and/or Appendix
C, O, CL	Evening Grosbeak • Avoid clearing/grubbing activities during nesting season • If construction is required during the active nesting season, an avian specialist will monitor for nesting activity. If evidence of nesting is observed, the Proponent will consult with appropriate regulatory agencies to determine an appropriate spatial and temporal buffer, based on site and seasonal specific parameters at the time of the observation • Limit light use to direct and focused light when needed for worker safety • Implement dust suppression plans • Implement noise management including use of mufflers on equipment and regular maintenance • Implement the Landbird SAR Mitigation and Monitoring Plan and Wildlife Management Plan • All site workers shall comply with regulations outlined in the Migratory Bird Convention Act, which prohibits the disturbance of migratory birds, their nests and eggs. If any nest is identified, the Proponent Environmental Technician must be notified immediately, so steps can be taken to identify the species and determine appropriate mitigation or avoidance if required. Species identified of particular risk and several species of birds known to nest around active construction sites will be included in the Wildlife Sighting Report Card similar to those required at the Touquoy Mine Site	6.3.8, 6.12.9, 6.13.8.4, SAR Landbird Mitigation and Monitoring Plan (Appendix A of Appendix P.7), draft Wildlife Monitoring and Management Plan (Appendix P.7), Appendix C.3 (draft Fugitive Dust Control Plan)
C, O, CL	Peregrine Falcon • Avoid clearing/grubbing activities during nesting season • If construction is required during the active nesting season, an avian specialist will monitor for nesting activity. If evidence of nesting is observed, the Proponent will consult with appropriate regulatory agencies to determine an appropriate spatial and temporal buffer, based on site and seasonal specific parameters at the time of the observation • Limit light use to direct and focused light when needed for worker safety • Implement dust suppression plan • Implement noise management including use of mufflers on equipment and regular maintenance • Implement the Landbird SAR Mitigation and Monitoring Plan and Wildlife Management Plan • All site workers shall comply with regulations outlined in the Migratory Bird Convention Act, which prohibits the disturbance of migratory birds, their nests and eggs. If any nest is identified, the Proponent Environmental Technician must be notified immediately, so steps can be taken to identify the species and determine appropriate mitigation or avoidance if required. Species identified of particular risk and several species of birds known to nest around active construction sites will be included in the Wildlife Sighting Report Card similar to those required at the Touquoy Mine Site	6.3.8, 6.12.9, 6.13.8.4, SAR Landbird Mitigation and Monitoring Plan (Appendix A of Appendix P.7), draft Wildlife Monitoring and Management Plan (Appendix P.7), Appendix C.3 (draft Fugitive Dust Control Plan)

Table 9.1-1: Summary of Key Mitigation Measures by Valued Component (continued)

Project Phase	Mitigation Measures	Corresponding EIS Section Number and/or Appendix
C, O, CL	Greater Yellowlegs • Avoid clearing/grubbing activities during nesting season • Complete construction and upgrades of Haul Road within Wetland 64 outside of the active nesting season for Greater Yellowlegs, if practicable • If construction is required during the active nesting season, an avian specialist will monitor for nesting activity within Wetland 64 and adjacent undisturbed habitat. If evidence of nesting is observed, AMNS will consult with appropriate regulatory agencies to determine an appropriate spatial and temporal buffer, based on site and seasonal specific parameters at the time of the observation. • If new breeding evidence or nests are observed within 300 m of Project activities, a site mitigation plan will be developed in consultation with regulators. Nests will be monitored from a distance using binoculars or a spotting scope to avoid further human disturbance from monitoring. An acceptable setback (to be established in consultation with regulatory authorities) will be established. • New bypass roads have been micro-sited to avoid Wetland 64 and, as a result of PA and infrastructure modifications, a waterline has been rerouted and will no longer discharge into Wetland 64, avoiding resultant changes in hydrology • To avoid nesting activity, bird deterrents will be implemented within Wetland 64, as this is the only location where probably breading was observed, following best-management-practices used in the mining industry. • Implement dust suppression plans • Limit light use to direct and focused light when needed for worker safety • Implement noise management including use of mufflers on equipment and regular maintenance • Implement the Landbird SAR Mitigation and Monitoring Plan and Wildlife Management Plan • All site workers shall comply with regulations outlined in the Migratory Bird Convention Act, which prohibits the disturbance of migratory birds, their nests and eggs. If any nest is identified, the Proponent Environmental Technician must be notified immediately, so steps can be taken to identify the species and determine appropriate mitigation or avoidance if required. Species identified of particular risk and several species of birds known to nest around active construction sites will be included in the Wildlife Sighting Report Card similar to those required at the Touquoy Mine Site	6.3.8, 6.8.8, 6.12.9, 6.13.8.4, SAR Landbird Mitigation and Monitoring Plan (Appendix A of Appendix P.7), draft Wildlife Monitoring and Management Plan (Appendix P.7), Appendix C.3 (draft Fugitive Dust Control Plan)
Mi'kmaq of Nova Scotia		
EIS Review	Support Mi'kmaq third party review of AMNS's EIS, including mitigation and monitoring programs.	6.14.8, 6.14.10
EIS Review	Continuing to provide the opportunity for Mi'kmaq to delineate the specificity of Mi'kmaq traditional use, and meet with the Mi'kmaq to receive feedback on EIS conclusions and impacts.	6.14.8
Pre-Construction	Provide Mi'kmaq land users the opportunity to walk the Beaver Dam Mine Site and Haul Road with Proponent representatives to identify and document sensitive sites prior to construction	6.14.8
Pre-Construction	Provide a tour of the Beaver Dam Mine Site and Haul Road and information on Project operations to interested Mi'kmaq peoples.	6.14.8
Pre-Construction	Develop a Mi'kmaq Communication Plan with the Mi'kmaq of Nova Scotia that outlines an ongoing two-way communication process throughout the lifecycle of the Project.	6.14.8

Table 9.1-1: Summary of Key Mitigation Measures by Valued Component (continued)

Project Phase	Mitigation Measures	Corresponding EIS Section Number and/or Appendix
Pre-Construction	As part of the existing communications process, AMNS will build upon and strengthen a Complaints Management and Action Program for Mi'kmaq input in advance of Project commencement, as an opportunity for having grievances heard and addressed, and development of an emergency communication protocol.	6.14.8
Pre-Construction	Possible establishment of an environmental protection committee to review proposed and develop additional environmental mitigation protocols, oversee monitoring procedures and review/evaluate results. This committee should have representation from Proponent environmental experts, as well as Mi'kmaw representatives from Millbrook First Nation, Unama'ki Institute of Natural Resources, the Mi'kmaq Conservation Group, and NSE.	6.14.8
Construction	Design and construct bypass roads allow for travel routes to by-pass the Beaver Dam Mine Site and Haul Road and allow access to areas surrounding the Project.	6.14.8
Construction	In the event that Mi'kmaw archaeological features are encountered during construction or operation of the Project, all work in the area will be halted and immediate notification made to the Special Places Coordinator, Nova Scotia Museum, the KMKNO and the communities of Sipekne'katik and Millbrook As part of the EMS, AMNS will ensure mitigation measures are undertaken to prevent irreversible damage to Mi'kmaq archaeological resources and known burial site(s), including ensuring all Project activities are within the defined Project property boundaries only.	6.14.8, 6.15.8
On-going	AMNS will provide various opportunities for Mi'kmaq participation in the Project, including opportunities to participate in environmental monitoring and implementation of Mi'kmaq projects such as fish habitat offsetting, wetland compensation, and others. AMNS will continue to engage with the Mi'kmaq on various Project benefits.	6.14.8, 6.14.10, Appendix N.1 to N.7
On-going	Engage in open dialogue with affected communities relating to issues of limited Mi'kmaq access to the Beaver Dam Mine Site and Haul Road for the eight year project window and continue to review and discuss mitigation options including suitable alternative crown land access in close proximity to the Beaver Dam Mine Site and Haul Road.	6.14.8
On-going	Continue to engage with the Mi'kmaq of Nova Scotia to determine how they would like to participate and integrate traditional knowledge into the Reclamation and Closure Plan for the Project. AMNS will also provide the opportunity for the Mi'kmaq to provide input on species end land uses, revegetation, reclamation techniques, and for Mi'kmaq members to join the reclamation team to execute this Project phase.	6.14.8
On-going	Commitment to developing and conducting a Mi'kmaq Cultural Awareness Program for staff and contractors. Scope to be determined based on further discussions.	6.14.8
Physical and Cultural Heritage		
C	A program of archaeological shovel testing was conducted in fall 2020, in advance of any disturbance to Site 6, Areas 2 and 3. CRM Group cleared these areas of any requirement for further archaeological investigation	6.15.8, Appendix N.1 to N.7
C	If any development is to occur within 100 metres of Crusher Lake, intensified reconnaissance (i.e., shovel testing) should be conducted to identify any additional features.	6.15.8, Appendix N.1 to N.7
C	If any development is to occur specifically around the historic features identified during the 2014, 2015, 2016, 2018 and 2019 reconnaissance, intensified historical research and archaeological shovel testing should be conducted in advance of disturbance.	6.15.8, Appendix N.1 to N.7

Table 9.1-1: Summary of Key Mitigation Measures by Valued Component (continued)

Project Phase	Mitigation Measures	Corresponding EIS Section Number and/or Appendix
C	Any further changes in the layout of the mine and associated facilities be evaluated as to potential impacts to archaeological resources.	6.15.8, Appendix N.1 to N.7
O	In the event that archaeological resources or human remains are encountered during ground disturbance activities, it is required that all activity stop, and the Coordinator of Special Places, Nova Scotia Communities, Culture, & Heritage Department be contacted.	6.15.8, Appendix N.1 to N.7
Socio-economic Conditions		
C	Restriction of recreational activities within the spatial boundaries of the Project. Notification will be provided by signage. Communication Plan to communication access information to key stakeholders (Sections 3 and 4 [Public Engagement and Indigenous Peoples Engagement, respectively]). Liaison with any local recreation groups, such as ATV associations through an Ad Hoc group. Equipment maintenance. Reduction of mobile equipment accident risk through discussions with NSTIR, appropriate signage, and operator training.	6.16.11
O	Restriction of recreational activities within the spatial boundaries of the Project. Notification will be provided by signage. Liaison with local recreation groups, such as ATV associations. Equipment maintenance. Limiting haul truck operational hours to approximately 16 hours per day. Reduction of mobile equipment accident risk through discussions with NSTIR, appropriate signage, and operator training. Ongoing engagement with community associations, CLC and residents to assess and adaptively manage the site. Potential housing and employment studies to monitor impacts on population growth and housing market.	6.16.11
CL	Ongoing engagement with community associations, CLC and residents to assess and adaptively manage the site.	6.16.11
Accidents and Malfunctions		
Open Pit Mine Slope Failure	The pit slope design, construction and monitoring follow applicable regulations and recommendations provided by a qualified geotechnical professional.	6.18.6.1, Appendix A.2a and Golder (2021 In Progress)
Stockpile Slope Failure	The stockpile design, construction and monitoring follow applicable regulations and recommendations provided by a qualified geotechnical professional.	16.8.6.2
Settling Pond Failure	The water management ponds are designed by a qualified professional and lined with suitable materials, such as clay or a geosynthetic liner.	6.18.6.3
Infrastructure Failure	The infrastructure is designed following applicable regulations and recommendations provided by a qualified professional.	6.18.6.4

Table 9.1-1: Summary of Key Mitigation Measures by Valued Component (continued)

Project Phase	Mitigation Measures	Corresponding EIS Section Number and/or Appendix
Fuel and/or other spills	Fuel delivery suppliers and their personnel will have certification and training in fuel transport and delivery in compliance with applicable regulatory requirements. Onsite storage and dispensing of fuel products will be conducted in accordance with applicable regulatory requirements and adhere to the Petroleum Operation Procedure and related site-specific procedures. Staff will be trained in spill response measures. Spill response kits will be accessible and dedicated in areas of fuel storage and transfer.	6.18.7.1, Appendix A draft Spill Contingency Plan of Appendix P.1 draft Emergency Response Plan
Mobile Equipment Accident	The Beaver Dam Mine Site will have restricted traffic patterns, speed limits, right-of-way signage and training that will minimize the risk of mobile equipment accidents. Highway haul trucks will be remotely tracked and monitored. Communications will be maintained between vehicles using radios to minimize adverse interactions and ensure prompt response to any incident.	6.18.7.3
Tailings and Reclaim Water Pipelines Spills	Tailings and reclaim pipelines between the plant site, TMF and open pit will be designed and constructed to minimize the potential for release. Measures may include double walled tailings pipes, lined service trenches and adequately sized, lined, collection pond capable of containing the volume of the pipeline. The catchment pond would be lined with suitable materials, such as clay or a geosynthetic liner.	6.18.7.5
Cyanide Release (Touquoy Mine Site)	Cyanide is transported stored and handled in accordance with applicable regulatory requirements and the International Cyanide Management Code. Cyanide is stored and handled inside the plant footprint within a restricted containment area	6.18.7.6
Forest and/or Site Fires	Fire protection for the plant site will be via a "wet system" with hydrants located around the plant site area. The water contained within the lower portion of the raw water tank will be reserved for fire protection. Fire detection systems will be installed in buildings and key areas of the Beaver Dam Mine Site.	6.18.8
Effects of the Environment on the Project		
C	Project design to consider extreme weather events, temperature extremes, wind speed ranges, flood or drought conditions, lightning strikes. Project design will follow industry standards, including the National Building Code of Canada. An Emergency Response Plan will be implemented during the construction phase. An Occupational Health and Safety Plan will be implemented to protect worker health and safety	7.3
C	Stockpile design will consider collected geological data and will be designed with slopes at the angle determined by geotechnical analysis and acceptable safety factors. An Emergency Action Plan will be implemented during the construction phase	7.3
O	An Emergency Action Plan will be implemented during the operations phase. An Occupational Health and Safety Plan will be implemented to protect worker health and safety	7.3

Table 9.1-1: Summary of Key Mitigation Measures by Valued Component (continued)

