Appendix 2.2A-2
Mine Waste and Water Management Design Report

NEW GOLD INC.
BLACKWATER GOLD PROJECT






MINE WASTE AND WATER MANAGEMENT DESIGN REPORT

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NEW GOLD INC.
BLACKWATER GOLD PROJECT

MINE WASTE AND WATER MANAGEMENT DESIGN REPORT
VA101-457/6-11

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EXECUTIVE SUMMARY

Knight Piésold Ltd. (KP) was retained by New Gold Inc. (New Gold) to complete engineering studies and to develop the design of the mine waste and water management facilities for the Feasibility Study (FS). The facilities include the Tailings Storage Facility (TSF), waste rock dumps, low-grade stockpile, fresh water supply system, open pit water management, seepage and run-off collection and associated water management infrastructure.

The principal design objectives for the waste rock and tailings storage facilities are to protect the regional groundwater and surface water during both operations and in the long term (after closure), and to achieve effective reclamation at mine closure. The design of the waste rock and tailings storage facilities has taken into account the following requirements:

- Permanent, secure and total confinement of all solid waste materials within engineered disposal facilities.
- Control, collection, and removal of free-draining liquids from the waste and tailings facilities during operations for recycling as process water to the maximum practical extent.
- Prevention of ARD and minimization of metal leaching from reactive tailings and waste rock.
- The inclusion of monitoring features for all aspects of the facility to confirm performance goals are achieved and design criteria and assumptions are met.
- Staged development of the facility over the life of the project.

The TSF has been designed to permanently store tailings, PAG1 and PAG2 potentially acid generating (PAG) waste rock, and NAG3 potentially metal leaching non-acid generating waste rock generated during the operation of the mine. TSF Site C will be constructed first to provide storage capacity for start-up of the process plant. The facility (Site C) has been designed to contain the first two years of tailings and PAG waste rock. TSF Site D will be constructed to manage tailings and mine waste for the remainder of the operational life of the project (Years 3 to 17).

Specific overall features of the TSF are listed below:

- Cofferdams and sediment ponds to manage water during construction by either routing water around the TSF or directing water to the TSF for collection.
- Three (3) zoned water-retaining earth-rockfill dams referred to as the Site C Main Dam, Site C West Dam, and Site D Main Dam.
- Designated PAG/NAG3 waste storage areas located within the TSF.
- Environmental Control Dam (ECD) and interception trenches to recover potential seepage downstream of the Site D Main Dam. Water collected in the ECD reservoir will be directed back to the TSF using a pumpback recycle system.
- Collection channels that route runoff water to the TSF.
- Tailings distribution system.
- Reclaim water system.
- Tailings beaches.
- Supernatant water ponds.

Tailings from the process plant will be thickened and delivered by gravity through a pipeline from the thickener to either TSF Site C or TSF Site D. The pipeline will be laid parallel to a service road from the process plant to an energy dissipating drop box where the tailings distribution pipelines to TSF

Site C and Site D will separate. The tailings drop box will reduce the excess head for early stages of operation and will allow for discharge at closer locations along the dams. A bypass pipeline around the tailings drop box will maintain sufficient head for delivery of tailings to the far ends of TSF Site C and TSF Site D. The tailings pipeline system is entirely within the TSF catchment so any spills of tailings would report to the TSF.

Seepage will primarily be controlled by the low-permeability core zone, the tailings beach, the cut-off trenches, and the low-permeability subgrade (LPS) materials throughout much of the tailings basin. Seepage analyses were completed for TSF Sites C and D. Conservative results indicate up to approximately 55 L/s of seepage is expected to pass through the embankment and foundations of the Site D Main Dam at the maximum extent of the TSF in Year 17. The seepage modeling indicates a negligible amount of seepage, conservatively estimated at 2 L/s, could pass from the foundation of the Site D Main Dam beyond the ECD, located approximately 1 km downstream of the tailings dam. Virtually all of the seepage is predicted to daylight to surface or within the surficial sand and gravel zone upstream of the ECD. The seepage will be intercepted by two seepage interception trenches (one on each side of Davidson Creek), which will be excavated through the surficial sand and gravel terraces to LPS downstream of the Site D Main Dam and will report to the ECD pond. Recovered water will be pumped to TSF Site D and the collection pond will be maintained in a dewatered condition to the maximum extent practical.

Waste dump areas have been identified and subsequently refined and optimized to minimize surface water control requirements. NAG waste rock (NAG4 and NAG5) and overburden will be combined and placed in two permanent engineered dumps adjacent to the pit on the east and west sides (East Dump and West Dump).

The low-grade ore (LGO) stockpile location has been optimized to minimize the risk of impacts to the surrounding environment and limit surface water control requirements to the maximum extent practical. The LGO stockpile will be developed over an engineered low-permeability foundation with surface water and seepage collection and monitoring systems. Drainage from the LGO stockpile is expected to be acidic and contain elevated metals. Therefore the drainage will be collected, neutralized and discharged to the TSF. Any spills at the LGO stockpile are would report to the TSF.

Fresh water for the project will be sourced from Tatelkuz Lake, which is located approximately 20 km northeast of the mine site. The water will be conveyed via pipeline from the lake to the project site. The water supply system includes the following major components:

- Tatelkuz Lake intake.
- Fresh water supply pipeline.
- Booster pump stations.
- Fresh water reservoir.
- Temperature and flow control system.

The fresh water supply system was designed to provide:

- Continuous fresh water supply from Tatelkuz Lake for plant fresh water needs and to mitigate flow reductions in lower Davidson Creek.
- Occasional water supply from Tatelkuz Lake to supplement requirements for processing or to saturate PAG within the TSF, if required.

The primary objective of the closure and reclamation initiatives will be to return the TSF to a self-sustaining facility that satisfies the end land use objectives. The TSF is designed to maintain long-term stability, protect the downstream environment, and manage surface water. Upon mine closure, surface facilities will be removed in stages and full reclamation of the TSF will be initiated. The closure plan is compatible with a premature closure event. The low grade stockpile pad will be tested for contamination and removed and disposed of as required in the open pit or TSF. The pit will be allowed to flood and, upon filling, the pit lake will discharge via a constructed channel to the TSF and hence via a closure spillway to Davidson Creek. Seepage from the TSF will pass through constructed wetlands downstream of TSF Site D in the former ECD and freshwater reservoir areas and hence to Davidson Creek. The ECD and pumpback system will be retained until monitoring results indicate seepage from the TSF is of suitable quality for release to downstream waters. The groundwater monitoring wells and all other geotechnical instrumentation will be retained for use as long-term dam safety monitoring devices.

A package of design drawings was developed for the FS to facilitate preparation of material takeoffs to complete an economic comparison with +15% / -10% accuracy. The drawing package includes the following:

- General Arrangement Drawings (10 Drawings).
- Site Preparation, Access, and Sediment and Erosion Control (12 Drawings).
- Tailings Dam Construction (7 Drawings).
- TSF Instrumentation (7 Drawings).
- LGO Stockpile Preparation (1 Drawing).
- Fresh Water Supply System (11 Drawings).
- Environmental Control Dam (5 Drawings).
- Reclaim Water System (6 Drawings).
- Tailings Distribution System (9 Drawings).
- Water Management Systems – Electrical (11 Drawings).
- Open Pit Dewatering (3 Drawings).

The quantities (material takeoffs) for developing the initial and sustaining capital cost estimate and operating costs were derived from the drawings in this feasibility design report. Material takeoffs (MTOs) generated for the project include site preparation, heavy civil construction, piping, mechanical, instrumentation, and electrical work activities. The MTOs were transmitted to AMEC to derive unit costs, and to compile the initial capital, sustaining capital and operational costs.

The costs for the development of these facilities have been compiled and combined in a separate document for the Feasibility Study. The cost estimate final report was completed by AMEC in December 2013 (AMEC, 2013c).

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ABBREVIATIONS

ARD ..... acid rock drainage
Blackwater Gold Project ..... the project
BMP ..... best management practices
B.C. ..... British Columbia
^{o}C ..... degrees centigrade
CDA ..... Canadian Dam Association
cm/s ..... centimetres per second
COT ..... cut-off trench
ECD ..... Environmental Control Dam
ED ..... energy dissipation
EDGM ..... earthquake design ground motion
FS ..... Feasibility Study
GPa ..... gigapascal
ICOLD ..... International Commission on Large Dams
ICP ..... inductively coupled plasma
IDF ..... inflow design flood
IFN ..... instream flow needs
Kg/m^3 ..... kilograms per cubic metre
kPa ..... kilopascal
kW ..... kilowatt
LGO ..... low-grade ore stockpile
LPS ..... low permeability subgrade
L/s ..... litres per second
L/s/km^2 ..... litres per second per square kilometre
m ..... metre
MAP ..... mean annual precipitation
masl ..... metres above sea level
MCE ..... maximum credible earthquake
MDE ..... maximum design earthquake
mm ..... millimetre
Mm^3 ..... million cubic metres
ML ..... metal leaching
MPa ..... megapascal
MSC ..... Meteorological Service of Canada
Mt ..... million tonnes
m/s ..... metres per second
m^2/year ..... square metres per year
m^3/hr ..... cubic metres per hour
NAG ..... non-acid generating
New Gold ..... New Gold Inc.
NGA ..... New Generation Attenuation
NPR ..... Neutralization Potential Ratio
OBE ..... operations basis earthquake

OMS ..... Operations Maintenance and Surveillance ▲R2
OW ..... observation well
PAG ..... potentially acid generating
PEA ..... Preliminary Economic Assessment
PGA ..... peak ground acceleration
PMF ..... probable maximum flood
PMP ..... probable maximum precipitation
ppm ..... parts per million
PSD ..... particle size distribution
PW ..... pumping well
QA ..... quality assurance
Richfield ..... Richfield Ventures Corp.
RMR ..... rock mass rating
RQD ..... rock quality designation
SB ..... sediment basin
SCP ..... sediment control pond
SPMDD ..... standard proctor maximum dry density
SWE ..... snow water equivalent
TDH ..... total dynamic head
TFCS ..... temperature and flow control system
tonnes/m^3 ..... tonnes per cubic metre
TPD ..... tonnes per day
TSF ..... tailings storage facility
USCS ..... Unified Soil Classification System
VSD ..... variable speed drive

1 – INTRODUCTION

1.1 PROJECT DESCRIPTION

The Blackwater Gold Project (Blackwater) is a large gold-silver deposit located approximately 112 km southwest of Vanderhoof in central British Columbia, as shown on Figure 1.1. The project involves a conventional truck-shovel open pit mine and 60,000 tonnes per day (TPD) gold processing plant. Access to low cost hydroelectric power is available at the Glennanan BC Hydro Sub-station and will require the construction of a 139.5 km transmission line. Road access will be over an upgraded existing forest service road that branches south from Highway 16 at Engen.

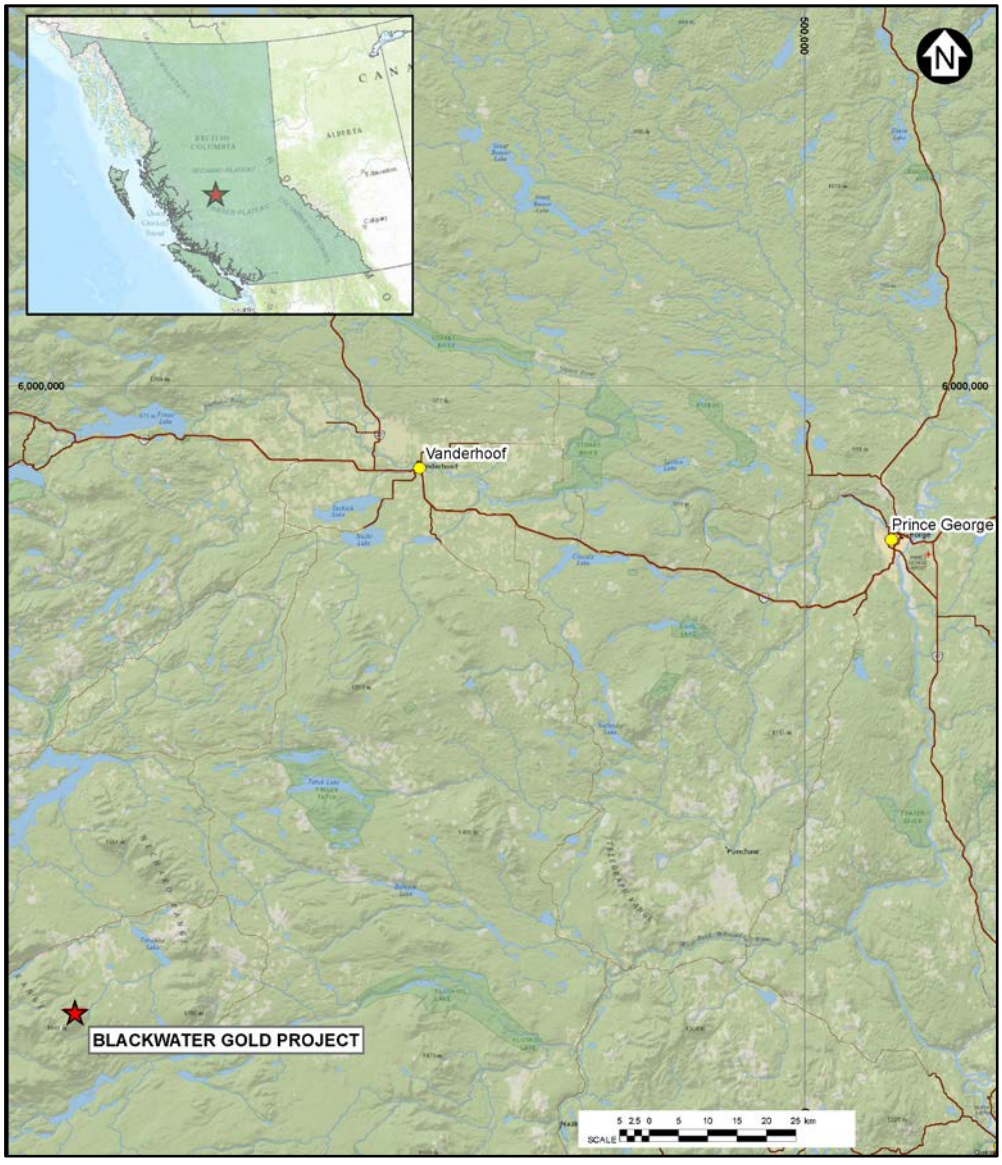


Figure 1.1 Project Location

1.2 PROJECT HISTORY

The Blackwater area was actively explored by Richfield Ventures Corp. (Richfield) starting in 2009. New Gold obtained the Blackwater property through the acquisition of Richfield in June 2011. KP was retained in early 2011 to complete a preliminary mine development assessment desktop study for the project. This was followed by a series of alternatives assessments for various mine development concepts for the waste and water management for the project from the middle of 2011 through early 2012. A Preliminary Economic Assessment (PEA) of the project was completed in the third quarter of 2012.

KP established a hydrometric and climate monitoring network at the project site in 2011, and has monitored and expanded the network continuously since its installation.

KP was commissioned in 2012 and 2013 to complete a series of six geotechnical and hydrogeological site investigation programs to support engineering studies for the tailings and water management systems, open pit, and associated mine site infrastructure in the project area. No pre-existing geotechnical or hydrogeological information was available prior to 2012.

1.3 SITE SELECTION

A preliminary assessment of tailings storage facility (TSF) site alternatives was conducted by Knight Piésold Ltd. (KP) for the Blackwater Gold Project in January 2011 (Knight Piésold Ltd., 2011a). Five potential locations for storage of 300 Mm^3 of tailings plus potentially acid generating (PAG) waste rock were identified within 10 km of the deposit area. The alternatives assessment considered economic, operational, and environmental factors and concluded that Sites C and D were the best options due to:

- Relatively high storage efficiency and low embankment volumes.
- Close proximity to the mineral deposit area.
- Ability to collect all mine site drainage.
- Location within the headwaters of davidson creek with minimal external upslope catchment area, simplifying operational water management.
- Sites were outside the ungulate winter range and blackwater river catchment, two key environmental considerations.

The alternatives assessment for waste and water management for the project continued in 2011 with a comparison between TSF Site C and Site D (Knight Piésold Ltd., 2011b). The study considered a Base Case mine plan that contemplated a 15 year mine life that produced approximately 220 Mt of ore at a mill throughput of 40,000 TPD and 702 Mt of waste materials, which included 192 Mt of NAG waste and 510 Mt of PAG waste. An Expansion Case mine plan was evaluated that considered a 21 year mine life that produced 308 Mt of ore at a mill throughput of 40,000 TPD and 985 Mt of waste materials, which included an estimate of 271 Mt of NAG waste and 714 Mt of PAG waste. The results of the comparative economic analysis indicated that the preferred TSF, from an economic perspective, was TSF Site C. TSF Site C was marginally better than TSF Site D for both the base case and expanded case, particularly due to the lower initial capital cost for development.

KP further evaluated locations and methods for mine waste management for the project in 2011 and 2012 (Knight Piésold Ltd., 2012a). The conceptual plans assumed that tailings would be deposited around the perimeter of the TSF from the embankment crests. The NAG waste was to be disposed

of in a waste dump near the pit and/or used to construct the TSF embankment. The PAG waste rock was to be managed using one of two methods:

- Co-disposal within the TSF in such a manner that it becomes progressively saturated by the supernatant pond to prevent oxidation and subsequent acid generation.
- Storage in a surface engineered stockpile with a compacted soil liner foundation and cover system.

A total of four mine development concepts were considered in the alternatives assessment. The study considered a Base Case mine plan that contemplated a 10 year mine life that produced approximately 210 Mt of ore at a mill throughput of 60,000 TPD and 501 Mt of waste materials, which included 142 Mt of NAG waste and 359 Mt of PAG waste. An Expansion Case mine plan was evaluated that considered a 15 year mine life that produced 320 Mt of ore at a mill throughput of 60,000 TPD and 867 Mt of waste materials, which included an estimate of 200 Mt of NAG waste and 667 Mt of PAG waste.

The concept of a hybrid Site C and Site D TSF was first evaluated in this alternatives assessment. The hybrid TSF C/D option with subaqueous PAG disposal was compared with TSF Site C with the on-land disposal of PAG for the Base Case, and with TSF Site D with the on-land disposal of PAG for the Expansion Case. The results of this alternatives assessment indicated that the preferred mine development concept for future studies should be based on the subaqueous disposal of PAG waste rock in the TSF. Subaqueous disposal was selected as the preferred method of waste rock disposal due to reduced environmental risk, reduced engineering complexity, reduced corporate liability, and lower overall costs.

The design of the hybrid TSF Site C and Site D mine development concept with subaqueous disposal of PAG waste and on-land disposal of NAG waste was continued during the Preliminary Economic Assessment (PEA). The TSF design for the PEA considered a 17 year mine life that produced approximately 356 Mt of ore at a mill throughput of 60,000 TPD. Development of the Open Pit produced 839 Mt of waste materials, which included 321 Mt of NAG waste and 518 Mt of PAG waste.

The PEA contemplated five types of open pit waste materials: overburden and four types of waste rock. Overburden and NAG4 waste rock were considered to be NAG and low metal leaching and used preferentially in dam construction or disposed of in an on-land dump. NAG3 waste rock exhibits greater metal leaching potential because of elevated zinc and cadmium content despite being considered NAG. This material was planned for use in the Site C Main Dam or the upstream shell zone of the Site D Main Dam as a construction material below the final TSF Site D pond elevation, or placed in an on-land waste dump adjacent to the open pit with a low permeability overburden dump foundation platform and drainage directed towards the open pit. PAG1 and PAG2 waste rock were considered to be PAG waste with subaqueous disposal in the TSF.

The Feasibility Study (FS) considers a similar waste disposal concept to the PEA with one major exception – NAG3 potentially metal leaching waste rock will be disposed of subaqueously in the TSF or used in construction of the upstream zone of TSF Site D Main Dam in order to reduce the potential for metal leaching. The FS introduces the classification of NAG5 waste rock. Additional geochemistry testing programs and waste classification studies have identified a waste rock that has a low zinc concentration as this material is the most benign and best available waste rock material for construction of the downstream shell zones of the TSF embankments.

1.4 SCOPE OF WORK

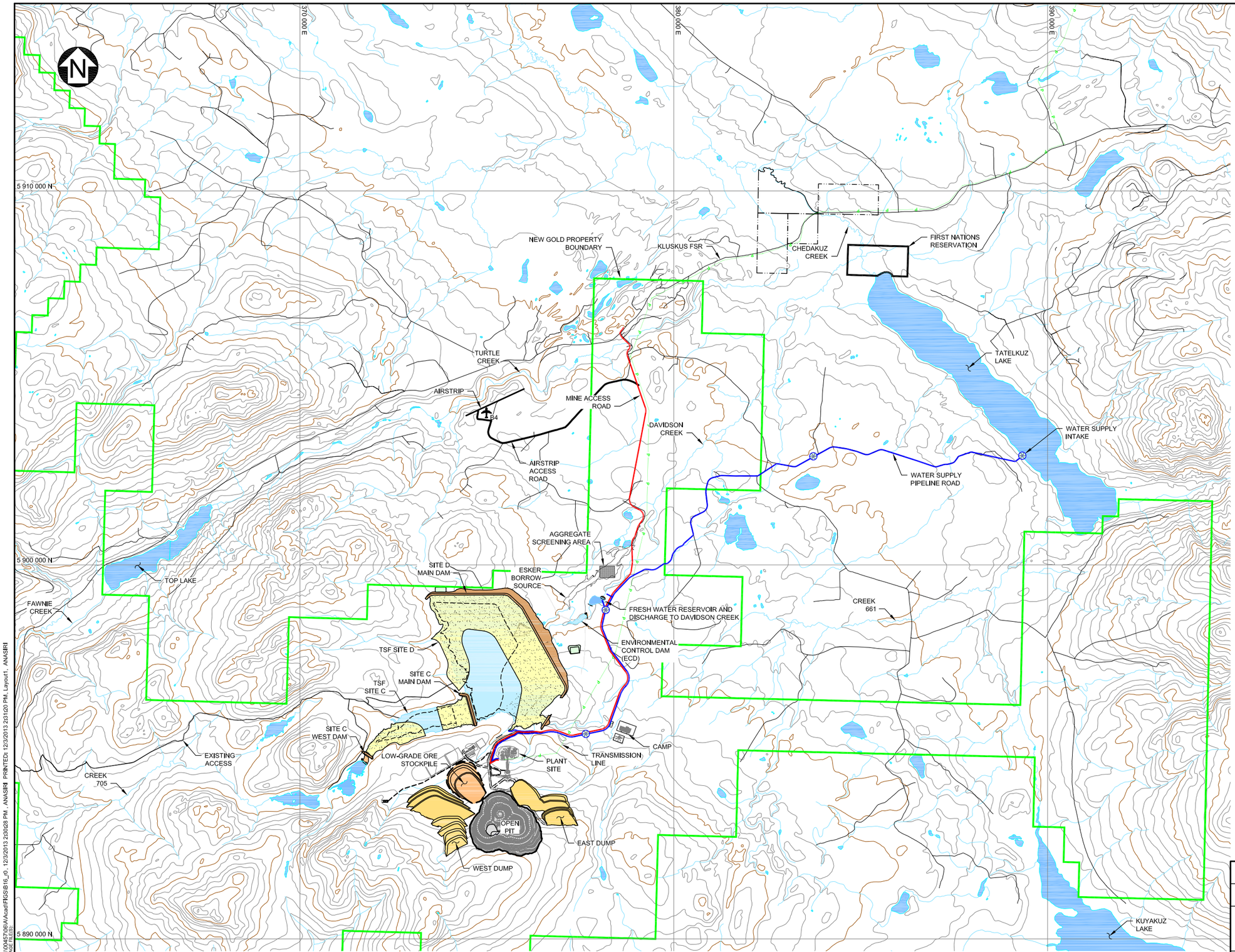
Knight Piésold Ltd. (KP) was retained by New Gold Inc. (New Gold) to complete engineering studies and to develop the design of the mine waste and water management facilities for the Feasibility Study (FS). The facilities include the Tailings Storage Facility (TSF), waste rock dumps, low-grade stockpile, fresh water supply system, open pit water management, seepage and run-off collection and associated water management infrastructure. An overview of the project area general arrangement is shown on Figure 1.2.

A package of design drawings were developed for the FS to facilitate preparation of material take-offs to complete an economic comparison with +15% / -10% accuracy. The design drawings are included in this report as Appendix A. The design of these facilities is the subject of this report.

1.5 FEASIBILITY STUDY REFERENCE REPORTS

The following KP subject matter reports were prepared as part of the FS:

- **2012 Site Investigations –** Knight Piésold report 2012 Site Investigation Report, Ref. No. VA101-457/6-1" dated September 23, 2013.
- **Open Pit Slope Design** – Knight Piesold report Feasibility Open Pit Slope Design, Ref. No. VA101-457/6-2 dated November 4, 2013.
- **2013 Site Investigations –** Knight Piésold report 2013 Site Investigation Report, Ref. No. VA101-457/6-4 dated November 7, 2013.
- **Plant Site Geotechnical Design** – Knight Piésold report Plant Site Geotechnical Design Report, Ref. No. VA101-457/6-5 dated November 27, 2013.
- **Tailings Lab Testing** – Knight Piésold report Tailings Lab Testing Report, Ref. No. VA101-457/6-7 dated November 4, 2013.
- **Geotechnical Characterization** – Knight Piésold report Geotechnical Characterization Report, Ref. No. VA101-457/6-8 dated November 29, 2013.
- **Open Pit Water Management** – Knight Piésold report Open Pit Water Management Plan Report, Ref. No. VA101-457/6-9 dated November 29, 2013.
- **Construction Water Management** – Knight Piésold report Construction Sediment and Erosion Control Plan Report, Ref. No. VA101-457/6-10 dated November 29, 2013.
- **Hydrometeorology** – Knight Piésold report 2013 Hydrometeorology Report, Ref. No. VA101-457/6-12 dated November 4, 2013.



LEGEND:

- TAILINGS BEACH
- MINE WATER
- FRESH WATER
- EMBANKMENT FILL
- NAG WASTE ROCK / OVERBURDEN
- LOW GRADE ORE
- TOPSOIL
- SURVEYED PARCELS
- WATER SUPPLY PUMPSTATION
- MINE HAUL ROAD
- MINE ACCESS ROAD
- PIPELINE SERVICE ROAD
- NEW GOLD PROPERTY BOUNDARY
- FIRST NATIONS RESERVATIONS
- EXISTING FORESTRY ROAD
- TRANSMISSION LINE

NOTES:

1. CONTOUR INTERVALS ARE APPROXIMATELY 30 METRES, BASED ON THE CANVEC TOPOGRAPHIC DATABASE FROM NATURAL RESOURCES CANADA.
2. DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
3. THIS GENERAL ARRANGEMENT SHOWS THE MAXIMUM EXTENTS OF ALL PROJECT FACILITIES.

SCALE A 1000 500 0 1000 2000 3000 4000 5000 m

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	CHK'D	APP'D
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NEW GOLD INC

BLACKWATER GOLD PROJECT

PROJECT AREA GENERAL ARRANGEMENT

Knight Piésold CONSULTING

P/A NO.	REF NO.
VA101-457/6	11

FIGURE 1.2 REV 0

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2 – MINE WASTE CHARACTERIZATION

2.1 GENERAL

Mine waste characterization studies were completed to a FS level and included tailings, mine waste rock and overburden assessments. Classification of mine waste at the Project was based on the results from Metal Leaching / Acid Rock Drainage (ML/ARD) test programs, BC government and international guidance, and best mining industry practice (BCMEM 1998, INAP 2009, MEND 2009, Price 1997). The mine waste classification studies were completed by others (AMEC, 2013b). The findings are summarized below.

The ML/ARD program was conducted in three phases and included both static and kinetic testing. Sulphur and metal assays (inductively coupled plasma (ICP) assay following aqua regia (AR) digestion) were completed as part of the exploration geological program on every meter of exploration drill core. This database provides extensive coverage of the project applicable to the ML/ARD assessment and includes over 250,000 sulphur and zinc assays.

Mine waste was classified based on whether it is predicted to be potentially acid generating (PAG) or non-acid generating (NAG) as shown by the calculated Neutralization Potential Ratio (NPR). NAG waste rock was further classified as to its metal leaching potential based on zinc concentration. Classification criteria are as follows:

- Ore and Tailings (PAG).
- Low-Grade Ore (PAG).
- Overburden (NAG).
- Waste Rock:
  - PAG1 – NPR ≤ 1.0 (PAG).
  - PAG2 – 1.0 ≤ NPR ≤ 2.0 (PAG).
  - NAG3 – NPR ≥ 2.0 and Zn ≥ 1000 ppm (NAG).
  - NAG4 – NPR ≥ 2.0 and 600 ≤ Zn ≤1000 ppm (NAG).
  - NAG5 – NPR ≥ 2.0 and Zn ≤ 600 ppm (NAG).

Oxide ore contains very low sulphur; significantly less than transitional and sulphide ore types, and most of the sulphur is expected to be non-acid generating sulphate sulphur. Zinc, cadmium and arsenic are also lower in the oxide ore compared to transitional and sulphide ore types. Lead is higher in oxide ore but has low mobility at the neutral pH expected in the TSF. Oxide ore tailings could be placed as the final lift over transitional and sulphide ore tailings in the TSF to reduce the potential for ARD and metal leaching.

Low-Grade Ore is classified as PAG with a relatively short lag time and the low grade ore stockpile is expected to generate acidic drainage with elevated metals until ore processing.

The project will use a conventional ore crushing, grinding and leaching process to produce a gold-silver doré. The tailings will report to three cyanide destruction vessels using the SO2/Air process before being discharge to the TSF as a single stream. The mill throughput is anticipated to be 60,000 TPD.

2.2 TAILINGS

A laboratory testing program was conducted to determine the geotechnical and physical characteristics of the Blackwater tailings. The test program and results are described in detail in the Tailings Lab Testing Report (Knight Piésold Ltd., 2013d) and summarized below.

A sample of the tailings representing ground feed thickened tailings was provided by New Gold for testing. The test program included Index Testing to enable geotechnical classification of the materials, and slurry settling, air drying, consolidation and permeability testing to determine the characteristics of the tailings for a range of conditions expected to be representative of field conditions.

The specific gravity of the tailings solids was determined to be 2.79 and the material can be described as non-plastic sandy-silt with trace clay. The particle size distribution of the tailings sample comprised approximately 44% fine sand, 46% silt, and 10% clay.

Undrained settling, drained settling, and air drying tests were carried out to provide information on the effect of initial slurry solids content of the settling and permeability characteristics of the material and the effect on water recovery and achieved density. Slurry settling (sedimentation) tests provide an estimate of the density to which the tailings slurry will settle in a sub-aqueous environment, under drained and undrained conditions. These tests provide an indication of the tailings dry density achieved in a storage facility after settling and before any significant consolidation occurs. Air drying tests were carried out on the tailings samples to determine the effect of air drying after initial slurry settling and removal of supernatant water.

The tests were performed for a target solids content equal to 50% and the main findings are as follows:

- Undrained settled dry density is 1.19 tonnes/m^3.
- Drained settled dry density is 1.35 tonnes/m^3.
- Supernatant water recovery is expected to be around 52% for undrained conditions and 62% for drained settled conditions.
- Air dried final dry density is 1.49 tonnes/m^3 and took approximately four days to complete air drying at room temperature.

Laboratory tests carried out to determine the consolidation and permeability characteristics of the tailings included slurry consolidometer testing, a low stress slurry consolidation test and a falling head permeability test (conducted on settled tailings after completion of drained settling). Relationships between coefficient of consolidation, void ratio and vertical coefficient of permeability to effective stress have been developed for the tailings. The calculated coefficients of consolidation for the tailings range from 20 m^2/year at very low stresses (representing unconsolidated of fresher tailings near surface) to over 1000 m^2/year at high stresses (representing more consolidated or deeper tailings within the deposit). The permeability of the tailings ranges from $3x10^{-5}$ cm/second at low stresses to about $4x10^{-6}$ cm/second at high stresses, corresponding to a reduction in void ratio.

Rheology testing of the tailings slurry was conducted on the tailings to determine slurry flow characteristics for the design of the tailings pipelines. The tailings rheology characterized the slurry as a non-Newtonian, Bingham plastic slurry typical of tailings slurries. It is fairly coarse and clean with good packing density and low rheology. The rheology results were used to establish

depositional velocities and frictional pressure losses in the tailings pipeline design. Tailings will be conveyed by pipelines and discharged from embankment crests into TSF.

2.3 OVERBURDEN

The terrain in the deposit area is generally hummocky with overburden varying from 5 to 20 m in thickness. The deepest overburden is expected on the east side of the open pit, where it may be up to 110 m thick. Two geotechnical drillholes were drilled on the east side of the open pit by Sonic drilling methods capable of recovering 5-inch diameter overburden core samples. The overburden from these drillholes was found to be consistently dense sandy, silty-gravel with some poorly defined sandy-silt layers.

The Unified Soil Classification System (USCS) has been used for describing and categorizing soil within groups to allow for the development of distinct soil properties. The overburden in the open pit was classified as a coarse grained soil with gravels and fines (SM-SC and GM-GC).

The overburden from the open pit will be used to construct the TSF embankments and to reclaim the TSF basin and waste rock dumps. A laboratory testing program was completed on samples collected from the overburden drillholes in the open pit to determine geotechnical properties of the overburden material for engineering design. The following laboratory tests were performed:

- Sixteen (16) particle size analyses (PSA).
- Two (2) modified proctor tests.
- Four (4) triaxial shear tests.
- Twenty-eight (28) density and moisture content tests.

The results of the laboratory program were presented in the Open Pit Slope Design Report (Knight Piésold Ltd., 2013b) and the geotechnical properties of the overburden in the open pit are summarized in Table 2.1 below.