Project Phase	Mitigation Measures	Corresponding EIS Section Number and/or Appendix
O	Stockpile design will be re-assessed following material placement to ensure slopes are geotechnical stable and within acceptable safety factors An Emergency Action Plan will be implemented during the operation phase	7.3
CL	Stockpile design will consider collected geological data and will be designed with slopes at the angle determined by geotechnical analysis and acceptable safety factors.	7.3

Table 9.1-2: Summary of Residual Effects by Valued Component

Project - VC Interactions	Summary of Mitigation	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
NOISE									
Construction – Beaver Dam Mine Site and Haul Road Noise from haul trucks, Haul Road widening and construction, and blasting and drilling of in-situ rocks	Equipment maintenance, best management practices, minimize blasting events.	N-L	Beaver Dam Mine Site and Haul Road LAA: Noise generated will likely extend beyond the PA	A	ST Effects can occur up to 1 year	R Effects occur regularly in the construction phase of the Project	R VC will recover to baseline conditions	Increased ambient noise	Not significant
Operations - Beaver Dam Mine Site and Haul Road Noise from haul trucks, blasting and drilling of in-situ rocks and the crushing of ore heavy machinery operation, and site vehicles	Equipment maintenance, dust suppression, hardened surface where practical, vehicle speed reduction, use of large haul vehicles to minimize trips, stabilization of stockpile slopes, covering of haul trucks, minimize blasts. Equipment maintenance, haul truck operations < 24 hours per day to minimize noise disturbance, limited engine idling, shutting off vehicle when parked unless this is precluded for safety or maintenance reasons.	N-L	At Points of Reception for Beaver Dam Mine Site, Haul Road, Touquoy Mine Sire) At Property Lines for Beaver Dam Mine Site, Haul Road LAA: effect extend beyond the PA into the LAA	A	LT Effects may extend beyond 3 years	R Effects occur regularly in the operational phase of the Project	R VC will recover to baseline conditions	Increased ambient noise	Not significant
Operations – Touquoy Mine Site Noise from blasting, crushing of ore, heavy machinery operation and site vehicles	Equipment maintenance, haul truck operations < 24 hours per day to minimize noise disturbance, limited engine idling, shutting off vehicle when parked unless this is precluded for safety or maintenance reasons.	N	At Property Lines LAA Noise generated is predicted to extend beyond the PA	A	LT Effects may extend beyond 3 years	R Effects occur regularly in the operational phase of the Project	R VC will recover to baseline conditions	Increased ambient noise	Not significant
AIR									
Construction – Beaver Dam Mine Site and Haul Road (Dust from haul trucks, Haul Road widening and construction)	Equipment maintenance, best management practices, minimize blasting events.	N Does not exceed guidelines or threshold	LAA Dust generated will likely extend beyond the PA	N/A VC is not expected to be affected by timing	MT Effects can occur beyond 12 months	R Effects occur regularly in the construction	R VC will recover to baseline conditions	Increased ambient dust	Not significant
Operations- Mine Site and Touquoy Mine Site at Property Lines and Points of Reception (Dust from onsite activities, vehicle travel, material handling and the crushing of ore)	Equipment maintenance, dust suppression, hardened surface where practical, vehicles to minimize trips, stabilization of stockpile slopes, cover of haul trucks, minimize blasts	N Does not exceed guidelines or threshold	LAA Dust generated will likely extend beyond the PA	N/A VC is not expected to be affected by timing	LT Effects may extend beyond 3 years	R Effects occur regularly during Operations	R VC will recover to baseline conditions	Increased ambient dust	Not significant
Operations- Haul Road at Property Lines (Dust from haul trucks)	Haul truck operations to minimize road surface disturbance during nighttime hours, implementation of Road Dust Best Management Practices Plan (with 80-90% or greater targeted dust suppression efficiency).	L Exceeds guidelines or threshold values by more than 20%	LAA Dust generated will likely extend beyond the PA	N/A VC is not expected to be affected by timing	LT Effects may extend beyond 3 years	S Exceedances are maximum values, sporadic to regular occurrence at Property Lines.	R VC will recover to baseline conditions	Increased ambient dust	Not Significant
Operations - Haul Road at Points of Reception (Dust from haul trucks)	Haul truck operations to minimize road surface disturbance during nighttime hours, implementation of Road Dust Best Management Practices Plan (with 80-90% or greater targeted dust suppression efficiency).	L Marginally exceeds guidelines or threshold values	LAA Dust generated will likely extend beyond the PA	N/A VC is not expected to be affected by timing	LT Effects may extend beyond 3 years	R Effects occur regularly in the operational phase of the Project	R VC will recover to baseline conditions	Increased ambient dust	Not Significant
LIGHT									
Construction and Active Closure – Beaver Dam Mine Site and Haul Road (Lights from haul trucks, site lighting)	Equipment maintenance, limited vegetation clearing.	L (qualitative assessment only – predicted to be less light propagation than operations phase described below)	RAA Lighting impacts may extend beyond the PA	A Seasonal aspects may affect VC (i.e., daylight hours)	MT Effects can occur beyond 12 months and up to 3 years	S Effects occur at regular intervals throughout the Project	R VC will return to baseline conditions	Increased ambient light	Not significant

Table 9.1-2: Summary of Residual Effects by Valued Component (continued)

Project - VC Interactions	Summary of Mitigation	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Operational – Beaver Dam Mine Site, Haul Road, Touquoy Mine Site (Lights from haul trucks, site lighting)	Equipment maintenance, haul truck operation <24 hours per day, minimize lighting (downward facing lighting, motion sensor lights, light positioning away from property boundaries were practical).	L Less than or equal to appropriate guidelines or threshold values	RAA Lighting impacts may extend beyond the PA	A Seasonal aspects may affect VC (i.e., daylight hours)	LT Effects may extend beyond 3 years	R Effects occur at regular intervals throughout the Project	R VC will return to baseline conditions	Increased ambient light	Not significant
GREENHOUSE GASES									
Construction – Beaver Dam Mine Site and Haul Road (Haul Road widening and construction, use of heavy machinery, haul trucks and site vehicle emissions)	Equipment maintenance, implementing fuel efficiencies, limited engine idling, use of more fuel efficient vehicles.	L	RAA	N/A	ST	C	R	Increased greenhouse gas emissions during operations	Not Significant
Operation – Beaver Dam Mine Site, Haul Road and Touquoy Mine Site (Emissions from haul trucks, site vehicles, heavy machinery, blasting and drilling of in-situ rocks)	Equipment maintenance, implementing fuel efficiencies, minimizing blasts, limited engine idling, use of more fuel efficient vehicles.	L	RAA	N/A	MT	C	R	Increased greenhouse gas emissions	Not Significant
Active Closure – Beaver Dam Mine Site (Emissions from haul trucks, site vehicles, heavy machinery)	Equipment maintenance, implementing fuel efficiencies, limited engine idling, use of more fuel efficient vehicles.	N-L	RAA	N/A	MT	I	R	Increased greenhouse gas emissions	Not Significant
GEOLOGY, SOIL, AND SEDIMENT QUALITY									
Construction and Operation – Beaver Dam Mine Site (exposure of acid generating material, impacted soil/sediment through migration of contaminants via dust deposition and runoff events.)	Select removal of impacted materials, wet dust suppression controls, hardened surfaces where practical, covering of haul trucks to reduce dust during transportation, vehicle speed reduction to minimize dust, spill preparedness. reclaiming/spreading stockpiles, soil/sediment quality,	L Minor changes from baseline conditions	LAA Potential adverse effects to soil/sediment quality and quantity outside the PA	A Seasonal aspects may affect VC (i.e., wind)	LT Effects may extend beyond 3 years	S Effects occur at irregular intervals throughout the Project	IR VC will not recover to baseline conditions	Soil and sediment quality, increased dust impact (i.e., flora and fauna/habitat, human health, etc.)	Not significant
Construction and Operational – Haul Road (Haul Road widening and construction, trucking activity, and sediment quality impacts through migration of contaminants via dust deposition and runoff events.	Slope stabilization, sediment and erosion control, best management practices, spill preparedness. reclaiming/spreading stockpiles, soil/sediment quality	L Minor changes from baseline conditions	PA Potential adverse effects confined to the PA	N/A VC is not expected to be affected by timing	MT Effects can occur beyond 12 months and up to 3 years	O Potential effects to occur once during the construction phase	R Sediment Quality will recover to baseline conditions after cessation of activities/ closure of the mine IR Soil under the footprint of the road will be lost.	Erosion, soil and sediment quality	Not significant
Operational – Touquoy Mine Site (soil/sediment quality)	Covering of haul trucks to reduce dust during transportation onsite, vehicle speed reduction to minimize dust onsite. reclaiming/spreading stockpiles, soil/sediment quality	L Minor changes from baseline conditions	LAA Potential adverse effects to soil/sediment quality and quantity outside the PA	A Seasonal aspects may affect VC (i.e., wind)	LT Effects may extend beyond 3 years	S Effects occur at irregular intervals throughout the Project	R Soil Sediment Quality will recover to existing conditions after cessation of activities/ closure of the mine	Soil and sediment quality, increased dust impact (i.e., flora and fauna/habitat, human health, etc.)	Not significant

Table 9.1-2: Summary of Residual Effects by Valued Component (continued)

Project - VC Interactions	Summary of Mitigation	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
GROUNDWATER QUALITY AND QUANTITY									
Construction – Beaver Dam Mine Site and Haul Road (Surface Water Alteration resulting in reduction of recharge to groundwater, blasting effects on GW, elevated nitrogen in GW from blasting residue)	Sediment and erosion control, pre-blast surveys within 800 m of potable wells, watercourse alteration permitting, inclusion of use of pit dewatering water and collected surface water instead of groundwater for dust control in the project design	M Mitigation strategies and best management practices reduce the magnitude of impact	PA VC confined to the Mine Site	A VC interaction is by timing considerations/during low flows	LT VC interaction effects extend into PCs	R VC interaction will occur regularly during construction phase	PR Mitigation not necessarily return to baseline conditions	Reduction in Water Quantity	Not Significant
Post-Closure – Beaver Dam Mine Site (Groundwater seepage from stockpiles discharge to surface water [Mud Lake, outlet watercourse from Mud Lake, Crusher Lake])	Installation of groundwater wells at the shores of these locations; periodic sampling to evaluate this prediction; modelling updates to include updated source term data/water quality inputs; if necessary groundwater will be intercepted (i.e., interception trench) upstream of wells and treatment will be considered to meet regulatory requirements prior to discharge into receiving environment. Monitoring will determine if additional adaptive management measures will be applied.	L Mitigation strategies and best management practices reduce the magnitude of impact	PA VC confined to the Mine Site	A VC interaction during low flow conditions is assessed	LT VC interaction effects extend into PCs	R Effects will occur at regular intervals during post closure phase of project	PR Mitigation not necessarily return to baseline conditions	Reduction in Water Quality	Not Significant
SURFACE WATER QUANTITY AND QUALITY									
Surface Water Quantity									
Construction – Beaver Dam Mine Site and Haul Road	Project Design to evaluate hydrology patterns. Erosion and Sediment Control Measures	Low Minor changes from baseline conditions	Discrete Effects are confined to the PA (Beaver Dam Mine Site and Haul Road)	N/A	Short-Term	S VC interaction will occur at irregular intervals throughout construction phase	Reversible to Partially Reversible	Change in Water Quantity (baseflow, stream flow in Mud Lake and WC23, WC26 due to project development/construction of water management diversions etc.)	Not Significant
Surface Water Quality									
Construction – Beaver Dam Mine Site and Haul Road (TSS and Dust Deposition)	Project Design to evaluate hydrology patterns. Erosion and Sediment Control Measures	Low Minor changes from baseline conditions	Discrete Effects are confined to the PA (Beaver Dam Mine Site and Haul Road)	N/A	Short-Term Effects can occur beyond 12 months and up to three years	S VC interaction will occur at irregular intervals throughout construction phase	R VC will recover to baseline conditions	Change in Water Quality Disturbance	Not Significant
Surface Water Quantity									
Beaver Dam Mine Site (Crusher Lake, Killag River, Tent Brook)	Surface water from pit dewatering activities will be designed to discharge back into Cameron Flowage/Killag River at rates to mimic seasonal flows, where practicable.	Negligible to Low Minor changes from baseline conditions	Local Effect are confined to the near-field assessment area	N/A	Short-Term to Medium Term	R Effects will occur at regular intervals throughout operations	Reversible VC will recover to baseline conditions once project activities have been completed	Change in hydrology in Cameron Flowage/Killag River	Not Significant
Beaver Dam Mine Site (Reduction in base flow to WC26 and WC23)	Predicted flow reduction. Monitoring to confirm, watercourse alteration permitting, fisheries authorization, if required	Low to High VC interaction Causes reduction in surface flow	Discrete Effects are confined to the Beaver Dam Mine Site	N/A	P VC interaction is permanent	C VC interaction will occur continuously	Irreversible While effect is reduced in PC, it is still measurable/ medium to high magnetite	Disturbance; impacts are due to the placement of stockpiles catchment	Not Significant
Beaver Dam Mine Site (Mud Lake)	Predicted flow reduction. Monitoring to confirm.	Medium to High Resultant change is outside natural variations from baseline conditions	Discrete Effects are confined to the PA (Beaver Dam Mine Site)	N/A	Long Term	C VC interaction will occur continuously	Partially Reversible Effect decreases in PC phases	Disturbance	Not significant

Table 9.1-2: Summary of Residual Effects by Valued Component (continued)

Project - VC Interactions	Summary of Mitigation	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Surface Water Quality									
Operations – Beaver Dam Mine Site (Surface water quality of Killag River from effluent discharge through north settling pond and groundwater seepage)	Water Treatment at discharge (as required)	Low to Negligible Negligible change in water quality	Local Effect are confined to the near-field assessment area	N/A	Short-Term to medium term	R VC interaction will occur regularly	IR VC will not return to baseline condition	Change in water quality in the Killag	Not significant
Operations Beaver Dam Mine Site and Haul Road (Release of non-mine-contact surface water to receiving waters resulting in reduction in water quality)	Erosion and Sediment Control Measures	Low to Negligible Minor change from baseline conditions	Local Effect are confined to the near-field assessment area	N/A	Short-Term to medium term	S VC interaction will occur sporadically	R VC will return to baseline conditions	Disturbance	Not Significant
Closure – Beaver Dam Mine Site (Surface water quality of Killag River from pit from effluent discharge)	Water Treatment at discharge (as required)	Low to Negligible Negligible change in water quality	Local Effect are confined to the near-field assessment area	N/A	Short-Term to medium term	R VC interaction will occur regularly	Partially Reversible Effect decreases in PC phases	Disturbance	Not Significant
Closure – Touquoy Mine Site (Storage of Beaver Dam tailings in the Touquoy open pit mine and surface water quality of Moose River from effluent discharge and groundwater seepage)	Treatment of water quality in pit as tailings are disposed in the open pit Water Treatment at discharge (as required) Continuation of the monitoring program that is currently underway at Touquoy since 2016	Low to Negligible Negligible change in water quality	Local Effect are confined to the near-field assessment area	N/A	Short-Term to medium term	R VC interaction will occur regularly	IR VC remains at the end of the activity	Disturbance	Not significant
WETLANDS									
Construction – Beaver Dam Mine Site and Haul Road (clearing and grubbing, direct wetland alteration, and upgrading and new Haul Road construction))	Sediment and erosion control, best management practices, spill preparedness, and engagement in the wetland permitting process.	M VC interaction causes direct loss of 4% of NSE mapped wetlands in the LAA. Direct impact to WSS.	PA Potential adverse effect to wetlands inside the PA	A Seasonal aspects may affect VC	P VC unlikely to recover to baseline conditions	O Effects occur once during the construction phase	IR VC will not recover to baseline conditions	Habitat Loss and Disturbance	Not Significant
Operational – Beaver Dam Mine Site (groundwater interactions, water quality, changes to flow regimes, accidents/malfunctions)	Sediment and erosion control, best management practices, spill preparedness, wetland monitoring and water management.	L VC interaction predicted to result in indirect loss of <1% of NSE mapped wetlands in the LAA	LAA Potential adverse effect to wetlands outside of the PA	A Seasonal aspects may affect VC	LT Effects may extend beyond 5 years	R Effects occur at regular intervals throughout the project	PR Mitigation cannot guarantee a return to baseline conditions	Disturbance	Not Significant
Operational – Haul Road (water quality, changes to flow regimes, accidents/malfunctions)	Sediment and erosion control, best management practices, spill preparedness, and wetland monitoring.	L Small change from baseline conditions	LAA Potential adverse effect to wetlands outside of the PA	A Seasonal aspects may affect VC	LT Effects may extend beyond 5 years	S Effects occur at irregular intervals throughout the Project	R VC will recover to baseline condition	Disturbance	Not Significant
Post Closure – Touquoy Mine Site (potential changes to hydrology in Moose River and associated riparian wetlands)	Sediment and erosion control, best management practices, and spill preparedness, wetland monitoring and water management. Discharge to mimic seasonal flows wherever practicable	N Negligible increase in water quantity, no expected impact to downstream wetlands	LAA VC interaction may extend beyond PA	A Seasonal aspects may affect VC	LT Effects may extend beyond 5 years	R Effects are expected to occur over a regular interval	PR VC will partially recover to baseline conditions	Disturbance	Not Significant
Closure (Active) – Beaver Dam Mine Site (wetland restoration and compensation)	Sediment and erosion control, best management practices, spill preparedness, wetland compensation	L VC interaction restores and compensates lost wetland habitat	PA Potential adverse effect confined to the PA	A Seasonal aspects may affect VC	LT Effects may extend beyond 5 years	O Effects occur once during the reclamation phase	PR Mitigation cannot guarantee a return to baseline conditions	Habitat Reclamation	Not Significant

Table 9.1-2: Summary of Residual Effects by Valued Component (continued)

Project - VC Interactions	Summary of Mitigation	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
FISH AND FISH HABITAT									
Direct									
Construction – Beaver Dam Mine Site & Haul Road Direct watercourse and wetland alteration	Sediment and erosion control, best management practices, spill preparedness, and completion of watercourse and fish habitat alteration permitting. Offset Plan. Fish Rescue	H VC interaction causes direct loss of fish habitat.	PA Potential adverse effect to fish habitat is limited to the PA	A Watercourse alteration will occur outside of sensitive periods for fish; however, other interactions may seasonally affect VC	P Effect is expected to be permanent	O Effects occur once during the construction phase	IR VC will not recover to baseline conditions	Habitat Alteration Disruption or Destruction	Not significant
Indirect									
Construction – Beaver Dam Mine Site Altered hydrology and altered surface water quality. Removal of historical tailings	Sediment and erosion control, best management practices, spill preparedness, and completion of watercourse and fish habitat alteration permitting. Offset Plan.	M (WC5) H (WC23, WC26, WC27)L moderate to high changes to baseline conditions on downstream habitats	LAA Potential adverse effect to fish habitat outside of the PA	A Seasonal habitat provisions may affect VC	P Effect is expected to be permanent	R Effects occur at regular intervals as construction progresses	IR VC will not recover to baseline conditions	Habitat Alteration	Not significant
Direct									
Construction – Haul Road Watercourse crossings	Sediment and erosion control, best management practices, spill preparedness, and completion of watercourse and fish habitat alteration permitting. Offset Plan.	L to H VC interaction causes direct loss of fish habitat. L < 20 m2, M 20 m2 - 100 m2, H > 100 m2 per crossing	PA Potential adverse effect to fish habitat is limited to the PA	A Seasonal habitat provisions may affect the VC	P Effect is expected to be permanent	O Effects occur once during the construction phase	IR VC will not return to baseline conditions	Habitat Alteration Disruption or Destruction	Not significant
Construction – Haul Road Watercourse crossings – improve fish passage	N/A	N/A	LAA Potential adverse effect to fish habitat outside of the PA	A Seasonal habitat provisions may affect the VC	P Increased habitat connectivity is permanent	O Effects occur once during the construction phase	IR VC will not return to baseline conditions	Increased habitat connectivity	Not significant
Indirect									
Operations –Beaver Dam Mine Site Indirect impacts including groundwater drawdown, groundwater seepage, altered surface water quality Cameron Flowage/Killag River Tent Lake Cope Brook	Interceptor trench west of PAG stockpile Water treatment (as required) Discharge point location at northern end of Cameron Flowage Surface water from pit dewatering activities will be designed to discharge back into Cameron Flowage/Killag River at rates to mimic seasonal flows, where practical Vegetative buffers to provide shade to on-site ponds Install groundwater pumps to supplement baseflow in Cameron Flowage Explosives Management Best Management Practices	L Interaction likely to cause indirect impacts to fish habitat	LAA Potential adverse effect to fish habitat outside of the PA	A Seasonal habitat provisions may affect VC	P Effect is expected to be permanent	R Effects occur at regular intervals throughout the Project	PR Groundwater drawdown effects will cease once the pit lake has filled. Surface water interactions are partially reversible	Habitat alteration	Not significant
Operations – Haul Road Indirect impacts to surface water quality	Sediment and erosion control, best management practices, and spill preparedness.	N Negligible change to fish and fish habitat	LAA Potential adverse effect to fish habitat outside of the PA	A Seasonal habitat provisions may affect VC	P Effect is expected to be permanent	R Effects occur at regular intervals throughout the Project	PR VC will partially return to baseline conditions (reduction in traffic once haul trucks cease)	Habitat alteration	Not significant

Table 9.1-2: Summary of Residual Effects by Valued Component (continued)

Project - VC Interactions	Summary of Mitigation	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Post Closure – Beaver Dam Mine Site and Touquoy Mine site Surface water quality Cameron Flowage/Killag River Moose River	Water treatment (as required)	N VC interaction will remain below appropriate guidelines	LAA VC interaction will extend beyond PA	A Seasonal aspects will affect VC	P Effect is expected to be permanent	R Effects are expected to occur over a regular interval	PR VC will partially recover to baseline conditions	Change in water quality	Not significant
HABITAT AND FLORA									
Construction – Beaver Dam Mine Site and Haul Road (clearing and grubbing, and Haul Road widening and construction)	Limit habitat disturbance and minimize Project Area during detailed design, sediment and erosion control, best-management practices, spill preparedness, dust control, re-establish habitat and associated vegetation communities during closure.	M Direct loss to habitat and flora. Partial mitigation through restoration.	PA Effects confined to the PA.	N/A VC is not expected to be affected by timing.	MT (Beaver Dam Mine Site) Effects occur beyond 5 years when closure activities commence at Beaver Dam Mine Site. P (Haul Road) Closure of the Haul Road not expected.	O Effects occur once during the construction phase.	PR Mitigation and reclamation cannot guarantee a return to baseline conditions.	Disturbance, Habitat Loss	Not Significant
Operation – Beaver Dam Mine Site, Haul Road and Touquoy Mine Site (dust from haul trucks, heavy machinery and mine operations)	Dust control, sediment and erosion control, best management practices, and spill preparedness.	M	LAA Potential effects below guideline levels beyond the PA.	N/A VC is not expected to be affected by timing.	MT Effects may occur up to 5 years.	R Effects will occur at regular intervals.	R VC will return to baseline conditions.	Disturbance	Not Significant
Closure (Active) – Beaver Dam Mine Site (re-vegetate using stockpile materials)	N/A	L Minor change from baseline conditions.	LAA Potential effects beyond the PA.	N/A VC is not expected to be affected by timing.	LT Effects extend beyond active closure phase.	O Effects occur once during the closure phase.	PR Mitigation and reclamation cannot guarantee a return to baseline conditions.	Habitat Reclamation	Not Significant
TERRESTRIAL FAUNA									
Construction – Beaver Dam Mine Site and Haul Road (habitat loss and fragmentation from clearing and grubbing)	Limit habitat disturbance and minimize Project footprint during detailed design, implement speed limits, install fences where necessary, and minimize lighting.	L < 5% direct loss of habitat types used by observed species within the LAA Partial mitigation through restoration.	RAA Potential adverse effect to fauna outside of the LAA (fragmentation)	A VC interaction may affect seasonal aspects of fauna.	MT (Beaver Dam Mine Site) Effects occur beyond 5 years when closure activities commence at Beaver Dam Mine Site. P (Haul Road) Closure of the Haul Road not expected.	O Effects occur once during the construction phase.	PR Mitigation and reclamation cannot guarantee a return to baseline conditions.	Habitat Loss	
Construction – Beaver Dam Mine Site and Haul Road (sensory disturbance (noise, light, dust deposition) and wildlife vehicle collisions from construction activities)	Implement speed limits, install fences where necessary, and minimize lighting.	M	LAA Potential adverse effect to fauna outside of the PA	A VC interaction may affect seasonal aspects of fauna.	ST Effects are limited to occur from as little as 1 day to 12 months	R Effects occur at regular intervals during the construction phase	R VC will recover to baseline conditions	Disturbance	
Operational – Beaver Dam Mine Site, Haul Road and Touquoy Mine Site (disturbance (noise, light, dust deposition and wildlife vehicle collisions) from haul trucks, heavy machinery and mine operations)	Implement speed limits, install fences where necessary, and minimize lighting.	M Moderate changes relative to baseline conditions in remaining and surrounding habitat.	LAA Potential adverse effect to fauna beyond the PA.	A VC interaction may affect seasonal aspects of fauna.	MT Effects may occur up to 5 years.	R Effects occur at regular intervals.	R VC will recover to baseline conditions	Disturbance	
Closure (Active) – Beaver Dam Mine Site (re-establishment of habitat for fauna)	N/A	L Minor change from baseline conditions.	LAA Potential effect to fauna outside of the PA	A VC interaction may affect seasonal aspects of fauna.	LT Effects extend beyond active closure phase.	O Effects occur once during the closure phase.	PR Mitigation and reclamation cannot guarantee a return to baseline conditions.	Habitat Reclamation	

Table 9.1-2: Summary of Residual Effects by Valued Component (continued)

Project - VC Interactions	Summary of Mitigation	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
AVIFAUNA									
Construction – Beaver Dam Mine Site and Haul Road (habitat loss from clearing and grubbing)	Limit habitat disturbance and minimize Project Area during detailed design, implement speed limits and minimize lighting.	L < 5% direct loss of habitat types used by observed species within the LAA Partial mitigation through restoration.	LAA Potential adverse effect to avifauna outside of the PA	A Although clearing and grubbing will occur outside of the sensitive period for avifauna, other activities will not.	MT (Beaver Dam Mine Site) Effects occur beyond 5 years when closure activities commence at Beaver Dam Mine Site. P (Haul Road) Closure of the Haul Road not expected.	O Effects occur once during the construction phase.	PR Mitigation and reclamation cannot guarantee a return to baseline conditions.	Habitat Loss	Not Significant
Construction – Beaver Dam Mine Site and Haul Road (sensory disturbance (noise, light, dust deposition) and wildlife vehicle collisions from construction activities)	Implement speed limits and minimize lighting.	M	LAA Potential adverse effect to avifauna outside of the PA	A VC interaction may affect seasonal aspects of avifauna.	ST Effects are limited to occur from as little as 1 day to 12 months	R Effects occur at regular intervals during the construction phase	R VC will recover to baseline conditions	Disturbance	Not Significant
Operational – Beaver Dam Mine Site, Haul Road and Touquoy Mine Site (disturbance (noise, light, dust deposition and wildlife vehicle collisions) from haul trucks, heavy machinery and mine operations)	Implement speed limits, install fences where necessary, and minimize lighting.	M Moderate changes relative to baseline conditions in remaining and surrounding habitat.	LAA Potential adverse effect to avifauna outside of the PA	A VC interaction may affect seasonal aspects of fauna.	MT Effects may occur up to 5 years.	R Effects occur at regular intervals.	R VC will recover to baseline conditions	Disturbance	Not Significant
Operations – Touquoy Mine Site Tailings deposition	Best management practices, Bird Deterrent Program implementation	L Change in habitat for avifauna	PA VC interaction is confined to the PA.	A VC interaction may occur during sensitive period for avifauna.	LT Effects may extend beyond 5 years	R VC interaction will occur at regular intervals	PR Mitigation cannot guarantee a return to baseline conditions	Creation of potential open water habitat; decreased water quality	Not Significant
SPECIES OF CONSERVATION INTEREST AND SPECIES AT RISK									
Priority Fish									
Operations –Beaver Dam Mine Site Indirect impacts including groundwater drawdown, groundwater seepage, altered surface water quality Cameron Flowage/Killag River Tent Lake Cope Brook	Indirect	Interceptor trench west of PAG stockpile Water treatment (as required) Discharge point location at northern end of Cameron Flowage Vegetative buffers to provide shade to on-site ponds Install groundwater pumps to supplement baseflow in Cameron Flowage Explosives Management Best Management Practices	L Interaction likely to cause indirect impacts to fish habitat	LAA Potential adverse effect to fish habitat outside of the PA	A Seasonal habitat provisions may affect VC	P Effect is expected to be permanent	R Effects occur at regular intervals throughout the Project	PR Groundwater drawdown effects will cease once the pit lake has filled. Surface water interactions are partially reversible	Habitat alteration
Post Closure – Beaver Dam Mine Site and Touquoy Mine site Surface water quality Cameron Flowage/Killag River Moose River	Indirect	Water treatment (as required)	N VC interaction will remain below appropriate guidelines	LAA VC interaction will extend beyond PA	A Seasonal aspects will affect VC	P Effect is expected to be permanent	R Effects are expected to occur over a regular interval	PR VC will partially recover to baseline conditions	Change in water quality