Table 2.1 Geotechnical Properties of Open Pit Overburden

Laboratory Test	Geotechnical Properties		
	Properties	Unit	Average
Particle Size Analysis	Gravel	%	**25**
	Sand %	%	**38**
	Silt %	%	**27**
	Clay %	%	**9**
Atterberg Limits	Liquid Limit		**23**
	Plastic Limit		**14**
	Plastic Index		**10**
Specific Gravity	Specific Gravity		**2.73**
Compaction Testing	Dry Density	kg/m^3	**2116**
	Optimum Moisture Content	%	**8.4**
Triaxial ShearTesting	Cohesion (c)	kPa	**13**
	Friction Angle (φ)	degrees	**37**
Flexible Wall Permeability Laboratory Test	Permeability	m/s	**9×10^{-8}**
Bulk and Dry Density	Moisture Content	%	**10**
	Dry Density	kg/m^3	**2099**
	Bulk Density	kg/m^3	**2359**

The USCS classification group allows for comparison of the laboratory determine geotechnical properties of the soil with published typical ranges of these properties. These properties include permeability, shear strength, compaction characteristics, workability and volume change potential of a soil, and how it will be affected by water, frost and other physical conditions.

2.4 MINE WASTE ROCK

Waste management concepts for the various classifications of waste rock are outlined below:

- NAG4 and NAG5 waste rock and overburden:
  - Used to construct the TSF embankments.
  - Surplus and unsuitable materials disposed of in one of two waste dumps on-land (East and West) near the pit.
  - Progressive reclamation of the West waste rock dump during operations and final revegetation of both dumps at closure.

- NAG3 waste rock (potentially metal leaching):
  - Used to construct the upstream zone of the TSF embankments.
  - Surplus co-disposed of within the TSF in such a manner that it is flooded within 3-5 years by the supernatant pond.
- PAG1 and PAG2 waste rock:
  - Co-disposed of within the TSF in such a manner that it is saturated within 1 year by the supernatant pond to prevent oxidation and subsequent acid generation.

3 – SITE CHARACTERIZATION

3.1 PHYSIOGRAPHY

The Project site is situated on the Nechako Plateau of British Columbia, part of the Interior Plateau east of the Coast Mountain Range, in an area of moderate relief characterized by gently undulating, northwest-trending hills cut by small to medium-sized drainages. The elevation of the Blackwater property ranges from just over 1,000 m in low-lying areas northeast of the proposed mine site to 1,800 m at the summit of Mt. Davidson on the southwest side of the property; Mt. Davidson is the highest peak in the Fawnie Range. The Blackwater deposit is located on the northern flanks of the mountain. Most of the proposed TSF, waste dump, and mine site infrastructure areas lie within the Davidson Creek watershed, with a portion of the open pit and east dump crossing into the catchment of Creek 661.

The Davidson Creek valley is incised locally and flows northeast from the site toward Chedakuz Creek downstream of Tatelkuz Lake. Creek 661 flows to Tatelkuz Lake. The footprint area of the proposed TSF lies within the upper reaches of the Davidson Creek catchment area. The terrain within this footprint is predominantly gently inclined, except along the incised portions of Davidson Creek. The latter areas are between the site of the proposed Site C Main Dam and the Site D Main Dam, where the slopes adjacent to the drainage are moderate to moderately steeply inclined.

3.2 HYDROMETEOROLOGY

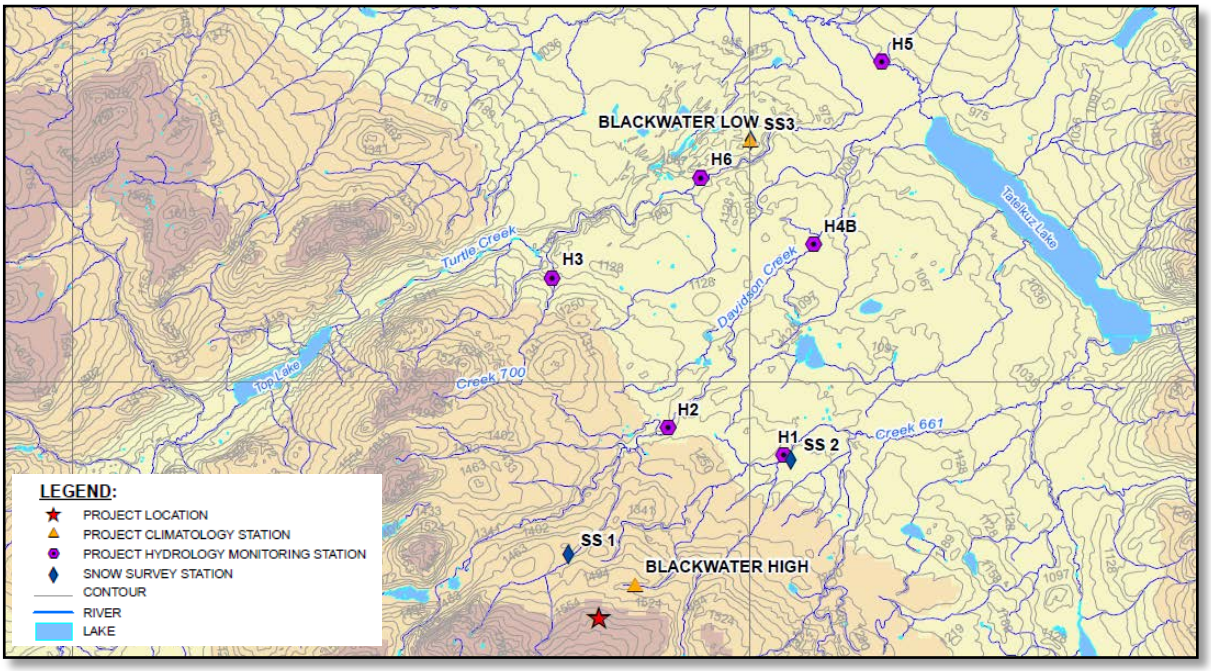
3.2.1 General

Hydrological and meteorological data have been collected at the project site since early 2011. The short-term site-specific data have been correlated with long-term regional data. The details of the hydrometeorology study were presented in the 2013 Hydrometeorology Report (Knight Piésold Ltd., 2013h). The study indicated that the available site and regional dataset was adequate to provide a reasonable basis for describing and quantifying the meteorological characteristics of the project area for the purpose of water balance modelling, engineering design, and environmental assessment. The key findings of the study have been summarized in the sections that follow.

3.2.2 Monitoring Locations

Hydrometric data are being collected at seven stations in the project area to support hydrometric characterization of the mine site area. The hydrometric stations are identified as H1 to H7. Meteorological data are being collected at two climate stations, which are identified as Blackwater High (elevation 1,470 m) and Blackwater Low (elevation 1,050 m). There are three snow survey stations (SS 1 to SS 3) that have been used to collect snowfall and snowmelt data at the site. The monitoring locations for the project site are shown on Figure 3.1.

Figure 3.1 Project Monitoring Stations



3.2.3 Mean Annual Precipitation

The long-term mean annual precipitation (MAP) for the project area is estimated to be 636 mm, for an elevation of approximately 1,470 m. This value is a result of interpretation of two project site meteorological stations and several regional stations operated by the Meteorological Services of Canada (MSC) branch of Environment Canada and the BC Forest Service Wildfire Management Branch.

3.2.4 Monthly Precipitation Distribution

The monthly distribution of precipitation was estimated for the purpose of water management planning. Approximately 51% of the annual precipitation at the project site falls as snow between November and March. The remaining 49% of the annual precipitation falls as rain, which may occur in any month of the year, but largely falls in the period of April to October. The monthly precipitation statistics that define these distributions are summarized in Table 3.1.

Table 3.1 Monthly Precipitation Distribution

Unit	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Total Precipitation (mm)	73	45	39	20	50	66	52	51	47	47	74	72	636
%/month	12%	7%	6%	3%	8%	10%	8%	8%	7%	7%	12%	11%	100%
Rain (mm)	0	0	0	13	50	66	52	51	47	31	0	0	310
% Precipitation as Rain/Month	0	0	0	65	100	100	100	100	100	65	0	0	49%
Snow – SWE (mm)	73	45	39	7	0	0	0	0	0	16	74	72	326
% Precipitation as Snow/Month	100	100	100	35	0	0	0	0	0	35	100	100	51%

NOTES:
1. SWE = SNOW WATER EQUIVALENT.
2. ADOPTED FROM TABLE 2.11 OF THE 2013 HYDROMETEOROLOGY REPORT (Knight Piésold Ltd., 2013h).

3.2.5 Return Period Extreme Precipitation

Estimates of extreme precipitation are required for many aspects of design. Estimated 24 hour extreme rainfall values were prepared for various return periods and for the probable maximum precipitation (PMP) to support the design of the project. Extreme precipitation events for the project site are summarized in Table 3.2.

Table 3.2 Extreme Precipitation Return Period Values

Return Period (years)	24-Hour Extreme Rainfall (mm)
2	37
5	44
10	50
20	55
50	61
100	66
200	71
500	78
1000	82
PMP	195

NOTES:
1. ADOPTED FROM TABLE 2.13 OF THE 2013 HYDROMETEOROLOGY REPORT (Knight Piésold Ltd., 2013h).

3.2.6 Mean Annual Runoff

The annual stream hydrographs in the project area are characterized by a very pronounced period of high flows during the spring freshet, followed by an extended period of steady low flows, with limited autumn storms. All creeks are affected by ice formation during the winter and the smaller systems typically freeze over during extended cold periods. Estimates of mean monthly and annual unit runoffs are summarized in Table 3.3.

Table 3.3 Project Site Long Term Unit Runoff

Station	Unit	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
H1	Unit Runoff (l/s/km^2)	0.7	0.7	1.2	3.6	14.5	13.6	4.0	1.9	1.5	1.6	2.1	1.0	3.8
	Discharge (L/s)	7	6	11	32	129	121	35	17	13	15	19	9	33
	Runoff (mm)	2	2	3	9	39	35	11	5	4	4	6	3	119
	% of Total Runoff	2%	1%	3%	8%	31%	29%	9%	4%	3%	4%	5%	2%	100%
H2	Unit Runoff (l/s/km^2)	2.8	2.7	3.3	6.0	18.5	17.4	6.3	4.0	3.4	3.7	4.1	3.1	6.1
	Discharge (L/s)	130	127	155	281	873	820	297	188	160	173	195	148	288
	Runoff (mm)	7	7	9	15	50	45	17	11	9	10	11	8	198
	% of Total Runoff	4%	4%	4%	8%	25%	23%	8%	5%	4%	5%	6%	4%	100%
H5	Unit Runoff (l/s/km^2)	2.4	2.4	2.7	4.5	10.8	9.6	4.6	2.9	2.4	2.5	3.1	2.6	4.2
	Discharge (L/s)	1450	1437	1610	2693	6388	5683	2726	1692	1447	1490	1840	1558	2501
	Runoff (mm)	7	6	7	12	29	25	12	8	6	7	8	7	133
	% of Total Runoff	5%	5%	5%	9%	21%	19%	9%	6%	5%	5%	6%	5%	100%

NOTES:

1. STATION H2 IS REPRESENTATIVE OF THE PROJECT AREA DUE TO ITS ELEVATION AND DRAINAGE AREA BEING SIMILAR TO THAT OF THE PROJECT AREA FACILITIES.
2. THE CALCULATION OF RUNOFF IN mm ASSUMES 28 DAYS IN FEBRUARY.
3. ADOPTED FROM TABLE 3.4 OF THE 2013 HYDROMETEOROLOGY REPORT (Knight Piésold Ltd., 2013h).

The unit runoff and the hydrograph shape at H2 are expected to most appropriately represent streamflow patterns in the project area. This is due to its close proximity to the project site, the moderate size of its catchment (47.2 km^2), as well as similarities to the project area in terms of vegetative cover, slope, aspect, and basin elevation. Furthermore, the H2 basin does not contain any large lakes and does not appear to have unusually high groundwater recharge.

The mean annual unit runoff for the project site is estimated to be 6.1 L/s/km^2, as shown in Table 3.3. The highest monthly runoff tends to occur in May, with 18.5 L/s/km^2, and the lowest occurs in February, with 2.7 L/s/km^2. The annual unit runoff equates to an annual runoff depth of 198 mm.

The runoff coefficient is a dimensionless number that defines the annual ratio of runoff to precipitation. The results of this analysis suggest an annual runoff coefficient of 0.31 (31%), which is consistent with regional coefficients.

3.3 REGIONAL GEOMORPHOLOGY

The surficial deposits in the Project area are from the Fraser Glaciation, the last period of ice sheet glaciation in British Columbia. The Cordilleran ice sheet covered the Interior Plateau from approximately 20,000 to 12,000 years ago, reaching elevations of 2,500 masl. At the peak of glaciation, the localized ice flow direction in the Project area was toward the northeast, as evidenced by drumlins, eskers, and other streamlined glacial landforms.

Deglaciation commenced approximately 15,000 to 16,000 years ago and proceeded with a frontal retreat to the west and southwest toward the Coast Mountains. The surface of the ice sheets was progressively lowered by down-wasting in the area. The pattern of ice-margin and subglacial meltwater channels indicates that areas of higher elevation in the vicinity of the mine site became ice-free before lower-elevation areas. Glacial ice appears to have stagnated in the Davidson Creek valley during late deglaciation producing ice-stagnation landforms such as kettles and kames. A large amount of glacial meltwater was channeled along Davidson Creek and other valleys in the area, producing eskers and meltwater channels.

Geomorphological evidence of glaciation suggests that at the height of the Fraser Glaciation, the ice elevation exceeded 1,750 m, higher than the tallest peaks in the Project region. An estimated 80% of the surficial materials in the Davidson Creek valley is classified as lodgement glacial till (Plouffe et. al. 2004), with the other 20% made up of ablation till, glaciofluvial, glaciolacustrine, fluvial, and organic material. The glacial till in the region ranges up to 100 m in thickness, and it is extremely rare to encounter large areas of naturally exposed bedrock outcrop (Giles et al., 1994). Uncommon ablation till is predominantly found at higher elevations on the valley sides while dominant deposits of lodgement till was encountered in the valley basin.

3.4 PROJECT BEDROCK GEOLOGY

Detailed geology can be found in the works of Diakow and Webster (1994), Diakow and Levson (1997), and Diakow et. al. (1997). The southern Nechako Plateau has a lower unit of Upper Jurassic volcaniclastic, sedimentary, and mafic to felsic volcanic rocks of the Bowser Lake Group. The Bowser Lake group are intruded by Late Cretaceous granitic to granodioritic plutons. Widespread Eocene volcanic arc-related extensional felsic volcanic rocks and minor sedimentary rocks of the Ootsa Lake Group overlie the Bowser Lake Group and are themselves overlain on higher ridges by basalt and andesite of the Eocene Endako Group. Intact bedrock exposure is rare and restricted to higher elevations in the area.

Two bedrock lithologies were encountered in the Davidson Creek watershed; an andesite from the Cenozoic Ootsa Lake Formation and fragmentals volcanics from Cretaceous Volcaniclastics and Flows. Bedrock in the west part of the TSF footprint also belongs to the Ootsa Lake Formation, but comprises rhyolites and felsic volcanic rocks. The bedrock in the southeast portion of the project area, including the footprint of the proposed Open Pit, is rhyolites and felsic volcanic rocks of the Entiako Formation, which belongs to the Middle Jurassic Hazelton Group. Bedrock to the west is basement rock from the Bowser Lake Group.

3.5 SEISMICITY

3.5.1 General

A seismicity assessment was carried out for the project, including a review of the regional seismicity and a probabilistic seismic hazard analysis (Appendix B). A seismic hazard analysis is required to provide seismic design parameters for the design of the TSF and for other facilities at the project site, including mine waste dumps and water management dams. Design ground motion parameters provided by the seismic hazard analysis include peak ground acceleration, spectral acceleration (defining the uniform hazard spectra) and earthquake magnitude.

3.5.2 Regional Tectonics and Seismicity

The project is situated within central B.C., where the level of recorded historical seismic activity has been low. The maximum earthquake magnitude for this region of central B.C. is estimated to be about Magnitude 7.0, based on historical earthquake data and the regional tectonics (Adams and Halchuk, 2003). There is potential for larger earthquakes of up to about Magnitude 7.5 along the coastal region of mainland western B.C., including the Coast Mountains.

The high seismicity offshore and west of the project site is associated with the Queen Charlotte fault system, which runs underwater along the west coast of Haida Gwaii and defines the boundary between the Pacific and North American tectonic plates. There is a potential for earthquakes of up to about Magnitude 8.5 along this fault system (Adams and Halchuk, 2003). More recently, two large earthquakes have occurred along this fault system; a Magnitude 7.7 earthquake on October 27, 2012 on Moresby Island (of the Haida Gwaii archipelago) and a Magnitude 7.5 event on January 5, 2013 located offshore of southeast Alaska. The closest of these events was approximately 475 km to the west of the project site. The amplitude of ground motions experienced at the project site from earthquakes along this fault system would be very low due to attenuation over such a large distance, with a peak ground acceleration (PGA) expected to be less than 0.05g.

The seismic hazard along the southwest coast of B.C. is significant due to subduction zone earthquakes along offshore faults and within the subducting oceanic tectonic plate (Juan de Fuca Plate). There is potential for very large earthquakes of Magnitude 8.0 to 9.0+ along this Cascadia subduction zone. Geological evidence indicates that these great subduction earthquakes occur on average approximately every 500 years, but this interval varies from about 300 to 800 years. The last occurred over 300 years ago. However, such an event would be located over 400 km southwest of the project site, and therefore the amplitude of ground motions experienced at the site are expected to be around 0.05g.

There is also potential for intraslab (inslab) earthquakes, occurring deep within the subducted Juan de Fuca plate that extends eastward beneath the North American plate. These events, which have potential to be as large as Magnitude 7.0 to 7.5, would likely occur over 300 km to the southwest, at a depth of over 35 km. Ground motions experienced at the project site for this type of subduction earthquake are also expected to be less than 0.05g.

The level of seismicity in the interior of B.C. and the Rocky Mountains region reduces rapidly with distance from the west coast to the north. The largest earthquake recorded in the southern Cordillera region was an event of about Magnitude 6.0 in 1918, located in the Valemount are of the Rocky Mountain trench. More recently, a Magnitude 5.4 earthquake occurred near Prince George in

1986 causing minor damage and a Magnitude 5.3 earthquake occurred in 2001 east of Dawson Creek. The maximum earthquake magnitude for eastern B.C. and the Rocky Mountains is estimated to be about Magnitude 7.0, with an upper bound estimate of 7.3, based on historical earthquake data and regional tectonics (Adams and Halchuk, 2003).

3.5.3 Seismic Hazard Analysis

The seismic hazard for the project has been defined using probabilistic methods of analysis. Historical earthquake data and regional tectonics were examined to identify potential seismic sources and maximum earthquake magnitude for each source.

The ground motions experienced at the project site are dependent on the regional ground motion attenuation characteristics and the earthquake source mechanism. The attenuation models for shallow crustal earthquakes were based on a set of four ground motion attenuation models, known as the New Generation Attenuation (NGA) relations (Earthquake Spectra, 2008). Attenuation relationships used for the interface subduction and intraslab subduction earthquake source zones were based on relationships developed specifically for oceanic subduction zone earthquakes (Youngs, 1997 and Atkinson, 2003).

The computer program EZ-FRISK was used to develop a seismic hazard model for B.C. and the surrounding regions (EZ-FRISK, 2008). The model was used to determine the relationships between PGA and annual frequency of occurrence for the project site. Median hazard values of PGA were determined for return periods up to 10,000 years. Predicted values for lower return periods were compared with those provided by the NRC seismic hazard database and were very similar. A summary of the probabilistic hazard analysis is provided in Table 3.4:

Table 3.4 Summary of Probabilistic Seismic Hazard Analysis

Return Period (Years)	Probability of Exceedance[1] (%)	Peak Ground Acceleration (PGA)[2]	
		Median PGA (g)	Estimated Mean PGA[3] (g)
100	16	0.015	0.02
500	3	0.033	0.04
1,000	2	0.045	0.05
2,500	0.7	0.062	0.07
5,000	0.3	0.070	0.08
10,000	0.2	0.090	0.11

NOTES:

1. PROBABILITY OF EXCEEDANCE CALCULATED FOR A DESIGN OPERATING LIFE OF 17 YEARS.
2. PEAK GROUND ACCELERATIONS ARE FOR SOFT ROCK / VERY DENSE SOIL (Vs_{30} = 360 – 760 M/SEC).
3. MEAN PGA VALUES ESTIMATED AS 1.2 X MEDIAN VALUES.

Deaggregation of the probabilistic seismic hazard results was carried out to provide the relative contributions of all potential seismic sources, and to more accurately define the characteristics of potential earthquakes contributing to the seismic hazard. The findings indicate that the seismic hazard at the project site for shorter return periods (less than about 1000 years) is predominantly from large magnitude earthquakes occurring along coastal B.C. and the Queen Charlotte fault

system. Ground motions associated with long return period events are also influenced by potential shallow crustal earthquakes occurring closer to the site within central B.C.

A design earthquake magnitude 8.5 has been selected for earthquake return periods of 500, 5,000, and 10,000 years, based on the review of regional tectonics and historical seismicity, and the findings of deaggregation of the probabilistic seismic hazard. This represents large magnitude earthquakes occurring along the Queen Charlotte fault system and Cascadia subduction zone. The potential for shallow crustal earthquakes occurring closer to the project site was also considered for longer return period events of 5,000 and 10,000 years, representing earthquakes of up to about Magnitude 7.5 along coastal B.C.

4 – GEOLOGICAL, GEOTECHNICAL AND HYDROGEOLOGICAL CONDITIONS

4.1 GENERAL

4.1.1 Project Area Geotechnical Characterization

Site investigations were conducted in 2012 and 2013 in a series of phases to evaluate geotechnical and hydrogeological conditions for the proposed TSF and waste dumps. Drillhole, ground geophysics, and test pit locations were adjusted as the program progressed and staged as a greater understanding of site conditions was acquired to focus on 'areas of interest'. Geotechnical site investigation programs carried out in 2012 and 2013 collected significant amounts of data to characterize the geology, hydrogeology and geotechnical conditions at the Project site. No pre-existing geotechnical or hydrogeological information was available prior to 2012. The factual data from the 2012 and 2013 site investigation programs were reported in the following documents.

- **2012 Site Investigations –** Knight Piésold report 2012 Site Investigation Report, Ref. No. VA101-457/6-1 (Knight Piésold Ltd., 2013a).
- **2013 Site Investigations –** Knight Piésold report 2013 Site Investigation Report, Ref. No. VA101-457/6-4 (Knight Piésold Ltd., 2013c).

A stand-alone geotechnical characterization report was prepared to present the compilation and assessment of the findings from the 2012 and 2013 site investigation data along with other relevant data from the Project area.

- **Geotechnical Characterization** – Knight Piésold report Geotechnical Characterization Report, Ref. No. VA101-457/6-8 (Knight Piésold Ltd., 2013e).

The findings of the geotechnical characterization of the project site are summarized in the following sections.

4.1.2 Surficial Material Types and Geotechnical Properties

Bedrock exposure in the Project area is rare and restricted to higher elevations. Soil cover is generally thick within the Davidson Creek watershed averaging over 60 meters. Bedrock is deepest along the Davidson Creek valley bottom where it is encountered at up to 107 meters depth. The surficial deposits are from the Fraser Glaciation, the last period of ice sheet glaciation in British Columbia. Dr. John Clague, a specialist geomorphology consultant, assessed the surficial geology of the Blackwater Project to defined a stratigraphic sequence and develop a geomorphological model. Stratigraphic units and the corresponding USCS classification that define engineering properties of the soil from surface downward to bedrock are as follows:

- **Holocene Deposits** – classified as a topsoil layer (OL, Pt).
- **Fraser Glaciation Deposits:**
  - **Glaciofluvial Deposits** – classified as coarse grained soils (GP-GW), coarse grained soils with sands and fines (GM, GW-GP) and coarse grained soils with fines (SP-SM).
  - **Glacial Till** – identified as coarse grained soils with gravels and fines (SM-SC and GM-GC).
  - **Glaciolacustrine Deposits** – classified as fine grained soils silts and clays (ML-CL).
- **Interglacial Fluvial Deposits** – classified as coarse grained soils with fines (GM, GW-GP) and coarse grained soils with fines (SP-SM).

- **Older Glacial Deposits** – classified as coarse grained soils with gravels and fines (SM-SC and GM-GC).
- **Reworked and in-situ regolith** – classified as coarse grained soils with fines (GC) to fine grained soils (CL).
- **Intact Bedrock** – classified as andesite and fragmental rocks that are strong to very strong, FAIR to GOOD rock, compressional wave velocities from 2,550 m/s to 5,460 m/s and low hydraulic conductivity values ranging in the order of 10^{-6} to 10^{-8} m/s.

The numbers of drillholes and test pits completed at each mine site infrastructure location are summarized in Table 4.1. The table includes a summary of the laboratory tests completed for each location to develop the surficial material characterization and geotechnical properties. The surficial material geotechnical properties are summarized in Table 4.2.

Table 4.1 Summary of 2012 and 2013 Data Collection

Infrastructure Components		Drillholes	Test Pits	PSD[1]	Hydrometer Test	Atterberg Limits	Natural Moisture Content	Density[2]/ Compaction[3]/ Triaxial[4]
Environmental Control Dam		6	-	61	61	61	52	-
Site D	Downstream Site D	13	41	91	93	86	56	-
	Site D Main Dam	24	24	54	61	56	52	$1^{(SP)}$
	Site D Basin	17	68	106	94	94	91	-
Site C	Site C Main Dam	11	8	47	46	46	44	-
	Site C Basin	1	9	3	3	3	1	-
	Site C West Dam	3	8	8	8	6	1	-
Plant Site		7	46	37	37	34	25	$1^{(SP)}$ $1^{(MP)}$
Coarse Ore Stockpile		1	-	2	2	2	2	$1^{(SP)}$ $1^{(MP)}$
Truck Shop		1	-	4	4	4	4	-
Waste Rock Dumps	West Dump	3	23	33	33	26	24	$2^{(SP)}$ $1^{(MP)}$
	East Dump	4	7	36	36	31	25	-
Open Pit Borrow		2	-	16	16	2	15	$2^{(MP)}$ $28^{(D)}$ $4^{(TX)}$
General site		3	70	79	47	55	21	$2^{(SP)}$
TOTAL		**94**	**304**	**565**	**553**	**512**	**398**	**$10^{(MP+SP)}$ $28^{(D)}$ $4^{(TX)}$**

NOTES:

1. PSD PARTICLE SIZE DISTRIBUTION ANALYSIS.
2. DENSITY TESTING (D).
3. COMPACTION TESTING; (SP) STANDARD PROCTOR, (MP) MODIFIED PROCTOR.
4. SHEAR STRENGTH TESTING: (TX) TRIAXIAL.

Table 4.2 Surficial Material Geotechnical Properties

USCS Classification		GW-GP	GM-GW, SM-SP	SP-SM	GM-GC, SM-SC	ML-CL	GC to CL
Geomorphological Model		Glaciofluvial Esker Deposits	Glaciofluvial Deposits – coarse	Glaciofluvial Deposits – fine	Glacial Till Deposits	Glaciolacustrine Deposits	Regolith
Particle Size Analysis	Gravel %	39 – 68 (52)	25 – 84 (46)	0 – 27 (7)	2 – 48 (25)	0 – 23 (3)	0 – 44 (13)
	Sand %	24 – 57 (39)	14 – 59 (37)	35 – 98 (71)	22 – 70 (41)	1 – 63 (21)	10 – 70 (45)
	Silt %	14	7 – 26 (14)	6 – 25 (19)	12 – 42 (27)	29 – 92 (62)	11 – 76 (32)
	Clay %	1	0 – 8 (3)	0 – 5 (3)	4 – 26 (7)	1 – 35 (13)	0 – 36 (10)
Moisture Content %		4 – 8 (6)	2 – 28 (9)	8 – 23 (15)	1 – 26 (11)	6 – 36 (18)	4 – 32 (17)
Atterbergs Limits for <200# Sieve	Liquid Limit		13 – 39 (24)	12 – 39 (24)	8 – 44 (24)	9 – 67 (28)	11 – 60 (33)
	Plastic Limit		6 – 29 (15)	7 – 32 (20)	5 - 31 (15)	6 – 33 (19)	7 – 32 (17)
	Plasticity Index		NP – 28 (9)	NP – 16 (8)	0 – 33 (9)	NP – 43 (11)	3 – 33 (17)
Seismic	Refraction Velocities		320 – 1050 m/s	200 – 800 m/s	1900 – 2500 m/s		2250 – 2600 m/s
Specific Gravity	Specific Gravity				2.7 – 2.8		
Compaction Testing (Std. Proctor)	Maximum Dry Density		2015 – 2090 kg/m^3		2008 – 2158 kg/m^3		
	Optimum Moisture Content		9 – 10 %		10 – 11%		
Compaction Testing (Mod. Proctor)	Maximum Dry Density		2159 kg/m^3		2028 – 2286 kg/m^3		
	Optimum Moisture Content		8.6 %		10 – 11%		
Triaxial Testing	Cohesion (c)				13 kPa		
	Friction Angle (Ø)				37°		
Permeability Laboratory Test	Constant head				10^{-7} – 10^{-11} m/s		
	Falling head				10^{-6} – 10^{-8} m/s		
Bulk and Dry Density	Moisture Content				7 – 11%		
	Dry Density				1789 – 2417 kg/m^3		
	Bulk Density				2061 – 2622 kg/m^3		

NOTES:

1. RESULTS IN BRACKETS ARE THE WEIGHTED AVERAGE I.E. (12).
2. NP: NON-PLASTIC.
3. ADOPTED FROM TABLE 4.1 OF THE GEOTECHNICAL CHARACTERIZATION REPORT (KNIGHT PIÉSOLD LTD., 2013E).

4.1.3 Bedrock Geotechnical Properties

Bedrock outcrop exposure is rare and generally restricted to higher elevations in the area. Bedrock is typically overlain by 40 to 50 metres of glacial deposits. Two geologic rock units were encountered in the TSF area; andesite from the Cenozoic Ootsa Lake Formation and fragmentals volcanics from the Cretaceous Volcaniclastics and Flows. The andesite and fragmentals units were highly weathered to approximately 20 m depth, becoming moderately to slightly weathered below this depth. The rock properties are summarized in Table 4.3.

Table 4.3 Summary of Rock Mass Properties

Bedrock		Rock Strength (MPa)	Strength Description	Young's Modulus (GPa)	Poisson Ratio	RQD %	RMR[89]	RMR Rating
Andesite	Median	212	MEDIUM STRONG TO VERY STRONG	58	0.19	55	59	GOOD
	Range	70 - 275		5 - 134	0.05 - 0.30	0 - 100	28 - 92	
Fragmentals	Median	125	MEDIUM STRONG TO VERY STRONG	36	0.10	38	50	FAIR to GOOD
	Range	60 - 189		19 - 53	0.08 - 0.31	0 - 93	28 - 67	

NOTES:
1. ADOPTED FROM TABLE 4.2 OF THE GEOTECHNICAL CHARACTERIZATION REPORT (Knight Piésold Ltd., 2013e).

Permeability testing of the rock mass generally indicated low hydraulic conductivity values ranging in the order of 10^{-6} to 10^{-8} m/s. The majority of tests exhibited laminar flow and lugeon values were typically between less than 1 and 5.

4.2 TSF SITE C

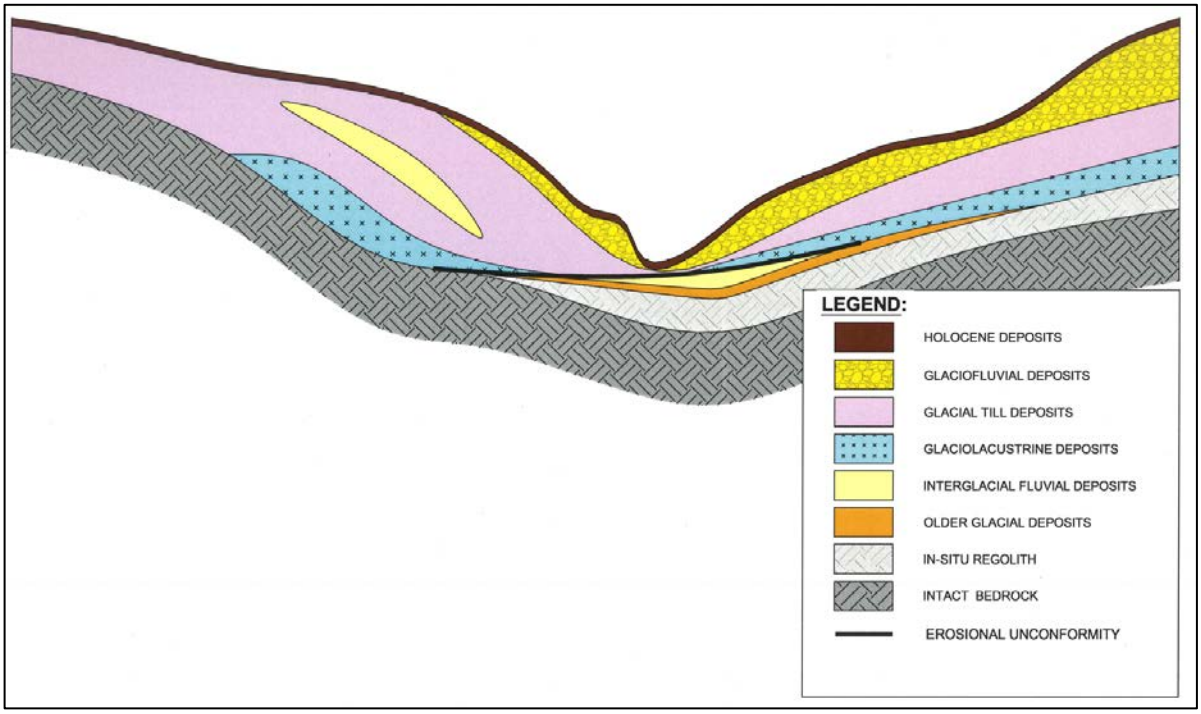
4.2.1 Site C Main Dam Geotechnical Conditions

Eleven drillholes and eight test pits were completed in the area of the Site C Main Dam alignment. The dominant surficial material type at the Site C Main Dam site is glacial till ranging in thickness from 27 m to 89 m. Glaciofluvial deposits are prevalent in this area and overlie the glacial till to form meltwater channel terraces between approximately 10 m and 35 m thick on either side of Davidson Creek. A regolith horizon was identified on the south side of the valley, ranging from approximately 12 m to 35 m in thickness. The completely weathered bedrock horizon was not encountered on the north side of the valley.

Static groundwater levels range from 3 m to 31 m mirroring topography. The TSF Site C Main Dam crosses the Davidson Creek pro-glacial meltwater corridor. Kames, meltwater channels, and meltwater erosional scarps occur immediately north and southwest of the dam. Potentially high-permeability interglacial fluvial deposits were identified within the glacial till. Infill drilling to determine the extents of these deposits found them to be discontinuous lenses and displayed no lateral continuity between adjacent drillholes. A schematic of the inferred stratigraphy at Site C Main Dam is shown on Figure 4.1.

The bedrock geology consists of andesitic volcanic rocks that are highly to moderately weathered to approximately 25 m depth. In-situ hydraulic conductivity testing indicates the rock mass has low permeability with typical values of $9x10^{-7}$ to $6x10^{-9}$ m/s.

Figure 4.1 Schematic of Site C Main Dam Inferred Stratigraphy



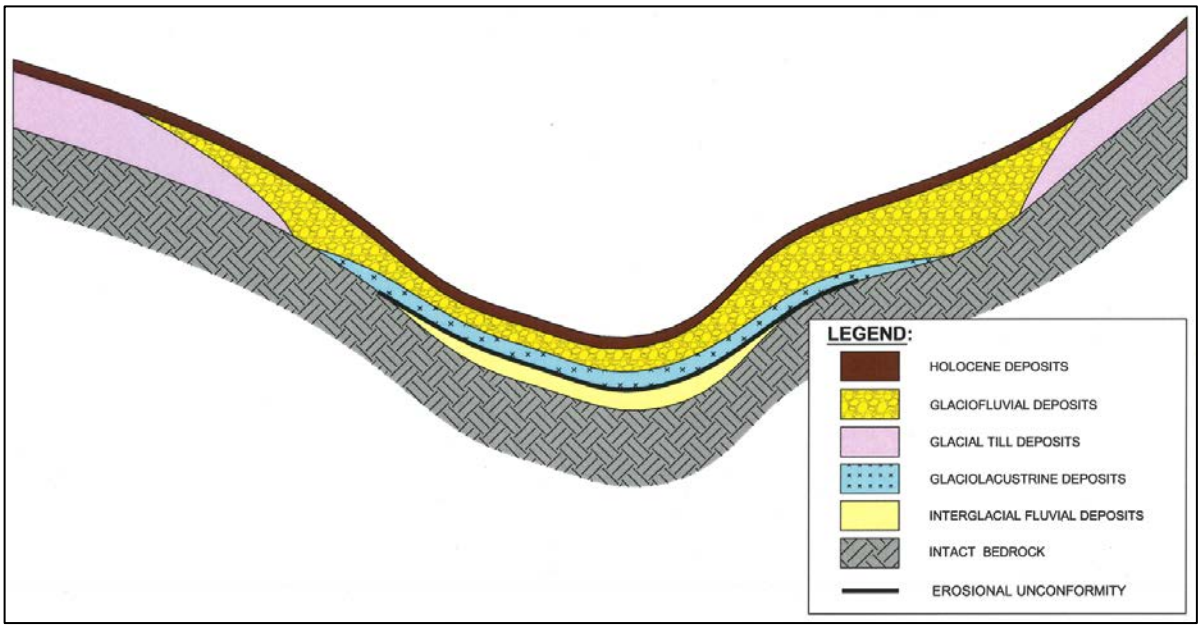
NOTES:
1. ADAPTED FROM FIGURE 5.3 OF THE GEOTECHNICAL CHARACTERIZATION REPORT (Knight Piésold Ltd., 2013e).

4.2.2 Site C West Dam Geotechnical Conditions

The Site C West Dam is located at the west end of TSF Site C downstream of the drainage divide of Davidson Creek. Drillholes and seismic lines have been completed in this area to investigate the subsurface conditions and optimize the dam alignment. The potential for terrain slope instability on the steep slopes and environmental concerns (small lake to west of dam) were identified further upstream at the drainage divide, and the Site C West Dam location was shifted downstream to its current position to avoid these concerns. Seismic refraction surveys conducted in the area of the dam indicated favourable foundation conditions with near surface intact bedrock. Intact bedrock was found at approximately 6 m depth, and surficial materials comprised dense fluvial sand and gravel deposits overly bedrock in the valley bottom contained by glacial till on side slopes.

Bedrock at this location is fragmentals (felsic tuff and felsic lapilli tuff). The regolith horizon was not encountered. Hydraulic conductivity in the bedrock is low, with values ranging from $4x10^{-7}$ m/s to $3x10^{-8}$ m/s. The static groundwater level is shallow, at 3 m depth. A schematic of the inferred stratigraphy at the Site C West Dam is shown on Figure 4.2.

Figure 4.2 Schematic of Site C West Dam Inferred Stratigraphy



NOTES:
1. ADOPTED FROM FIGURE 5.4 OF THE GEOTECHNICAL CHARACTERIZATION REPORT (Knight Piésold Ltd., 2013e).

4.2.3 TSF Site C Basin Geotechnical Conditions

One drillhole and 26 test pits were completed within the TSF Site C basin area to evaluate the near-surface conditions to identify the presence of potential seepage pathways. The geotechnical foundation conditions are characterized by glaciofluvial deposits ranging from 1 m to 7 m thick overlying intact bedrock. Bedrock is much shallower in this area than the rest of the TSF. Static groundwater levels range from 1 m to 4 m and mirror the surface topography. The bedrock geology consists of slightly weathered andesitic volcanic and fragmentals rocks. In-situ hydraulic conductivity testing indicates the rock mass has low permeability with a range of 10^{-6} m/s to 10^{-8} m/s.TSF SITE D

4.2.4 Site D Main Dam Geotechnical Conditions

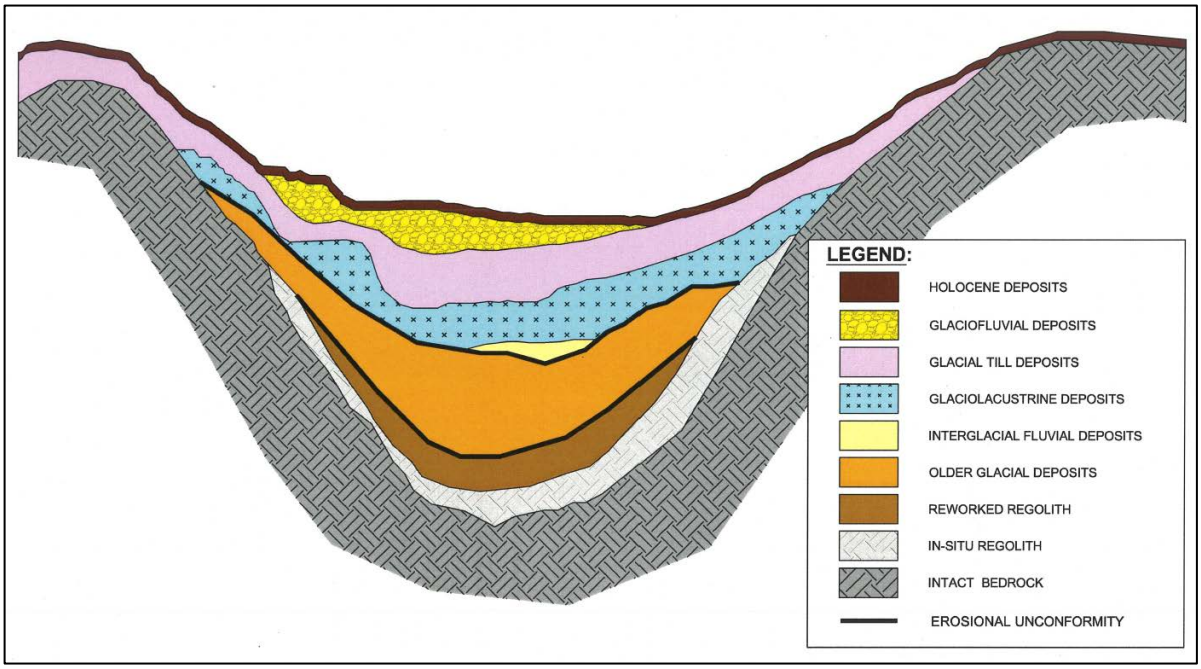
The Site D Main Dam alignment was established to optimize use of the natural topography of the Davidson Creek watershed, allowing for efficient and long-term storage of mine waste. Twenty-four drillholes and 24 test pits were completed in the vicinity of the Site D Main Dam alignment. The foundation conditions have been characterized by a surficial glacial sequence ranging from 4 m to 96 m thick overlying bedrock. These deposits are thickest in the centre of the Davidson Creek valley. Surficial materials at the north abutment are particularly thick, ranging from 14 m to 96 m. The regolith horizon ranges in thickness from approximately 2 m to 30 m. Static groundwater levels range from 7 m to 32 m below ground surface, mirroring the surface topography. The groundwater depth is consistent with the saturated zone identified by the seismic refraction survey lines.

The dominant surficial material type in the Site D Main Dam area is low-permeability lodgement glacial till. Glaciofluvial deposits overlie the glacial till deposits to form meltwater channel with terraces between approximately 10 m and 20 m thick on either side of Davidson Creek. Bedrock is

close to surface on the southern side of the Site D Main Dam. The Site D Main Dam crosses the Davidson Creek pro-glacial meltwater corridor. A glaciofluvial kame complex extends beneath approximately half of the Site D Main Dam on the north side of Davidson Creek. Meltwater channels, a few small eskers, and meltwater erosional scarps were mapped on the south side of Site D Main Dam. Interglacial fluvial deposits were identified within the glacial till. These zones were found to be discontinuous and displayed no lateral continuity between adjacent drillholes. A schematic of the inferred stratigraphy at the Site D Main Dam is shown on Figure 4.3.

The bedrock geology consists of andesitic volcanic rocks that are highly to moderately weathered to approximately 20 m depth. In-situ hydraulic conductivity testing demonstrates the rock mass has low permeability ranging from $1x10^{-6}$ to $1x10^{-9}$ m/s. An inactive fault was inferred on the south side of Davidson Creek, based on the 2012 site investigation program drilling. Two drillholes targeted the inferred fault (inactive) during the 2013 site investigations to determine hydraulic conductivity the orientation of the fault. The fault zone was found to be a high angle near vertical fault and to have a low permeability ranging from $6x10^{-7}$ to $9x10^{-9}$ m/s.

Figure 4.3 Schematic of Site D Main Dam Inferred Stratigraphy



NOTES:
1. ADOPTED FROM FIGURE 5.2 OF THE GEOTECHNICAL CHARACTERIZATION REPORT (Knight Piésold Ltd., 2013e).

4.2.5 TSF Site D Basin Geotechnical Conditions

Seventeen drillholes and 68 test pits were completed in the TSF Site D basin area to evaluate the near surface conditions to identify the presence of potential seepage pathways. The geotechnical foundation conditions are characterized by a surficial glacial sequence ranging from 3 m to 94 m thick overlying bedrock; this sequence is deepest in the centre of the Davidson Creek valley. The regolith ranges from approximately 3 m to 30 m thick. Static groundwater levels range between 4 m to 25 m depth mirroring the surface topography.

The dominant surficial material type in the Site D basin is low-permeability glacial till. Glaciofluvial meltwater channel deposits overlie the glacial till deposits to form terraces between approximately 10 m and 20 m thick on either side of Davidson Creek. The Davidson Creek drainage basin contains a succession of meltwater channels expressed by a series of up to six glaciofluvial terraces. The terraces provide evidence of sequential down cutting erosion by meltwater streams. Interglacial fluvial deposits were identified within the glacial till; these zones were found to be discontinuous and displayed no lateral continuity between adjacent drillholes.

The bedrock geology consists of andesitic volcanic rocks highly to moderately weathered to a depth of approximately 20 m. In-situ hydraulic conductivity testing has shown the rock mass has relatively low permeability ranging from 10^{-7} to 10^{-8} m/s.

4.2.6 TSF Site D Main Dam South Abutment

The south abutment of the Site D Main Dam creates a surface water divide between the Davidson Creek and Creek 661 catchments. A meltwater channel drains this area. An isolated segment (south segment) of the dam will be constructed at the catchment divide late in the mine life. Bedrock near the south abutment is typically near surface, except in the meltwater channel. Seismic lines and drillholes encountered glacial till and glaciofluvial deposits at 20 to 40 m depth overlying bedrock in the meltwater channel.

4.3 ENVIRONMENTAL CONTROL DAM (ECD)

The ECD and interception trenches will be located approximately 1 km downstream of the Site D Main Dam. The hydrogeological assessment of the TSF to determine the ECD location is described in Section 5.7 and Appendix C. Six drillholes and five test pits were completed in the area of the ECD and interception trenches area. The ECD and interception trench foundation conditions are characterized by a surficial material sequence ranging from 24 m to 108 m thick with the deepest portion in the centre of the Davidson Creek valley. The regolith horizon ranges from approximately 2 m to 30 m thick in this area. The static groundwater level is a reflection of the surficial topography and ranges from 21 m to 53 m.

The dominant surficial material types encountered at the ECD and interception trenches consists of glaciofluvial deposits and glacial lodgement till. The glaciofluvial deposits overlie the glacial till deposits to form terraces up to approximately 30 m thick flanking either side of the Davidson Creek meltwater channel and extending towards the north. The northern glaciofluvial deposits are found on the southwestern edge of a large esker and kame deposit. The bedrock geology consists of andesitic volcanic rocks that are highly to moderately weathered for approximately 20 m depth.

4.4 WASTE DUMPS AND LOW-GRADE ORE (LGO) STOCKPILE

4.4.1 General

Two waste rock dumps will be constructed, the West Dump and the East Dump. Seven drillholes and 30 test pits were completed in the area of the waste rock dumps to characterize the foundation conditions. One drillhole and three test pits were completed in the area of the LGO Stockpile.

4.4.2 East Dump

The East Dump will be situated on a gentle sloping area that drains to the northeast. The geotechnical foundation conditions in this area are characterized by a surficial material sequence ranging from 24 m to 108 m thick, with the thickest deposits at the lower elevations. The glaciofluvial deposit from a sub-glacial meltwater corridor was identified in the footprint area of the East Dump. Static groundwater levels range between artesian conditions to a depth of 12 m. The bedrock geology consists of highly weathered andesitic volcanic rocks that are at less than 5 m depth.

4.4.3 West Dump

The West Dump will be situated on a gentle sloping area draining to the northwest. The geotechnical foundation conditions are characterized by surficial materials ranging from 18 m to 75 m in thickness, being thickest at lower elevations. Several eskers and localized kames and ablation till were identified in the footprint area of the West Dump. Bedrock is shallow on the upper slopes at 3 to 4 m depth. The bedrock geology consists of highly weathered andesitic volcanic rocks at less than 5 m depth. Static groundwater levels range from 3 m to 4 m below surface and mirror the surficial topography.

4.4.4 LGO Stockpile

One drillhole and three test pits were completed in the area of the LGO Stockpile. Glaciofluvial deposits comprising a meltwater corridor and kame complex was identified in the footprint of the stockpile. The foundation materials are characterized by glaciofluvial surficial deposits up to 18 m thick overlying the highly weathered andesitic bedrock. The static groundwater level is at approximately 13 m depth below ground surface.

4.5 ADDITIONAL TSF AREA FINDINGS

Specific ‘areas of interest’ were identified from the 2012 site investigations program and are discussed in this report, including:

- **Topsoil layer** – The topsoil thickness is typically 0.1 m to 0.2 m, with localized wetlands accumulations where the thickness increases to greater than 1 m.
- **Groundwater conditions** – In the general vicinity of the tailings basin, groundwater was found to be approximately 25 m below the surface and generally forms a subdued reflection of topography. Groundwater depths become shallower closer to Davidson Creek.
- **Davidson Creek meltwater channel** – Terrain landform mapping identified a meltwater channel corridor in the Davidson Creek drainage. Additional mapping confirmed the surficial meltwater channel within the TSF basin is a surficial unit and not hydraulically connected to the interglacial fluvial deposits.
- **Interglacial fluvial deposits beneath the TSF** – Detailed investigations and data compilation confirmed interglacial fluvial deposits within the TSF were uncommon, discontinuous and not hydraulically connected.
- **Ablation till distribution** – Ablation till frequency and distribution were mapped within the mine site footprint and was found to be restricted to the higher elevations and not associated within the tailings basin.

- **Highly weathered bedrock** – The potential for highly weathered bedrock to have high hydraulic conductivity values was tested. This zone has been conservatively identified as having the potential to act as a seepage pathway beneath the TSF where the bedrock surface is shallow at Site D Main Dam southern extent.
- **Inferred faults** – The previously identified inferred fault (inactive) of the Site D Main Dam southern extent was found to have low hydraulic conductivity.
- **Characterize surficial material along embankments** – The material characteristics along the embankments were assessed and the depth to Low Permeability Subgrade (LPS) or bedrock were identified along the Site D Main Dam, Site C West Dam and ECD interception trench alignments to provide depths for the cutoff trench designs.
- **Environmental Control Dam** – The hydrogeological assessment indicated that secondary seepage control is required downstream of the tailings embankment to intercept potential upwelling seepage. The ECD should be located 1 km downstream of the Site D Main Dam across Davidson Creek to collect seepage for recycle to the TSF.

5 – TAILINGS STORAGE FACILITY DESIGN

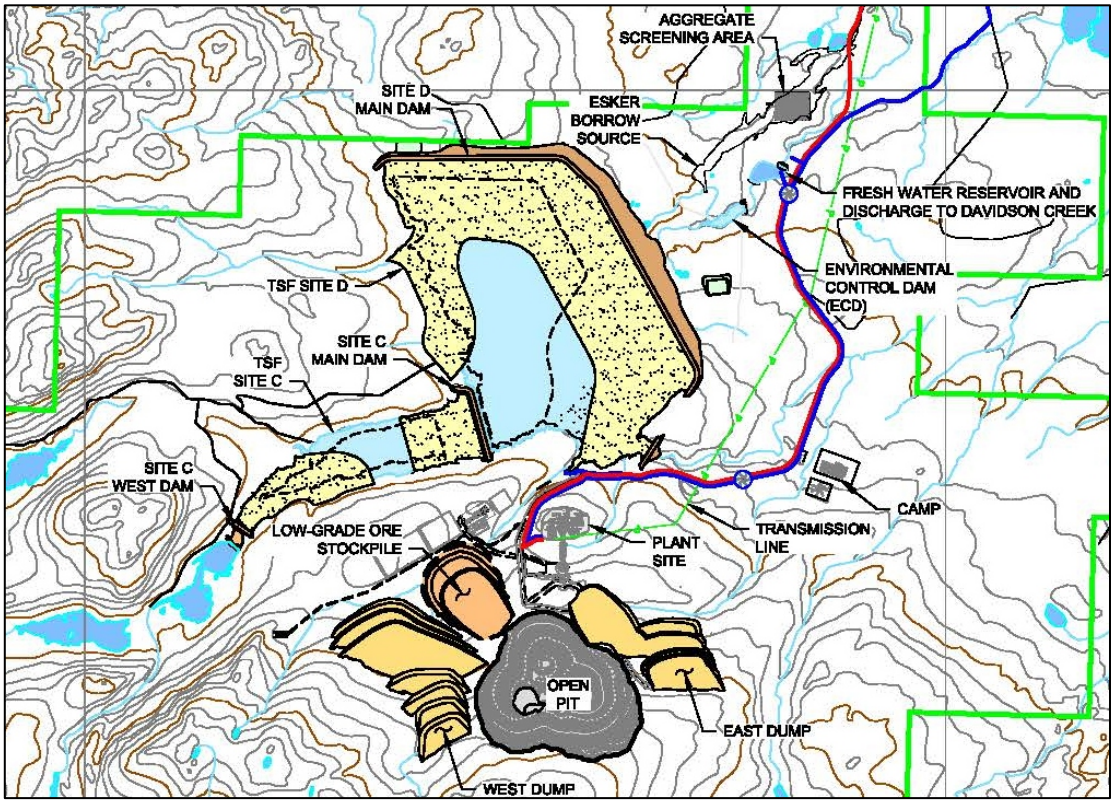
5.1 GENERAL

The principal design objectives for the waste rock and tailings storage facilities are to protect the regional groundwater and surface water during both operations and in the long term (after closure), and to achieve effective reclamation at mine closure. The design of the waste rock and tailings storage facilities has taken into account the following requirements:

- Permanent, secure and total confinement of all solid waste materials within engineered disposal facilities.
- Control, collection, and removal of free-draining liquids from the waste and tailings facilities during operations for recycling as process water to the maximum practical extent.
- Prevention of ard and minimization of metal leaching from reactive tailings and waste rock.
- The inclusion of monitoring features for all aspects of the facility to confirm performance goals are achieved and design criteria and assumptions are met.
- No surface water discharge to the environment during mine operations.
- Staged development of the facility over the life of the project.

The Tailings Storage Facility (TSF) was designed to permanently store tailings, PAG1 and PAG2 potentially acid generating (PAG) waste rock, and NAG3 potentially metal leaching non-acid generating waste rock that is generated during the operation of the mine. The TSF is comprised of two adjacent sites, Site C and Site D, as shown in Figure 5.1.

Figure 5.1 TSF General Arrangement



5.2 DESIGN BASIS

Design and operating criteria have been developed for the Feasibility Study to facilitate preparation of drawings, material take-offs, and an economic comparison with +15% / -10% accuracy. The design criteria reflect the FS mine plan and operating strategy.

Considerations used in the development of the TSF design are summarized as follows:

- TSF located on New Gold claims.
- Norwest "FinalFeasibilitySchedule-July282013" Detailed Mine Schedule provided on August 8, 2013.
- Annual staging of the TSF dam lifts allows for storage of the next year of tailings and waste rock disposal, an operational pond volume of 10 Mm^3 and storage of the Inflow Design Flood (IDF) during operations with at least 1 m of freeboard for wave runup.
- Conventional, thickened tailings disposal with tailings solids content of 50% by weight.
- TSF filling schedule based on the Detailed Mine Schedule including material movements to dam construction and waste disposal.
- Overburden dry density of 1.9 tonnes/m^3 when placed in on-land dumps and in the embankment shell zones, and 2.0 tonnes/m^3 when placed and compacted in the dam core zone.
- Water for the process plant sourced from the TSF supernatant ponds at a flow rate of 3200 m^3/hr.
- Closure spillway from TSF Site C constructed in Year 5 to allow passage of the PMF without consideration for attenuation provided by storage below the spillway crest.
- Potential use of TSF Site C for water storage from years 3 to the end of mining.

The design and operating criteria for the project are presented on Table 5.1 below.

Table 5.1 Design and Operating Criteria

ITEM	DESIGN CRITERIA
1.0 GENERAL	
Site Coordinates	• Approximately 375 000 E , 5 895 000 N (UTM NAD 83) and in NTS sheet 93F/02
Site Elevation	• Approximately 1000 to 1700 masl
Codes and Standards	• Health Safety and Reclamation Code for Mines in British Columbia (2008), Mines Act (RSBC 1996), ASTM, CDA Dam Safety Guidelines (2007) and related codes.
Mine Production	• Total ore milled = 344 million tonnes (Mt)
	• Throughput = 60,000 tonnes per day (tpd).
	• Open pit stripping ratio = approximately 2:1 (excluding rehandle).
	• Mine Life = approximately 17 years
Climate Conditions	• Mean Annual Precipitation = 636 mm
	• Mean Annual Evaporation for the Project Site = 445 mm
Rainfall Storm Events	• 1 in 10 year 24 hour precipitation = 50 mm
	• 1 in 50 year 24 hour precipitation = 61 mm
	• 1 in 200 year 24 hour precipitation = 71 mm
	• Probable Maximum Precipitation 24 hr rainfall = 195 mm

2.0 MINE WASTE MANAGEMENT			
2.1 Waste Properties			
Tailings	•	Total tailings production = 344 Mt	
	•	Dry density = 1.30 t/m3.	
	•	Specific Gravity of Solids = 2.79	
Potentially Acid Generating (PAG) Waste Rock - PAG1 and PAG2	•	PAG co-disposed with tailings = 366 Mt	
	•	Waste Rock Specific Gravity = 2.7	
	•	Dry density = 2.2 t/m3.	
Potentially Metal Leaching Waste Rock - NAG3	•	NAG3 (Total 79 Mt) - co-disposed with tailings = 47 Mt and Used to construct upstream zone of TSF embankments = 32 Mt	
	•	Waste Rock Specific Gravity = 2.7	
	•	Dry density = 2.2 t/m3.	
Non-Acid Generating (NAG) Waste Rock - NAG4 and NAG5	•	NAG4 (Total 44 Mt) - Disposed in stockpiles = 42 Mt and Used to construct TSF embankments = 2 Mt	
	•	NAG5 (Total 108 Mt) - Disposed in stockpiles = 54 Mt and Used to construct TSF embankments = 54 Mt	
	•	Waste Rock Specific Gravity = 2.7	
	•	Dry density = 2.2 t/m3.	
Non-Acid Generating (NAG) Overburden	•	Overburden (Total 87 Mt) - Disposed in stockpiles = 47 Mt and Used to construct TSF embankments = 40 Mt	
	•	Overburden Specific Gravity = 2.7	
	•	Dry density = 1.9 to 2.0 t/m3.	
Low Grade Ore (LGO)	•	50 Mt stockpiled in an engineered facility for processing during Years 15-17	
	•	Specific Gravity = 2.7	
	•	Dry density = 2.2 t/m3.	
2.2 Tailings Storage Facility (TSF)			
Function	•	Two impoundments (Site C and D) provides for secure and permanent storage of tailings and management water for reuse in the process.	
Concept	•	Total tailings storage codisposed with 366 Mt of PAG and 79 Mt NAG-ML waste rock within two impoundments formed by three embankments. Embankments raised in stages and constructed using the centreline method.	
Storage Capacity	•	Site C - 2 years of tailings production and co-disposed waste rock, allowance for minimum 10 M m3 process water pond, plus IDF and freeboard.	
	•	Site D - remaining tailings production and co-disposed waste rock, allowance for minimum 10 M m3 process water pond, plus IDF and freeboard.	
	•	Raised Embankment - next year of tailings and co-disposed waste rock, 10 M m3 process water pond, plus IDF and freeboard.	
	•	Ultimate Embankment at Closure - Total tailings production and co-disposed waste rock plus storage and freeboard to attenuate	
CDA Consequence	•	Very High	
Inflow Design Flood (IDF)	•	2/3 between the 1/1000 year and Probable Maximum Flood (PMF), calculated in accordance with CDA Guidelines - Section 6.4	
Flood Management - Catchment Areas	•	Site C Catchment Area = approximately 7.1 km2	
	•	Site D Catchment Area = approximately 41.5 km2	
Inflow Design Flood (IDF) Volumes	•	Site C = 5 M m3 (based on catchment area and 681 mm IDF runoff depth)	
	•	Site D = 28 M m3 (based on catchment area and 681 mm IDF runoff depth)	
Design Freeboard	•	Minimum 1 m above design storage capacity for wave runup; assumes tailings beaches developed at 0.5% slope from dam crest.	
Operational Criteria	•	Flood management: Inflows are contained within the impoundment. The storage volume assumes any diversion systems are non functional during the IDF.	
	•	Supernatant water reclaimed for re-use in mill process.	
	•	Excess water monitored and TSF raises managed appropriately.	
Closure Criteria	•	Surface runoff of non-contact water routed to natural streams.	
	•	TSF Closure Spillways: Pass PMF sized for the 24 hour PMP and 1/100 year snowmelt (459 mm) without consideration of the runoff attenuation provided by storage below the spillway crest.	
Seepage	•	Measures to control seepage include: - lower permeability core zone with filter/transition zones for raised embankments - lower permeability tailings deposit - downstream seepage collection ponds, interception trenches and wells, and pump-back systems	
	•	Collected seepage is monitored and managed appropriately.	
Seismic	•	Magnitude = 8.5	
	•	Peak horizontal ground acceleration = 0.08g (mean hazard value)	
	•	Earthquake Design Ground Motion (EDGM) = 1/5,000 year event	
Embankment Stability	•	Permanent embankment slopes to be no steeper than 2H:1V to facilitate reclamation, and achieving the minimum required Factors of Safety (FOSmin) for the following loading conditions:	
	•	End of construction (starter dam and dam raises)	FOSmin = 1.3
	•	Long term (at closure)	FOSmin = 1.5
	•	Seismic (Pseudo-static loading condition)	FOSmin = 1.0
	•	Seismic (Post-earthquake loading condition; full liquefaction of tailings	FOSmin = 1.5
Embankment Crest Width	•	Minimum 30 m during contractor construction periods and 50 m during mine fleet construction periods to facilitate 2-way haul traffic and reduce turn and dump time.	
	•	Minimum 40 m working surfaces during downstream stepouts.	

2.3 Waste Rock Dumps		
Function	•	Two engineered stockpiles provide for secure and permanent storage of excess NAG waste rock (Types 4 and 5) and overburden.
Surface Water	•	Diverted around dumps to TSF using diversions field fit to advancing fill platforms.
Seepage	•	Seepage collected and routed to TSF
Closure Criteria	•	Surface runoff of non-contact water routed to natural streams.
	•	Slopes to be covered with salvaged overburden and revegetated.
2.4 Haul, Service, and Diversion Roads		
Function	•	Haul roads for construction equipment from pit rim and borrow areas to embankments for delivery of embankment construction materials and waste rock.
	•	Service roads for access to pipeworks (fresh water, tailings, & reclaim systems) and Diversion Roads for runoff management.
Dimensions	•	Haul roads were sized according to Health Safety and Reclamation Code for Mines in British Columbia (2008). Allowances for safety barriers and ditches are included as required.
Operational Criteria	•	Roads to be accessible year round; maintenance and snow removal to be appropriate for intended frequency of use.
Closure Criteria	•	Roads will be partially reclaimed to maintain access suitable for a 4WD light truck.
4.0 TAILINGS DISTRIBUTION **4.1 Tailings Distribution**		
Function	•	Transport tailings from the mill process to the TSF by gravity.
	•	Develop tailings beaches upstream of the TSF embankments.
Physical Properties	•	Slurry Solids Content = 50% by weight
	•	Specific Gravity of Slurry = 1.47
	•	Median particle diameter for bulk slurry = 66.3 µm
	•	Percent finer than 75 µm = 56% (passing # 200 sieve) Percent finer than 44 µm = 44%
	•	Median particle diameter for coarse fraction = 105 µm
Capacity	•	60,000 t/day solids throughput with 100% mill availability (2,505 t/hr average).
	•	Site C: One delivery line to Main and West Dams each capable of transporting 100% of tailings with offtakes spaced 150 m apart along the dam perimeter. The line to West Dam includes offtakes along the south side of the TSF spaced 150 m apart.
	•	Site D: One delivery line to Main Dam extending to North Dam capable of transporting 100% of tailings. This line includes offtakes around the dam perimeter spaced 150 m apart.
	•	Site D: Additional delivery line along the West perimeter road capable of transporting 100% of tailings. This line includes offtakes around TSF perimeter spaced 150 m apart.
	•	One emergency discharge line capable of transporting 120% of tailings to Site C and Site D each.
	•	Production surges are managed with a built-in 20% surge capacity in the tailings lines.
General Criteria	•	Gravity discharge from mill used where sufficient head is available.
	•	Tailings deposition to Site C for Years 1 to 3. Tailings deposition to SiteD for Years 3 to 17.
	•	Tailings discharge through spigots placed 150 m apart.
	•	Pump stations as required where gravity discharge is not sufficient.

5.3 TAILINGS DAM HAZARD CLASSIFICATION

The Canadian Dam Association Dam Safety Guidelines (CDA, 2007) were used to determine the dam classification and suggested minimum Inflow Design Flood (IDF) and Earthquake Design Ground Motion (EDGM) for the project tailings dams. Classification of the tailings dams was carried out by considering the potential incremental consequences of a failure. The dam safety classification for the project tailings dams is VERY HIGH. The following suggested design flood and earthquake levels were adopted from the CDA guidelines for the construction and operational phases of the project:

- IDF – 2/3 between 1/1000 year and Probable Maximum Flood (PMF).
- EDGM – 1/5000 year return period.

A draft bulletin was released by the Canadian Dam Association in 2013 (CDA, 2013). This bulletin indicates that a mining dam with a dam safety classification of VERY HIGH should be designed for the PMF and Maximum Credible Earthquake (MCE) in the closure phase. The following design flood and earthquake levels were adopted for the closure phase of the project.

- IDF – PMF.
- EDGM – MCE (1 in 10,000 year event).

5.4 LAYOUT AND OPERATING STRATEGY

5.4.1 General

The filling schedule for TSF Site C and Site D was based on the Detailed Mine Schedule for the project and is presented in Table 5.2. A filling curve was developed for each Site that takes into account the storage characteristics of the facility and includes the approximate rate of rise of the tailings and waste rock platform, supernatant pond allowance, and IDF freeboard.

The IDF volume used in the design varies based on the catchment area reporting to the facility. The IDF is based on capturing runoff from an event of 681 mm, calculated in accordance with the CDA Guidelines. The applicable IDF volumes for the design of the facility during operations are as follows:

- TSF Site C = 5 Mm^3.
- TSF Site D = 28 Mm^3.

The filling curves for Site C and Site D are presented as Figure 5.2 and Figure 5.3, respectively. Specific overall features of the TSF are listed below:

- Cofferdams and sediment ponds to manage water during construction by either routing water around the TSF or directing water to the TSF for collection.
- Three (3) zoned water-retaining earth-rockfill dams referred to as the Site C Main Dam, Site C West Dam, and Site D Main Dam.
- Designated PAG/NAG3 waste storage areas located within the TSF.
- Environmental Control Dam (ECD) and interception trenches to recover potential seepage downstream of the Site D Main Dam and direct water back to the TSF using a pumpback recycle system.
- Collection channels that route runoff water to the TSF.
- Tailings distribution system.
- Reclaim water system.
- Tailings beaches.
- Supernatant water ponds.