Table 9.1-2: Summary of Residual Effects by Valued Component (continued)

Project - VC Interactions	Summary of Mitigation	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Priority Terrestrial Fauna									
Construction – Beaver Dam Mine Site and Haul Road (habitat loss and fragmentation from clearing and grubbing)	Limit habitat disturbance and minimize Project footprint during detailed design, implement speed limits, install fences where necessary, and minimize lighting.	L < 5% direct loss of habitat types used by observed SAR and SOCI within the LAA Partial mitigation through restoration.	RAA Potential adverse effect to fauna outside of the LAA (fragmentation)	A VC interaction may affect seasonal aspects of fauna.	MT (Beaver Dam Mine Site) Effects occur beyond 5 years when closure activities commence at Beaver Dam Mine Site. P (Haul Road) Closure of the Haul Road not expected.	O Effects occur once during the construction phase.	PR Mitigation and reclamation cannot guarantee a return to baseline conditions.	Habitat Loss	Not Significant
Construction – Beaver Dam Mine Site and Haul Road (sensory disturbance (noise, light, dust deposition) and wildlife vehicle collisions from construction activities)	Implement speed limits, install fences where necessary, and minimize lighting.	M	LAA Potential adverse effect to fauna outside of the PA	A VC interaction may affect seasonal aspects of fauna.	ST Effects are limited to occur from as little as 1 day to 12 months	R Effects occur at regular intervals during the construction phase	R VC will recover to baseline conditions	Disturbance	Not Significant
Operational – Beaver Dam Mine Site, Haul Road and Touquoy Mine Site (disturbance (noise, light, dust deposition and wildlife vehicle collisions) from haul trucks, heavy machinery and mine operations)	Implement speed limits, install fences where necessary, and minimize lighting.	M Moderate changes relative to baseline conditions in remaining and surrounding habitat.	LAA Potential adverse effect to fauna beyond the PA.	A VC interaction may affect seasonal aspects of fauna.	MT Effects may occur up to 5 years.	R Effects occur at regular intervals.	R VC will recover to baseline conditions	Disturbance	Not Significant
Closure (Active) – Beaver Dam Mine Site (re-establishment of habitat for fauna)	N/A	L Minor change from baseline conditions.	LAA Potential effect to fauna outside of the PA	A VC interaction may affect seasonal aspects of fauna.	LT Effects extend beyond active closure phase.	O Effects occur once during the closure phase.	PR Mitigation and reclamation cannot guarantee a return to baseline conditions.	Habitat Reclamation	Not Significant
Priority Avifauna									
Construction – Beaver Dam Mine Site and Haul Road (habitat loss from clearing and grubbing)	Limit habitat disturbance and minimize Project footprint during detailed design, implement speed limits and minimize lighting.	L < 5% direct loss of habitat types used by observed species within the LAA Partial mitigation through restoration.	LAA Potential adverse effect to avifauna outside of the PA	A Although clearing and grubbing will occur outside of the sensitive period for avifauna, other activities will not.	MT (Beaver Dam Mine Site) Effects occur beyond 5 years when closure activities commence at Beaver Dam Mine Site. P (Haul Road) Closure of the Haul Road not expected.	O Effects occur once during the construction phase.	PR Mitigation and reclamation cannot guarantee a return to baseline conditions.	Habitat Loss	Not Significant
Construction – Beaver Dam Mine Site and Haul Road (sensory disturbance (noise, light, dust deposition) and wildlife vehicle collisions from construction activities)	Implement speed limits and minimize lighting.	M	LAA Potential adverse effect to avifauna outside of the PA	A VC interaction may affect seasonal aspects of avifauna.	ST Effects are limited to occur from as little as 1 day to 12 months	R Effects occur at regular intervals during the construction phase	R VC will recover to baseline conditions	Disturbance	Not Significant
Operational – Beaver Dam Mine Site, Haul Road and Touquoy Mine Site (disturbance (noise, light, dust deposition and wildlife vehicle collisions) from haul trucks, heavy machinery and mine operations)	Implement speed limits, install fences where necessary, and minimize lighting.	M Moderate changes relative to baseline conditions in remaining and surrounding habitat.	LAA Potential adverse effect to avifauna outside of the PA	A VC interaction may affect seasonal aspects of fauna.	MT Effects may occur up to 5 years.	R Effects occur at regular intervals.	R VC will recover to baseline conditions	Disturbance	Not Significant
Operations – Touquoy Mine Site Tailings deposition	Best management practices, Bird Deterrent Program implementation	L Change in habitat for avifauna	PA VC interaction is confined to the PA.	A VC interaction may occur during sensitive period for avifauna.	LT Effects may extend beyond 5 years	R VC interaction will occur at regular intervals	PR Mitigation cannot guarantee a return to baseline conditions	Creation of potential open water habitat; decreased water quality	Not Significant

Table 9.1-2: Summary of Residual Effects by Valued Component (continued)

Project - VC Interactions	Summary of Mitigation	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Closure (Active) – Beaver Dam Mine Site (re-establishment of habitat for fauna)	N/A	L Minor change from baseline conditions.	LAA Potential effect to avifauna outside of the PA	A VC interaction may affect seasonal aspects of fauna.	LT Effects extend beyond active closure phase.	O Effects occur once during the closure phase.	PR Mitigation and reclamation cannot guarantee a return to baseline conditions.	Habitat Reclamation	Not Significant
MI'KMAQ OF NOVA SCOTIA									
Construction – Beaver Dam Mine Site and Haul Road Direct effect on archaeological resources and burial site	Ensure no Project activities occur outside of PA, education and procedures in place as part of the EPP to halt work and notify the Mi'kmaq if archaeological deposits are encountered.	N No interactions with known archaeological Mi'kmaq resources and burial sites are expected. Identified resources will be avoided	PA VC confined to the mine site	N/A This project interaction is not expected to be affected by timing	ST VC interaction will occur during construction phase	O VC interaction will occur once	IR VC remains at the end of the activity	None	Not Significant
Construction – Beaver Dam Mine Site and Haul Road Direct habitat loss, including wetlands, and loss of plants of significance to the Mi'kmaq	Minimize footprint as per Project design, implementation of mitigation and monitoring as per other VCs to minimize indirect effects, engagement and involvement of the Mi'kmaq throughout Project (including monitoring and compensation)	L Mitigation strategies and best management practices reduce the magnitude of impact	PA VC confined to the mine site	A timing is applicable and clearing and grubbing will be completed outside of the growing season wherever practicable	ST VC interaction will occur during construction phase	O VC interaction will occur once	PR VC remains at the end of the activity	Loss of plant specimens, habitat loss. Reclamation will restore some native plant species but not expected to return to baseline	Not Significant
Construction and Operations – Beaver Dam Mine Site and Haul Road Direct and indirect impacts to fish and fish habitat	Minimize footprint as per Project Design, erosion and sediment control to minimize impact, and water quality treatment, if required. Fisheries Act Authorization and Fish Habitat Offset Plan	L Mitigation strategies and best management practices reduce the magnitude of impact	PA/LAA Direct effect within PA, indirect effect within LAA	A Seasonality (spawning) windows applicable	MT VC interaction will occur during construction, operations and active reclamation	O/S Effects will be once from direct impacts, effects will be sporadic from indirect impacts	IR VC interactions are permanent	Habitat loss, change in water quality/quantity. Positive change in water quality due to historical tailings management	Not Significant
Construction and Operations – Beaver Dam Mine Site and Haul Road Indirect impacts to fauna- loss of habitat; noise and fragmentation	Minimize footprint as per Project Design, utilize existing roads wherever practicable, provision of bypass roads to maintain access.	L Mitigation and best management strategies reduce magnitude of impact	PA/LAA Direct effect within PA, indirect effect within LAA	A Seasonality (breeding windows) applicable	MT VC interaction will occur during construction, operations and active reclamation	R effects will be regular from indirect impacts	PR Traffic will reduce on roads once operations cease	Habitat loss, potential changes in species movement patterns	Not Significant
Construction and Operations – Beaver Dam Mine Site and Haul Road Predicted noise and air potential interaction with traditional practices surrounding the Project	Utilize berms and other mitigation where required to reduce noise levels to minimize indirect impact to Mi'kmaq; share noise study results and involve Mi'kmaq in data collection. Use of chemical dust suppressants on Haul Road to ensure 80% dust control.	L noise and dust levels predicted to be elevated above background but in compliance at the property boundaries,	LAA Noise will potentially affect wildlife patterns in close proximity to the Mine (LAA)	N/A This project interaction is not expected to be affected by timing	MT VC interaction will occur during construction, operations and active reclamation (2-3 yrs) phases of the Project	R VC interaction will occur at regular intervals throughout the Project	R VC interaction will recover to baseline after Project activities are completed	Sensory Disturbance	Not Significant
Construction and Operations – Beaver Dam Mine Site and Haul Road Predicted Light levels and potential interaction with traditional practices surrounding the Project	Maintenance of forested canopy wherever practicable within the Project property boundaries. Limit unnecessary lighting at Beaver Dam Mine Site; utilization of potential green energy options	L Light levels are predicted to meet guidelines at residences. Elevated light levels above background will be present up to 2 km from the Mine	LAA light from the Beaver Dam Mine Site is predicted to extend into the LAA	A Timing is applicable as visual effect is adjusted based on foliage on trees	MT VC interaction will occur during construction, operations and active reclamation (2-3 yrs) phases of the Project	R VC interaction will occur at regular intervals throughout the Project	R VC interaction will recover to baseline after Project activities are completed	Sensory Disturbance	Not Significant
Construction, Operations and Closure, Beaver Dam Mine Site and Haul Road Potential impact to human health from the Project	Implement mitigation and monitoring measures identified for each VC for the life of the Project as required	L Adverse health effects from dust exposure, the consumption of country foods harvested from the vicinity of the Mine Site, and recreational water use are not anticipated.	LAA This project interactions resulting in potential health effects extend into the LAA	N/A This project interaction is not expected to be affected by timing	MT VC interaction will occur during construction, operations and active reclamation (2-3 yrs) phases of the Project	R VC interaction will occur at regular intervals throughout the Project	R VC interaction will recover to baseline after Project activities are completed	Human Health	Not Significant

Table 9.1-2: Summary of Residual Effects by Valued Component (continued)

Project - VC Interactions	Summary of Mitigation	Residual Environmental Effects Characteristics						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction, Operations and Closure, Beaver Dam Mine Site and Haul Road Potential impact to the economic, social and mental well being of the Mi'kmaq of Nova Scotia from the Project	Continue discussions with the Mi'kmaq to determine appropriate mitigation and compensation requirements, where appropriate. Proposed multi-use bypass road. Potentially suitable alternative tracts of Crown land are available surrounding the Beaver Dam Mine Site and Haul Road. Mi'kmaq participation in monitoring programs and development of Reclamation and Closure Plan for the Project.	L	LAA	A	MT VC interaction will occur during construction, operations and active reclamation (2-3 yrs) phases of the Project	C	PR	Change in economic, social and mental well being of the Mi'kmaq of Nova Scotia	Not Significant
Construction, Operations and Closure – Beaver Dam Mine Site and Haul Road Restriction and loss of access for traditional practice during construction, operations and active reclamation of the Mine	Continue discussions with the Mi'kmaq to determine appropriate mitigation and compensation requirements, where appropriate. Proposed multi-use bypass road. Potentially suitable alternative tracts of crown land are available surrounding the Beaver Dam Mine Site and Haul Road	L Mitigation strategies and best management practices reduce the magnitude of impact	LAA Access restriction is confined to PA; hunting effects may be felt within LAA due to sensory disturbance and/or firearm restrictions	N/A This project interaction is not expected to be affected by timing	MT VC interaction will occur during construction, operations and active reclamation (2-3 yrs) phases of the Project	R VC interaction will occur regularly	R VC returns to baseline conditions at the end of the activity	Loss of Access	Not Significant
Construction, Operations and Closure – Beaver Dam Mine Site and Haul Road Development of Project	Continue confidential discussions with the Mi'kmaq of Nova Scotia (parallel to the federal environmental assessment) to identify employment, community and economic benefits.	L Considerable and tangible opportunities for Mi'kmaq communities	RAA Opportunities can be considered across the RAA	N/A This project interaction is not expected to be affected by timing	MT to LT Opportunities will extend past operational period into reclamation and post closure.	C There are continuous opportunities throughout all project phases.	R VC returns to baseline conditions at the end of the activity	Benefits to the Mi'kmaq of Nova Scotia	Not Significant
PHYSICAL AND CULTURAL HERITAGE									
Construction – Beaver Dam Mine Site and Haul Road (Identification and/or damage to physical and cultural heritage resources – Site 6 and Areas 2 and 3)	Evaluate changes to layout for potential impacts to archaeological resources. Complete intensified historical research, additional shovel pit testing, where required, and detailed documentation at archeological features prior to disturbance cause by Project activities, in conjunction with Mi'kmaq agencies as required. Contact Coordinator of Special Places, Nova Scotia Communities, Culture, & Heritage Department if human remains or archaeological deposits are identified.	L Site 6 will be lost due to Project activities. This site contains the remains of a twentieth century structure. Impacts to Areas 2 and 3 will be minimized where practicable. These areas underwent additional shovel tests in fall 2020 and were cleared of further investigation.	PA Effects confined to the PA.	N/A VC is not expected to be affected by timing.	P Effects are permanent.	O Effects will occur once within the life of the Project.	IR VC will not return to baseline conditions.	Loss of resource	Not significant

Notes: See each Valued Components Thresholds for Determination subsections for specific for magnitude criteria definitions (Section 6) and Section 5.11, Table 5.11-1 for general definitions of the below characteristics.