Knight Piésold CONSULTING

TABLE 5.2

NEW GOLD INC
BLACKWATER GOLD PROJECT

MINE WASTE AND WATER MANAGEMENT DESIGN REPORT
TSF FILLING SCHEDULE

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YEAR	TAILINGS SOLIDS		WASTE ROCK INTO TSF1			TSF STORAGE REQUIREMENT					
						SITE C			SITE D		
	Total Tailings Cummulative tonnes	Total Tailings Solids m3	Annual Total tonnes	Total Cummulative tonnes	Total Cummulative m3	Tailings Solids + WR m3	Supernatant Pond Allowance m3	Total Required Storage Volume m3	Tailings Solids + WR m3	Supernatant Pond Allowance m3	Total Required Storage Volume m3
Preproduction	0	0	6,619,000	6,619,000	3,008,636	3,008,636	10,000,000	13,008,636			
1	10,819,000	8,322,000	15,903,000	22,522,000	10,237,273	18,559,273	10,000,000	28,559,273		8,000,000	8,000,000
2	32,719,000	25,168,000	28,484,000	51,006,000	23,184,545	35,405,273	10,000,000	45,405,273	12,947,273	10,000,000	22,947,273
3	54,619,000	42,015,000	28,317,000	79,323,000	36,055,909				42,665,636	10,000,000	52,665,636
4	76,519,000	58,861,000	38,396,000	117,719,000	53,508,636				76,964,364	10,000,000	86,964,364
5	98,419,000	75,707,000	34,921,000	152,640,000	69,381,818				109,683,545	10,000,000	119,683,545
6	120,322,000	92,555,000	43,805,000	196,445,000	89,293,182				146,442,909	10,000,000	156,442,909
7	142,225,000	109,404,000	45,226,000	241,671,000	109,850,455				183,849,182	10,000,000	193,849,182
8	164,128,000	126,252,000	44,974,000	286,645,000	130,293,182				221,139,909	10,000,000	231,139,909
9	186,031,000	143,101,000	48,039,000	334,684,000	152,129,091				259,824,818	10,000,000	269,824,818
10	207,934,000	159,949,000	34,949,000	369,633,000	168,015,000				292,558,727	10,000,000	302,558,727
11	229,836,000	176,797,000	15,940,000	385,573,000	175,260,455				316,652,182	10,000,000	326,652,182
12	251,738,000	193,645,000	11,158,000	396,731,000	180,332,273				338,572,000	10,000,000	348,572,000
13	273,640,000	210,492,000	9,272,000	406,003,000	184,546,818				359,633,545	10,000,000	369,633,545
14	295,542,000	227,340,000	7,239,000	413,242,000	187,837,273				379,772,000	10,000,000	389,772,000
15	317,444,000	244,188,000	0	413,242,000	187,837,273				396,620,000	10,000,000	406,620,000
16	339,346,000	261,035,000	0	413,242,000	187,837,273				413,467,000	10,000,000	423,467,000
17	344,455,000	264,965,000	0	413,242,000	187,837,273				417,397,000	10,000,000	427,397,000

M:\1\01\00457\06\A\Report\11 - Waste and Water Management Design Report\Tables\[11 - Tables - r0.xlsx]5.2 - Filling Schedule

Tailings density (t/m3)	1.3
Waste rock density (t/m3)	2.2

NOTES:

1. WASTE ROCK INTO TSF INCLUDES TYPE 1, TYPE 2 AND TYPE 3 EXCLUDING WASTE ROCK USED IN DAM CONSTRUCTION.
2. WASTE ROCK DELIVERED TO TSF SITE C IN YEARS 2015-2017, AND TO TSF SITE D THEREAFTER.

REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D
0	04DEC'13	ISSUED WITH REPORT VA101-457/6-11	DDF	BB	KJB

Figure 5.2 TSF Site C Filling Curve

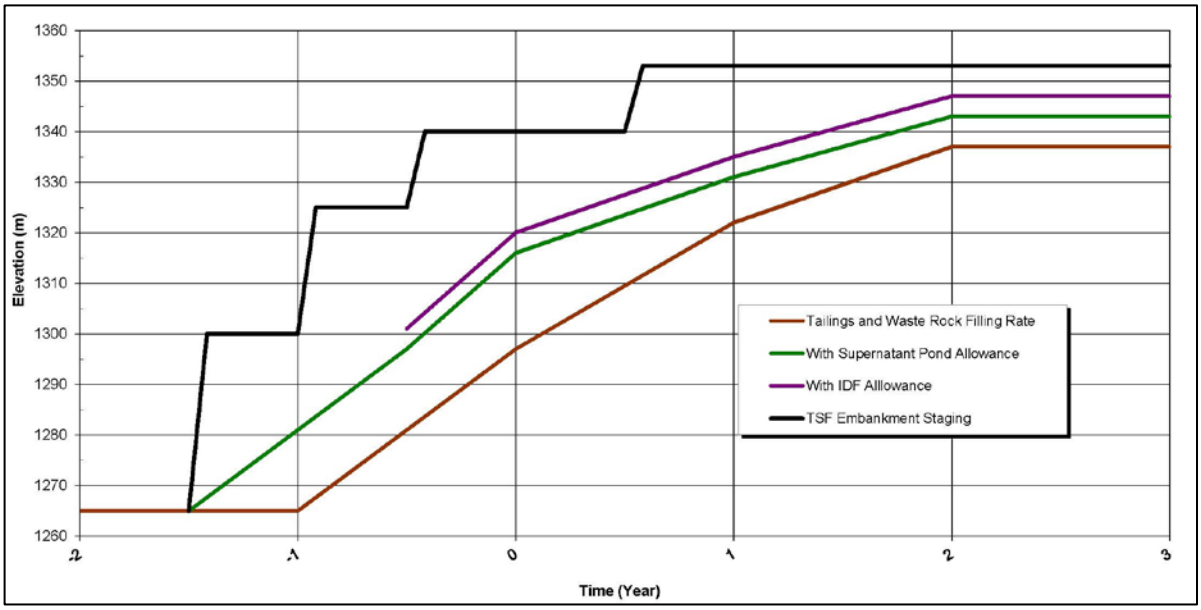
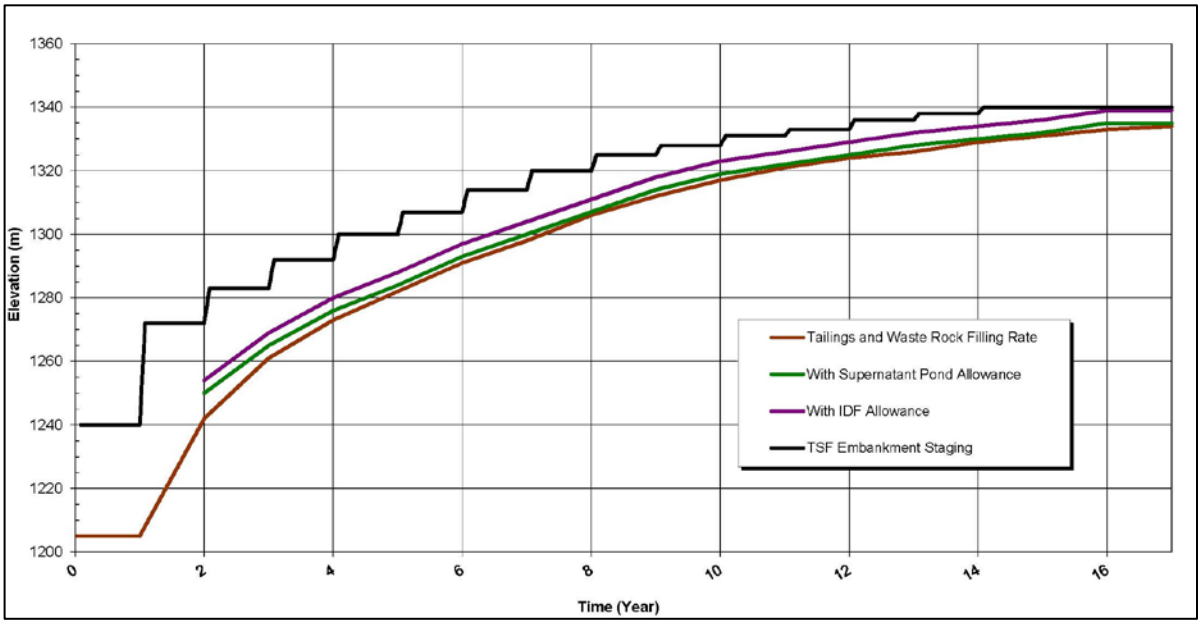


Figure 5.3 TSF Site D Filling Curve



5.4.2 PAG and NAG3 Disposal Area Considerations

The PAG and NAG3 waste rock disposal area (henceforth referred to as the PAG disposal area) within the TSF footprint will be developed as part of preproduction construction to provide a location for PAG disposal from the pit stripping to expose the orebody. The PAG disposal area will be developed at the same or similar rate of rise as TSF filling level but will be several metres higher to provide a dry, stable placement surface for truck traffic. The design objective for the PAG area is to

flood the waste rock within one year of placement. The maximum elevation of the waste storage area will remain at an elevation where it can be flooded by the supernatant pond in the case of premature closure. At closure, this waste storage area will be covered by 0.3 m of overburden and submerged below the final closure tailings elevation.

The PAG disposal area during preproduction and Year 1 of operations will be within and near the center of TSF Site C. The disposal area will expand as a fill platform with overall slopes at angle of repose. The tailings beaches will provide a low permeability seepage barrier between the coarse, permeable waste rock and the tailings embankments.

The PAG disposal area beginning in Year 2 will be within TSF Site D. Waste placement will commence near the upstream zone of the TSF Site D Main Dam below an elevation of approximately 1240 m and will extend west up the valley as a lobe. Beginning in year 3, the PAG fill platform will be located in the east and north areas of the facility. The fill platform will rise slightly above and with the TSF filling level from Year 3 until Year 14 with the cessation of mining activity. The PAG disposal fill platform will typically rise at a rate that stays at least 5 m below the current dam crest elevation. The fill platform will typically meet the advancing tailings beach approximately 500 to 1000 m away from the dam.

The surface of the PAG disposal area will be progressively covered by tailings and the supernatant pond between Year 15 and 17 during low-grade ore processing when waste rock production has ceased with the cessation of active mining in the open pit.

5.4.3 Tailings Consolidation Considerations

The TSF filling schedule was based on an average settled density of 1.3 tonnes/m^3. Tailings consolidation testing was completed for the project and indicated the following settled density values for the various stages of tailings deposit consolidation:

- Undrained settled dry density is 1.19 tonnes/m^3.
- Drained settled dry density is 1.35 tonnes/m^3.
- Air dried final dry density is 1.49 tonnes/m^3 and took approximately four days to complete air drying.

A comparison between the average settled density of the tailings deposit used in the layout of the facility and the drained settled density determined by laboratory testing was completed. The design value of 1.3 tonnes/m^3 used in the design leads to a reasonably conservative estimate of storage capacity required in the TSF. There is an incremental potential overestimate of storage capacity in the TSF of 9 Mm^3 when comparing the design value to the laboratory value, which corresponds to less than 1 m of embankment height in TSF Site D. The incremental difference in terms of project cost is negligible and leads to a conservative increase in operational freeboard for the TSF.

5.5 FOUNDATION PREPARATION AND CUT-OFF TRENCH REQUIREMENTS

5.5.1 General

Extensive drilling, test pitting and lab testing was completed at the site to characterize the material type beneath the dams and investigate the depth to LPS (Low Permeability Subgrade) materials. LPS material has been defined using the following criteria:

- USCS material criteria as SM-SC, GM-GC, ML-CL material.

- Dense and/or compact.
- greater than 15% fines.
- Underlying material acts as an aquitard.

The dam foundations will be cleared and stripped in preparation for fill placement for each stage. The foundation preparation and cut-off trench requirements at each dam are discussed in the following sections.

5.5.2 Site C Main Dam

An allowance for the removal of up to 1 m of topsoil and unsuitable overburden across the dam footprint has been included in the design based on a review of test pit and drillhole information. Unsuitable soils will be removed from the foundation of the Site C Main Dam and the upstream low permeability zone will be keyed below the surficial sand and gravel layer. Keying into LPS is not required for the Site C Main Dam, but the underlying material is expected to have greater than 15% fines and be compact. The key-in layer does not need to act as an aquitard, but will not act as a flow conduit. The depth of the key trench is anticipated to be 3 to 5 m deep at the base of the Davidson Creek.

5.5.3 Site C West Dam

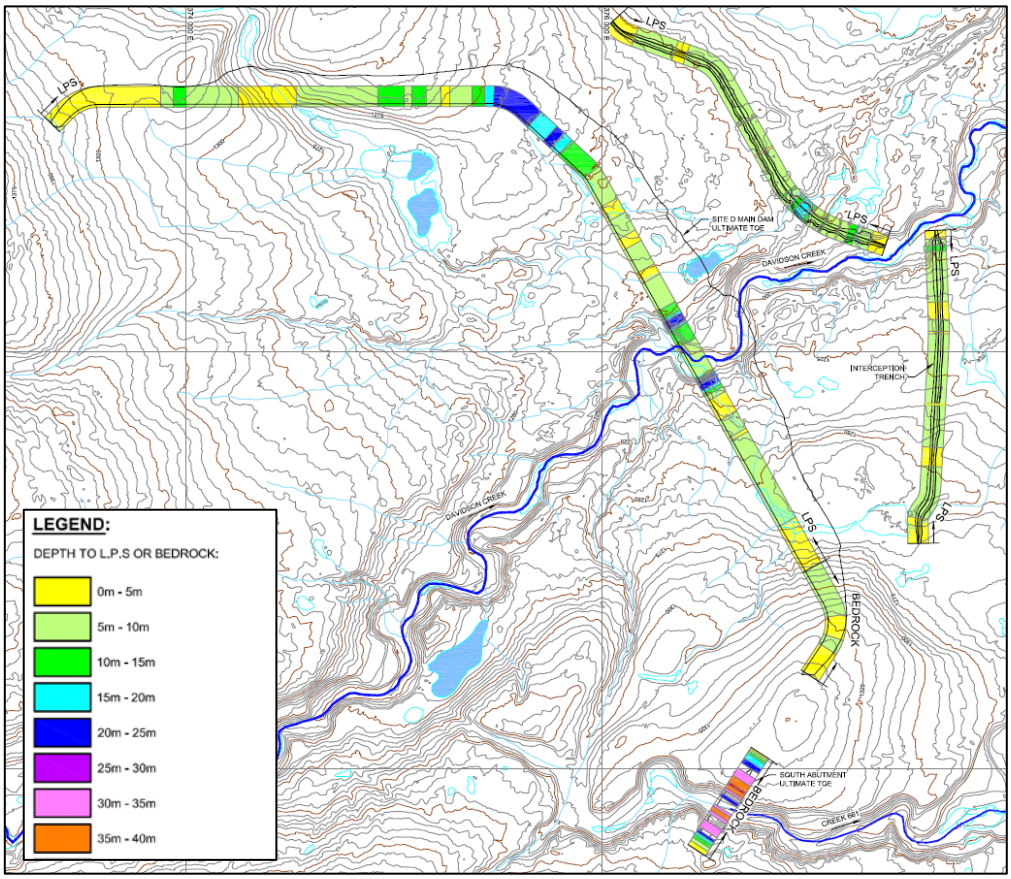
The Site C West Dam will require a 5 to 10 m cut-off trench to key the dam into bedrock or LPS. Intact bedrock was encountered at 6 m depth in the center of the channel, and LPS or bedrock materials are expected at less than 6 m-depth on the valley side slopes in the vicinity of this dam. An allowance for the removal of up to 1 m of topsoil and unsuitable overburden across the dam footprint has been included in the design based on a review of test pit and drillhole information.

5.5.4 Site D Main Dam

The drillholes encountered suitable LPS materials at depths ranging from 5 m to 25 m along the Site D Main Dam centreline. Depths to suitable LPS materials were greater adjacent to Davidson Creek and on the northeastern side of the dam alignment crossing the meltwater corridor eroded down into the glacial lodgement till deposits and in-filled with surficial sands and gravels; thus increasing the cut-off trench depth. The south segment of the Site D Main Dam that isolates the Creek 661 catchment will be founded on intact bedrock with excavation depths of 30 to 40 m. An allowance for the removal of up to 1 m of topsoil and unsuitable overburden across the dam footprint has been included in the design based on a review of test pit and drillhole information.

The estimated depth to LPS or bedrock for the design of the Site D Main Dam cut-off trench is shown on Figure 5.4.

Figure 5.4 Depth for Cut-off Trench Design at Site D Main Dam



NOTES:
1. ADOPTED FROM FIGURE 7.4 OF THE GEOTECHNICAL CHARACTERIZATION REPORT (Knight Piésold Ltd., 2013e).

5.6 EMBANKMENT CONSTRUCTION

The TSF Site C Main Dam will be constructed to elevation 1353 m and the TSF Site D Main Dam to elevation 1340 m. The total fill requirement for the tailings dam construction is 73.9 Mm^3, of which 8.1 Mm^3 is required for TSF Site C construction and 65.8 Mm^3 is required for TSF Site D. Construction material will be sourced from pit stripping and external borrow areas. TSF Site C will use 6.6 Mm^3 of material from pit stripping and 1.5 Mm^3 from external borrow sources. TSF Site D will use 59.2 Mm^3 of material from pit stripping and 6.6 Mm^3 from external borrow sources. A total of 65.8 Mm^3 will come from pit stripping and 8.1 Mm^3 from external borrow areas, which equates to 89% of materials from pit stripping.

The earth-rockfill dams will comprise the following zones:

- The core zone (Zone S) will be constructed from low-permeability glacial till from nearby external borrows and from pit stripping. The material will consist of well-graded silty sand with some gravel with a fines content of 20 to 60% passing the #200 sieve. This material will generally require no processing except for the removal of oversized particles. The material will be placed in maximum 300 mm lifts loose and compacted by combination of smooth drum vibratory rollers and pad foot compactors to 95% Standard Proctor Maximum Dry Density (SPMDD).

- The filter zone (Zone F) will be constructed with clean, fine to coarse sand. It will be placed adjacent to and downstream of the core zone to prevent piping of the core zone material and reduce pore pressures within the embankment. This material will be a processed non-reactive sand material from the aggregate screening area in the esker deposits located downstream of TSF Site D. Zone F will be placed and spread in maximum 600 mm lifts loose and compacted by 4 to 6 passes with smooth drum vibratory rollers.
- The transition zone (Zone T) will be constructed adjacent to and downstream of the filter zone (Zone F). It will be constructed with processed non-reactive fluvial, colluvial, or selected NAG4 or NAG5 waste rock. The transition zone will prevent the migration of fines from the core zone and Zone F into the pervious downstream shell zone (Zone C). Zone T will be placed and spread in maximum 600 mm lifts loose and compacted by 4 to 6 passes with smooth drum vibratory rollers.
- Shell zones (Zone C) will be constructed on both the upstream and downstream sides of the dam with random fill comprising overburden and specific waste rock material types. Compaction will be done with trucks across the main fill by routing haul truck patterns to produce a uniformly compacted lift, and a vibratory smooth drum roller used on the edges of lifts with a minimum 4 to 6 passes. The lift thickness and specified maximum particle sizes will be based on the truck placement fleet as follows:
  - Contractor Fleet: Placed and spread in maximum 1,000 mm lifts with a maximum particle size of 1,000 mm.
  - Mine Fleet: Placed and spread in maximum 2,000 mm lifts with a maximum particle size of 2,000 mm.

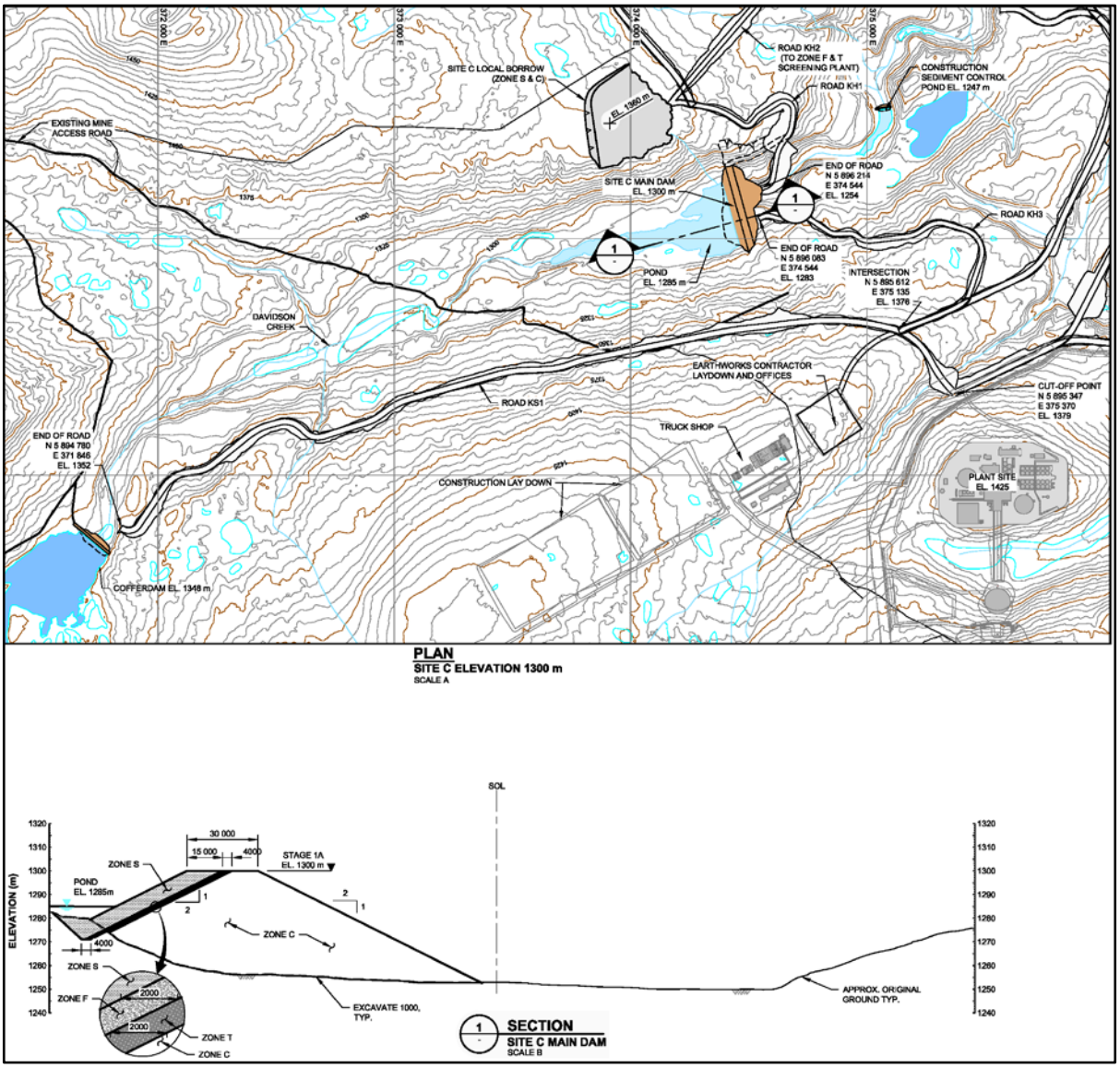
5.6.1 TSF Site C

TSF Site C will be constructed first to provide storage capacity for start-up of the process plant. The facility was designed to contain the first two years of tailings, PAG waste rock and may provide water storage for later years.

Initially, two cofferdams and a downstream sediment pond will be constructed to manage surface water. The cofferdam for the Site C Main Dam will be built into the dam footprint, and sized to contain flows from a 1 in 10 year wet August through October and 1 in 10 year 24 hour storm, with 2 m of additional freeboard. There will be a sediment pond constructed downstream of the Site C Main Dam footprint to allow for collection and pumpback of construction water runoff. The second cofferdam will be constructed upstream of the Site C West Dam, and will create and isolate the TSF from the fish compensation pond and channel constructed in the upstream reach of the catchment.

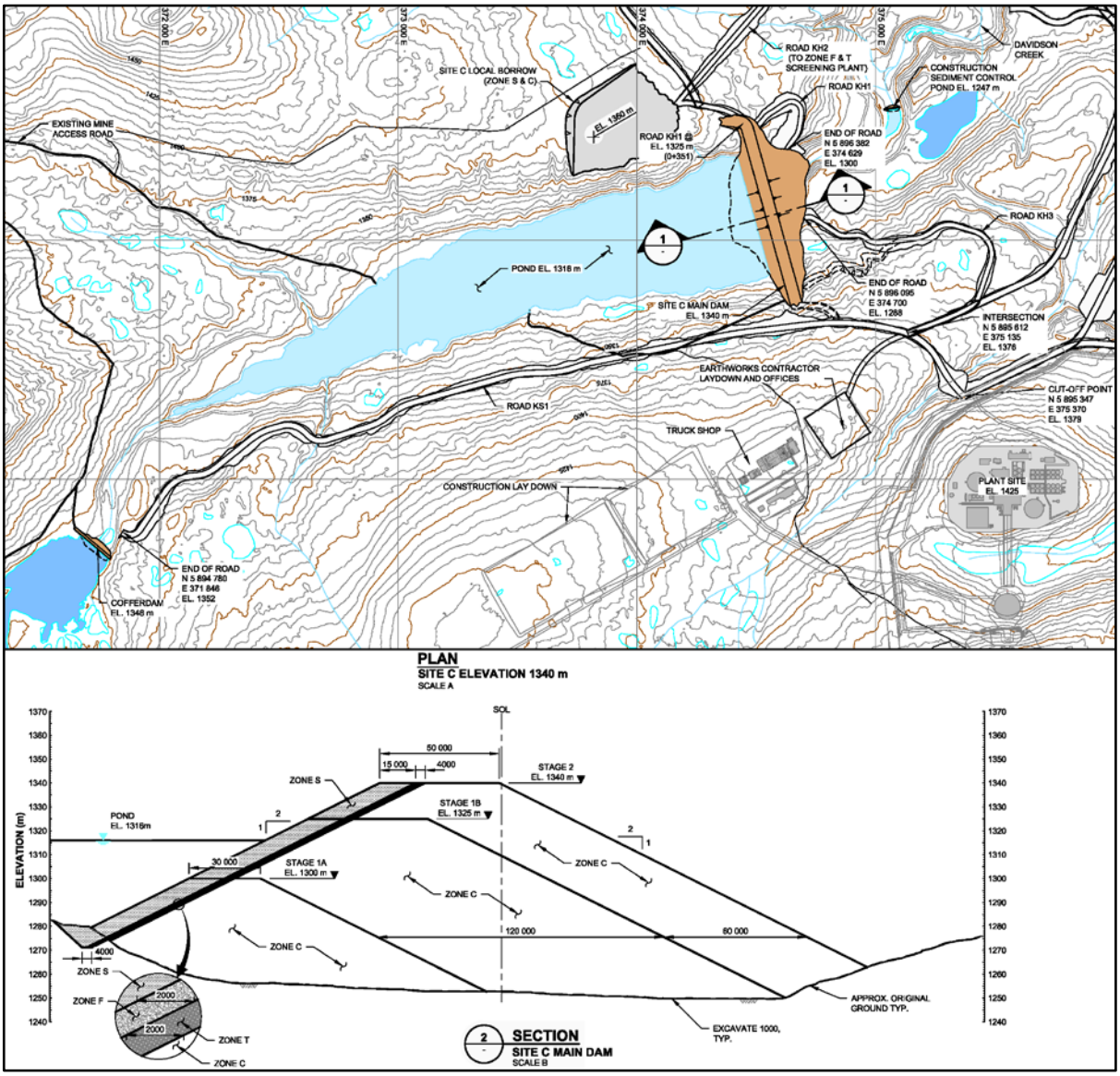
Construction of the Stage 1A dam will commence following completion of the sediment and erosion control features. The dam will be built to elevation 1300 m by the end of Year -2 as shown on Figure 5.5. Construction of Stage 1A will require 0.8 Mm^3 of construction material from nearby external borrow sources.

Figure 5.5 TSF Site C Year - 2 Construction Plan



Construction of the Stage 1B raise will commence beginning in early Year -1, immediately following completion of Stage 1A. The dam will be raised to elevation 1325 m to provide sufficient capacity to impound PAG waste rock generated during pre-production pit stripping and a start-up pond up to 10 Mm^3 with additional capacity to contain the IDF. Construction of Stage 2 will commence thereafter and will be completed by the end of Year -1. The dam will be raised to elevation 1340 m, providing additional capacity required to contain the first year of tailings and PAG waste rock. The Year -1 construction plan is shown on Figure 5.6. Construction of Stage 1B and 2 will require a total of 4.4 Mm^3 of construction material from pit stripping (4.0 Mm^3) and external borrow sources (0.4 Mm^3).

Figure 5.6 TSF Site C Year -1 Construction Plan



In the first year of operations the final lift (Stage 3) on the Site C Main Dam will be completed to elevation 1353 m. Construction of the final lift will commence in early Year 1 with a downstream shell zone step-out of approximately 50 m. The step-out will be constructed by the mine fleet during the first three quarters of the year, with the actual dam raise occurring later in the year. Construction of Stage 3 will require 2.7 Mm^3 of construction material, with 2.5 Mm^3 coming from pit stripping and the balance from external borrow sources (0.2 Mm^3). In addition, the Site C West Dam will be constructed to elevation 1353 m. The construction of the West Dam will require approximately 0.2 Mm^3 of material obtained entirely from external borrow sources. This includes a 5 m deep cut-off trench down to bedrock. The cut-off trench will be backfilled with Zone S (39,000 m^3) material and Zone F (2,500 m^3) material.

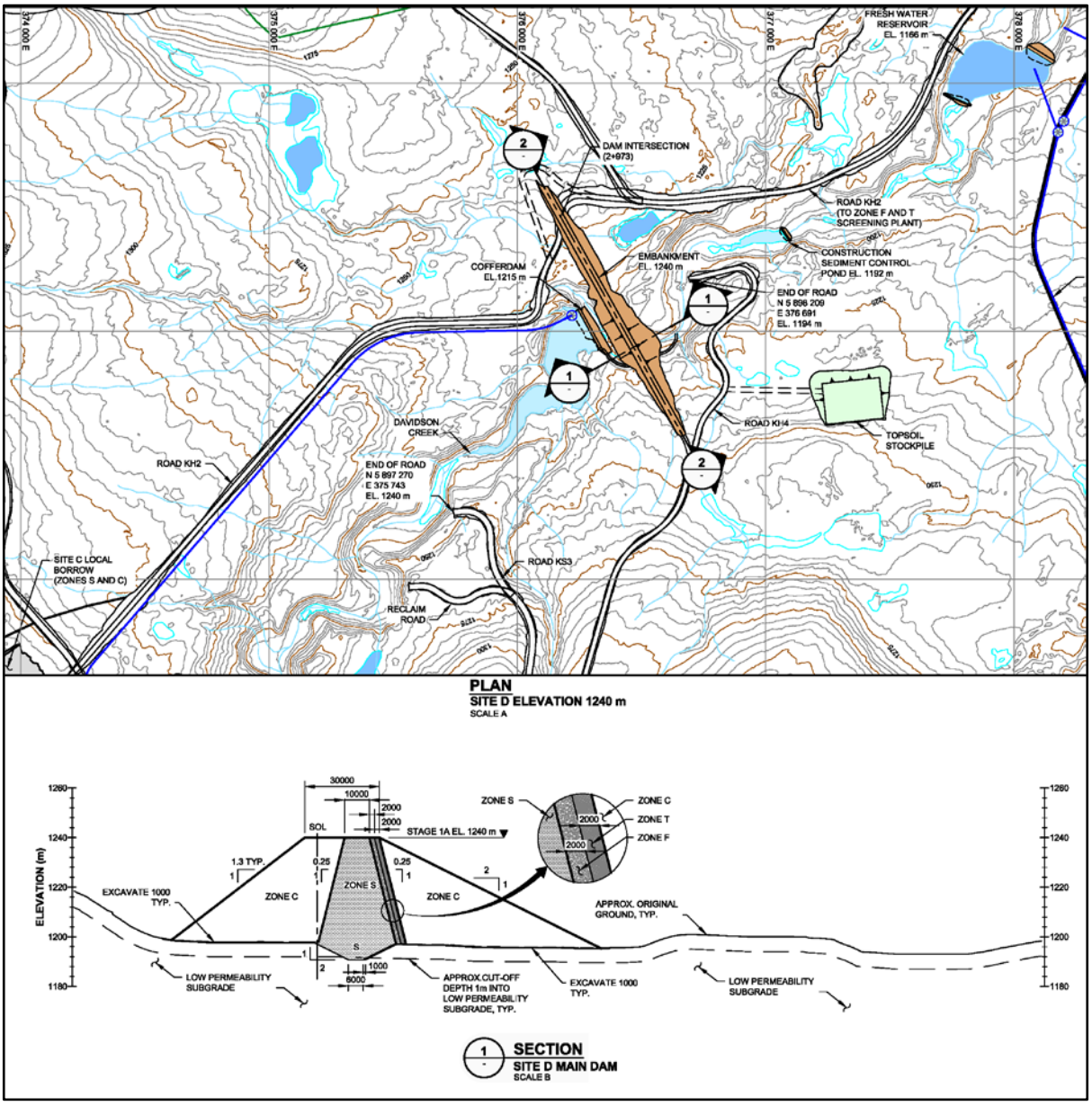
5.6.2 TSF Site D

TSF Site D will be constructed to manage tailings and mine waste for the remainder of the operational life of the project (Years 3 to 17). The facility is designed to contain tailings, PAG waste rock, and an operational supernatant pond of at least 10 Mm^3 with additional capacity to contain the IDF. The embankment foundations will be cleared and stripped in preparation for fill placement for each stage. A cut-off trench (COT) will be excavated through the surficial sands and gravels and keyed into the low permeability subgrade. The COT will be 7 m wide at the base of the excavation and will typically range from 5 to 20 m deep, with an average depth of approximately 15 m. The total excavation requirement for the cut-off trench is about 6 Mm^3. The cut-off trench excavation will be backfilled with approximately 5.8 Mm^3 of Zone S backfill and 0.2 Mm^3 of Zone F material.

Initially, a cofferdam and a downstream sediment pond will be constructed for water management purposes. The cofferdam will be built into the ultimate dam footprint and sized to contain flows from a 1 in 10 year wet October through December and 1 in 10 year 24 hour storm, with 1 m of additional freeboard. A spillway to bypass the construction area has been designed to manage a 1 in 200 year storm event. The cofferdam and spillway will be constructed in late 2015 to allow for water collection from the TSF Site D drainage area. A temporary pump system and pipeline sized to pump 1,500 m^3/h of water has been designed for this location to route the spring and summer high flows up to TSF Site C to accumulate the start-up water pond volume.

Construction of Stage 1A for TSF Site D will commence in Year -1. The COT will be excavated on the abutments first during the earlier months, with in-creek works occurring during the summer low flow period beginning in August. The dam will be built to elevation 1240 m by the end of Year -1 as shown on Figure 5.7. Construction of Stage 1A will require 2.1 Mm^3 of construction material, provided from pit stripping (1.1 Mm^3) and external borrow sources (1.0 Mm^3).

Figure 5.7 TSF Site D Year -1 Construction Plan



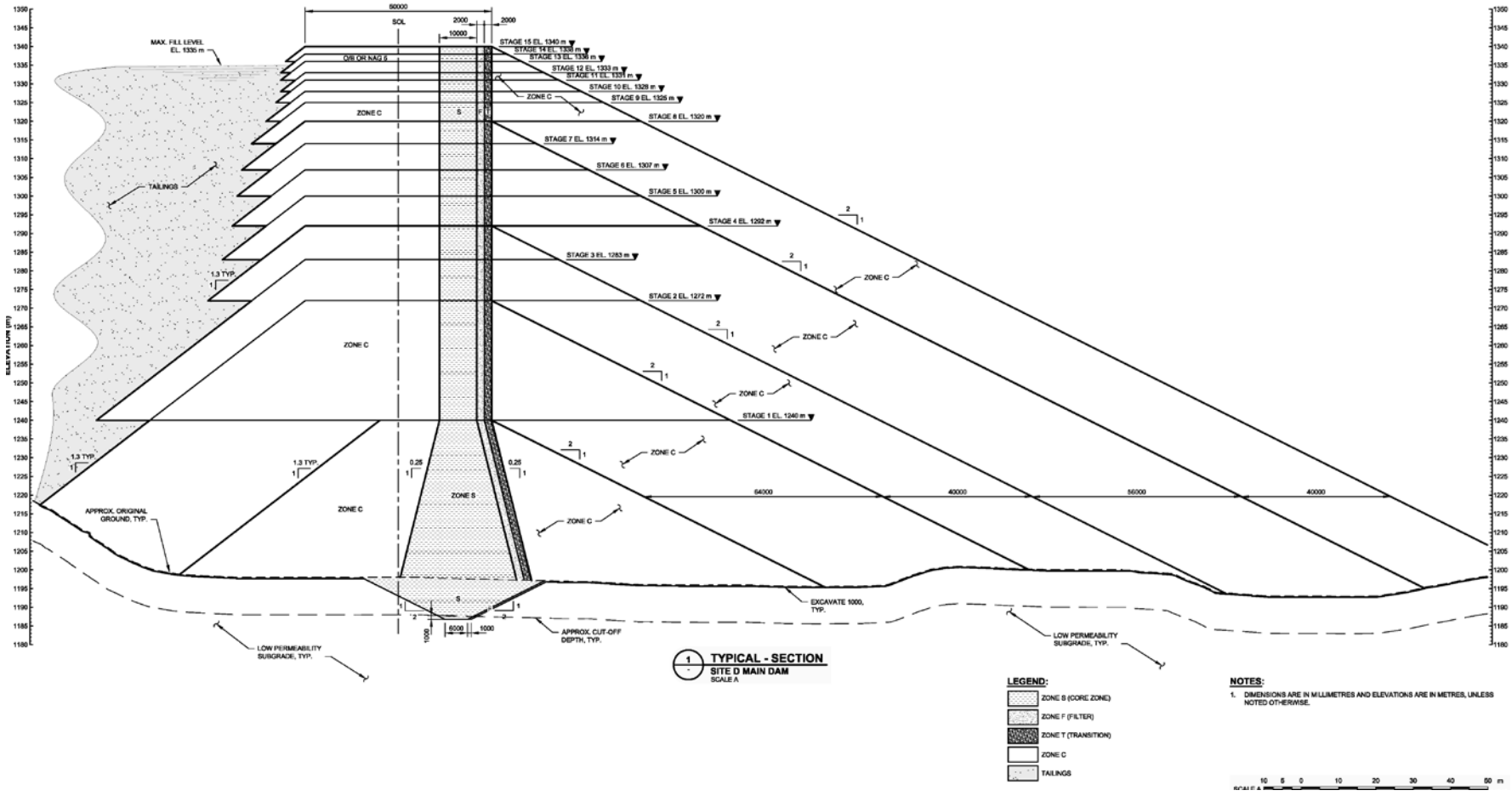
Construction of the Stage 1B dam will commence beginning in early Year 1, immediately following completion of Stage 1A. The dam expansion will consist of upstream and downstream step-outs of the shell zone (Zone C) at elevation 1240 m. The step-outs will be constructed in approximately 65 m wide sections and be completed by the mine fleet using select material from pit stripping. Construction of Stage 1B will require 2.7 Mm^3 of material from the pit. The detailed mine plan shows the mine fleet will deliver 4.1 Mm^3 during 2017, and the additional 1.4 Mm^3 will be used to commence construction of the next downstream step-out to support future dam stages.

Construction of Stage 2 will commence in Year 2 and the tailings dam will be raised to elevation 1272 m, providing enough capacity to impound PAG generated during Year 2, tailings and PAG

waste rock generated during Year 3, and a pond up to 10 Mm^3 with additional capacity to contain the IDF. Construction of Stage 2 will require a total of 7.2 Mm^3 of construction material; 6.2 Mm^3 from pit stripping and 1 Mm^3 from reuse of COT excavation material and other external borrow sources.

The tailings dam will be raised annually thereafter to maintain the storage capacity of the TSF. Each raise is designed to meet the projected design storage requirements. The staged expansion of the Site D Main Dam is shown on Figure 5.8.

Figure 5.8 TSF Site D Main Dam Staged Expansions



The mining fleet will provide from pit stripping Zone S (core) and Zone C (shell) material for raising the dam. The filter (Zone F) and transition (Zone T) will be sourced from the aggregate screening area located downstream of the TSF. Zone S material will be stockpiled near the TSF during the initial 8 years of pit stripping to build a 3 Mm^3 stockpile, and re-handled by the mine fleet in the later years of dam expansion to provide Zone S for the core zone and COT.

5.6.3 Winter Construction Considerations

Open pit mining will be a continuous process, and the construction of the tailings embankments will reflect this. Winter construction will be necessary in order to reduce re-handling of materials and to maintain the required crest elevation from year to year. It is expected that Zone C material placement in the upstream and downstream shell zones will be completed during the winter. Core zone and filter/transition zone material placement will be scheduled in the summer months as much as possible, but from time to time will occur in the winter months if summer construction delays are encountered.

Precedent exists for the construction of earthfill structures in freezing conditions, with special considerations. These include Knight Piésold supervised construction of the Kemess Mine tailings embankment, and more recently the Mt. Milligan Tailings Storage Facility, both of which are located in central B.C. ▲R2

Embankment fill, particularly in the core, filter and transition zones, must be compacted before it freezes in order to meet density requirements. Haul time and compaction methods will need to address this priority – for example, sheep's foot packers leave depressions in the fill that increase the rate of heat loss and collect snow. It may be more efficient to have loaded haul trucks make several passes over a lift before dumping.

A lift may freeze after it has been compacted without significantly reducing its density. Material may be placed on top of a frozen lift provided that ice, snow, and loose frozen material are removed first. An acceptable fill surface is 90% free of ice and snow, with the remaining 10% consisting of small discontinuous patches. Small areas will be prepared immediately in front of the advancing lift and covered as quickly as possible.

Borrow areas require careful management in freezing conditions, as frozen material must be separated and spoiled. Snow and frozen material will be removed from working areas just prior to excavation to minimizing re-freezing.

Haul roads will require extra attention in winter to maintain safety and keep haul time from increasing dramatically. Extra equipment such as sand trucks and graders will be necessary as will a supply of road sand.

Spoil factors and equipment down time increase as temperatures decrease. The loss of efficiency during winter months can be reduced by clearly outlining a set of construction procedures in advance. All QA staff, operators and supervisors will be aware of the procedures. It may not be possible to place core zone material properly in temperatures below approximately -15 ^{o}C, even with quality procedures in place. It may be more efficient to place coarse rockfill in the embankment shell zones during these times and schedule overburden material removal from the pit to occur in the summer months so it can be utilized efficiently in embankment construction.

5.7 SEEPAGE ANALYSES AND SEEPAGE CONTROL MEASURES

Seepage will primarily be controlled by the low-permeability core zone constructed prior to the development of the tailings beach, the cut-off trenches, and the low-permeability subgrade materials. A description of the geotechnical and hydrogeological site investigation programs completed in support of the project, and the interpretation of the foundation material characteristics are described in Section 4 of this report. Seepage from the TSF will result from infiltration of ponded water directly through the embankment fill and the natural ground, and from expulsion of pore water as the tailings mass consolidates.

Special design provisions incorporated into the tailings dam design to minimize seepage losses include the development of extensive tailings beaches (which isolate the supernatant pond from the dam), hydraulic barriers, embankment drainage collection systems, and toe drains at the downstream toe of the dams to reduce seepage gradients. Additional seepage collection ditches constructed along the toe of the embankments will collect seepage and surface runoff, and direct the flow to the pumpback systems.

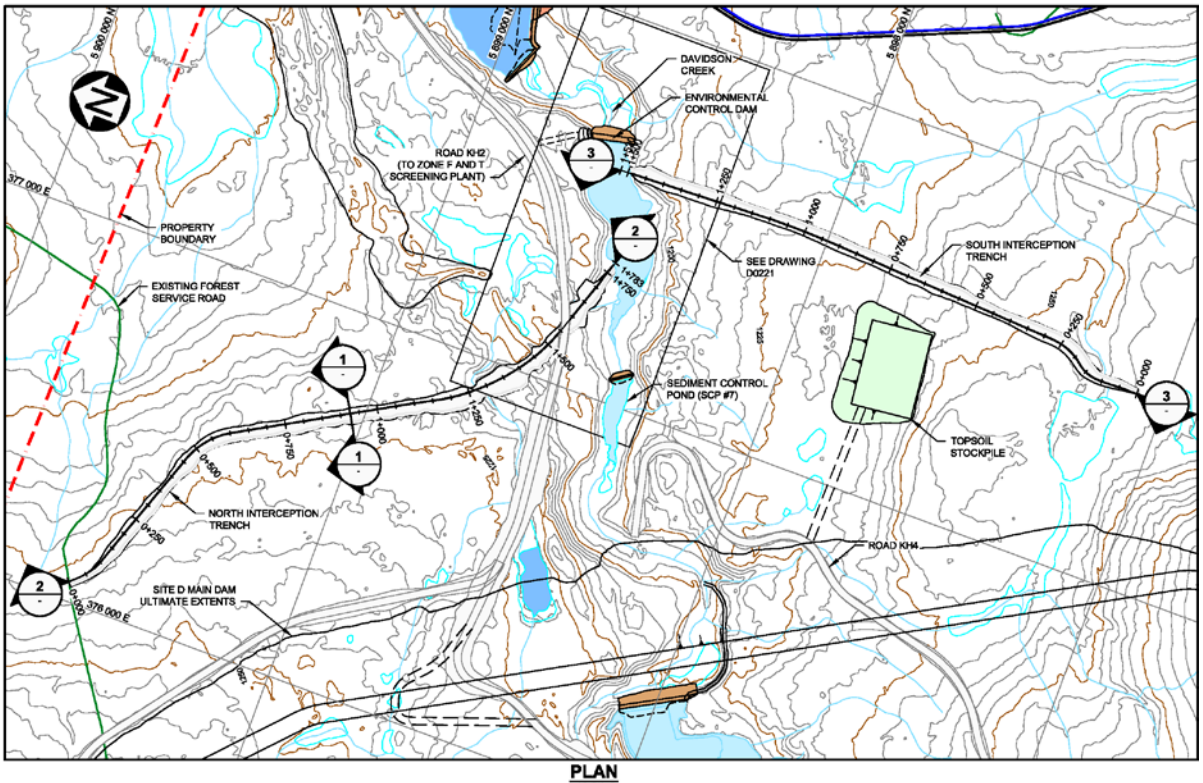
Seepage analyses were completed for TSF Sites C and Site D (Appendix C). Results indicate that approximately 55 L/s of seepage is expected to pass through the embankment and foundations of the Site D Main Dam at the maximum extent of the TSF in Year 17. The majority of the embankment seepage (53 L/s) would flow through the main section of the dam that faces downstream along Davidson Creek, the vast majority of this seepage is expected to be recoverable using the special design provisions discussed above and the secondary downstream collection systems associated with the Environmental Control Dam (ECD), discussed below. The seepage modeling found a negligible amount of seepage (0.2 L/s) could pass from the foundation of the Site D Main Dam beyond the ECD, located approximately 1 km downstream of the tailings dam. Virtually all of the seepage was predicted to daylight to surface or within the surficial sand and gravel zone upstream of the ECD.

The remaining 2 L/s of total seepage leaving the TSF is predicted to pass through the north and south abutments in weathered and fractured bedrock and may be unrecoverable without additional engineering measures.

Secondary seepage collection at the ECD will be achieved by constructing a collection dam approximately 1 km downstream at a topographic low point in Davidson Creek. This location was established based on a hydrogeology assessment where potential seepage paths were projected to daylight. A pumpback system will manage seepage and storm water inflows. Recovered water will be pumped to the TSF Site D and the collection pond will be maintained in a dewatered condition to the maximum extent practical. Seepage through this dam will be captured in an embankment drain system and sump, and pumped back to the ECD pond.

Two seepage interception trenches (one on each side of Davidson Creek) will be excavated through the surficial sand and gravel terraces downstream of the Site D Main Dam and will report to the ECD pond. The seepage interception trenches (North and South) are located based on the results of geotechnical drilling along the proposed alignments. The trenches will be excavated and keyed into the low-permeability subgrade (as shown on Figure 5.4 in Section 5.5) and will be approximately 3.3 km long with a depth ranging from 5 to 15 m. The ECD and interception trench layout is shown on Figure 5.9.

Figure 5.9 Environmental Control Dam and Interception Trenches



Embankment seepage from TSF Site C Main Dam is predicted to be approximately 21 L/s during Years 1 and 2 and will be captured at the downstream construction sediment control pond and recycled back to the TSF Site C pond with the exception of a small portion of seepage recovered in TSF Site D. This seepage recovery and pumpback system will be decommissioned at Year 3 and all subsequent seepage will be recovered by the seepage control measure developed for TSF Site D.

Groundwater monitoring wells have been installed in the downstream areas below Site D and could be converted to recovery wells, if required, to recover any foundation seepage. Additional monitoring wells will be installed prior to commissioning Site D as required.

The Site C West Dam seepage will be controlled in the long term by constructing a pond upstream of the TSF with an elevation higher than the TSF supernatant pond, and by selectively discharging the benign oxide tailings to hydraulically separate the supernatant pond from the West Dam. The elevation of the supernatant pond in Site C will be passively controlled by the closure spillway for the facility. The fresh water pond level upstream of the TSF will create a hydraulic barrier establishing a fresh water seepage hydraulic gradient towards the TSF. The area between the two dams will be backfilled and graded towards the fresh water pond. A seepage sump and pumpback system will be constructed between this pond the TSF, which will be used for monitoring water quality.

5.8 EMBANKMENT STABILITY ANALYSES

Stability analyses were carried out to confirm the stability of the embankments under both static and seismic loading conditions (Appendix D). These analyses comprised checking the stability of the embankment arrangement for each of the following cases:

- Static conditions during operations and post-closure.
- Earthquake loading from the operating basis earthquake (obe) and the maximum design earthquake (mde).
- Post-earthquake conditions using residual (post-liquefaction) tailings strengths.

The stability analyses were carried out using the limit equilibrium computer program SLOPE/WFactors of safety have been computed using the Morgenstern-Price method.

In accordance with international recommendations (ICOLD, 1995) and standard industry practice, the minimum acceptable factor of safety for the tailings embankment under static conditions is 1.3 for short-term operating conditions and 1.5 for long-term (steady-state and post-closure) of the TSF. A factor of safety of less than 1.0 is acceptable under earthquake loading conditions provided that calculated embankment deformations resulting from the seismic loading are not significant and that the post-earthquake stability of the embankment maintains a factor of safety greater than 1.2, implying there is no flow slide potential.

The seismic stability assessment of the TSF has included estimation of seismically induced deformations of the dam from the OBE and MDE events. The OBE has been defined as the 1 in 500 year earthquake with a mean Peak Ground Acceleration (PGA) of 0.04g and design earthquake magnitude of 8.5. The MDE corresponds to the 1 in 5,000 year earthquake with a mean PGA of 0.08g and design earthquake magnitude of 8.5. The 1 in 10,000 year earthquake was also considered to demonstrate the robustness of the embankment design to seismic loading. The PGA for the 1 in 10,000 year event is 0.11g.

The stability analyses results satisfy the factor of safety design criteria and shows the proposed design is adequate to maintain both short term (operational) and long term (post-closure) stability. The seismic analyses indicate any embankment deformations during earthquake loading from the OBE, MDE, and 1 in 10,000 year event would be minor and would not have a significant impact of the available embankment freeboard or result in any loss of embankment integrity. The results indicate the embankments are not dependent on tailings strength to maintain overall stability and integrity.

5.9 TAILINGS DISTRIBUTION SYSTEM DESIGN

Tailings from the process plant will be thickened and delivered by gravity through a pipeline from the thickener to either the TSF Site C or the TSF Site D TSF. The pipeline will be laid parallel to a service road from the process plant to an energy dissipating drop box where the tailings distribution pipelines to TSF Site C and Site D will separate. The tailings drop box will reduce the extra pressure head during the early stages and allow for discharge at closer locations along the dams. A bypass pipeline around the tailings drop box maintains sufficient head for delivery of tailings to the far ends of TSF Site C and Site D. The feasibility design basis and component selection of the tailing distribution system was presented previously (Knight Piésold Ltd., 2013l). The arrangement and

development sequence of the tailings distribution system is shown on Figure 5.10 and described below.

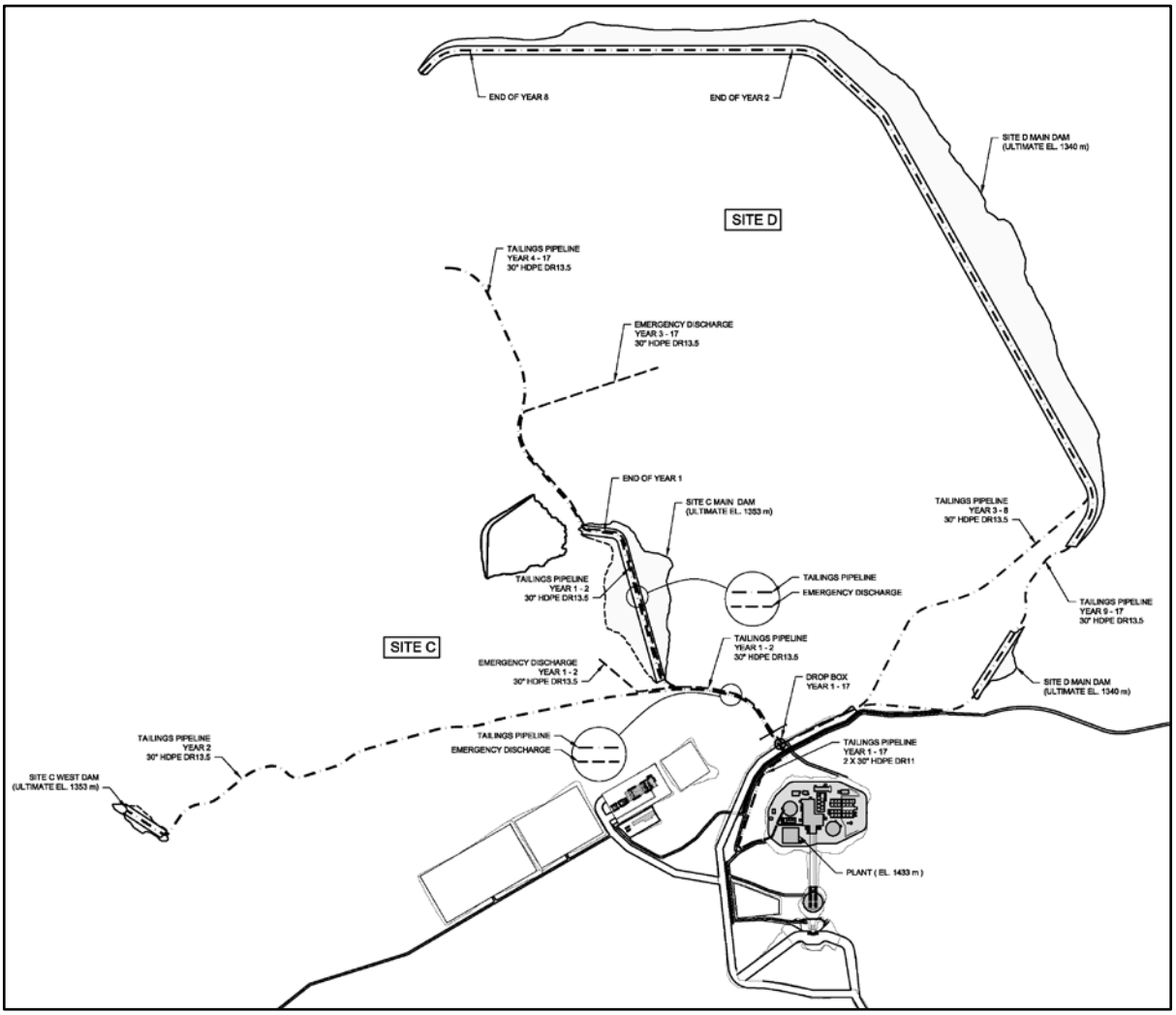
The tailings pipelines are sized to enable gravity flow for the entire duration of the mine life while dissipating as much energy head through friction as possible. This energy dissipation is necessary considering the substantial elevation difference between the plant site and the TSF that varies from 161 m to 80 m throughout operations. The majority of the pipelines for the tailings distribution system are 30 inch HDPE DR13.5.

Additional pipelines extending from the drop box to either TSF Site C or Site D will be constructed to allow for emergency discharge to each TSF. The discharge locations for these pipelines will be at sufficient distances from the reclaim barges to limit accumulation of suspended solids in the reclaim water in the vicinity of the barges.

The tailings distribution pipeline will initially extend along a service road to the Site C Main Dam where tailings will be deposited during the first two years of operations. Spigot locations will be placed every 150 m along the dam crest. The tailings beach will provide a low permeability transition zone between the coarse, permeable waste rock in the center of the TSF and the tailings embankments providing seepage control.

The pipeline to Site C will be extended to the West Dam in Year 1. Spigots will be placed every 150 m along the Site C West Dam and along the service road on the south perimeter of the TSF to enable tailings deposition around the perimeter of the TSF. Selective tailings distribution methods will be used to hydraulically separate the supernatant pond from the West Dam with the benign oxide tailings, and for capping of the PAG tailings and waste rock with more benign oxide tailings in Years 2 and 3.

Figure 5.10 Tailings Distribution System Arrangement



The tailings pipeline will be extended from the drop box to the Site D Main Dam along a service road in Year 2 of operations to allow for deposition of tailings at Site D beginning in Year 3. Spigot locations will be placed every 150 m along the dam crest. The pipeline that extends to the Site C West Dam will be decommissioned in Year 4, removed, and placed along a service road on the west side of TSF Site D extending to the north of the Site C Main Dam. This will allow for the discharge of tailings on the west side of the facility during dam raises on the Site D Main Dam and for selective tailings distribution to manage the size and location of the supernatant pond.

The tailings distribution pipeline along the Site D Main Dam will typically be raised with each stage of the dam. The dam crest elevation will reach 1300 m in Year 5 of operations and the tailings pipeline will be extended fully around TSF Site D, to allow for deposition along the majority of the perimeter. In Year 8 of operations a portion of the service road and tailings distribution pipeline running from the drop box to the Site D Main Dam will be relocated to allow access to the advancing dam crest elevation along the southeast side of the facility. This service road will then allow for the expansion of the TSF to the ultimate dam crest elevation of 1340 m.

A north-south oriented causeway may be constructed towards the end of operations into the Site D tailings basin area from the south side across the PAG stockpile area to allow for the efficient spigotting of tailings into the basin to maximize storage volume and develop the closure configuration. The causeway will be capped with a thin overburden layer and blanketed with a thin veneer of tailings. This submerged topographic ridgeline creates a longer flow path for the pit lake inflow to the TSF spillway discharge point and removes the potential for a short-circuit to develop in the TSF lake.

5.10 GEOTECHNICAL MONITORING INSTRUMENTATION

Geotechnical instrumentation will be installed along one plane through the Site C West Dam, Site C Main Dam and Fresh Water Reservoir, and in five planes through the Site D Main Dam. The instrumentation will be installed during construction and over the life of the project. The geotechnical instrumentation will be comprised of vibrating wire piezometers, slope inclinometers and surface movement monuments, and will be installed in the foundations, embankment fill, and on the embankment crests. An instrumentation plan was developed for eight proposed monitoring planes. A section for each plane was prepared showing preliminary instrumentation requirements. The location, types, and number of instrumentation will be further evaluated during detailed design of the project. The plan and sections are included in the drawings in Appendix A (Drawings D0180 to D0186). Movement monuments will be spaced 100 to 200 m apart. A summary of the instrumentation in each plane is provided in Table 5.3. The instrumentation for the ECD will be similar to Plane 8 for the Fresh Water Reservoir. ▲R2

Table 5.3 TSF Instrumentation Summary

Instrumentation Plane (and Location)	Vibrating Wire Piezometers			Slope Inclinometer
	Foundation	Fill	Tailings	
1 (Site C West Dam)	2	3	0	0
2 (Site C Main Dam)	8	6	0	0
3 (Site D Main Dam)	2	9	1	0
4 (Site D Main Dam)	2	9	1	2
5 (Site D Main Dam)	2	13	3	2
6 (Site D Main Dam)	2	7	0	2
7 (Site D Main Dam)	1	8	0	0
8 (Fresh Water Reservoir)	6	7	N/A	0
Total	**25**	**62**	**5**	**6**

▲R2

NOTES:
1. INSTRUMENTATION PLANE NUMBER IS BASED ON DESIGN DRAWING D0180 INCLUDED IN APPENDIX A.

Instrumentation monitoring will be routinely completed during construction and operations. Measurements during construction will be taken and analysed on a routine basis to monitor the response of the embankment fill and the foundation from the loading of the embankment fill. The frequency of monitoring for the piezometers and inclinometers may be decreased once the effects of initial construction have dissipated. Surface monuments will be surveyed at least twice per year during operations. An Operations Maintenance and Surveillance (OMS) Manual will be prepared following initial construction and prior to commissioning of the TSF to provide comprehensive operating instructions for the TSF and related facilities. ▲R2

5.11 NAG DISPOSAL AREAS AND LOW-GRADE ORE STOCKPILE

Waste dump areas have been identified and subsequently refined and optimized to minimize surface and seepage water control requirements. NAG waste rock (NAG4 and NAG5) and overburden will be combined and placed in two permanent engineered dumps adjacent to the pit on the east and west sides (East Dump and West Dump). The dump foundations will be cleared in preparation for fill placement. A 30 m strip along the advancing dump toe will be stripped and the topsoil will be spoiled in a windrow at the toe. Selective stripping of topsoil in other areas within the dump foundations will be completed to remove thick areas of topsoil that would be valuable for reclamation or in apparent drainages where increased pore pressures or weak foundation materials could affect dump stability. The toe of the dump will be keyed into competent sub-grade with oversized material to enhance dump stability. A total of 63 Mm^3 of material will be stored in these waste rock dumps outside of the TSF. Water that infiltrates through the East dump will be collected at the base of the dump in a collection pond and directed by gravity to the TSF. The dumps will be developed with overall slopes to facilitate reclamation with growth media at closure. Surface water runoff during operations and at closure will be diverted around the dump to the TSF. Temporary surface water ditches will be field fit with the advancing fill platforms within the footprint of the dumps to manage surface water runoff and seepage. ▲R2

The low-grade ore (LGO) stockpile location has been optimized to minimize the risk of impacts to the surrounding environment and limit surface water control requirements to the maximum extent practical. Additional details about the surface water and seepage control infrastructure for the LGO stockpile are included in Section 6.7.

An assessment of the stability rating for the East Dump, West Dump, and LGO stockpile has been carried out using the waste and stockpile stability rating system as described in the interim guidelines provided by the B.C. Mine Waste Rock Pile Research Committee (BCMWRPRC, 1991). All three areas have been classified as “Class II” low failure hazard dumps (rating of 500). The development of the stability rating for each facility is shown on Table 5.3 below.

Stability analyses for each of the dump facilities have been carried out in accordance with the recommended level of effort indicated the guidelines. The stability analyses were carried out using the limit equilibrium computer program SLOPE/W with a similar methodology to the stability analyses for the TSF embankment that was discussed in Section 5.8. The stability of each dump was assessed for a deep seated failure surface propagating a minimum of 100 m from the crest of the pile, a mid-sized failure surface propagating a minimum of 50 m from the crest, and a smaller scale failure surface allowed to form just at the crest of the pile. The results of the stability analyses satisfy the requirements for factors of safety as indicated in the guidelines. The seismic analyses indicate that any embankment deformations during earthquake loading from the OBE and MDE would be minor and would not result in significant displacement in the piles. Detailed results of the dump stability analyses are provided in Appendix D. ▲R2

Table 5.4 Waste Dump and LGO Stockpile Stability Rating Summary

Key Factors Affecting Stability	Point Rating					
	West Dump		Low Grade Ore Stockpile		East Dump	
	Condition	Point Rating	Condition	Point Rating	Condition	Point Rating
Dump Height	75	50	70	50	90	50
Dump Volume	Medium	50	Medium	50	Medium	50
Dump Slope	Flat	0	Flat	0	Flat	0
Foundation Slope	Flat	0	Flat	0	Flat	0
Degree of Confinement	Moderately Confined	50	Moderately Confined	50	Moderately Confined	50
Foundation Type	Competent	0	Competent	0	Competent	0
Dump Material Quality	Moderate	100	Moderate	100	Moderate	100
Method of Construction	Mixed	100	Mixed	100	Mixed	100
Piezometric & Climatic Conditions	Intermediate	100	Intermediate	100	Intermediate	100
Dumping Rate	Slow	0	Slow	0	Slow	0
Seismicity	Moderate	50	Moderate	50	Moderate	50
DUMP STABILITY RATING		**500**		**500**		**500**
	Class	**Failure Hazard**	**Class**	**Failure Hazard**	**Class**	**Failure Hazard**
Dump Stability Class	II	Low	II	Low	II	Low

The guidelines (BCMWRPRC, 1991) specify the following recommended level of effort for investigation and design of mine rock and overburden piles with a low failure hazard rating:

- Thorough site investigation.
- Test pits, sample may be required.
- Limited lab index testing.
- Basic stability analyses required.
- Routine visual and instrument monitoring.

The level of effort completed to date for the East Dump, West Dump, and LGO stockpile meets the effort level suggested in the guidelines.

In accordance with the guidelines, routine visual and instrument monitoring of the waste rock dumps and LGO stockpile will be required during construction, operation, and closure of the facilities to confirm design assumptions, document behavior and establish loading limits. Instrumentation will be required in critical locations of the dump including; steep areas, near the toe of the dump, areas with potential for increased piezometric pressures, zones of rapid or steep dump placement, or weak foundation soils observed during construction. The instrumentation will include: ▲R2

- Piezometers to measure pore water pressures in the foundation and waste rock and overburden
- Surface movement monuments to monitor for deformations, and
- Surface extensometers to monitor any tension crack development, as required.

Protocols for visual monitoring and review of instrumentation and monitoring data, and subsequent action will be developed as part of a waste rock management or monitoring plan during a subsequent phase of project design. Observation and recording of information will be completed systematically and consistently using staff familiar with the work. The plan will include the following elements: ▲R2

- Construction logs including material source and quantity
- Photographic records and written inspection reports
- Physical surveys of the extent of the dump using traditional or GPS methods to detect any surface movements and to record the rate of dump placement
- Laboratory test work of fill materials including index properties, shear strength and durability testing to confirm design assumptions
- Regular monitoring of instrumentation and analysis, and
- Periodic review and inspection by a qualified external geotechnical engineer.

▲R2

6 – WATER MANAGEMENT SYSTEM DESIGN

6.1 WATER MANAGEMENT OBJECTIVES

The water management objective is to provide sufficient water to support the mill water requirements and maintain potentially acid generating (PAG) materials in the TSF in a subaqueous state, while mitigating environmental impacts to downstream receiving waters. Water will be controlled to minimize erosion in areas disturbed by construction activities and to prevent release of sediment-laden water to the receiving environment. This includes collection and diversion of surface water runoff, constructing and operating sediment control ponds, seepage collection systems, and pumpback systems. The key facilities requiring water management planning are the:

- Open pit.
- Plant site, truck shop, and laydown areas.
- Construction camp.
- Roads.
- TSF.
- East and West waste rock dumps.
- Low grade ore stockpile.

The key elements for water management are:

- Spillways.
- Collection and diversion ditches.
- ECD.
- Freshwater reservoir.
- Seepage collection and pump back systems.
- Fresh water supply system.
- Surface and groundwater monitoring systems.
- Sediment and erosion control measures including sediment control ponds for the facilities listed above.

Water within the project area will be recycled and used to the maximum practical extent by collecting and managing site runoff from both undisturbed and disturbed areas. Site runoff water will be collected and stored within the TSF and used to inundate the PAG waste rock and tailings solids to prevent ARD and minimize ML. Excess water will be stored in the supernatant ponds within the TSF and recycled to the mill for use in the process. The water supply sources for the project are as follows:

- Runoff from the catchment above the project site.
- Direct precipitation onto the TSF and runoff from the mine site facilities.
- Water recycle from the TSF supernatant ponds.
- Groundwater from open pit dewatering and depressurization.
- Fresh water pumped from tatelkuz lake for plant fresh water needs and to mitigate flow reductions in lower davidson creek for downstream fisheries.
- Periodic water supply from tatelkuz lake to supplement requirements for processing or to saturate PAG waste rock within the TSF, if required.

The following sections describe the water management strategies, design elements, and facilities through the construction (preproduction), operations, and closure phases of the project.

6.2 WATER MANAGEMENT AND SEDIMENT CONTROL

6.2.1 Sediment and Erosion Control

A construction phase Sediment and Erosion Control Plan (SECP) was prepared for the project as part of the study (Knight Piésold Ltd., 2013g). The plan outlines the objectives and strategies that will be implemented to manage water and mitigate erosion throughout the construction phase of the project. The key objectives of the SECP are the following:

- Minimize the extent of land disturbance.
- Isolate disturbed areas and contain sediment-laden water.
- Collect water for storage within the TSF for use during operations.