Magnitude		Geographic Extent		Timing		Duration		Frequency		Reversibility	
N	Negligible	PA	Project Area	N/A	Not Applicable	ST	Short-Term	O	Once	R	Reversible
L	Low	LAA	Local Assessment Area	A	Applicable	MT	Medium-Term	S	Sporadic	IR	Irreversible
M	Moderate	RAA	Regional Assessment Area			LT	Long-Term	R	Regular	PR	Partially Reversible
H	High					P	Permanent	C	Continuous		

Table 9.1-3: Summary of Residual Effects for Socio-economic Conditions

Theme Areas	Topics within Theme Area	Linkages to other Plans and Guiding Documents	Pathway	Mitigation	Direction	Magnitude	Duration	Geographical Extent	Reversibility	Frequency	Residual Effect
Workforce Development	Training Opportunities	One NS Goal, Atlantic Growth Strategy	Apprenticeship training program and internal training opportunities provide opportunities for certifications and training.	N/A	Positive	L	Short Term	RAA	N/A	C	Insignificant
	Opportunities for Advancement within career	One NS Goal	Internal hiring and opportunities for graduates provided by AMNS employment opportunities, support career advancement.	N/A	Positive	L	Short Term	RAA	N/A	C	Insignificant
	New employment - direct and indirect	One NS Goal, Atlantic Growth Strategy	Beaver Dam will provide new employment opportunities, both through direct and indirect sources.	N/A	Positive	H	Short Term	LAA	N/A	C	Significant
	Labour Force attachment	One NS Goal	New high quality employment opportunities provide opportunities for working age people to attached to the labour force.	N/A	Positive	L	Short Term	RAA	N/A	C	Insignificant
	Impact on Educational Attainment	One NS Goal, Atlantic Growth Strategy; SDG	Apprenticeship training program supports educational attainment and providing opportunity for graduates of both NSCC and university programs.	N/A	Positive	N	Short Term	RAA	N/A	C	Insignificant
	Youth Employment Rate	One NS Goal; Halifax Partnership	Employment opportunities for young people (under 30) through both direct and indirect sources.	N/A	Positive	N	Short Term	RAA	N/A	C	Insignificant
	Suppliers	Halifax Partnership, One NS Goal	There will be need for suppliers from the local areas to provide supports, which may impact the suppliers labour needs.	N/A	Positive	M	Short Term	RAA	N/A	C	Significant
	Labour Force Attachment - Indigenous	One NS Goal; Halifax Partnership; KMKNO Pillars	MOU and IBA provide support to Mi'kmaq lead employment programs.	N/A	Positive	N	Short Term	RAA	N/A	C	Insignificant
Demographics	In-Migration	Halifax Partnership, One NS Goal, Atlantic Growth Strategy	New employment opportunities may attract new residents to the province.	N/A	Positive	N	Short Term	LAA	N/A	C	Insignificant
	Rural Re-Population	Halifax Partnership, One NS Goal	New employment opportunities may attract new residents to the LOA supporting communities that are seeing population declines.	Monitoring of population growth related to mine operations	Positive	N	Short Term	LAA	N/A	C	Insignificant
Healthy Communities	Hospitals	SDG	With new populations and industry, local hospital usage may increase.	N/A	Negative	N	Short Term	LAA	R	C	Insignificant
	Family Doctor Availability	SDG	New resident may impact family doctor availability.	N/A	Negative	N	Short Term	LAA	R	C	Insignificant
	Seniors Supports	SDG	Through Community investment AMNS has made and plans to continue to make investments to seniors related initiatives.	N/A	Positive	N	Short Term	LAA	R	I	Insignificant
	Schools	SDG	If rural re-population occurs, there may be an increase in school populations.	N/A	Positive	N	Short Term	LAA	R	C	Insignificant
	Recreational Facilities		Potential increase of recreational facilities or support for new recreation facilities planned for the area.	N/A	Positive	N	Short Term	LAA	R	I	Insignificant
	Housing	SDG	Impact on housing availability requires further study and is market dependent	Monitoring of population increase on housing market		U	Short Term	LAA	R		
	Climate Change and Energy	SDG					Short Term				
	Local Taxation	Once Nova Scotia	Direct and indirect benefits to the local, provincial and federal governments.	N/A	Positive	L	Short Term	LAA	R	C	Insignificant

Table 9.1-3: Summary of Residual Effects for Socio-economic Conditions (continued)

Theme Areas	Topics within Theme Area	Linkages to other Plans and Guiding Documents	Pathway	Mitigation	Direction	Magnitude	Duration	Geographical Extent	Reversibility	Frequency	Residual Effect
Land Use, Recreational	Snowmobiling and ATV Use	Halifax Partnership	Support and upgrades to existing and proposes off-road trail systems and potential partnership opportunities.	Construction of bypass roads.	Positive	N	Long Term	LAA	R	C	Significant
	Active Transportation	HRM Policies	Increased traffic on public roads in limited locations may create concerns about walking and biking safety.	Construction of bypass roads	Negative	N	Long Term	LAA	R	C	Significant
	Access to Camps		With the construction of a haul road, access to camps will be maintained or possibly improved.	Construction of bypass roads	Positive	N	Long Term	LAA	R	C	Significant
	Haul Road Safety		The existing haul road will have increase operational safety parameters which will improve the safety on the road by separating heavy traffic from recreational users, small vehicles and non motorized usage.	Construction of bypass roads	Positive	N	Short Term	LAA	R	C	Significant
	Noise		See section on noise.	See Chapter ???					R		
	Hunting and Fishing	Halifax Partnership	The haul road and mine site may impact hunting by altering migration patterns and by reducing hunting opportunities near the mine site and haul road, as required by the relevant act. Access to fishing areas will be improved, potentially leading to increased recreational fishing.	Construction of bypass roads	Negative	L	Short Term	LAA	R	C	Significant
Parks and Open Space, Tourism	Protected Areas and Wilderness Areas	Halifax Partnership	No impact.	N/A	Neutral	N	Short term	LAA	N/A	N/A	Insignificant
	Local Community Sites	SDG	No impact.	Protection of Date Rock	Neutral	N	Short Term	LAA	R	C	Insignificant
	Tourism Opportunities	Halifax Partnership, One NS Goal	Potential for increased attraction to the area to view mining related activities.	N/A	Positive	N	Short Term	LAA	N/A	N/A	Insignificant
	Regional Visitation	Halifax Partnership, One NS Goal	No anticipated impact.	N/A	Neutral	N	Short Term	LAA	N/A	N/A	Insignificant
Roads and Traffic	Traffic Impact		Increased traffic on public roads in limited locations may create concerns about walking and biking safety.	Access and Safety Plan	Negative	M	Short Term	LAA	R	C	Insignificant
	Road Infrastructure		Potential for improvements to public roads to address increased usage by proponent. Increased usage may result in negative impacts or degradation of public road infrastructure.	Insert language about paying for paving.	Negative and Positive	M	Long Term	LAA	R	C	Insignificant
	Private Road Infrastructure		Private road will be improved to a high standard, which will be left in place after mine operations cease.	N/A	Positive	N	Long Term	LAA	R	C	Insignificant
	Public Road Crossings		Improvements to road crossings at the haul road and highway 224.	Install crossings to allow access to other lands	Positive	N	Permanent	LAA	R	C	Insignificant
	Pedestrian Safety		Increased traffic on public roads in limited locations may create concerns about walking and biking safety.	Access and Safety Plan	Negative	N	Short Term	LAA	R	C	Insignificant
Impact on Government Revenues	Provincial Taxation and Benefits	One Nova Scotia	Direct and indirect taxation benefits to the province.	N/A	Positive	L	Short Term	RAA	R	C	Insignificant
	Federal Taxation and Benefits	Atlantic Growth Strategy	Direct and indirect taxation benefits to the province.	N/A	Positive	L	Short Term	RAA	R	C	Insignificant

Notes: Section 6.16.12, Table 6.16-27 for specific Socio-economic Conditions residual effects and significance rating criteria and Section 5.11, Table 5.11-1 for general definitions of the below characteristics.

Magnitude		Geographic Extent		Timing		Duration		Frequency		Reversibility	
N	Negligible	LAA	Local Assessment Area	N/A	Not Applicable	ST	Short-Term – within life	O	Once	R	Reversible
L	Low	RAA	Regional Assessment Area	A	Applicable	LT	Long-Term Beyond life	I	Intermittent	IR	Irreversible
M	Moderate					P	Permanent	R	Regular		
H	High							C	Continuous		

Table 9.1-4: Summary of Residual Cumulative Effects by Valued Component

Residual Adverse Cumulative Effects (After Mitigation and Compensation if required)	Significance Levels						Overall Significance of Residual Adverse Effects and Rationale
	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	
NOISE							
Cumulative increased noise levels (Noise from construction, operation, reclamation, and operation of mining, haul trucks, forestry activities and haul road usage)	L Noise levels are expected to be less than or equal to appropriate guidelines or threshold values at the Beaver Dam Mine Site and Haul Road property boundary. Additive cumulative effects may occur when forestry operations occasionally coincide with Project activities and hauling ore from FMS and Cochrane Hill to Touquoy Mine Site for processing	LAA The cumulative effects causing increased background noise levels will not extend beyond the LAA.	A VC is expected to be affected by timing, with sporadic nature of timber harvesting.	LT Effects may extend beyond 8 years.	R Additive periods of potential effects from the Project and forestry operations are likely to be limited in frequency. However, cumulative effects to baseline noise levels from the use of the Beaver Dam Haul Road by Beaver Dam, Fifteen Mile Stream and Cochrane Hill Gold Projects will occur regularly throughout the operational phase of the Project.	R VC will recover to baseline conditions once operations have stopped.	Low Adverse Effect (Not Significant) Effects are limited to the LAA based on Project interactions and usage of the Beaver Dam Haul Road by various activities. Furthermore, the VC is anticipated to recover to baseline conditions once the operation of the mine has stopped. Effects would be confirmed through monitoring.
AIR							
Increased cumulative dust during operation of the Project (Dust from mining and haul trucks)	M Possible exceedance of guidelines or threshold values when forestry operations occasionally coincide with hauling from the Project to the Touquoy Processing Facility along with ore or concentrate from Fifteen Mile Stream and Cochrane Hill Projects.	LAA The cumulative effects causing increased background air concentrations will not extend beyond the LAA.	A VC will be affected by timing – drier periods will increase fugitive dust emissions relative to wetter times of the year.	LT Effects may extend beyond 7 years.	R Additive periods of potential effects from the Project and forestry operations are likely to be limited in frequency. However, cumulative effects to ambient dust levels from the use of the Beaver Dam Haul Road by the Project, the Fifteen Mile and Cochrane Hill Gold Projects will occur regularly throughout the operational phase of the Project.	R VC will recover to baseline conditions once operations have stopped.	Moderate Adverse Effect (Not Significant) Effects are limited to the LAA where there are limited sensitive receptors, and the use of the Beaver Dam Haul Road. Furthermore, the VC is anticipated to recover to baseline conditions once the operation Project has been completed. Effects would be confirmed through monitoring.
LIGHT							
Increased light levels during operation of the Project (operational light levels and light from transportation of gold concentrate and use of the Beaver Dam Haul Road by other projects)	L Less than or equal to appropriate guidelines or threshold values.	LAA The cumulative effects causing increased background light concentrations will not extend beyond the LAA. Exception to this is the cumulative light along the Beaver Dam Haul Road which is outside of the Project LAA but described herein.	N/A VC is not expected to be affected by timing.	LT Effects may extend beyond 8 years.	R Additive periods of potential effects from the Project and forestry operations are likely to be limited in frequency. However, cumulative effects to ambient light levels from the use of the Beaver Dam Haul Road Use by Fifteen Mile Stream and Cochrane Hill Gold Projects will occur regularly throughout the operational phase of the Project.	R VC will recover to baseline conditions once operations have stopped.	Low Adverse Effect (Not Significant) Effects are limited to the LAA where there are limited sensitive receptors, and the use of the Beaver Dam Haul Road. Furthermore, the VC is anticipated to recover to baseline conditions once the operation of the Beaver Dam Mine SIte has been completed.
SURFACE WATER							
Potential for residual cumulative effects to all surface water systems within each RAA (Touquoy Mine Site and Beaver Dam Mine Site).	L With mitigation strategies, predicted receiver concentrations are predicted to be greater than guidelines and increase by greater than 10% over baseline levels, but remains well within the observed range of natural variation (25th to 75th percentile baseline water quality).	LAA Cumulative effects are confined to the LAA.	A Cumulative effect would be more significant during low flow conditions and/or sensitive spawning windows.	LT Effects may extend beyond 7 years.	R Effects will occur at regular intervals throughout operations.	PR Mitigation cannot guarantee a return to baseline conditions.	Minor Adverse Effect (Not Significant) Given implementation of proposed mitigation methods, no significant adverse cumulative effect is expected.
FISH AND FISH HABITAT							
Cumulative disturbance to fish and fish habitat within the RAA.	L Differing from the existing environment/ baseline conditions, within natural variation	LAA Potential adverse cumulative effect to fish habitat outside of the PA.	A Cumulative effect would be more significant during sensitive spawning windows.	P Effect is expected to be permanent.	C Effects will occur on a continuous basis throughout operations and closure.	IR Effects of flow reduction and direct impacts from Haul road crossings are expected to be irreversible.	Low Adverse Effect (Not Significant) Fish habitat offsetting is anticipated to compensate for lost fish habitat from the Project itself. No other pathway for residual effects from surrounding projects has been identified.