Six discrete areas of development have been identified within the project boundary for the SECP. These areas include:

- Construction laydown, truck shop, and earthworks contractor laydown and offices.
- Plant site and crusher.
- Construction camp.
- Borrow areas (aggregate screening area).
- TSF.
- Open pit and waste dumps.

Specific surface water control elements and measures will be implemented to minimize erosion and prevent sediment discharge into surrounding areas. Surface water sediment mobilization and erosion will be managed throughout the site by:

- Installing sediment controls prior to construction activities.
- Limiting the disturbance to the minimum practical extent.
- Reducing water velocity across the ground, particularly on exposed surfaces and in areas where water concentrates.
- Progressively rehabilitating disturbed land and constructing drainage controls to improve the stability of rehabilitated land.
- Applying slope roughening to the surface in rehabilitation areas to promote infiltration.
- Protecting natural drainages and watercourses by constructing appropriate sediment control devices such as collection and diversion ditches, sediment traps, and sediment ponds.
- Restricting access to rehabilitated areas.
- Constructing surface drainage controls to intercept surface runoff.

Subsurface water will be controlled by the use of sump pits, wells, or removable pumping stations to draw down the natural water table and provide dry stable construction areas. Excavations will be kept stable and workable by pumping water collected in the excavation sump pits to sediment control devices such as temporary holding ponds, sediment basins, or sediment filter bags where required.

An adaptive management approach will be implemented that allows sediment and erosion control works to be field fit to suit conditions encountered during construction. Best management practices (BMPs) will be implemented prior to and during construction. Regular monitoring and maintenance of implemented BMPs will confirm success of the plan. The temporary sediment and erosion control

features will be reclaimed after the area has stabilized. The following is a summary list of BMPs that may be used at the project site depending upon conditions encountered:

- Vegetation management and re-vegetation.
- Mulching.
- Rolled erosion control products.
- Surface roughening.
- Re-contouring.
- Silt fencing.
- Temporary sediment traps and sediment basins.
- Filter bags.
- Flocculants.
- Collection or diversion ditches.
- Culverts.
- Exfiltration areas.

In addition to the BMPs described above, a sediment control pond (SCP) has been designed for each major area of disturbance.

The SCPs were designed based on the Guidelines for Assessing the Design, Size and Operation of Sedimentation Ponds Used in Mining (BC MOELP 1996). The ponds were designed to accommodate a live storage equal to the 1 in 10 year 24-hour storm event with a half meter of freeboard, and to settle out sediment particles sized 0.01 mm (and larger), while providing a retention time of at least 10 hours. Each pond and pond outlet spillway was designed to withstand a 1 in 200 year 24-hour storm event, in accordance with the aforementioned guidelines. AMEC conducted studies on overburden samples from the Blackwater site to identify an appropriate flocculent to aid sediment settling, if required. Any surface water discharges to receiving streams from the SCPs will meet federal and provincial discharge standards.

The collection and diversion ditches were designed for the 1 in 10 year 24-hour storm event. All ditches will be accompanied by a silt fence installed downslope of the ditch to prevent potential residual sediment movement along undisturbed slopes.

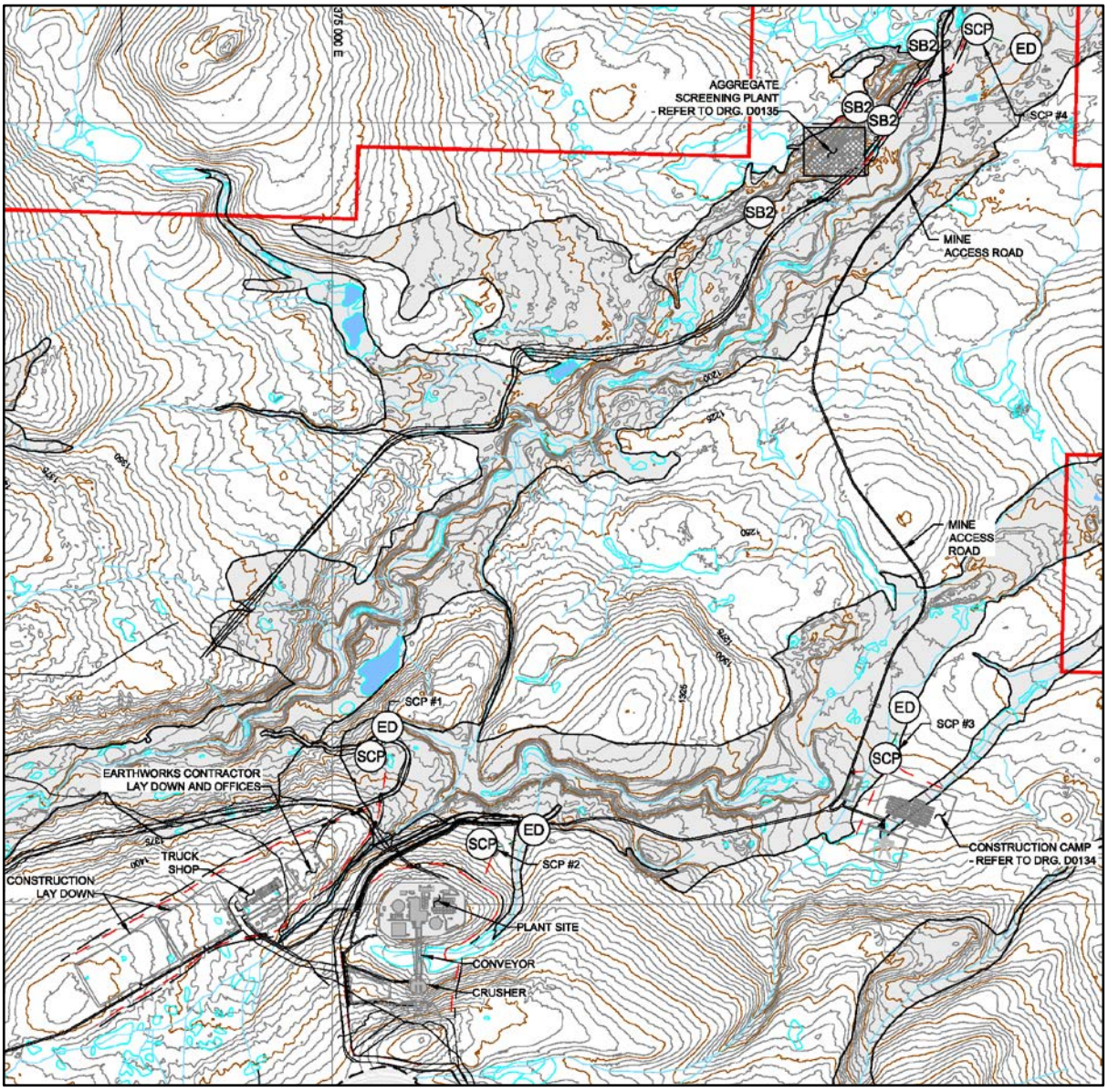
6.2.2 Early Sediment Control Activities

The sequence of construction of the mine facilities was evaluated as part of the study. Construction will initially commence in four areas. These four areas are as follows:

- Construction laydown areas (SCP #1).
- Plant site and crusher area (SCP #2).
- Construction camp area (SCP #3).
- Aggregate screening area (SCP #4).

A SCP has been designed for each of these areas and will be constructed prior to disturbance at the sites. A discharge is expected from the pond at each location during construction. These four SCPs are shown in Figure 6.1.

Figure 6.1 Sediment and Erosion Control Plan - Start of Year -2



The following sequence of activities for construction of SCPs will be followed:

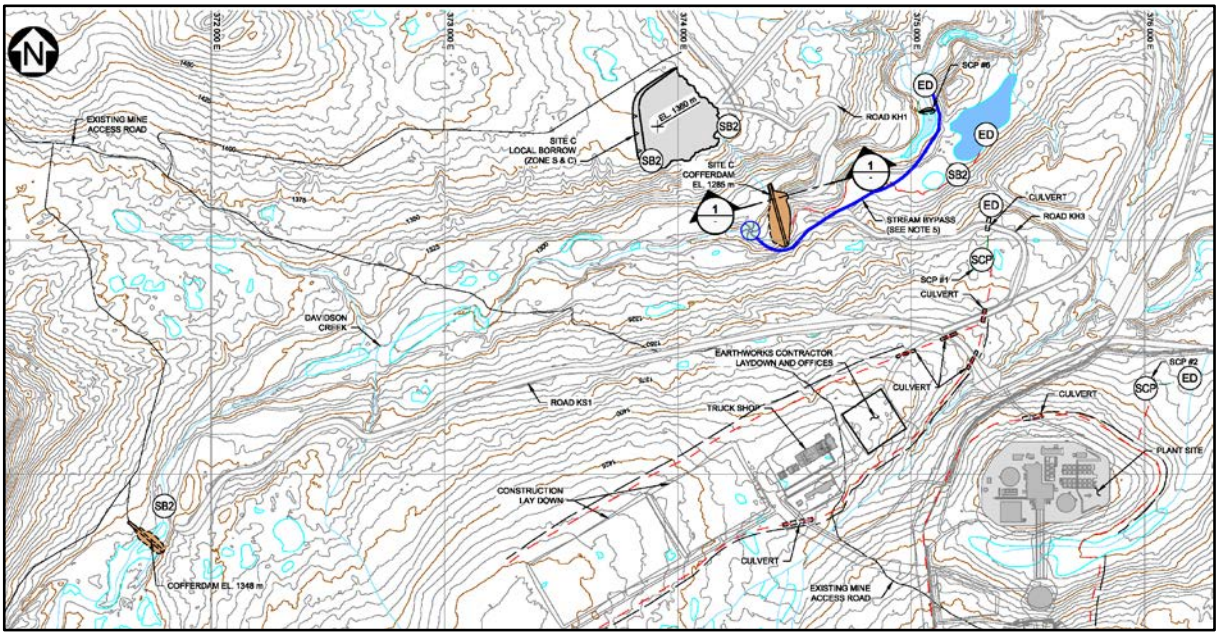
- Construct access roads into each area and install appropriate BMPs along the routes.
- Construct SCPs and discharge channels.
- Construct collection ditches around the perimeter of each area reporting to the SCP.
- Construct the facilities in each area.
- Monitor and maintain the SCP and BMPs until construction is complete or the TSF is available to collect and contain site runoff.

6.2.3 TSF Construction

Construction of the TSF Site C cofferdam will commence as soon as permits are received. The cofferdam is expected be in service until October of Year -2 (3 months), at which point the

construction of Stage 1A of the Site C Main Dam elevation will rise above the cofferdam, rendering the cofferdam obsolete. The cofferdam has been designed to store the 1 in 10 year 24-hour storm event, as well as the 1 in 10 year wet August, September, and October water volumes. The sediment control pond (SCP #6), located downstream of the dam, will be constructed prior to the commencement of the Site C cofferdam construction. The arrangement is shown on Figure 6.2 below.

Figure 6.2 Site C Construction Water Management



The construction water management plan for the TSF Site C dam includes the following sequence of activities:

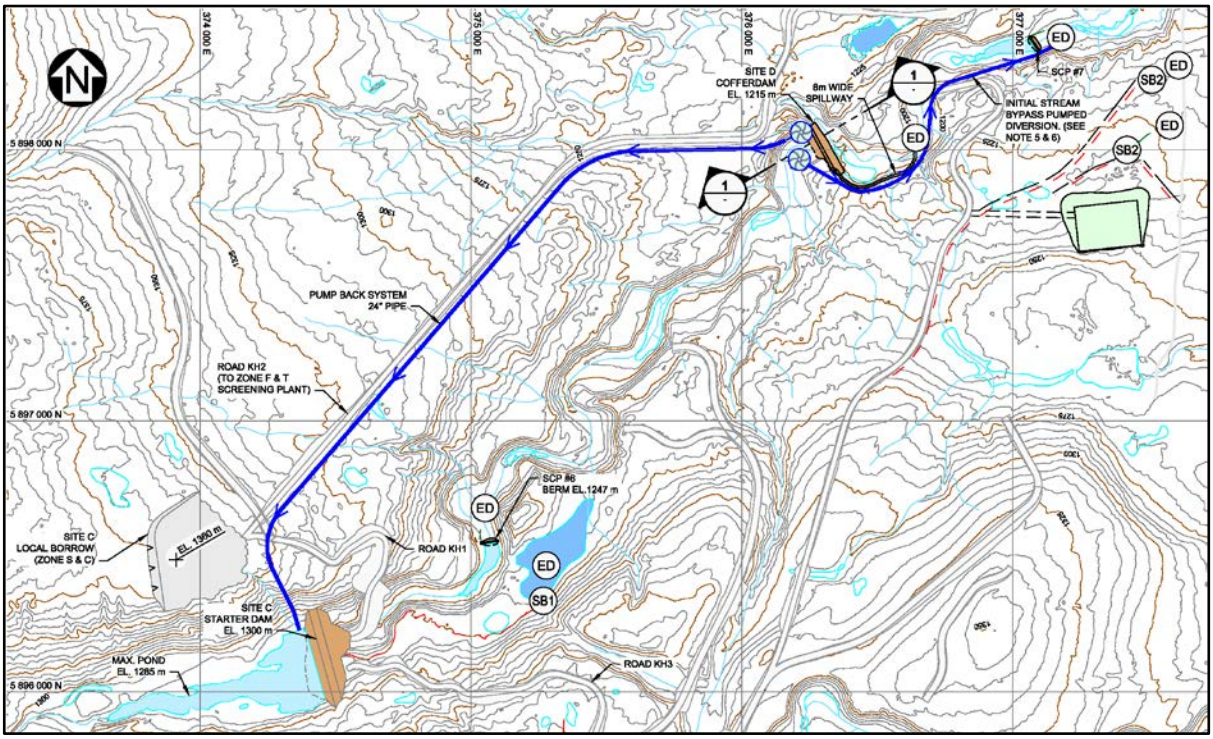
- Construct access roads employing temporary sediment and erosion control BMPs.
- Install a temporary bypass diversion pumping system on Davidson Creek to provide clean water diversion while the SCP and cofferdam are constructed. The temporary stream diversion will direct water into a pipeline and subsequently downstream of the work area. A riprap lined outfall will be used at the end of the pipeline for energy dissipation (ED).
- Install BMPs and establish site isolation using collection ditches around the Site C cofferdam area.
- Construct the SCP downstream of the construction area.
- Strip the foundation area for the cofferdam and store material in a topsoil stockpile that drains to the SCP.
- Construct the cofferdam from Zone S material to an elevation of 1285 m.

Construction of the TSF Site D cofferdam will commence during construction of the Site C Main Dam in October of Year -2. It is designed to store the 1 in 10 year 24-hour storm event, as well as the 1 in 10 year wet October, November, and December water volumes. The cofferdam includes a spillway, which has been designed to safely pass the 1 in 200 year 24-hour storm event peak flow.

A sediment control pond (SCP #7), located downstream of the cofferdam, will be constructed prior to any disturbance in the vicinity of the Site D cofferdam.

Construction of the Site D Main Dam will not commence until Year -1. The Site D cofferdam, constructed to elevation 1215 m, will initially impound water during Year -1. Water collected behind the Site D cofferdam will be pumped back to TSF Site C to provide the start-up water pond volume. The pumpback system is designed to pump 1,500 m^3/hr of water in order to capture a large portion of the spring and summer freshet flows. Water behind the cofferdam will accumulate at a slower rate during the lower flow times of the year and can be pumped down as required. The spillway will pass flows that exceed the design pumping capacity of the system. The Site D cofferdam, pumpback system, and SCP #7 arrangement is shown on Figure 6.3 below.

Figure 6.3 Site D Construction Water Management



The pumpback system will consist of five (5) installed Godwin HL160M Dri-Prime skid-mounted diesel drive pumps (or equivalent). A spill containment area will be prepared around the diesel tanks for this pump system. The pumps will feed a single 24 inch HDPE DR9 pipeline that will convey the water just over 3 km at 170 m of total dynamic head (TDH).

The Site D cofferdam will function until the end of Year -1 when Stage 1A at the Site D Main Dam is completed. The cut-off trench bulk excavation and construction of the main dam will occur between August and December, with an exposure period between October and December for completion of the in-creek cut-off trench section and mass dam construction to an elevation above the cofferdam. The final Stage 1A elevation will be 1240 m. The cofferdam will remain in place during Year 1 until it becomes part of the expanded upstream footprint of the Site D Main Dam. The pumpback system

will remain in place during Years 1 and 2 to provide additional make-up water, if required, in the TSF Site C supernatant pond.

The construction water management plan for the TSF Site D dam includes the following sequence of activities:

- Construct access roads employing temporary sediment and erosion control BMPs.
- Install a temporary bypass diversion pumping system on Davidson Creek to provide clean water diversion while the SCP and cofferdam are constructed.
- Install bmps and establish site isolation using collection ditches around the Site D cofferdam area.
- Construct the SCP downstream of the construction area.
- Strip the foundation area for the cofferdam and store material in a topsoil stockpile.
- Construct the cofferdam from Zone S material to an elevation of 1215 m.
- Pumpback sediment laden water from the downstream SCP for storage above the cofferdam.

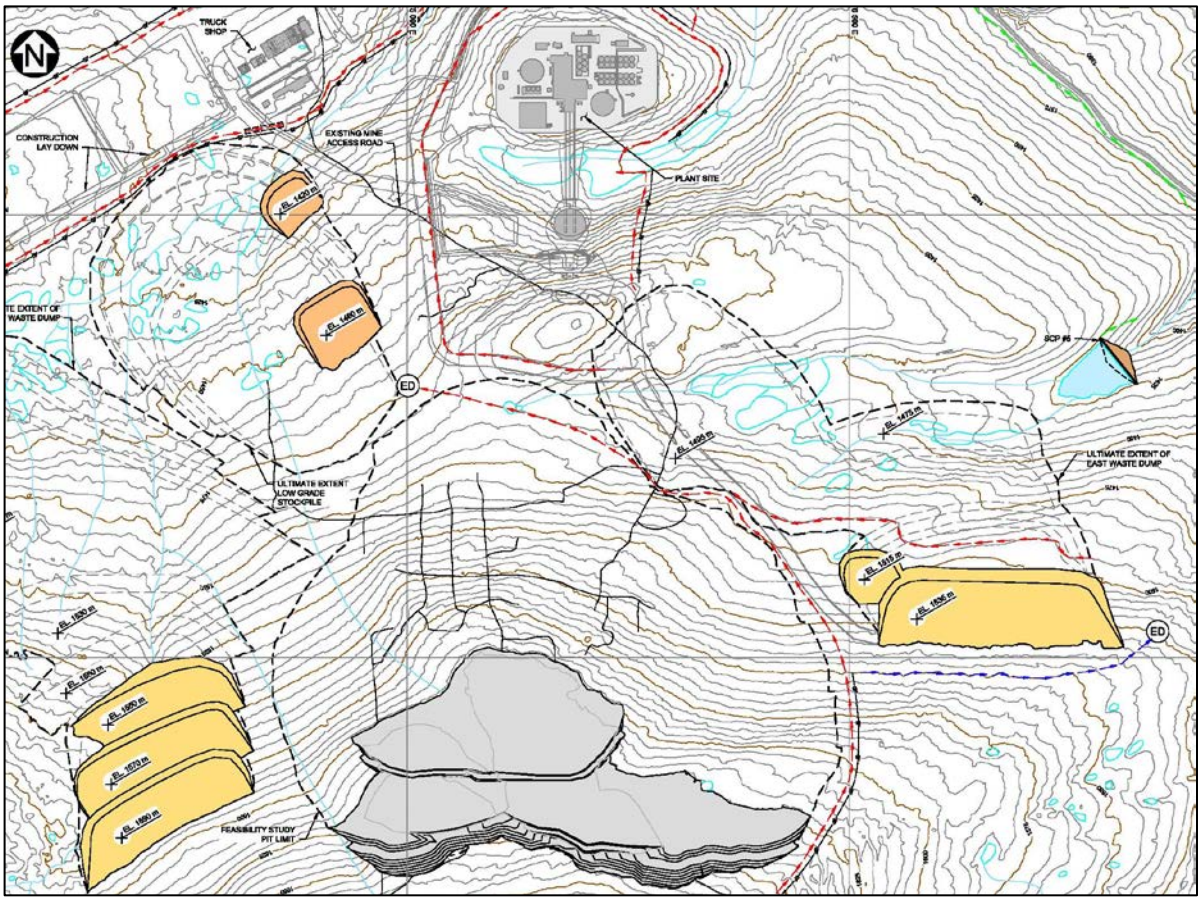
6.2.4 Open Pit and Waste Dumps

Pre-stripping of the open pit will commence in late Year -2. The pre-stripped material will be used in dam construction or disposed of in the East and West Dumps. A SCP (SCP #5) will be constructed prior to any disturbance in the open pit area.

SCP #5 is designed to manage runoff from the east side of the open pit and the ultimate extents of the East Dump, as shown on Figure 6.4 below. The SCP will accommodate a live storage equal to the 1 in 10 year 24-hour storm and will provide a retention time of over 10 hours for settling of suspended sediment. The spillway is designed to manage the 1 in 200 year 24-hour storm in accordance with BC guidelines (BC MOELP, 1996) and Dam Safety Guidelines (CDA, 2007) for a “Significant” consequence dam.

The SCP will discharge to a diversion channel and will subsequently flow to the TSF Site D cofferdam for storage and re-use in processing.

Figure 6.4 Sediment Control for Open Pit and Waste Dumps



6.3 TAILINGS STORAGE FACILITY

6.3.1 General

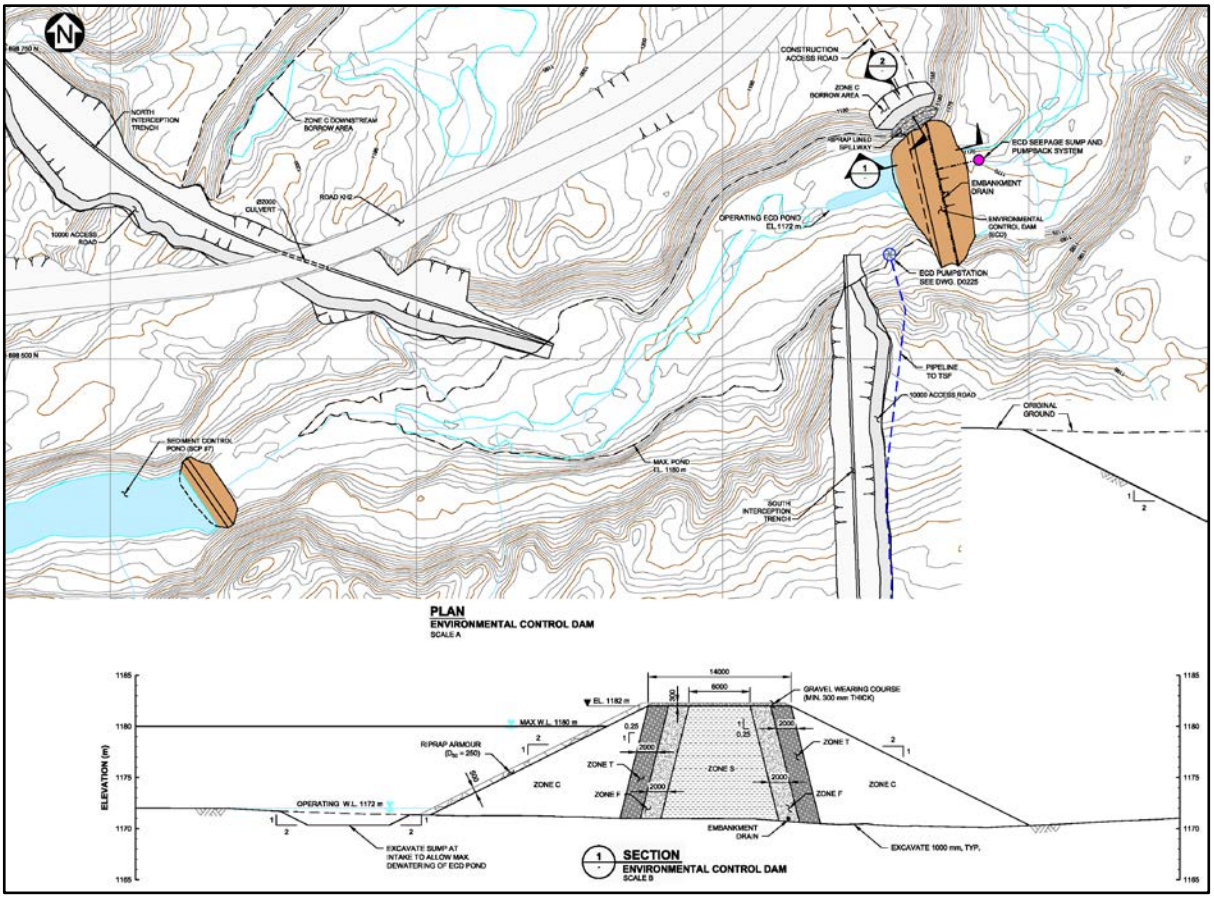
The construction, operations, and closure water management strategies for the project have been developed by identifying the size and position of the planned mine site facilities, and establishing catchment area boundaries based on the mine site development concept. All site drainage during operations and closure will drain by gravity to the TSF. Seepage from the TSF and waste rock dumps will be collected and directed to the TSF or recycled back to the TSF. This mine layout strategy simplifies water management, spill control and closure as well as provides water for the process.

6.3.2 Environmental Control Dam (ECD)

The primary seepage collection point downstream of the TSF has been located approximately 1 km downstream at a topographic low point in Davidson Creek. The collection pond will be created by constructing a 12 m high water retaining dam (ECD) across Davidson Creek. The dam is designed to contain continuous seepage and runoff from events up to the 1 in 100 year 24-hour storm. The spillway is designed to pass the 1 in 200 year 24-hour storm. The pond will collect drainage from the

two interception trenches as discussed in Section 5.7, dam runoff and upwelling groundwater seepage. The ECD concept is shown on Figure 6.5.

Figure 6.5 Environmental Control Dam (ECD)



The primary pumpback system at the ECD is designed to maintain the pond at a minimum water level to reduce the potential for seepage under the ECD. The intake is a concrete structure equipped with a trash rack and is set at elevation 1170 m. The pumpback system is comprised of four 375 kW vertical turbine pumps (3 operating and 1 installed spare) and requires at least 2 m submergence to operate. The system is designed to pump a maximum of 1,080 m^3/hr to the TSF through an 18 inch standard steel pipeline. The design flow rate is equivalent to a 10 day pump-out of the ECD pond following the 1 in 100 year design storm. The pumping system would normally operate intermittently as the ECD pond exceeds the minimum operating depth of 2 m, and at less than maximum capacity using one or more pumps.

The ECD will have an embankment drainage system, seepage collection sump with a flow monitoring device, and pumpback system to collect and recycle seepage back into the ECD impoundment.

6.3.3 Water Reclaim System

Water will be reclaimed from the tailings ponds at TSF Sites C and D, and will be delivered to the reclaim water tank at the processing facility. The water will consist of supernatant from the settled tailings solids and runoff from precipitation and snowmelt within the reporting catchment areas. The reclaim pipeline will consist of sections of 30 inch diameter steel pipe (Schedule 40 A53 Grade A) and 32 inch diameter HDPE DR13.5 and DR17 pipe. Steel pipe will be used for the initial high pressure sections of the pipeline closest to the reclaim pumps, while HDPE pipe will be used for the remainder of the pipeline.

The reclaim water system will initially utilize a barge-mounted pumpstation equipped with four 750 kW vertical turbine pumps sized to deliver 3,200 m^3/hr of reclaim water. The reclaim barge will initially be anchored in TSF Site C during Years 1 and 2 of operations, and then moved to TSF Site D late in Year 2 for the remainder of mine operations and closure. A reclaim structure will be constructed in TSF Site C during Year 2. The reclaim structure design is similar to the ECD pumpstation design. It will consist of a concrete intake structure with stoplogs and trash racks. The structure will be set at elevation 1337 m and requires 3 m of submergence to operate. The pump system will consist of four vertical turbine pumps with the same pumps and motors as the barge-mounted system for consistency of spare parts and ease of maintenance.

The reclaim structure has been designed to operate within a 3 m fluctuation in TSF pond level, which equates to a 5 Mm^3 fluctuation in pond volume. The TSF pond level will be passively controlled with a spillway to the north of the Site C Main Dam. The spillway will have an invert at elevation 1343 m, which could allow for long term availability of the Site C reclaim structure as a backup system and for additional water storage for the process.

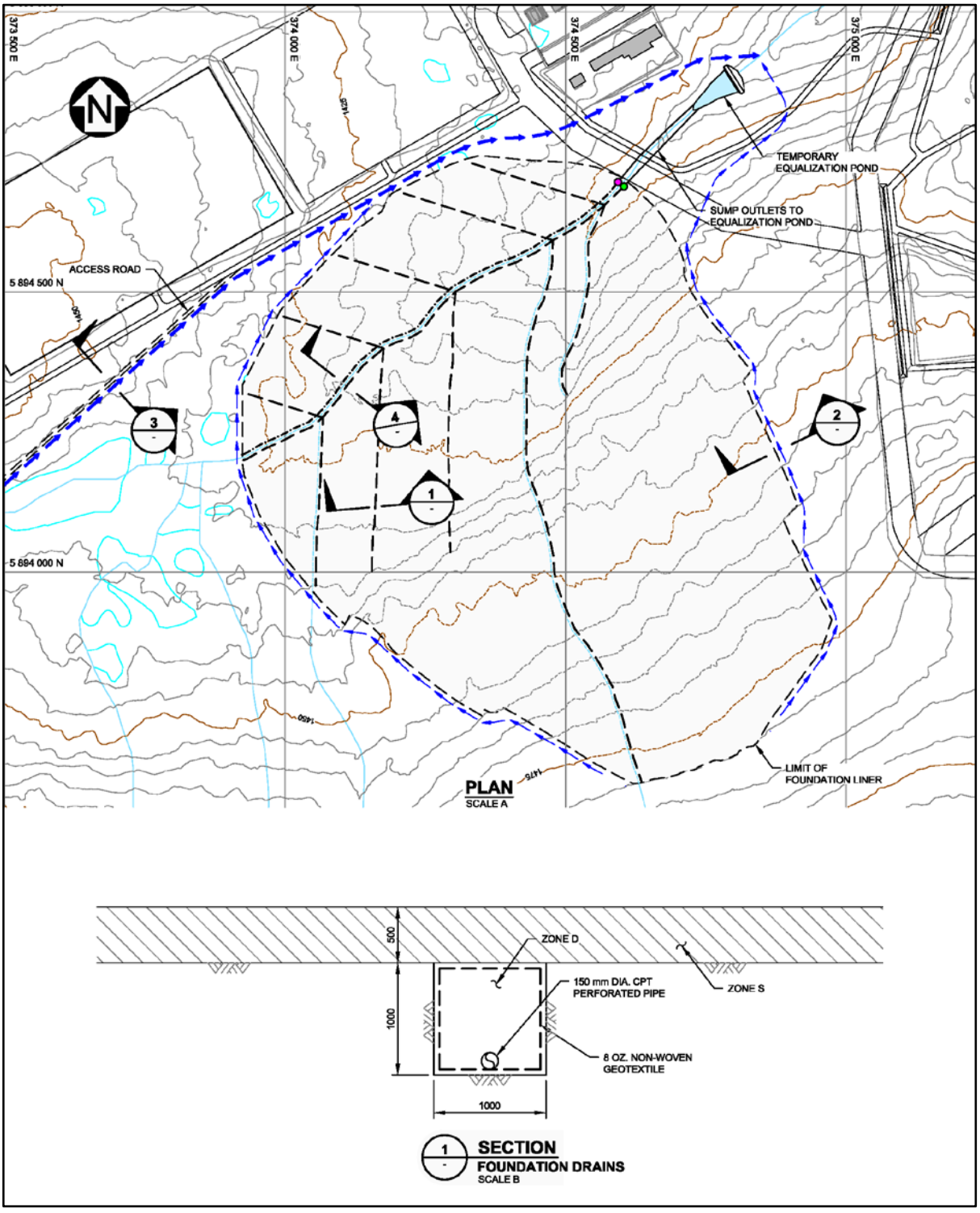
6.4 LOW GRADE ORE STOCKPILE AND WASTE DUMPS

6.4.1 Low-Grade Ore Stockpile

The low-grade ore (LGO) stockpile will be developed over an engineered low-permeability foundation with surface water and seepage collection and monitoring systems. Drainage from the LGO stockpile is expected to be acidic and contain elevated metals. Therefore the drainage will be collected, neutralized and discharged to the TSF. The water management plan is shown on Figure 6.6.

Runoff from the up-slope undisturbed catchment will be diverted around the stockpile by a 3 m wide diversion channel excavated adjacent to a 6 m wide access road. Foundation drains will be installed in the footprint area of the stockpile within existing drainage courses or in any areas of seepage encountered during topsoil stripping. A 500 mm layer of compacted Zone S material from overburden stripping in the pit will be placed on the LGO stockpile foundation. The sub-grade treatment will extend approximately 10 m beyond the stockpile edge to allow for runoff collection from the stockpile. A collection drain will be placed above the low-permeability subgrade in the low point of the pad to facilitate collection of seepage. The collection drain and foundation drains will report to their respective seepage sumps near the edge of the stockpile. Seepage quality of both systems can be monitored at this location, prior to discharge to an equalization pond. A perimeter diversion ditch 1 m wide will wrap the ultimate extents of the stockpile to divert non-contact water around the stockpile.

Figure 6.6 Low-Grade Ore Stockpile Water Management



The low-grade stockpile foundation will be constructed in three stages. The first stage will occur during Years -2 and -1 and will consist of approximately 50% of the area, with the remaining 50% distributed into Years 2 and 4.

6.4.2 NAG Waste Dumps

The East and West Dumps layouts have been refined to minimize surface water control requirements. Foundation drains will be installed in areas of existing drainage courses or when excessive seeps or springs are encountered during clearing and grubbing. These drains will collect potential seepage through the dump foundations. Non-contact surface water will be diverted around the dumps during operations and closure and will be field fit with the advancing fill platforms. A 30 m strip along the advancing dump toes will be stripped and the topsoil will be spoiled in a windrow. Water that infiltrates through the dump will be collected in ditches along the strip near the toe of the dumps and routed to a sediment basin, prior to being directed to the TSF. Unrecovered seepage from the West dump would flow to the pit or TSF and any unrecoverable seepage from the East dump will be collected downstream and directed to the TSF using the structures constructed from the construction sediment and erosion control plan.

6.5 OPEN PIT WATER MANAGEMENT PLAN

6.5.1 General

The open pit dewatering system comprises of a combination of the following three sub-systems:

1. Surface water management
2. In-pit groundwater depressurization, and
3. Perimeter depressurization.

Surface water dewatering systems have been designed to manage the surface water inflows from rain storm events and the associated snowmelt. A combination of in-pit and perimeter pumping wells will be implemented to achieve acceptable slope depressurization and pit dewatering. The pit dewatering design is based on lowering the groundwater table within the higher permeability zone to approximately 15 meters below the pit base elevation. In–pit groundwater wells will remove water from storage in the higher permeability zone. Additional drawdown will result in the surrounding rock mass as groundwater flows towards the higher permeability zone. Perimeter dewatering wells will be established along the south high wall to lower and extend the cone of depression beyond the pit walls to satisfy the depressurization requirements outlined in the open pit wall stability analyses.

The open pit surface water and groundwater dewatering assessment and pit water management system design is described in detail in the Open Pit Water Management Plan Report (Knight Piésold Ltd., 2013f). A summary of the findings is provided below.

6.5.2 Surface Water Management

The open pit development sequencing throughout the mine life was divided into five general stages to evaluate the requirements for surface water management. The 1 in 100 year 24 hour return period storm was used to size the pit surface water management system and to assess the duration of dewatering that would be required in the pit bottom following a storm.

The total volume of surface water runoff from the design storm event was calculated by applying the total precipitation depth (rainfall and snowmelt) and runoff coefficient over the open pit catchment area. The calculated water runoff volume for sizing the dewatering system is summarized in Table 6.1.

The surface water management system was designed for a maximum pumping flow rate of 700 m^3/hr. The maximum pumping flow rate was selected as the optimal flow rate of a 16 inch diameter DR11 HDPE pipe. The optimal flow rate was determined for a flow velocity between 2.0 m/s and 2.5 m/s.

Table 6.1 Open Pit Storm Inflow Volumes

STAGE		Catchment Area (m^2)	Runoff Volume (m^3)	Pumping Rate (m^3/h)	Time to Dewater (Days)
Stage 1 (Year 1)	Pit Bottom (El. 1550m)	751,300	73,627	700	4
	Secondary (El. 1585m)	395,937	38,802	700	2
Stage 2 (Year 6)	East Catchment (El. 1370m)	1,389,324	136,154	700	8
	West Catchment (El. 1405m)	823,555	216,862	700	13
Stage 3 (Year 7)	Pit Bottom (El. 1345m)	2,264,753	221,946	700	13
Stage 4 (Year 9)	Pit Bottom (El. 1300m)	2,370,863	232,345	700	14
Stage 5 (Year 13)	North (El. 1120m)	591,153	57,933	700	3
	East (El. 1165m)	1,124,161	110,168	700	7
	West (El. 1180m)	654,687	232,260	700	14

The surface water management pipelines will be installed adjacent to the open pit haul roads. A pump unit will be placed adjacent to sump areas in the base of the pit after a storm, and the water will be pumped to the crest of the pit wall using a series of booster pumps positioned along the pipeline. The pump system will consist of a series of Godwin HL250M Dri-Prime skid-mounted diesel drive pumps (or equivalent). The number of pumps will increase as the pit depth increases. The total dynamic head for the initial intake and between subsequent booster pump units must not exceed 100 meters in order to maintain the pumping flow rate of 700 m^3/hour. The pumps will be converted to the HL250M pumps from the Godwin HL160M pumps that will be used for the freshet water capture system in TSF Site D during pre-production and early operations.

The water from the surface water management system will flow by gravity in the pipeline approximately 200 m to the dewatering system junction after exiting the pit. Water from the surface water management system will be combined with groundwater from the depressurization systems at the dewatering junction header.

6.5.3 Groundwater Depressurization

In–pit groundwater wells will dewater the more permeable broken rock zone. Additional drawdown will result in the surrounding rock mass as groundwater flows towards this higher permeable zone. Perimeter dewatering wells will be established along the south high wall to lower and extend the cone of depression beyond the pit walls to the specified set back distance indicated in the slope stability assessment. The sequence of development for dewatering wells is provided below. Details of the well locations and depths are summarized in Table 6.2.

Table 6.2 Open Pit Dewatering Well Details

Well ID	Easting	Northing	Well Collar Elevation	Well Bottom Elevation
			masl	masl
PW13-1	375,124	5,893,288	1546	1246
PW13-3	375,905	5,892,341	1646	1346
PW15-1	376,350	5,892,521	1600	1250
PW15-2	375,660	5,892,348	1635	1285
PW15-3	375,186	5,892,347	1655	1305
PW15-4	374,727	5,892,428	1620	1270
PW15-5	374,582	5,892,727	1570	1220
PW16-1	376,137	5,892,394	1605	1255
PW16-2	375,531	5,892,333	1660	1310
PW16-3	374,955	5,892,381	1635	1285
PW16-4	374,618	5,892,611	1590	1240
PW22-17	375,705	5,893,361	1350	1000

NOTES:

1. PLANNED INSTALLATION DATES AND LOCATIONS OF PUMPING WELLS PW16-1, PW16-2, PW16-3, AND PW16-4 WILL BE REASSESSED BASED ON OBSERVATIONS DURING WELL INSTALLATION IN YEAR -2.
2. ALL WELLS ASSUMED TO BE 350 M DEEP FOR PLANNING PURPOSES. WELLS WILL BE AS ACHIEVABLE TO A MAXIMUM DEPTH OF 450 M.

Pre-Production (Years -2 and -1)

- Re-develop existing pumping wells PW13-1 and PW13-3 for inclusion in dewatering system.
- Install five perimeter pumping wells in Year -2 (PW15-1 to PW15-5) along the south wall.
- Install eleven observation wells to measure groundwater water levels around the open pit perimeter (OW1 to OW10 and OW19) in Year -2.
- Commission dewatering wells PW15-1 to PW15-5 and PW13-3 in the last quarter of Year -2.
- Install four perimeter pumping wells in Year -1 (PW16-1 to PW16-4) along the south wall.
- Commission in-pit well PW13-1 in Year -1.

Years 1 to 3

- Evaluate performance of pumping wells and determine if backup wells will be required in areas where elevated pore pressures resulting from well failure has the potential to compromise pit slope stability and result in major interruptions to mining operations.
- Install remaining observation wells (OW11 to OW18) around the northern sections of the ultimate open pit.

Year 6

- Install secondary in-pit well PW22-17 and decommission PW13-1.

The dewatering wells will be installed using an air rotary drill rig to a nominal depth of 350 m and maximum depth of 450 m depending on drilling conditions encountered. Steel well screens will be installed upon completion with a minimum diameter of 8 inch for the perimeter wells and 10 inch for the in-pit wells. If ground conditions limit the well size or achievable depth of installation, adjustments to the dewatering system will be required to achieve the design objectives.

The perimeter wells will incorporate 6 inch submersible turbine pumps individually rated for a flow rate of either 14 or 20 m^3/hr, depending on the installed well location. The perimeter wells will be interconnected by a pipeline around the perimeter of the open pit. The pipeline will be 4 inch to 6 inch diameter DR17 HDPE pipe. The perimeter wells will initially be spaced at 400 m intervals around the south wall of the pit during Year -2 with the installation of wells PW15-1 to PW15-5. The spacing will be reduced to approximately 200 m in the following year by installation of wells PW16-1 to PW16-4. The final locations of PW16-1 to PW16-4 will be based on observations during the installation of the dewatering wells in the year prior and response of the wells during initial pumping. Staged installation of pumping wells will provide additional data on aquifer characteristics and will enable a more efficient dewatering system design.

The in-pit wells will have 10 inch diameter well screens and 8 inch diameter submersible turbine pumps. The in-pit well pumps will be rated for a flow rate of 80 m^3/hr, and will be connected to the overall pit water management system by a 6 inch diameter DR17 HDPE pipeline. The flow from both depressurization systems will be combined with flow from the surface water system at a junction header near the rim of the open pit before discharging by gravity in a 20 inch diameter DR17 HDPE pipeline to Sediment Control Pond 1 and subsequently to TSF Site D.

The maximum dewatering rate for the depressurization system was estimated to be 62 L/s during Year 6. The final dewatering rate at ultimate pit expansion was estimated to be 48 L/s. The groundwater depressurization system will include flow measurement devices, water level meters, and adjacent observation wells (OW1 to OW18) with vibrating wire piezometers installed to verify the effectiveness of the system.

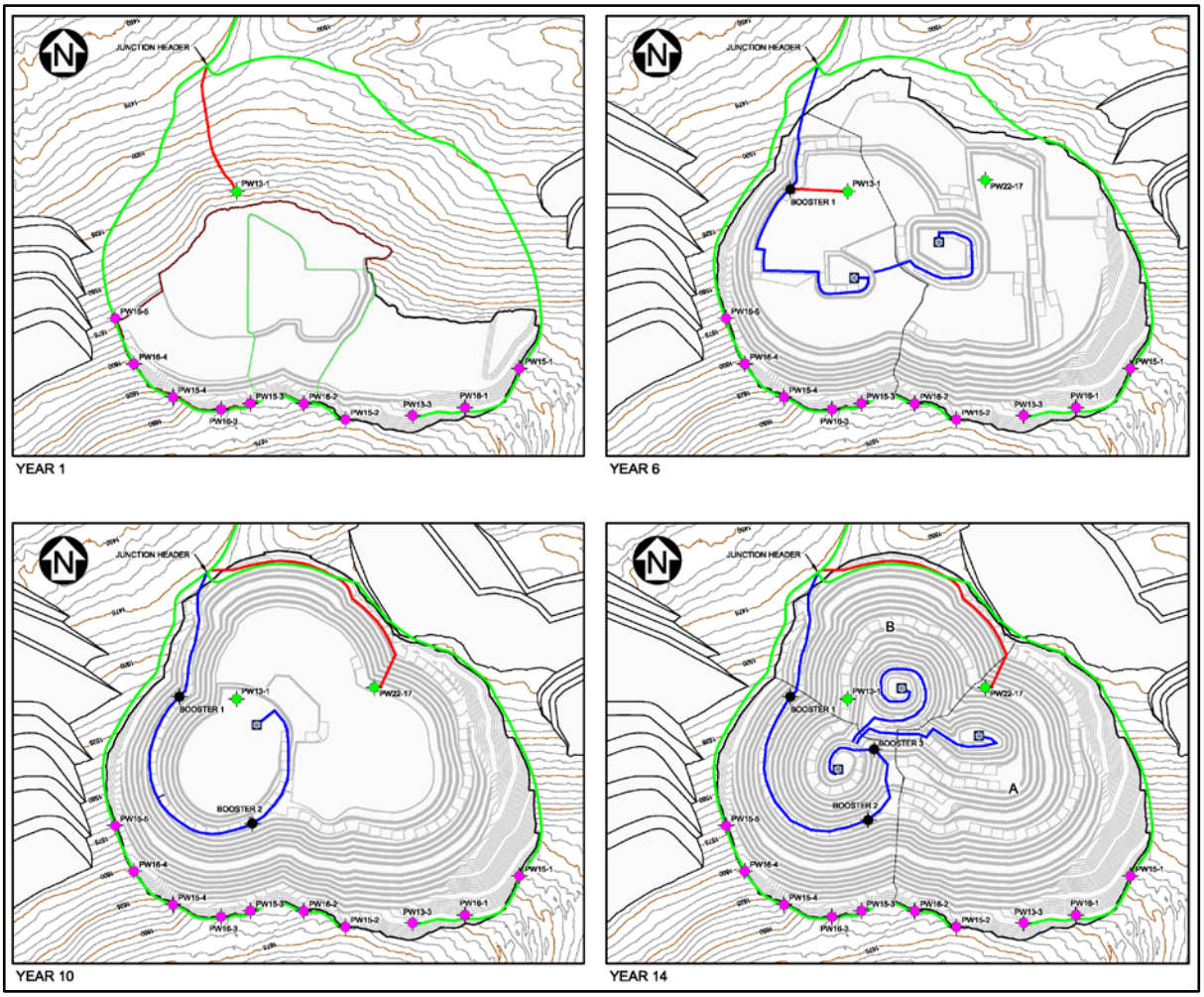
The open pit depressurization system has been designed for the “best estimate” of required pumping. The well installations will be required to intersect productive fracture systems and be functional. The drilling and development of successful and useful dewatering wells can be highly variable in bedrock and wells with insufficient yield will need to be replaced. The pit dewatering strategy has included for additional wells. An additional well for backup purposes has been accounted for at each location, to be installed as part of sustaining capital for the project.

Pump and well failures can lead to a rise in piezometric levels, which may affect slope stability. Pump replacement can be easily completed and the time required is not critical to the success of the

system, but the time required for drilling, installing and commissioning a new well could extend over several months. The installation time can be affected by site accessibility, rig availability, installation time, and the time it takes to re-establish steady-state pumping conditions. Therefore, the early performance of these wells will be evaluated to determine if the installation of backup wells is prudent along any critical areas of the pit where well failure would adversely affect the pit wall stability. The stability analyses provided in previous sections of this report indicate that elevated pore pressure conditions will adversely influence pit slope stability in areas where the broken zone is present, and therefore KP has assumed that backup dewatering wells will be required in select areas of the pit during Years 1 to 3.

The staged development of the pit dewatering systems are shown on Figure 6.7 and includes the perimeter dewatering wells and pipelines (green), in-pit dewatering well and pipeline (red), and in-pit surface water management system (blue).

Figure 6.7 Final Pit Dewatering System Extents



6.6 FRESH WATER SUPPLY SYSTEM

6.6.1 General

Fresh water for the project will be sourced from Tatelkuz Lake, which is located approximately 20 km northeast of the mine site. The water will be conveyed via pipeline from the lake to the project site. The water supply system includes the following major components:

- Tatelkuz Lake intake.
- Fresh water supply pipeline.
- Booster pump stations.
- Fresh water reservoir.
- Temperature and flow control system.

The fresh water supply system was designed to provide:

- Constant fresh water supply from Tatelkuz Lake for plant fresh water needs and to mitigate flow reductions in lower Davidson Creek.
- Occasional water supply from Tatelkuz Lake to supplement requirements for processing or to saturate PAG within the TSF, if required.

6.6.2 Lake and Route Selection

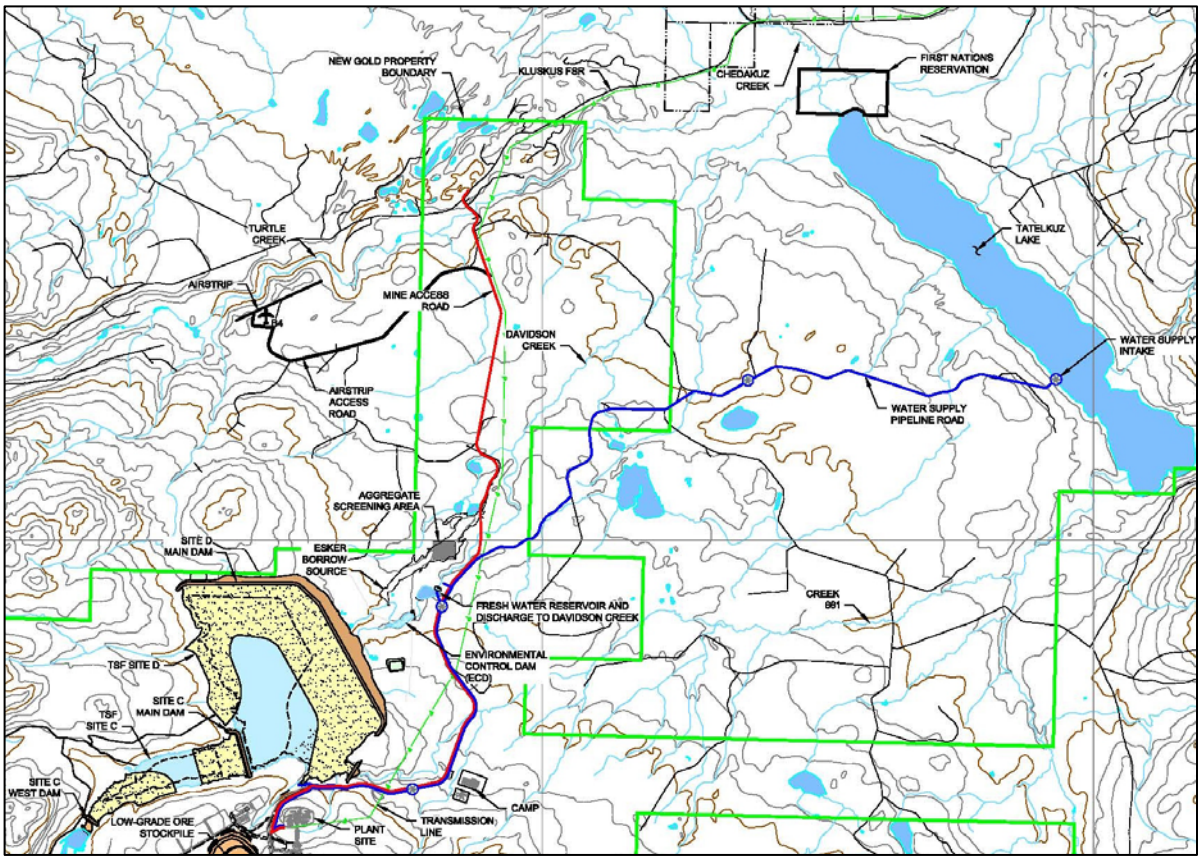
A trade-off study to identify potential long-term freshwater water sources for the project was previously completed by KP (Knight Piésold Ltd., 2012b). The finding of this study indicated that Tatelkuz Lake was the most practical fresh water supply option, and that it would have the lowest environmental impact and risk from a water supply standpoint.

The selected water intake location on Tatelkuz Lake was based primarily on preference by local stakeholders because of the presence of a pre-existing forestry clear-cut that approaches the lake. The pipeline route from Tatelkuz Lake to the fresh water reservoir follows existing forestry roads to the maximum practical extent; the route from the fresh water reservoir to the plant site and TSF Site D will be along a pipeline service corridor adjacent to the mine access road.

6.6.3 Water Balance Considerations

Three primary water bodies were considered during the design of the fresh water supply system: Tatelkuz Lake, Davidson Creek, and Chedakuz Creek. The flow requirements for these three water bodies are interrelated and essential in designing the system to meet environmental design objectives. The general arrangement of the fresh water supply system is shown on Figure 6.8. Tatelkuz Lake is located to the northeast of the mine site area. Tatelkuz Lake is fed by a watershed of approximately 395 km^2, and the outlet flows towards the northwest via Chedakuz Creek. Davidson Creek flows from the upper reaches of the mine site area towards the northeast to its confluence with Chedakuz Creek less than 1 km downstream of Tatelkuz Lake.

Figure 6.8 Fresh Water Supply General Arrangement



The mine site and TSF development will reduce the contributing watershed area to Davidson Creek from approximately 78 km^2 to 32 km^2 at the downstream extent of the TSF and the runoff water generated in the upstream portion of the catchment is needed to maintain the mine site water balance. The mitigation strategy to prevent impacts to Davidson Creek requires discharge of fresh water into the creek at the downstream extent of the mine site area. This fresh water will be supplied by taking a very small portion of the water from Tatelkuz Lake and pumping it to the project area and discharging it back into Davidson Creek. The removal of this water volume from the lake to provide a flow rate to Davidson Creek will reduce outflow from the lake and corresponding depth of flow (and lake level) at the outlet into Chedakuz Creek. Fresh water discharged into Davidson Creek will flow for approximately 12 km in the creek before it returns to Chedakuz Creek less than 1 km downstream from the lake.

A lake withdrawal model was created to assess the impact of providing supplemental flows to Davidson Creek on both lake outflow and lake level (Knight Piésold Ltd., 2013j). The withdrawal model is a standard reservoir routing model which uses 40 years of synthetically derived records, in conjunction with outlet survey information and lake bathymetry. The model simulates the attenuation of lake inflows. The model shows the planned withdrawals have minor impacts on overall lake levels between seasons with average conditions being impacted by between 3 and 5 centimeters at the outlet in any season, approximately corresponding to an average depth change of 7%.

Consequently, impacts on lake outflows are similarly minor, with an average discharge reduction of 15%.

6.6.4 Design Basis and Operating Criteria

The design and operating criteria for the fresh water supply system evolved during the course of the study. A summary of these criteria are outlined in Table 6.3 below.

Table 6.3 Fresh Water Supply System Design Criteria

ITEM	DESIGN CRITERIA
1.0 General	
Site Coordinates	Tatelkuz Lake: 53.3 Latitude, 124.73 Longitude, Elevation - 914 m
Climate	Estimated Mean Annual Precipitation = 636 mm
	Average Annual Lake Evaporation = 443 mm
2.0 Design Operating Life	
Pre-production	System Operation during Pre-production = 1 year (April 2016 - April 2017)
Mine Production	Mine Life = 17 years (nominal throughput = 60,000 tpd)
Closure	System Operation during Closure Phase = 16 years
3.0 Water Management	
Water Requirements	Davidson Creek minimum instream flow needs (IFN) = 414 - 2,016 m^3/h (115 - 560 L/s)
	Mill freshwater requirements at 60,000 tpd production rate = 120 m^3/h (33 L/s)
	Davidson Creek flushing flows = 4,030 m^3/h for 3 days (1120 L/s) plus 3 days ramping up/down
	Minimum surplus capacity allowance (allowance for extreme dry) = 3,000,000 m^3/yr (340 m^3/h)
	PAG saturation water (as required to meet saturation time steps)
Water Supply	Source: Tatelkuz Lake
	Intake System - submerged intake with onshore wet well
Fresh Water Reservoir	Minimum storage capacity: seven days max flow demand
	Storage capacity - 400,000 m^3
	Embankment height = 14 m
4.0 Water Pipeline	
Pipeline Design	Material - Combination - Steel and HDPE
	Alignment - Adjacent to access/maintenance road and buried 0.6 m for fire protection only
Pump Design	Maximum TDH lift per pump station: 300 m
	One standby unit at each pump station
Pipeline Elevations	Tatelkuz Lake = 927 m
	Fresh Water Reservoir = 1,169 m
	TSF = 1320 m (highest elevation on pipe route = 1,350 m)
	Plant Site = 1433 m
Pipeline Lengths (horizontal length)	Pressure pipeline: Tatelkuz Lake to Fresh Water Reservoir = 13,600 m
	Pressure pipeline: Fresh Water Reservoir to Plant = 6,790 m
	Pressure pipeline: Fresh Water Reservoir to TSF = 6,830 m
	Gravity discharge: Fresh Water Reservoir = 100 m
	Gravity discharge: TSF Site 'D' = 750 m

The mine fresh water requirements for the design of the fresh water supply system included the following:

- Davidson Creek instream flow needs (IFN).
- Davidson Creek flushing flows.
- Plant fresh water needs (gland water, etc.).
- Reclaim water to support processing in extreme dry conditions (minimum surplus capacity).
- Additional water for flooding waste rock in the TSF, if required.

Five design flow rates for the fresh water supply system were examined to determine the most suitable design flow rate. A summary of the design flow rate options considered, and their corresponding storage requirements for normal operation of the system, surplus pumping capacity and pipe size requirements are shown in Table 6.4.

Table 6.4 Design Flow Rate Trade-off

Maximum Pump Flow Rate	Surplus Water Capacity	Surplus Water Availability	Average Storage Requirements	Pipe Diameter	
(m^3/hr)	(m^3)	(months)	(m^3)	(Steel)	(HDPE)
1,500	1,670,000	5	1,470,000	20"	24"
2,000	4,290,000	8	740,000	22"	26"
2,400	**6,090,000**	**8**	**190,000**	**24"**	**30"**
2,500	6,530,000	8	190,000	24" (2)	30"
3,530	6,530,000	9	190,000	30"	N/A

NOTES:

1. 22" STEEL PIPE IS NOT A STANDARD SIZE, WOULD POTENTIALLY NEED TO UPGRADE TO 24".
2. OPERATING AT THE UPPER END OF VELOCITY CAPACITY FOR 24" PIPE.

A design flow rate of 2,400 m^3/hr was selected to minimize the required storage capacity for normal operation of the system.

The design flow rate of the system is largely driven by the Instream Flow Needs (IFN) in Davidson Creek. The mine site and TSF development will reduce the contributing watershed area to Davidson Creek from approximately 78 km^2 to 32 km^2 at the downstream extent of the TSF. The runoff water generated in the upstream portion of the catchment is needed to maintain the mine site water balance. Target IFN flows for Davidson Creek were developed in conjunction with AMEC Earth and Infrastructure (AMEC, 2013a). The IFN values are considered to be a continuous demand on the system and are variable throughout the year. IFN will be supplied to Davidson Creek from the pre-production period, when Davidson Creek is cut-off at TSF Site D, through the operational life of the project and closure period until post-closure when the Open Pit and TSF are discharging with water quality suitable for release to Davidson Creek. The final IFN values are shown in Table 6.5.

Storage is needed as a contingency in the event of system repair or maintenance as discussed in Section 6.6.7, and for the release of flushing flows periodically in the creek. Minimum surplus capacity has been sized to ensure the system has additional pumping capacity and availability to provide an additional 3 Mm^3 of water per year as a contingency against a series of extremely dry years. The derivation of the minimum surplus capacity is discussed along with the mine site water balance in Section 6.7.

Table 6.5 Davidson Creek Instream Flow Needs (IFN)

Biological stanza	Date	Flow recommendation
Overwintering Freshet	December 1– May 10 May 11 – May 15	**125 L/s (450 m^3/hr)**
Rainbow Spawning	May 16 – June 30	**560 L/s (2015 m^3/hr)**
Rainbow Incubation Kokanee Spawning	July 1 – August 31	**150 L/s (540 m^3/hr)**
Rainbow Rearing Kokanee Incubation / Rearing	September 1 – November 30	**115 L/s (415 m^3/hr)**

6.6.5 Tatelkuz Lake Intake Design Considerations

Three lake intake structure options were considered in the design of the fresh water supply system. The options were as follows:

- A submersible pump unit.
- A floating barge structure.
- A land-based wet-well structure.

The submersible pump/motor unit would be installed in a pipe casing drilled parallel to the lake bed and connected to a screen intake. Submersible motors have limited horsepower capacity and given the high flowrate and elevation increase requirements of the application, they were considered impractical. This concept was abandoned.

The floating barge structure option was a packaged unit with four (three operating and one stand-by) vertical turbine pumps. The barge structure provided the capacity to reach Booster Station 1. The barge would be positioned approximately 25 m from the lake edge and be anchored to the lake shore at four locations.

The wet-well structure was a permanent concrete well structure situated on the shore line of Tatelkuz Lake. The structure would consist of a large concrete sump, which is gravity fed by a screened intake feeder pipe in the lake. Four (three operating and one stand-by) vertical turbine pumps would be installed in the sump and will pump to Booster Station 1. The pump station would have a concrete foundation and steel superstructure with an installed crane.

Five factors were identified to assess the two remaining lake intake options:

- Seasonal water level variation.
- Lake bathymetry.
- Structure maintenance.
- Environmental effects.
- Cost.

The seasonal variability and lake bathymetry could both have a significant effect on the design and effectiveness of each of the intake options. The wet-well structure has a static intake location and the depth needs to be designed for the lowest possible lake level in order for it to operate during low natural lake levels. The floating barge structure adjusts to variations in lake level, but could be affected by annual winter ice formation in the lake. A gradually sloping lake bathymetric profile could

be problematic for a barge installation as the barge may need to be installed at an extended distance from the lake shore, which would make the access walkway and anchor system less viable.

A stage-discharge relationship was developed for the lake based on measured lake elevations and estimated outlet discharges. This relationship was used to develop a long term synthetic stage series for a 40 year period (January 1973 to May 2013), which represents the best estimate of historic lake surface elevations. The results of the analysis indicated the maximum lake level fluctuation was in the order of 2 m during that period, while under average conditions the lake level fluctuates within 0.8 m annually. The lake levels are the highest during the freshet period from April to August, while they vary within a relatively narrow range during the rest of the year (Knight Piésold Ltd., 2013i).

Maintenance ease is critical for the long-term operation of the intake and for reducing operational costs associated with the facility. Crane access for replacing pumps and motor units was considered, as well as year round personnel access for routine maintenance requirements (pump inspection and servicing). The land-based wet-well was considered to be preferable from a maintenance and safety standpoint.

The environmental effects of the structures and ease of permitting was taken into consideration. A barge structure can be installed with minimal disturbance below the water line of the lake, but the potential construction of an extended walkway on the lake could have environmental implications such as impacts to the riparian zone and potentially to fish habitat. The directionally drilled suction lines and screened intake along the lake bed for the wet-well structure would create more lake bed disturbance than the floating barge, but would not involve alteration of the lake shore within the zone of seasonal variability. Aesthetics were also considered in the assessment of the options. A barge on the lake surface was considered to be less aesthetically pleasing than a pump house building on the edge of the lake. In the winter a fog bank would develop around the barge from the open water.

A scoping level cost was prepared for the wet-well structure to compare with the budget pricing provided by a floating barge supplier. The wet-well structure was selected as the preferred intake structure to carry into the feasibility design.

The wet-well concept was selected for the feasibility design for the following reasons:

- The lake level variation was analyzed and determined to operate within a relatively small and manageable range.
- The land-based wet-well was considered to be preferable for year round maintenance access.
- A land-based system was considered have less of an impact on the riparian zone and to be more aesthetically pleasing since the intake screens and intake pipelines would be below lake level and ground, respectively.
- There was significant expected cost benefit of choosing the wet-well structure (several million dollars savings).

For the FS design, the wet-well will be a permanent two-level concrete structure constructed on the shore line of Tatelkuz Lake. The lower level will be a 6 m-deep wet-well chamber with a plan area of approximately 6 m by 10 m. The wet-well will be fed by two 24 inch directionally drilled HDPE DR17 pipeline intakes. Each intake will be approximately 50 m long and equipped with a fish screen. The upper level concrete structure will serve as the pump house floor and is twice the size in plan area as the wet-well chamber. Four 525 kW vertical turbine pumps (3 operating and 1 installed spare) will be

mounted on the pump house floor and will draw a continuous water supply from the wet-well chamber. The pumps will be equipped with variable speed drives (VSD) and the intake will have a dedicated motor control centre (MCC). The pumpstation is capable of pumping the design flow to Booster Station 1. The structure will have a steel superstructure and removable roof hatches for pump installation, removal and maintenance.

6.6.6 Fresh Water Supply Pipeline and Booster Pump Stations

The pipeline material selected was a combination of 24 inch diameter steel pipe (Schedule 10 A53 Grade A) and 28 inch diameter HDPE DR17. Steel pipe will be used for the initial high pressure sections of the pipeline closest to each booster pump station, while HDPE pipe will be used for the remainder of the pipeline. The pipeline will be buried with a nominal cover of 600 mm of random fill either by excavation or soil mounding above grade, for basic fire and tampering protection.

The total pipeline length from the lake to the fresh water reservoir will be approximately 13.6 km with a total static head of 243 m. This pipeline segment requires one booster pump station (Booster Station 1) to reach the reservoir. The first pipeline segment from the intake to Booster Station 1 includes 3,000 m of steel pipe and 3,000 m of HDPE pipe. The second segment from Booster Station 1 to the fresh water reservoir uses approximately 3,900 m of steel pipe and 3,800 m of HDPE pipe.

The location of Booster Station 1 is approximately 6 km from the lake and is the halfway point in total dynamic head (TDH) for this pipeline profile. The booster pump station uses the same pump and motor units as the intake pump station, which improves the ease of maintenance and reduces the number of spares. The pump station will have four 525 kW vertical turbine pumps (three operating and one stand-by) in pump cans, a concrete foundation with a plan area of 13 m by 15 m, and a steel superstructure with a dedicated crane. The canned pump package has a suction header connected to the main pipeline to feed the four pump units. A holding tank with a five minute capacity has been specified as a buffer for smooth pump operation. The pumps discharge from the station into a discharge header that connects into the continuing pipeline to Booster Station 2 and 3.

Booster Station 2 and 3 are combined in the same structure. The structure will have a concrete foundation with a plan area of 10 m by 20 m, and a steel superstructure with a dedicated crane. A holding tank with a five minute capacity included as a buffer for smooth pump operation. The tank is fitted with an immersion heater to prevent freezing during system maintenance. The tank feeds the inflow pipeline into the combined pumphouse. The pipeline inlet has a tee that splits flows towards Booster Stations 2 and 3, or towards the gravity discharge pipeline to the fresh water reservoir. A shut off valve with a pressure relief valve is fitted on the gravity line to the reservoir so excess water in the system will drain directly to the reservoir. A discharge offtake that feeds directly into the temperature and flow control building (bypassing the reservoir) is positioned prior to the booster station and holding tank. This offtake allows for direct discharge of the full pipeline flow to Davidson Creek in the event of system or reservoir maintenance.

Booster Station 2 consists of two 75 kW (one operational and one standby) vertical turbine pumps in pump cans. Water will be conveyed from this pump station through Booster Station 4, which is 4.2 km away and has the same pump configuration and sizing as Booster Station 2. Booster Station 4 will lift the water to the fresh water tank at the plant site area. The fresh water tank design is within the scope of AMEC.

Reclaim water to mitigate deficit conditions in the TSF can be directly drawn from the Fresh Water Pipeline when surplus capacity is available in the system. The water will be taken from Booster Station 3, which is connected to the main pipeline and is adjacent to Booster Station 2 in the pumphouse building. Booster Station 3 was designed as an in-line pump station with a similar pump can configuration as Booster Station 1. It will have four 450 kW vertical turbine pumps (all four operational and one uninstalled spare). Water will be pumped from this pump station to the high point in the system (elevation 1350 m) before being discharged by gravity to the supernatant pond at TSF Site D. This pump station will be operated as a contingency during extreme dry conditions at the mine site or if additional water is required to raise the pond water level and saturate the PAG waste in the TSF.

The electrical systems for operation of the fresh water supply intake and booster stations were prepared as part of the study. The plan includes single line diagrams and control block diagrams for the overall system and for each location. The system requires a 25 kV overhead line stepped down with a pad or pole mounted transformer (depending on location) to 4.16 kV or 600V power supply at each location. The electrical and control systems at each location include a motor control centre (MCC) and local control panel(s) with remote input and output (I/O). The main programmable logic controller (PLC) for the system will be located at Booster Station 4.