Table 9.1-4: Summary of Residual Cumulative Effects by Valued Component (continued)

Residual Adverse Cumulative Effects (After Mitigation and Compensation if required)	Significance Levels						Overall Significance of Residual Adverse Effects and Rationale
	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	
SPECIES OF CONSERVATION INTEREST AND SPECIES AT RISK							
Cumulative loss, alteration and the disturbance of habitats throughout the RAA relating to SOCI and SAR.	L The maximum cumulative Project edge effect will affect 512 ha of interior forest habitat in consideration of the Beaver Dam and FMS Projects, which accounts for 0.7% of predicted interior forest in the RAA. There is limited additional development pressures from other projects in the RAA, as demonstrated by the few projects identified within this evaluation.	RAA Loss of habitat used by priority species has occurred on a regional scale.	A Cumulative effect would be more significant during sensitive period for each priority species.	LT Effects may extend beyond 7 years.	S The loss of habitat associated with the Beaver Dam Mine Site will occur once. However, the potential future loss of habitat associated with the Beaver Dam Project and other regional projects in the future could occur throughout the lifetime of the Project.	PR Reclamation cannot guarantee a return to baseline conditions.	Low Adverse Effect (Not Significant) The small proportion of regional habitat that supports priority species that would be lost as a result of this Project will be restored during the reclamation stage of Closure Phase. There is limited additional development pressure from projects in the RAA.
MI'KMAQ OF NOVA SCOTIA							
Effects to Mi'kmaq of Nova Scotia and their traditional land use as a result from impacts to air quality, noise, light, surface water, fish habitat, and human health, and cumulative limitations to land use for traditional purposes from multiple projects within the RAA.	L Mitigation and best management strategies reduce magnitude of impact. The loss of access to a maximum area of 6,282 ha from all identified projects in the RAA accounts for 0.64% of all land within the RAA, and 0.88% of available crown land within the RAA.	LAA Direct cumulative effects within PA, indirect cumulative effects within LAA. BD Haul Road cumulative effects within LAA for BD Haul Road.	A Seasonal windows applicable. Air dispersion affected by season and wind direction, noise and light effects will be limited by foliage when present on trees, effects to fish and fish habitat are more sensitive during spawning windows (spring and fall).	LT Effects will extend beyond 8+ years – will extend to eight years of limited access to the Beaver Dam Mine Site, less than the defined 20 years in the context of the Mi'kmaq of Nova Scotia VC significant threshold.	R VC interaction will occur regularly.	R VC interaction will recover to baseline after Project activities are completed.	Moderate Adverse Effect (Not Significant) Assuming that the proposed compensation measures are applied for the Project and that they achieve their objectives, the predicted residual cumulative effects on the Mi'kmaq of Nova Scotia with regards to impacts to air quality, noise, light, surface water, fish habitat, and human health, are assessed to be adverse, but not significant. Loss of access is limited to 0.88% of available crown land within the RAA.

Legend (refer to Section 5.11, Table 5.11-1 for definitions)

Magnitude		Geographic Extent		Timing		Duration		Frequency		Reversibility	
N	Negligible	PA	Project Area	N/A	Not Applicable	ST	Short-Term	O	Once	R	Reversible
L	Low	LAA	Local Assessment Area	A	Applicable	MT	Medium-Term	S	Sporadic	IR	Irreversible
M	Moderate	RAA	Regional Assessment Area			LT	Long-Term	R	Regular		
H	High					P	Permanent	C	Continuous		

Table 9.2-1: Summary of Atlantic Mining NS Inc. Beaver Dam Mine Project General Commitments

Project Phase	General Commitments	EIS Section
Pre-construction	The Proponent will voluntarily establish an Independent Tailings Review Board for design, construction and operational phases of project infrastructure including the TMF.	Section 1 Introduction
Pre-construction	The Proponent intends to maintain adequate insurance and bonding to ensure its commitments are met. This includes maintaining financial bonding to ensure that adequate reclamation security is in place at all times during the construction, development and operational phases of the mining projects, as well as appropriate environmental impairment liability insurance.	Section 1 Introduction
Pre-construction	The Proponent commits to completing its operations in adherence with best available practices (BAPs) and industry standards as per guides developed by Mining Association of Canada, such as the Towards Sustainable Mining initiative, and the Canadian Dam Association.	Section 1 Introduction
On-going	The Proponent is committed to maintaining its CLC for the life of the Project.	Section 3 Public Engagement
On-going	The Proponent is committed to developing a long-term, positive and productive relationship with the Mi'kmaq of Nova Scotia based on principles of mutual respect, transparency, honesty and integrity, and a partnership approach to engagement.	Section 4 Indigenous Peoples Engagement
Construction and Operation to plan for Closure	Commitment to reclamation with Mi'kmaq participation in planning and implementation to restore habitats and allow traditional practices to resume within the Mine Site.	Section 4 Indigenous Peoples Engagement
Construction	The Proponent is committed to removing the historical tailings that may be disturbed as a part of site construction and operation. This tailings removal will be conducted during the construction phase.	Section 6.6 Groundwater Quality and Quantity
Construction (baseline EEM work was initiated in 2020)	Preparation of an Environmental Effects Monitoring Program in conjunction with submission of the Provincial Industrial Approval and the Metal and Diamond Mining Effluent Regulations	Section 6.7 Surface Water Section 6.9 Fish and Fish Habitat
Pre-construction (during permitting)	Development of a Seloam Brook Realignment Construction Plan in conjunction with submission of the Provincial Industrial Approval and Fisheries Act Authorization	Section 6.7 Surface Water
Construction, Operation, Closure	There will be a modular effluent treatment plant present on site during the construction phase and this system can be adapted and utilized throughout the life of mine, as required based on site effluent quality.	Section 6.7 Surface Water
Pre-construction (during permitting)	Development of Detailed Design for Seloam Brook Realignment and associated downstream water control structures and a Fish Rescue Plan to support the Fisheries Act Authorization. This detailed design will be developed through engagement with the Mi'kmaq of Nova Scotia and through consultation with DFO and IAAC.	Section 6.7 Surface Water Section 6.9 Fish and Fish Habitat
Pre-construction	Development of a Bird Nest Mitigation Plan if clearing and grubbing is required within the approved breeding bird timing window	Section 6.12 Avifauna Section 6.13 SAR/SOCI
Pre-construction (on-going)	On-going refinement of a communication protocol which will describe how the Proponent will communicate with the Mi'kmaq of Nova Scotia during ongoing exploration and operational phases of the projects, and in the event of a release or spill of a hazardous substance	Section 6.13 Mi'kmaq of Nova Scotia

Table 9.2-1: Summary of Atlantic Mining NS Inc. Beaver Dam Mine Project General Commitments (continued)

Project Phase	General Commitments	EIS Section
On-going	The Proponent is committed to ongoing Mi'kmaq engagement and participation for the life the Project – prior to, during and post environmental assessment. This includes communication and information sharing, face-to-face meetings, discussion of impacts and mitigations, and any other issues that may arise as the Project develops.	Section 4 Indigenous Peoples Engagement Section 6.14 Mi'kmaq of Nova Scotia
On-going	The Proponent will continue to work with the Mi'kmaq of Nova Scotia to provide specificity in analysis, where possible, to support comprehensive conclusions of Project impacts and to support mitigation and accommodation opportunities.	Section 6.14 Mi'kmaq of Nova Scotia
On-going and Pre-construction	The results of Mi'kmaq engagement have been considered and incorporated in the environmental effects assessment and are reflected in the Proponent's commitments to involve the Mi'kmaq in the development and implementation of mitigation and monitoring measures and proposed compliance and effects monitoring programs.	Section 6.14 Mi'kmaq of Nova Scotia
Pre-construction	Develop potential partnerships with Mi'kmaq environmental groups on specific ecological monitoring and restoration projects.	Section 6.14 Mi'kmaq of Nova Scotia
Construction	Development of a Dam Breach Inundation Study for incorporation into an Emergency Response Plan.	Section 6.18 Accidents and Malfunctions
Construction, Operation	Development of an Operation, Monitoring and Surveillance Manual (OMS) which provides a documented framework for actions, and a basis for measuring performance and demonstrating due diligence during the operational phase of the Project.	Section 6.18 Accidents and Malfunctions
Pre-construction	Development of the Environmental Management System (EMS) and all associated management and monitoring plans.	Section 10.1 Environmental Management System (EMS)

10 FOLLOW-UP AND MONITORING PROGRAMS PROPOSED

10.1 Environmental Follow-Up Program

AMNS understands that monitoring is a mechanism to gauge Project performance and measure against baseline conditions and effects as predicted in the EIS, as well as expectations of regulators, the public, the Mi'kmaq of Nova Scotia and interested parties. Results of programs will be documented and where appropriate, summaries of compliance and effects monitoring programs will be available via stakeholder and Mi'kmaq engagement mechanisms, such as CLC and other ad-hoc groups as defined in the draft Public Engagement Plan (Appendix A.6).

The CLC is one of the primary opportunities for AMNS to include the participation of the local community, including First Nations communities wherever possible, during development and implementation of the Project. Beyond the CLC, AMNS will engage with local community groups and the Mi'kmaq of Nova Scotia, as well as sharing information with the pubic as defined in the draft Engagement Plan (Appendix A.6). AMNS recognizes the inherent value in an open and flexible approach to engagement and monitoring. The Proponent views engagement and monitoring programs as dynamic and not static, such as collection of data, review of data, and refinement of programs, as well as mechanisms to share the results of programs. AMNS's approach to engagement is presented in Sections 3 and 4 of the EIS as well as the draft Public Engagement Plan (Appendix A.6).

Select VCs may be monitored, as defined in the EIS, before the start of construction. These monitoring programs will be undertaken to further design and guide mitigation measures as well as defining sampling program components, locations, frequency, and parameters related to the MDMER program and other related permitting, such as those required for wetland and watercourse alterations.

The results of follow-up monitoring programs will be provided to regulators as per the conditions of the EIS and other approvals and permits. The CLC and other interested stakeholders will be informed of the results of the follow-up programs and will be involved in the planning and implementation of these programs, where deemed appropriate and as defined in the draft Engagement Plan (Appendix A.6).

Monitoring results will be documented and reported in a format specified in approvals and permits.

10.2 Environmental Monitoring Plans

AMNS recognizes that the responsibility for all monitoring programs and mitigation commitments ultimately rest with the company. Many aspects of monitoring and mitigation that will occur during all phases of the Project (i.e., construction, operation, closure.) may be conducted through a sub contract but AMNS ultimately has responsibility for implementing mitigation and monitoring strategies committed to in the Updated 2021 EIS and for items added by regulators.

Proposed monitoring programs for the Project in the environmental follow-up program include noise, air, sediment, groundwater, surface water, wetlands, fish and fish habitat, habitat and flora, birds, and SAR and SOCI. The Proponent is commits to the involvement of the Mi'kmaq and in particular Millbrook First Nations in the development of monitoring programs for the Project.

The follow-up monitoring programs may be implemented up to one year prior to the start of construction; however, details of these programs will be determined following discussions with regulators. Preconstruction monitoring will be completed based on seasonality as required (e.g., breeding seasons, winter track surveys, vegetation surveys, etc.).

AMNS also recognizes that there may be additional requirements identified in approvals, such as the Industrial Approval that would be applied for from the Province of Nova Scotia through Part V – Approvals. Monitoring reports will be completed at a frequency determined by NSE. This is anticipated to be annual based on the existing IA for the Touquoy Gold Project. The regulatory agencies will provide guidelines for preparing monitoring reports, such as the number, content, frequency, and format.

Operational practices and compliance programs will be routinely reviewed based on monitoring results and will be adaptively managed based on discussions with regulators, stakeholders, public and Mi'kmaq and in particular Millbrook First Nations, as necessary.

Table 10.1-1: Beaver Dam Mine Project Monitoring Commitments

Valued Component	General Monitoring Commitments	Detailed Monitoring Commitments (if applicable)	Corresponding EIS Section Number
Noise	At the Touquoy Mine Site and Beaver Dam Mine Project, noise monitoring will be undertaken throughout the operation of the facility if any complaints or concerns are received.	No noise monitoring is required since the nearest residence is approximately 5 km south of the BDM Mine Site. However, some noise monitoring at site may be undertaken to determine appropriate noise mitigation.	Section 6.1.4.2
	Further assessment of baseline monitoring before construction, during construction, and during mining operations will be conducted to ensure impacts are below the Nova Scotia Environment (NSE) guidelines and the Health Canada noise guidance which allows for an incremental increase in the percentage of highly annoyed population in the community to remain below 6.5 percent at sensitive receptors.		Section 6.1.7.4.1
	Additional noise monitoring could be undertaken in the future if required as part of the Industrial Approval process.		Section 6.1.7.4.1
	Noise monitoring would be completed during each blasting event, as required by the Nova Scotia Environment and Labour (NSEL) Pit and Quarry Guidelines (NSEL 1999). Blast monitoring generally involves noise and vibration monitoring during each blasting event and includes monitoring at the nearest residence to the Beaver Dam Mine Site, which in this case would be at Beaver Lake IR 17.		Section 6.1.8
	Noise monitoring will be completed as directed by regulators or as a result of a complaint or engagement.		
Air	Ongoing monitoring of air pollutants will determine compliance with these standards, and any exceedance or complaint by the general public and/or Mi'kmaq o Nova Scotia and in particular Millbrook First Nations, will be discussed with regulators and/or the Citizen Liaison Committee (CLC), and mitigation programs and operational practices will be reviewed to determine the appropriate course of action.	Air Monitoring Program will be established as directed by NSE. AMNS will implement a Fugitive Dust Monitoring Program A draft Engagement Plan (Appendix A.6) has been developed to help guide engagement over the life of the Project	Section 6.2.10 Appendix A.6
Light	No additional monitoring is recommended. Additional ambient light monitoring would occur if directed by regulators or as a result of a complaint.		Sections 6.3.8, 6.3.10
Greenhouse Gases (GHGs)	Facilities with emissions falling below the reporting threshold of 50 kilotonnes (kt) per year can voluntarily report their GHG emissions. Atlantic Mining NS Inc. (AMNS) voluntarily reports GHG at the Touquoy Mine and will continue to do so should Beaver Mine Project be approved.		Section 6.4.4.1
	AMNS will continue to evaluate opportunities at the sites to reduce GHG emissions at their existing and proposed operations.		Section 6.4.5
	GHG emissions will be reviewed on an annual basis throughout the operation of the Touquoy processing facility.		Section 6.4.10
Geology, Soils, and Sediment	Construction techniques, erosion and sediment control measures, and a sediment monitoring program for the receiving environment is described in the draft Erosion and Sediment Control Plan that will be finalized and submitted as part of Industrial Approval Application process. .		Appendix C of Water Management Plan (Appendix P.4)

Table 10.1-1: Beaver Dam Mine Project Monitoring Commitments (continued)

Valued Component	General Monitoring Commitments	Detailed Monitoring Commitments (if applicable)	Corresponding EIS Section Number
	Monitoring will be undertaken to continue to define Historic Tailings Management. A draft Historic Tailings and Waste Rock Management Plan (Appendix has been drafted and will be finalized as part of the Industrial Approval Process.	Delineation and subsequent management of historical tailings and waste rock (soil and sediment) that is located within the footprint of Project infrastructure	Appendix E.9
	A draft Beaver Dam Project - ML/ARD Assessment Report (Appendix E.2) will continue to assess geochemical source terms and determine PAG. The assessment monitoring report will be finalized as part of the Industrial Approval process.	Operational Geochemical Testing Program: confirmatory testing of open pit blast hole drill cuttings to confirm geochemical predictions of mine rock at a frequency to be determined by the Project geochemists, geologists, and with consideration of available NRCAN and comparable guidance documents.	Appendix E.2
		Geochemical source term predictions heavily rely on theoretical constraints, representative geochemical test work, and the availability of site analogue data. To close data gaps that would increase the confidence in the geochemical source term predictions for future model iterations, the following recommendations are made	Appendix E.2
Groundwater	A draft Groundwater Monitoring Program has been developed (Appendix G of Water Management Plan P.4) that described monitoring that will continue during baseline/pre-construction, construction and through the closure phase to validate the predictions presented in the Groundwater Quality and Quantity Effects Assessment (Section 6.6).	The Groundwater Monitoring Program will form part of a broader Aquatic Effects Monitoring Program (AEMP) that will address interactions among VCs (e.g, surface water, fish and fish habitat).	Section 6.6.10 Appendix G of Water Management Plan (Appendix P.4)
	A groundwater monitoring program will be developed in association with requirements of wetland and watercourse alteration permits issued for direct wetland and watercourse alterations associated with the Project.		
Surface Water	A preliminary monitoring plan has been prepared as part of the Mine Water Management Plan (MWMP) Section 8. This monitoring plan outlines the proposed monitoring commitments for water quality and quantity from baseline conditions through construction, operation, and closure. A total of 16 surface water assessment sites during the construction stage have been selected for continued monitoring at the Beaver Dam Mine for either quality, quantity, or both. Their locations and monitored metrics are shown on Figure 8-1 of the MWMP. total of 19 surface water assessment sites during the operation and 17 during PC have been proposed for continued monitoring at Beaver Dam for either quality, quantity or both. Their proposed locations and monitored metrics are shown on Figure 8-2 and Figure 8-3 respectively. Surface Water Monitoring will form part of part of a broader Aquatic Effects Monitoring Program (AEMP) that will address interactions among VCs a		Mine Water Management Plan (Appendix P.4)
Wetlands	A Preliminary Wetland Monitoring Plan has been prepared for the EIS. A detailed Wetland Monitoring Plan will be established to support the Industrial Approval application, through the life cycle of the permitting process and will commit to monitoring during baseline/pre-construction to establish baseline conditions, and through the operational phase, closure and post closure (as determined to be required). Wetland monitoring will be completed for the Project on selected representative wetlands that have been predicted to have direct or indirect effects from Project development.		6.8.10, Preliminary Wetland Monitoring Plan (Appendix H.3)

Table 10.1-1: Beaver Dam Mine Project Monitoring Commitments (continued)

Valued Component	General Monitoring Commitments	Detailed Monitoring Commitments (if applicable)	Corresponding EIS Section Number
Fish and Fish Habitat	Monitoring of standard mitigations described above will be supported by the Mine Water management Plan (MWMP) and Aquatic Effects Monitoring Program (AEMP). The AEMP will monitor all aquatic ecosystems where Project effects are predicted to validate impact predictions as well as to identify adaptive management measures that may be required during construction, operations, and closure. The scope of the AEMP involves monitoring of water quality, water quantity, sediment quality, periphyton, benthic invertebrates, fish habitat and community, and fish health and fish tissue. The AEMP describes the proposed sampling frequency, schedule and intensity, as well as identified significance thresholds, action levels and suggested responses should significant thresholds be exceeded. The AEMP also provides a proposed reporting schedule to federal and provincial regulators. Complete offsetting for HADD including the finalization of an Offsetting Plan, for permanent loss of fish habitat through fish habitat restoration activities, subject to DFO approval, as required under the *Fisheries Act*. Monitoring will clearly be defined in the final Offset Plan, in consultation with DFO.		6.9.8.2, 6.9.8.3, 6.9.10, Appendix J.3 (Fish and Fish Habitat Baseline), AEMP to be provide prior to permitting stage
Habitat and Flora	No specific monitoring recommended. See SAR/SOCI monitoring recommendations.		6.10.10
Fauna	The Wildlife Management Plan (WMP) outlines protocols to minimize interactions between wildlife and Project activities. As part of the WMP, a Mainland Moose Management Plan (MMMP) will be developed and will commit to monitoring mainland moose during baseline/pre-construction to establish baseline conditions, and through the operational phase, closure, and post-closure (as determined to be required). Monitoring associated with the MMMP will be completed for the Project on selected transects within suitable mainland moose habitat and will be consistent with methods presented in the EIS, described in detail in Section 6.11.		6.11.9, 6.11.11, Wildlife Management Plan (Appendix P.7)
Avifauna	Conduct routine inspections for avifauna during construction, operation and active closure activities as directed by regulators. See SAR/SOCI monitoring recommendations.	Avoid construction on native vegetation during the regional breeding season for migratory avifauna where practicable (beginning of April to end of August for migratory avifauna; ECCC 2015). Where this is not practicable, an avifauna nest mitigation plan will be developed.	6.12.10, 6.12.11
Species at Risk and Species of Conservation Interest	Specific plans have been developed for SAR/SOCI, as part of or in addition to those outlined in Fish and Fish Habitat, Fauna, Avifauna and Habitat and Flora. Permitting may be required for Species at Risk, and additional monitoring requirements will be determined during permitting, in consultation with NSL&F.	Preliminary Wetland Compensation Plan includes proposed SAR conservation allowances WMP includes Mainland Moose Management Plan (MMMP) Lichen Monitoring Plan Landbird SAR Mitigation and Monitoring Plan Conceptual Aquatic Effects Monitoring Program includes priority fish species	6.13.9, 6.13.10, Preliminary Wetland Compensation Plan (Appendix H.3), Wildlife Management Plan (Appendix P.7), Lichen Mitigation and Monitoring Plan (Appendix P.6), Landbird SAR Mitigation and Monitoring Plan (Appendix A of Appendix P.7), Aquatic Effects Monitoring Program (to be provided prior to permitting stage)
Physical and Cultural Heritage	No additional monitoring is recommended, unless further changes to the Project layout or if development is to occur specifically around the historic features identified during the 2014, 2015, 2016, 2018 and 2019 reconnaissance.		6.15.8, 6.15.10

Table 10.1-1: Beaver Dam Mine Project Monitoring Commitments (continued)

Valued Component	General Monitoring Commitments	Detailed Monitoring Commitments (if applicable)	Corresponding EIS Section Number
Mi'kmaq of Nova Scotia	AMNS commits to providing the opportunity for Mi'kmaq participation in community-based monitoring programs and development of the Reclamation and Closure Plan. As the Project moves forward, discussions will continue with the Mi'kmaq of Nova Scotia regarding participation opportunity in the development, implementation and evaluation of proposed compliance and effects monitoring programs. These could include monitoring programs such as: • Wetland Monitoring; • Wildlife Monitoring, including Moose; and • Other monitoring programs such for air, surface water, groundwater, and noise. In addition, AMNS will hold periodic meetings with the Mi'kmaq of Nova Scotia, including Millbrook and Sipekne'katik First Nations, to review overall environmental compliance and effects monitoring programs associated with other VCs, and provide data and results of monitoring programs. On-going dialogue will continue with the Mi'kmaq of Nova Scotia regarding participation in, and implementation of, monitoring programs for the Project. The effects monitoring program will verify the effectiveness of mitigation measures associated with minimizing any potential effects to human health from consumption of or contact with country foods, water and soils, and results will be shared with local Indigenous groups.		6.14.10
Accidents and Malfunctions	Undertaken as necessary, geotechnical monitoring will be ongoing		6.18
Effects of the Environment on the Project	Undertaken as necessary		7

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12 ABBREVIATIONS, ACRONYMS AND GLOSSARY

12.1 Abbreviations and Acronyms

AAQC	Ambient Air Quality Criteria
ACCDC	Atlantic Canada Conservation Data Centre
AEMP	Aquatic Effects Monitoring Program
AGS	Atlantic Growth Strategy
ALDs	Anoxic limestone drains
AMNS	Atlantic Mining NS Inc.
AMO	Abandoned Mine Openings
ANFO	Ammonium Nitrate, Fuel Oil
ANSMC	Assembly of Nova Scotia Mi'kmaq Chiefs
APEC	Atlantic Provinces Economic Council
AQI	Air Quality Index
ARD	Acid Rock Drainage
ARM	Acid Rain Mitigation Project of the West River (Sheet Harbour)
As	arsenic
ATV	All terrain vehicles
ATVANS	All-Terrain Vehicle Association of Nova Scotia
BAP	Best Available Practices
BCM	bank cubic metres
BFI	baseflow Index
BMP	best management practices
CAAQS	Canadian Ambient Air Quality Standards
CaCO3	Calcium Carbonate
CCME	Canadian Council of Ministers of the Environment
CCME FWAL	Canadian Council of Ministers of the Environment Water quality Guidelines for the Protection of Freshwater Aquatic Life
CDA	Canadian Dam Association
CEAA	Canadian Environmental Assessment Agency
CEPA	Canadian Environmental Protection Act
CERB	Canada Emergency Response Benefit
CFM	Cubic feet per minute
CH4	Methane
CIL	Carbon in Leach
CLC	Citizen Liaison Committee
CMA	Census Metropolitan Area
CMM	Confederacy of Mainland Mi'kmaq

CO	Carbon Monoxide
CO_2	Carbon Dioxide
CO_{2e}	Carbon Dioxide Equivalent Units
COC	contaminant of concern
COO	Chief Operating Officer
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CRA	Conestoga-Rovers & Associates
CSM	Conceptual Site Model
CSP	corrugated steel pipe
CWS	Canadian Wildlife Service
DFO	Fisheries and Oceans Canada
DO	Dissolved Oxygen
DO	Dissolved Oxygen
DOC	Dissolved Organic Carbon
DSM	Digital Surface Model
DTH	down the hole
DU	designatable units
EA	Environmental Assessment
EARD	Environmental Assessment Registration Document
ECCC	Environment and Climate Change Canada
eDNA	Environmental DNA
EEM	Environmental Effects Monitoring
EGSPA	Environmental Goals and Sustainable Prosperity Act
EIS	Environmental Impact Statement
EMM	Preliminary Environmental Effects Monitoring Plan
EMS	Environmental Management System
EOM	End of Mine
EP	Engagement Plans
EPP	Environmental Protection Plan
EQS	Nova Scotia Environment Quality Standards
ESFWA	Eastern Shore Forest Watch Association
ESIA	Environmental Study Impact Assessment
ESMH	Eastern Shore Memorial Hospital
FEC	Forest Ecosystem Classification
FHAA	Fish Habitat Assessment Area
FOS	Fine ore stockpile
FTE	Full-time equivalents
FWAL	Freshwater Aquatic Life

GCL	Geosynthetic Clay Liner
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GLC	ground level concentrations
Golder	Golder Associates Ltd
GPS	Global Positioning System
HDPE	High-density Polyethylene
HIS	Habitat Suitability Indexing
HMANA	Hawk Monitoring Association of North America
HRM	Halifax Regional Municipality
HU	habitat units
IA	Industrial Approval
IAAC	Impact Assessment Agency of Canada
ICMC	International Cyanide Management Code
IDF	Intensity, Duration and Frequency
ILE	Institute of Light Engineers
ILR	Intensive Leach Reactor
IR	Indian Reserve
IR2	Round 2, Information Requests
ISQG	Interim Sediment Quality Guidelines
KBCM	kilo bank cubic metre
kLCM	kilo loose cubic metre
KMKNO	Kwilmu'kw Maw-klusuaqn Negotiation Office
KPIs	Key Performance Indicators
LAA	Local Assessment Area
LGO	low-grade ore
LOEC	Lowest observed effect concentration
LSA	Lichen Study Area
MACA	Mooseland and Area Community Association
MAD	mean annual discharge
MBBA	Maritime Breeding Bird Atlas
MBCA	Migratory Birds Convention Act
MBR	Migratory Birds Regulations
MCBA	Migratory Birds Convention Act, 1994
MCG	Mi'kmaw Conservation Group
MDMER	Metal and Diamond Mining Effluent Regulations
MEKS	Mi'kmaq Ecological Knowledge Study
MEL	McCallum Environmental Limited

MIA	Mining Infrastructure Area
MLCM	Million loose cubic metres
MMMP	Mainland Moose Management Plan
MMTS	Moose Mountain Technical Services
MOU	Memorandum of Understanding
MPS	Municipal Planning Strategy
MRC	Moose River Consolidated
MTRI	Mersey Tobeatic Research Institute
MVMH	Musquodoboit Valley Memorial Hospital
MWMP	Mine Water Management Plan
N_2O	Nitrous Oxide
NaCN	Sodium Cyanide
NAG	non-acid generating
NaOH	sodium hydroxide
NAPS	National Air Pollution Surveillance Network
NCNS	Native Council of Nova Scotia
NGO	Non-Governmental Organization
NO_X	Oxides of Nitrogen
NPA	Navigation Protection Act, 1985
NPRI	National Pollutant Release Inventory
NRCAN	Natural Resources Canada
NSAQS	Nova Scotia Air Quality Standards
NSCCH	Nova Scotia Department of Communities, Culture, and Heritage
NSDEM	Nova Scotia Department of Energy and Mines
NSDMA	Nova Scotia Department of Municipal Affairs
NSDNR	Nova Scotia Department of Natural Resources
NSE	Nova Scotia Environment
NSECC	Nova Scotia Environment and Climate Change
NSESA	Nova Scotia Endangered Species Act
NSL&F	Nova Scotia Department of Lands and Forestry
NSSA	Nova Scotia Salmon Association
NSSA AMP	Nova Scotia Salmon Association Acid Mitigation Project
NSTAT	Department of Transportation and Active Transit
NSTIR	Nova Scotia Department of Transportation and Infrastructure Renewal
NWPA	Navigable Waters Protection Act, 1985 (repealed)
O_3	Ozone
OAA	Office of Aboriginal Affairs
OMS	organic material stockpile

PA	Project Area
PAG	potential acid generative
PAPR	powdered air purifying respirators
PC	Post Closure
PEL	Probable Effect Level
PLS	Plain Language Summary
PM	Particulate Matter
PM_{10}	Coarse Particulate Matter; 10 micrometers in aerodynamic diameter
$PM_{2.5}$	Fine Particulate Matter; 2.5 micrometers in aerodynamic diameter
PPE	personal protective equipment
ppm	parts per million
qPCR	quantitative polymerase chain reaction
RAA	Regional Assessment Area
RCMP	Royal Canadian Mounted Police
ROM	Run Of Mine
SAR	Species at Risk
SARA	Species at Risk Act, 2002
SEP	Stakeholder Engagement Plan
SMP	Special Management Practices
SO_2	Sulphur Dioxide
SO_4	Sulfate
SOCI	Species of Conservation Interest
SOP	Standard Operating Procedure
SSD	species sensitivity distribution
SSWQO	site-specific water quality objectives
SU	Southern Uplands
TC	Transport Canada
TDS	Total Dissolved Solids
TIR	Department of Transportation and Infrastructure Renewal
TLRUS	Traditional Land and Resource Use Study
TLS	till stockpiles
TMF	Tailings Management Facility
TOR	Terms of Reference
TPM	Total Particulate Matter
TSP	total suspended particulates
TSS	Total Suspended Solids
USEPA	United States Environmental Protection Agency
VC	Valued Component

VECs	Valued Environmental Components
VOC	Volatile Organic Compounds
VT	Vegetation types
WBM	water balance model
WMP	Wildlife Management Plan
WQG	Water quality guidelines
WRSA	Waste Rock Settlement Area
WRSH	West River Sheet Harbour
WSS	Wetlands of special significance
WTS	water treatment system
YOY	Young of the year
ZVI	Zone of Visual Influence

12.2 Units of Measure

%	percent
<	less than
>	greater than
°C	degrees Celsius
µg/m^3	micrograms per cubic metre
µm	micro metres
cm	centimetre
cm/year	centimetres per year
dBA	decibels
E	East
El.	Elevation
g/s	grams per second
g/t	grams per tonne
ha	hectare
Hz	hertz
kg	kilogram
kg/hr	kilogram per hour
kg/t	kilogram per tonne
km	kilometre
km^2	square kilometre
kt	kilotonne
kt	kilo tonnes
kV	kilovolt
kW	kilowatt
L	litre
L/a	litres per annum
L/d	liters per day

m	metre
m^2	square metre
m^3	cubic metre
m^3/d	cubic metre per day
m^3/h	cubic metres per hour
m^3/sec	cubic metre per second
m^3/y	cubic metre per year
masl	metres above sea level
mg/L	milligram per litre
mg/m^3	milligram per cubic metre
ML	million litres
mm	millimetre
Mm^3	million cubic metres
Mm^3/y	million cubic metres per year
Mt	million tonnes
Mt/yr	million tonnes per year
MW	megawatt
N	North
NTU	nephelometric turbidity unit
oz	ounces
pH	concentration of hydrogen ions
ppb	parts per billion
pphm	parts per hundred million
ppm	parts per million
S	South
t	tonne
t/d	tonne per day
t/hr	tonne per hour
t/m	tonne per cubic metre
t/m^3	tonnes per cubic metres
t/y	tonnes per year
TCU	true colour unit
V	volt
W	West
wt%	percent by weight
µg/g	microgram per gram
µg/L	microgram per litre
µS/cm	microSiemens per centimetre

12.3 Glossary

Abiotic	Non-living factors that influence an ecosystem, such as climate, geology and soil characteristics.
Acid rock drainage	Acidic pH rock drainage due to the oxidation of sulphide minerals that includes natural acidic drainage from rock not related to mining activity; an acidic pH is defined as a value less than 6.0.
Active layer	The layer of ground above the permafrost that thaws seasonally during the summer and refreezes in the fall.
Ammonium nitrate fuel oil	A widely used explosive mixture.
Anthropogenic	Relating to, or resulting from the influence of human beings on nature.
Armouring	Protecting a channel from erosion by covering with protective material.
Backfilling	Using material to refill an excavated area.
Biophysical	The biological (e.g., plants, animals) and physical (e.g., air, water, soil) components of the natural environment.
Bioremediation	Use of microorganisms or their enzymes to return soil altered by contaminants back to its original condition.
Biotic	Living components of an ecosystem.
Boulder	A large rounded mass of rock lying on the surface of the ground or embedded in the soil.
Breccia	A fragmental rock whose fragments are angular.
Catchment	An area of land where water from precipitation drains into a body of water.
Commitments	Actions that AMNS formally agrees to undertake
Degrit	A degrit module consists of cyclones that separate the fine kimberlite (less than 0.25 mm) from the grits (greater than 0.25 mm but less than 1.0 mm).
Diabase	A dark coloured, fine to medium-grained igneous intrusive rock.
Diversion channel	an artificial channel built to reduce excess water flow, particularly during flooding, by diverting some of this flow to a lake or the sea or to a purpose-bult waterway.
Dyke	A tabular body of igneous rock that cuts across the bedding or foliation of the rock it intrudes.
Entrainment	The entrapment of one substance by another substance.
Fetch	An area of a waterbody where waves are generated by a wind having a constant direction and speed (also called Generating Area).
Fines	Silt and clay particles.
Flocculant	Chemicals that promote flocculation by causing colloids and other suspended particles in liquids to aggregate, forming a floc.
Freeboard	The distance between the water level and the top of a containing structure such as a dyke crest or channel top of bank.
Freshet	Seasonal surface runoff associated with spring melt.
Game Sanctuaries	Game Sanctuaries were established early in the 20th century to protect wildlife and a "nucleus of breeding stock". Today, wildlife management tools reduce the risk of extinction, but the game sanctuary designation remains as a tool for government to regulate lands, "where unusual concentrations of wildlife are vulnerable to site specific threats." Game Sanctuaries are enabled under the Nova Scotia Wildlife Act.
General fill	Rock not graded as to size or quality
Granular fill	Screened and sized rock material for earthworks/construction.
Grits	Processed kimberlite particles between 0.25 mm and 1.0 mm in size.
Grizzly	A grating, usually constructed of steel rails to separate coarse material from plant feed.
Groundwater	Water within interconnected pore spaces of the subsurface within the saturated zone below the water table.
Habitat	The place or environment where a plant or animal naturally or normally lives or occurs.

Heat-traced pipes	Piping with electric heating elements to prevent freezing.
Humidity cell	A type of kinetic test in which a small sample (about 1 kg) is placed in an enclosed chamber in a laboratory, alternating cycles of moist and dry air is constantly pumped through the chamber, and once a week the sample is rinsed with water; chemical analysis of rinse water yields concentrations of elements and other parameters used to calculate reaction rates.
Hydraulic gradient	The difference in piezometric level or hydraulic head between two points over a change in distance in the direction, which yields the greatest change in hydraulic head.
Hydrocarbons	Oil based products.
Infrastructure	Basic facilities, such as transportation, communications, power supplies and buildings, which enable an organization, project or community to function.
Landfarm	Facility that contains soil during bioremediation.
Littoral	The shallow, shoreline area of a lake.
Make-up water	The process water required to replace that lost by evaporation or leakage in a closed-circuit, recycle operation.
Mature climax	A forest stand of trees aged 80 to 125 years old
Mine rock	Excavated bed rock surrounding the kimberlite deposits. Mine rock consists primarily of granitic rock material.
Mineralization	To transform a metal into an ore; to impregnate or supply with minerals or an inorganic compound; to convert into mineral or inorganic form.
Mitigation	An approach, action or process to reduce or eliminate impacts of a project on the environment, community, stakeholder or society. To take action on a mitigation AMNS would issue a commitment to the mitigation.
Muskeg	Bog: especially a sphagnum bog of northern North America often with tussocks. A usually thick deposit of partially decayed vegetable matter of wet boreal regions.
Nature Reserves	Nature reserves are areas selected to preserve and protect, in perpetuity, representative and special nature ecosystems, plant and animal species, features and natural processes. Scientific research and education are the primary uses of nature reserves and recreation is generally restricted. Nature Reserves are protected under the Nova Scotia Special Places Protection Act.
Old Forest	A stand or collection of stands containing Old Growth and/or mature climax conditions.
Old Growth Forest	A stand with trees 125 years or older
Open-pit mine	A mine where rock or mineral extraction from the earth is done using a pit or borrow open to the surface, rather than using a tunnel into the earth.
Ore body	An accumulation of ore, which is a type of rock that contains minerals with important elements that are typically mined.
Overburden	Materials of any nature, consolidated or unconsolidated, that overlie a deposit of useful materials. In the present situation, overburden refers to the soil and rock strata that overlie kimberlite deposits.
Overwintering	To remain alive over winter.
Permafrost	Permanently frozen subsoil occurring throughout the polar regions.
pH	The degree of acidity (or alkalinity) of soil or solution. The pH scale is generally presented from 1 (most acidic) to 14 (most alkaline). A difference of one pH unit represents a ten-fold change in hydrogen ion concentration.
Plant phenology	The study of periodic plant life cycle events and how these are influenced by seasonal and interannual variations in climate.
Potable water	Water that is suitable for drinking.
Potentially acid generating rock	Rock that when oxidized by surface weathering may form acid which can then leach metals. Leached metal ions can be harmful to fish and other aquatic life.
Propagules	Root fragments, seeds, and other plant materials that can develop into a plant under the right conditions.

Reagent	A substance or compound that is added to a system to bring about a chemical reaction or is added to see if a reaction occurs.
Runoff	The portion of water from rain and snow that flows over land to streams, ponds or other surface waterbodies. It is the portion of water from precipitation that does not infiltrate into the ground, or evaporate.
Run-of-mine	The raw unprocessed or uncrushed material in its natural state obtained after blasting or digging, from the mineralized zone of a lease area.
Sediment	Solid material that is transported by, suspended in, or deposited from water. It originates mostly from disintegrated rocks; it also includes chemical and biochemical precipitates and decomposed organic material, such as humus. The quantity, characteristics and cause of the occurrence of sediment in streams are influenced by environmental factors. Some major factors are degree of slope, length of slope soil characteristics, land usage and quantity and intensity of precipitation.
Seepage	Slow water movement in subsurface. Flow of water from man-made retaining structures. A spot or zone, where water oozes from the ground, often forming the source of a small spring.
settling pond	An earthen or concrete structure using sedimentation to remove settleable matter and turbidity from wastewater. The basins are used to control water pollution.
Sub-watershed	A smaller portion of a watershed containing a drainage area that is connected to the larger portion by a single channel.
Succession	The progressive replacement of one dominant type of species or community by another in an ecosystem until a stable climax community is established.
Sumps	A well or pit in which liquids collect below floor level.
tailings	Finely ground residuals that remain after the mill process has removed the valuable metals from the ore.
Talik	A layer of year-round unfrozen ground that lies in permafrost areas.
Tertiary watershed	Tertiary Watershed are subdivisions of secondary watershed.
Thermistors	An instrument used to measure temperature.
Till	Till is an unsorted glacial sediment. Glacial drift is a general term for the coarsely graded and extremely heterogeneous sediments of glacial origin. Glacial till is that part of glacial drift which was deposited directly by the glacier. It may vary from clays to mixtures of clay, sand, gravel, and boulders.
Total dissolved solids	The total concentration of all dissolved materials found in a water sample.
Total suspended solids	A measurement of the concentration of particulate matter found in water.
Turbidity	The cloudiness or haziness of a fluid caused by individual particles (suspended solids) in water that are generally invisible to the naked eye.
Utilidors	A utility corridor built underground or aboveground to carry utility lines such as electricity, water and sewer.
Valued Components	Components of the natural and human environment that are considered by the proponent, public, Aboriginal groups, scientists and other technical specialists, and government agencies involved in the assessment process to have scientific, ecological, economic, social, cultural, archaeological, historical, or other importance
Waste rock	Bedrock that has been mined and transported out of the pit but does not have metal concentrations of economic interest.
Waterbody	A body of water forming a physiographical feature, for example a sea or a reservoir
Watercourse	A natural or artificial channel through which water flows.
Watershed	Also know as a catchment basin, includes all land that is drained by a watercourse and its tributaries. Water sheds are split into four categories; Primary, Secondary, Tertiary, and Quaternary.
Wetlands	A wetland is a distinct ecosystem that is flooded by water, either permanently or seasonally, where oxygen-free processes prevail. The primary factor that distinguishes wetlands from other land forms or water bodies is the characteristic vegetation of aquatic plants, adapted to the unique hydric soil.

Wilderness Areas	These are provincially significant protected areas which are designated under the Nova Scotia Wilderness Areas Protection Act. Forestry and road development are not permitted. Other activities such as mining, vehicle use, building structures or trails, and managing or removing plants are prohibited except in certain circumstances as outlined in the legislation. Hunting is permitted.