A summary of the pump station locations, specifications, flow rates, design head, and power requirements is provided in Table 6.6.

Table 6.6 Pump Station Summary

PUMP STATION ID	UTM COORDINATES (ZONE 10)	MAX FLOWRATE	TOTAL DYNAMIC HEAD (TDH)	PUMP SPECIFICATIONS
Intake Pump Station	389323 E, 5902922 N	2,400 m^3/hr	174 m	4 x 525 kW motor w/ VSD
Booster Station 1	383741 E, 5902892 N	2,400 m^3/hr	179 m	4 x 525 kW motor w/ VSD
Booster Station 2	378200 E, 5898846 N	120 m^3/hr	153 m	2 x 75 kW motor w/ VSD
Booster Station 3	378200 E, 5898846 N	2,100 m^3/hr	223 m	4 x 450 kW motor w/ VSD
Booster Station 4	377648 E, 5895474 N	120 m^3/hr	132 m	2 x 75 kW motor w/ VSD

6.6.7 Fresh Water Reservoir

The fresh water reservoir will be constructed as an in-stream reservoir located downstream of the final seepage collection point at the Environmental Control Dam (ECD). The reservoir will be created by constructing a dam with a height of 14 m across Davidson Creek. The embankment is designed

as a water retaining structure and will have a low permeability core with appropriate filter zones and random fill shell zones. The dam will impound approximately 400,000 m^3 of fresh water. A spillway routes storm flows through the reservoir and around the dam. The spillway is designed to manage the 1 in 200 year 24-hour storm IDF in accordance with Dam Safety Guidelines (CDA, 2007) for a Significant consequence dam.

The reservoir slopes and basin floor will be covered with riprap. Appropriate sediment control BMPs will be implemented on natural drainages entering the reservoir.

The size of the reservoir has been based on an estimate of contingency storage required for a reasonable range of possible malfunctions in the operation of the fresh water supply system. This capacity is sufficient to meet the contingency requirements. The malfunctions considered in the assessment, remediation strategy for each malfunction, and anticipated maximum repair timelines in summer and winter are summarized in Table 6.7.

Table 6.7 Fresh Water Reservoir Contingency Sizing Assessment

MALFUNCTION	REMEDIATION	SUMMER REPAIR	WINTER REPAIR
Pipeline Damage	Repair / replace pipe with contingency supply on-site	7 days	14 days
Failure of Pump	Installed stand-by pumps included in design	Continuous	Continuous
Intake Obstruction	Use twin intake at reduced capacity Diver to Repair	Continuous 7 days	Continuous Weather Dependent, less than 30 days
Loss of Power Supply	Provide backup supply	7 days	7 days

6.6.8 Temperature and Flow Control System

Discharge from the reservoir to Davidson Creek will occur from a screened intake assembly through a concrete encased 24 inch diameter steel pipeline with a filter diaphragm and seepage control drainage system along the base of the pipeline. The discharge pipeline at the downstream toe of the dam bifurcates to two pipelines: a 6 inch steel pipe for the IFN flows and a 24 inch steel pipe for the flushing flows (channel maintenance). Release of water through the discharge pipeline will be controlled by a Temperature and Flow Control System (TFCS). The TFCS enables discharge flows into Davidson Creek to be controlled as much as practical to match the required flow and desired water temperatures. The TFCS consists of temperature and flow measurement devices and associated control logic feedback loops on the downstream discharge pipeline. The reservoir bypass line connects directly to the water supply pipeline to provide cooler water when required into the discharge flow to manage the discharge water temperature. The reservoir by-pass line also provides the capacity to directly discharge the range of required IFN to allow for reservoir

maintenance, if required. The discharge outlet includes a riprap lined outfall channel for energy dissipation and to assist with aeration to raise dissolved oxygen levels in the discharged water.

6.7 SITE WATER BALANCE

6.7.1 Introduction

A monthly operational and closure water balance was developed for the Blackwater Project using the GoldSim© software package. The model estimated the magnitude and extent of any water surplus and/or deficit conditions in the TSF based on a range of possible climatic conditions. The model included one year of pre-production (Year -1) and 17 years of operations at a nominal milling rate of 60,000 TPD dry, and 18 years of closure until the TSF discharges to Davidson Creek. The model incorporates the following major project components:

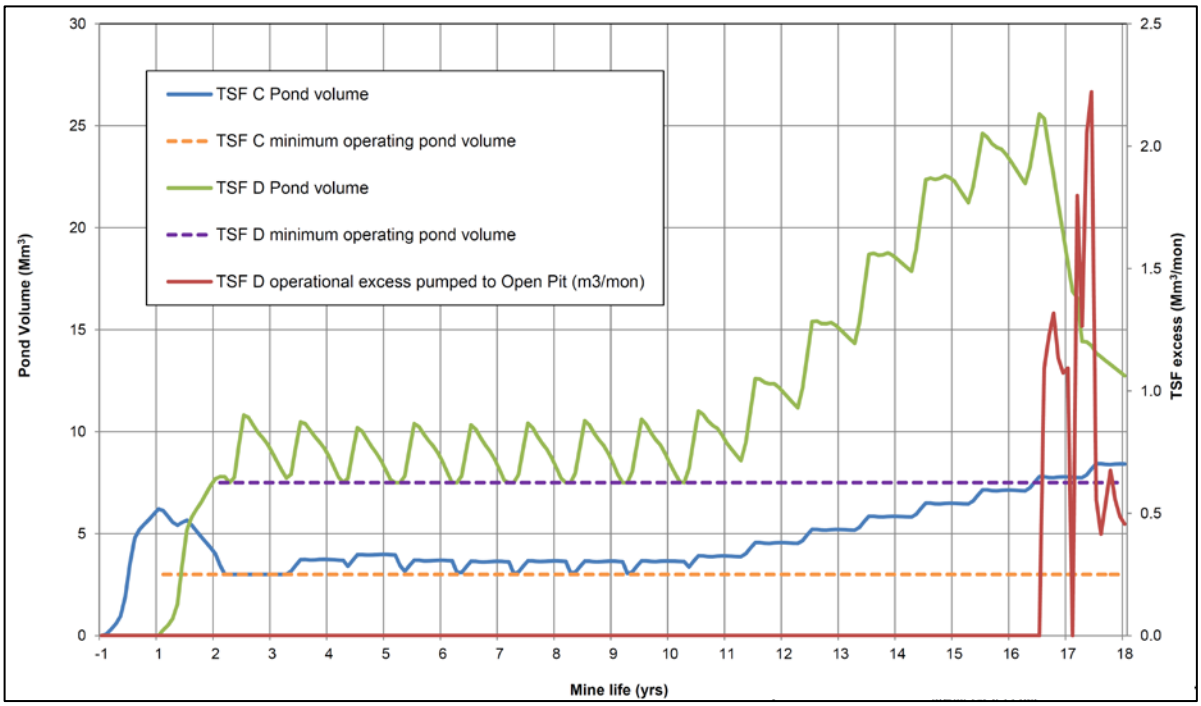
- Open pit.
- Mill.
- LGO Stockpile.
- TSF Site D.
- TSF Site C.
- East and West waste rock and overburden dumps.

The model inputs parameters and results of the water balance were described previously (Knight Piésold Ltd., 2013k). The referenced document is included as Appendix E and the results are summarized in the following sections.

6.7.2 Results

The water balance model included a start-up pond of at least 6 Mm^3 (under average conditions) accumulated in TSF Site C in the one year prior to mill start up, of which 1.0 Mm^3 accumulates behind the TSF Site C Main Dam based on runoff from its contributing upslope catchment (7.1 km^2), with the additional 5.0 Mm^3 from the TSF Site D undisturbed contributing catchments (25 km^2). This runoff will be collected behind a cofferdam located at the TSF Site D Main Dam location and be pumped to the TSF Site C pond until the start of operations. The minimum operating pond volumes for TSF Sites C and D were assumed to be 3.0 Mm^3 and 7.5 Mm^3, respectively. The predicted pond volumes available from construction to closure for both facilities, based on average precipitation conditions are shown on Figure 6.9.

Figure 6.9 Predicted Pond Volumes - Average Conditions

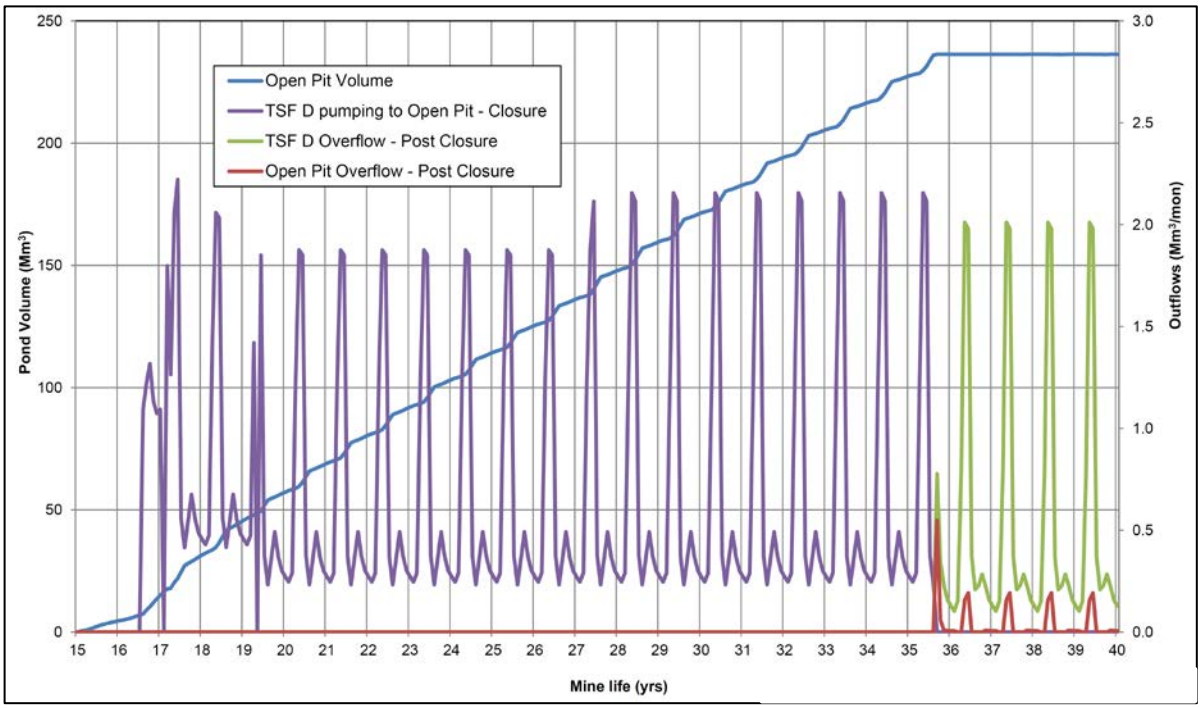


The facilities are in a balance or surplus condition throughout operations, as the water accumulated within the supernatant ponds in TSF Sites C and D including from open pit dewatering will satisfy the mill process requirements under average precipitation conditions. Freshwater required for the mill (1.05 Mm^3/year), will be provided by pumping from Tatelkuz Lake. From Years 5 to 10 when tailings are being deposited in TSF Site D, reclaim water is withdrawn from both the supernatant pond of TSF Site D and TSF Site C to meet the process water requirements. The additional process water requirement from TSF Site C is largely needed during the winter months when precipitation falls as snow, but with snowmelt during the spring freshet period, excess water becomes available and the system then operates in a surplus condition. The amount of surplus increases over time due to increasing runoff from the expanding disturbed areas of the mine facilities, and also from decreases in waste rock production and corresponding decreases of water storage in waste rock voids for the mine rock stored within TSF Site D.

The maximum operating pond volume for TSF Site D was based on a spillway elevation of 1336 m. However, as shown on Figure 6.9, TSF Site D is predicted to exceed its maximum operating pond volume in the last year of operations, therefore a portion of the upstream contributing catchment might be diverted around the facility to Davidson Creek in the later years of mine life.

The results of the closure pit filling model are shown on Figure 6.10. The open pit begins filling in Year 15 when the dewatering system is decommissioned after open pit mining has ceased. At the end of mill operations in Year 17 (after processing the LGO), the surplus inflow to TSF Site D (inflow minus losses) is pumped to the open pit to aid in pit filling.

Figure 6.10 Closure Pit Filling Model



TSF Site C continues to naturally overflow into TSF Site D via a closure spillway in Year 27. The open pit takes approximately 20 years from the end of mining to fill based on average precipitation conditions. TSF Site D is predicted to begin discharging via the closure spillway in that same year. Therefore it will take a total of 18 years after the end of mill operations before the system will discharge to Davidson Creek.

A stochastic analysis was completed to analyze the range of possible cumulative pond volumes available in TSF Site C and TSF Site D over the mine life, as defined by the 95th percentile wet and dry values (5% and 95% chance of being equalled or exceeded in any month, respectively). This range of volumes also indicates possible active or live storage capacity in the TSF ponds for a reasonably large range of anticipated climatic conditions. The stochastic water balance highlights the sensitivity of the TSF pond volumes to the assumed climatic inputs and pond minimum/maximum operating capacities. The stochastic results indicate that for extreme dry conditions (5th percentile), the accumulated TSF ponds, open pit and associated contributing catchments are not able to supply enough water to meet the process water requirements until Year 11, and the system will operate in a deficit condition until that time, as indicated in Table 6.8.

Table 6.8 Annual Stochastic Volume of Make-up Water Requirement

Mine Life	Annual volume of make-up water required to supplement TSF reclaim (m^3/yr)			Annual volume of make-up water required from freshwater source (m^3/yr)
	5th Percentile	50th Percentile (Median)	95th Percentile	
-1	0	0	0	0
1	0	0	0	1,051,200
2	2,000,400	0	0	1,051,200
3	2,389,900	0	0	1,051,200
4	2,865,800	0	0	1,054,080
5	2,655,700	0	0	1,051,200
6	2,918,600	0	0	1,051,200
7	2,903,800	0	0	1,051,200
8	2,741,400	0	0	1,054,080
9	2,708,800	0	0	1,051,200
10	1,801,800	0	0	1,051,200
11	979,120	0	0	1,051,200
12	0	0	0	1,054,080
13	0	0	0	1,051,200
14	0	0	0	1,051,200
15	0	0	0	1,051,200
16	0	0	0	1,054,080
17	0	0	0	259,200

The stochastic analysis indicates under extreme dry conditions the supplemental make-up water requirement to support operation of the mine is less than 3 Mm^3 per year. The fresh water supply system has enough design capacity to augment this projected worst case deficit.

The TSF operational pond capacity is sufficient to manage a reasonable range of surplus water conditions. Water levels will be monitored to confirm that the water balance assumptions are accurate and that an operational surface water discharge from the TSF will not occur until closure. As a contingency, non-contact surface water diversions can be created to divert runoff away from the TSFs and the TSF dams can be raised more frequently, if required.

7 – CLOSURE AND RECLAMATION

7.1 GENERAL

The primary objective of the closure and reclamation initiatives will be to eventually return the TSF to a self-sustaining facility that satisfies the end land use objectives. The TSF is designed to maintain long-term stability, protect the downstream environment, and manage surface water. Activities that will be carried out during operations and at closure to achieve these objectives are discussed in the following sections.

7.2 DECOMMISSIONING AND CLOSURE

Upon mine closure, surface facilities will be removed in stages and full reclamation of the TSF will be initiated. The closure plan is compatible with a premature closure event. General aspects of the closure plan include:

- Selective discharge of tailings around the facility during the final years of operations to establish and flatten the final tailings beach to facilitate surface water management and reclamation.
- Placing an oxide tailings cover up to 3 m thick on Site C beaches such that transition and sulphide tailings remain saturated over a wide range of precipitation conditions.
- Placing an oxide tailings/overburden cover up to 5 m thick on the Site D beach such that transition and sulphide tailings remain saturated over a wide range of precipitation conditions.
- Covering the exposed tailings beaches and PAG waste rock with approximately 30 cm of overburden.
- Establishing wetlands and revegetating the upland beaches.
- Pumping the tailings pond supernatant to the pit for about 18 years to expedite the development of the pit lake and flooding of the majority of PAG rock in the ultimate pit walls.
- Dismantling and removing the tailings and reclaim delivery systems and all pipeline structures, and equipment not required beyond mine closure.
- Constructing spillways and overflow channels.
- Removing the seepage collection pumpback systems at such time that suitable water quality for direct release is achieved.
- Establishing polishing wetlands for treatment of seepage in the former sediment pond, ECD and freshwater reservoir downstream of Site D Main Dam.
- Removing and re-grading all access roads, ponds, ditches, and borrow areas not required beyond mine closure.
- Long-term stabilization of all exposed erodible materials.

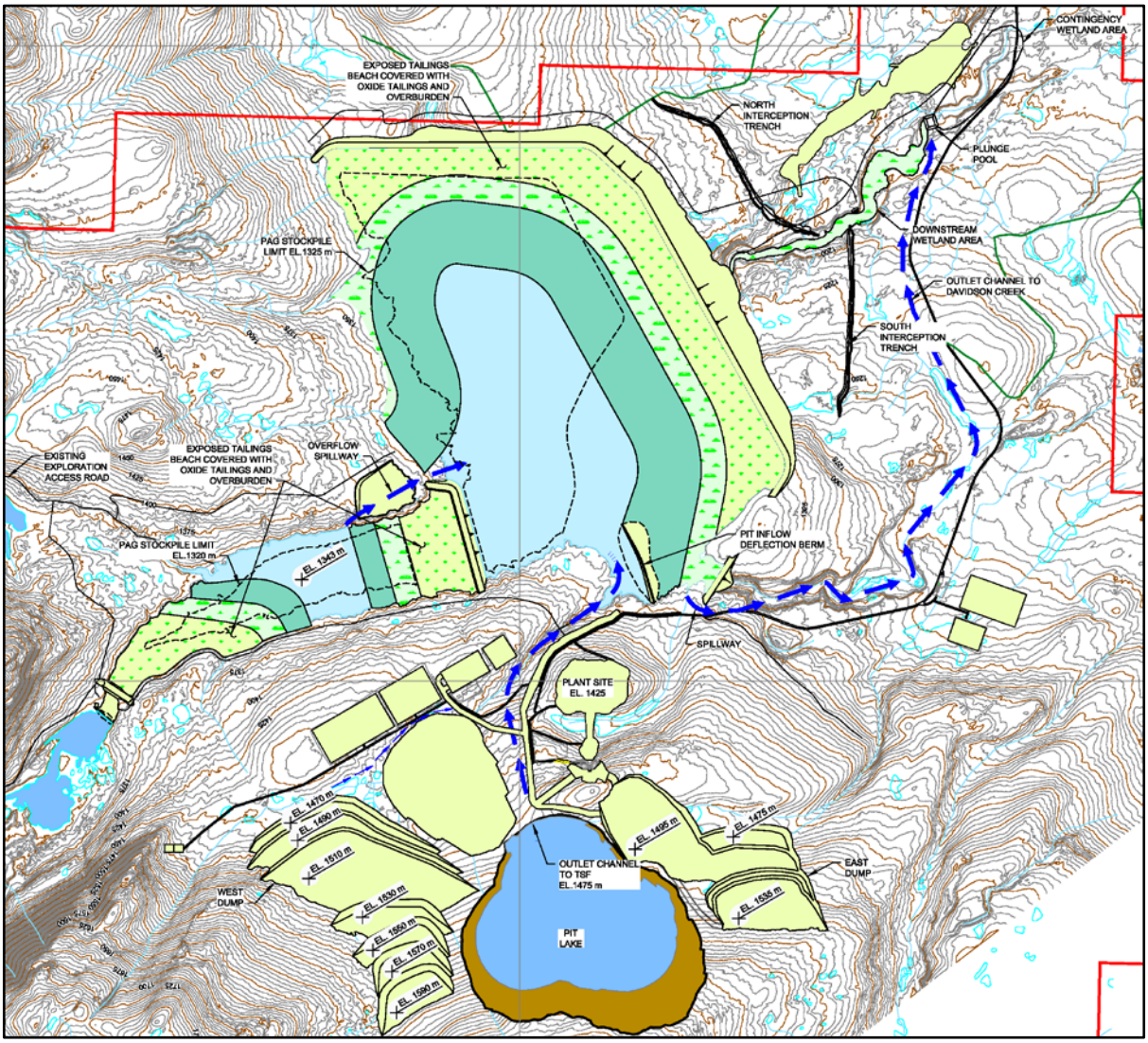
At closure, the remaining waste rock dump areas not progressively reclaimed will be reclaimed with overburden and re-vegetated. The low grade stockpile pad will be tested for contamination and removed and disposed of as required in the open pit or TSF. The pit will be allowed to flood and, upon filling, the pit lake will discharge via a constructed channel to the TSF and hence via a closure spillway to Davidson Creek. A north-south oriented causeway may be constructed towards the end of operations into the Site D tailings basin area from the south side across the PAG stockpile area to allow for the efficient spigotting of tailings into the basin to maximize storage volume and develop the closure configuration. The causeway will be capped with a thin overburden layer and blanketed with a thin veneer of tailings. This submerged topographic ridgeline creates a longer flow path for the pit

lake inflow to the TSF spillway discharge point and removes the potential for a short-circuit to develop in the TSF lake.

Seepage from the TSF will pass through constructed wetlands downstream of TSF Site D and hence to Davidson Creek.

The TSF general arrangement plan after closure is shown in Figure 7.1.

Figure 7.1 General Arrangement Post Closure



7.3 ON-GOING MONITORING REQUIREMENTS

The Environmental Control Dam (ECD) and pumpback system will be retained until monitoring results indicate seepage from the TSF is of suitable quality for release to downstream waters. The groundwater monitoring wells and all other geotechnical instrumentation will be retained for use as long-term dam safety monitoring devices.

Post-closure requirements will include an annual inspection of the TSF and on-going evaluation of water quality, flow rates, and instrumentation records to confirm design assumptions for closure.

8 – MATERIAL TAKEOFFS

8.1 GENERAL

The quantities (material takeoffs) for developing the initial and sustaining capital cost estimate and operating costs were derived from the drawings in this feasibility design report of the mine waste facilities and water management systems for the Project. Material takeoffs (MTOs) generated for the project include site preparation, heavy civil construction, piping, mechanical, instrumentation, and electrical work activities. The MTOs were transmitted to AMEC to derive unit costs, and to compile the initial capital, sustaining capital and operational costs. KP were involved in cost review meetings to validate the unit costs applied to the MTOs that were provided, and the overall cost estimates for initial and sustaining capital.

8.2 DRAWING PACKAGES

MTOs were derived from the feasibility design drawings where sufficient detail was available. Quantities provided were “neat-line” measured or calculated quantities with no allowance for design growth included. Allowances were provided based on recent experience where the level of design detail was not sufficient for measurement or calculation of quantities.

The feasibility design drawing package is included as Appendix A. The drawing package includes the following:

- General Arrangement Drawings (10 Drawings).
- Site Preparation, Access, and Sediment and Erosion Control (12 Drawings).
- Tailings Dam Construction (7 Drawings).
- TSF Instrumentation (7 Drawings).
- LGO Stockpile Preparation (1 Drawing).
- Fresh Water Supply System (11 Drawings).
- Environmental Control Dam (5 Drawings).
- Reclaim Water System (6 Drawings).
- Tailings Distribution System (9 Drawings).
- Water Management Systems – Electrical (11 Drawings).
- Open Pit Dewatering (3 Drawings).

8.3 DEVELOPMENT OF MATERIAL TAKEOFFS

8.3.1 Site Preparation and Heavy Civil Works

Site preparation and civil earthworks MTOs were provided as neat, in place quantities, with no allowance for swell, compaction, and waste. Mass earthworks quantities were generated from a 3D model of the works using LiDAR topography as the rough grade. The backfill materials and levels of compaction were specified in the designs drawings. Quantities for rough grading of the construction haul roads and service roads were generated from in a 3D model targeting 30% more cut than fill. Quantities for finish grading were derived from planimetric areas and thicknesses.

Structural quantities were calculated from design drawings without allowances for waste and over-pour. Steel superstructures were provided as a plan area quantity. Concrete quantities were grouped by shape classification: e.g. slabs, walls, and supports.

8.3.2 Piping

Overland piping for the water management and tailings distribution systems were measured from drawings and provided as neat-line quantities without allowance for design growth, waste, and snaking. The MTOs were provided as lengths by type of service with material, grade and diameter specified.

8.3.3 Mechanical and Electrical

Major mechanical equipment was specified on process flow diagrams for each area and added to the project equipment list at the request of AMEC. Budgetary quotations were solicited from reliable vendors for all pumps and motors, and provided to AMEC for consideration during preparation of the cost estimates.

The electrical MTOs were based on single line diagrams prepared for the water management systems. The battery limit between KP and AMEC scope was established to be the 25 kV line. KP provided the MTOs for anything between the 25 kV pole and the facilities within KP design scope. The KP scope included the transformer to step down power, and the associated electrical and control equipment for the building.

8.3.4 Dam Instrumentation

Allowances for dam instrumentation for each instrumentation plane were provided by KP based on recent project experience. The allowances were based on the instrumentation plan and sections prepared for the feasibility study design drawings and are considered to be all-in cost allowances including supply of materials, labor, drilling and earthworks.

8.4 WORK BREAKDOWN STRUCTURE

The MTOs completed by KP for the estimate were organized using the following Work Breakdown Structure (WBS):

Task 1000 – Mining

- 1100 – Mine Stockpiles and Waste:
  - 1110 – Low-grade Ore Stockpile Site Preparation.
  - 1120 – East Dump Site Preparation.
  - 1130 – West Dump Site Preparation.
- 1400 – Mine Infrastructure:
  - 1450 – Pit Dewatering.

Task 4000 – Tailings Facilities

- 4100 – Site Preparation:
  - 4110 – Logging.
  - 4120 – Roads.
  - 4130 – Sediment and Erosion Control.
  - 4140 – Borrow Development and Laydowns.
- 4200 – TSF Site C:
  - 4210 – Cofferdams.
  - 4220 – Site C Main Dam (up to EL. 1300 m).

  - 4230 – Site C Main Dam (up to EL. 1325 m).
  - 4240 – Site C Main Dam (up to EL. 1340 m).
  - 4250 – Instrumentation.
- 4300 – TSF Site D:
  - 4310 – Cofferdams.
  - 4320 – Site D Cut-off Trench.
  - 4330 – Site D Main Dam (up to EL. 1240 m).
  - 4340 – Instrumentation.
- 4400 – Tailings Distribution and Water Reclaim:
  - 4410 – Service Roads.
  - 4420 – Water Reclaim System for TSF Site C.
  - 4430 – Tailings Distribution System for TSF Site C.
- 4500 – TSF Power Distribution.
- 4600 – Sustaining Capital (by year):
  - 4610 – TSF Site Preparation.
  - 4620 – TSF Site C.
  - 4630 – TSF Site D.
  - 4640 – Tailings Distribution and Water Reclaim.
  - 4650 – TSF Power Distribution.
  - 4660 – Environmental Control Dam.
  - 4670 – Mine Stockpiles and Waste.
  - 4680 – Fresh Water Supply System.

Task 6000 – Off-Site Facilities

- 6200 – Fresh Water Supply System:
  - 6220 – Tatelkuz Lake Intake and Pump Station.
  - 6230 – Fresh Water Supply Booster Pump Stations.
  - 6240 – Fresh Water Supply Pipeline.
  - 6250 – Fresh Water Reservoir.
  - 6260 – Water Supply Power Distribution.

8000 – Owner's Costs

- 8900 – Start Up:
  - 8950 – TSF Construction.

The final MTOs are separated by level two task description and provided in Appendix F.

The costs for the development of these facilities have been compiled and combined in a separate document for the Feasibility Study. The final report on the cost estimate was completed by AMEC in December 2013 (AMEC, 2013c).

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10 – CERTIFICATION

This report was prepared, reviewed and approved by the undersigned.



Prepared: _____
Daniel Fontaine, P.Eng.
Project Engineer

Reviewed: _____
Bruno Borntraeger, P.Eng.
Specialist Engineer

Approved: _____
Ken Brouwer, P.Eng.
President

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APPENDIX A

DESIGN DRAWINGS

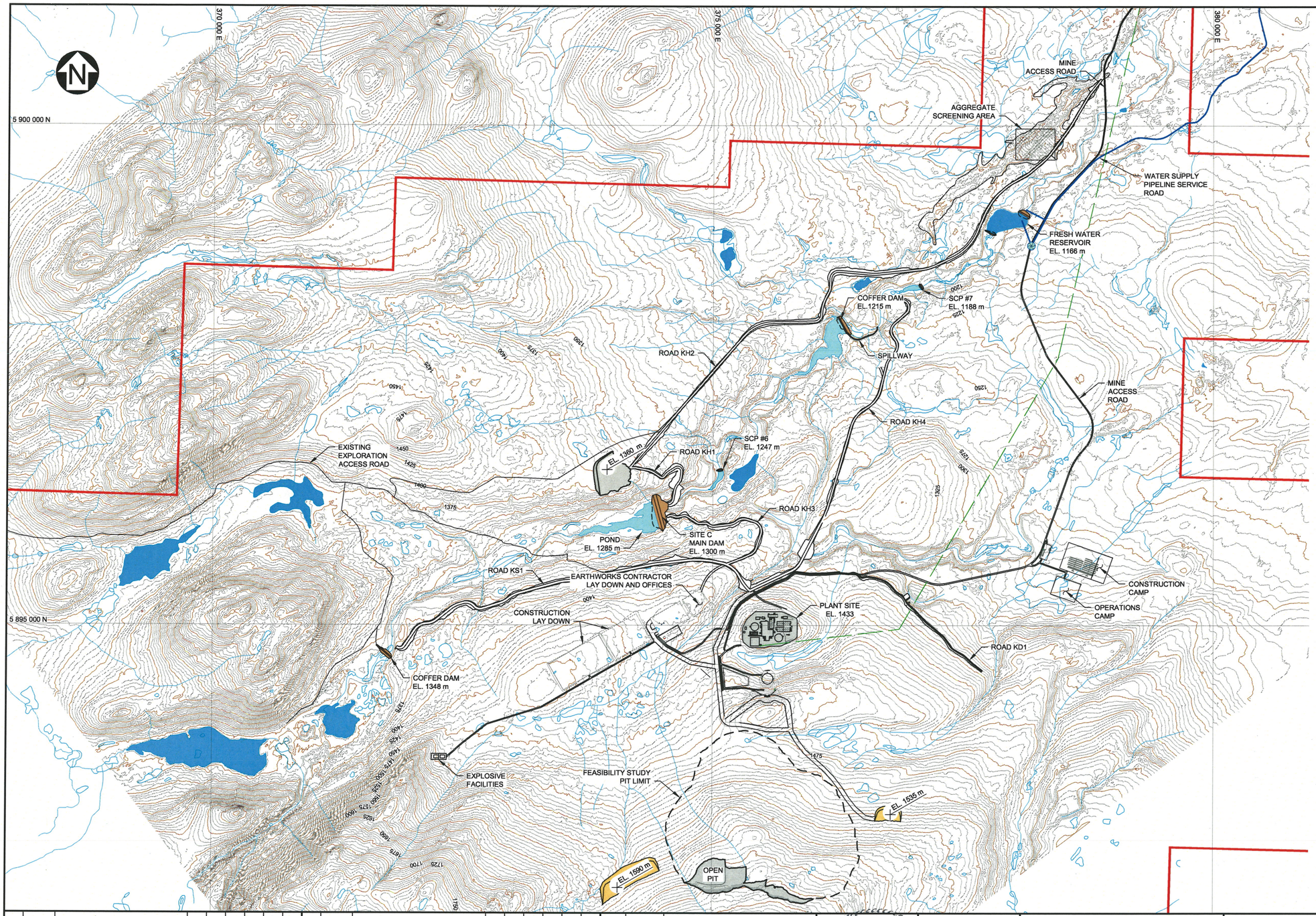
(Pages A-1 to A-83)

TABLE A.1

NEW GOLD INC.
BLACKWATER GOLD PROJECT

MINE WASTE AND WATER MANAGEMENT DESIGN REPORT
DRAWING LIST

KP DWG No.	Rev.	Revision Date	Package	Drawing Title Title
D0101	0	04DEC'13	General Arrangement	General Arrangement - End of Year -2 - Plan
D0102	0	04DEC'13	General Arrangement	General Arrangement - End of Year -1 - Plan
D0103	0	04DEC'13	General Arrangement	General Arrangement - End of Year 1 - Plan
D0104	0	04DEC'13	General Arrangement	General Arrangement - End of Year 2 - Plan
D0105	0	04DEC'13	General Arrangement	General Arrangement - End of Year 3 - Plan
D0106	0	04DEC'13	General Arrangement	General Arrangement - End of Year 4 - Plan
D0107	0	04DEC'13	General Arrangement	General Arrangement - End of Year 8 - Plan
D0108	0	04DEC'13	General Arrangement	General Arrangement - End of Year 17 - Plan
D0109	0	04DEC'13	General Arrangement	General Arrangement - Closure End of Year 20 - Plan
D0110	0	04DEC'13	General Arrangement	General Arrangement - Post Closure - Plan
D0115	0	04DEC'13	Tailings Dam Construction	Tailings Storage Facility - Site C - Main Dam and West Dam Section
D0116	0	04DEC'13	Tailings Dam Construction	Tailings Storage Facility - Site D - Main Dam Section
D0117	0	04DEC'13	Tailings Dam Construction	Construction Material Specifications
D0120	0	04DEC'13	Site Preparation	Tailings Storage Facility - Site Preparation - Logging
D0125	0	04DEC'13	Site Preparation	Tailings Storage Facility - Site Preparation - Roads
D0126	0	04DEC'13	Site Preparation	Tailings Storage Facility - Site Preparation - Road Typical Sections
D0130	0	29NOV'13	Sediment and Erosion Control Plan	Sediment and Erosion Control Plan - Start of Year 2015
D0131	0	29NOV'13	Sediment and Erosion Control Plan	Tailings Storage Facility - Site C - Cofferdam Plan
D0132	0	29NOV'13	Sediment and Erosion Control Plan	Tailings Storage Facility - Site D - Cofferdam Plan
D0133	0	29NOV'13	Sediment and Erosion Control Plan	Waste Dumps and Open Pit
D0134	0	29NOV'13	Sediment and Erosion Control Plan	Plan - Camp Area - Start of Year 2015
D0135	0	29NOV'13	Sediment and Erosion Control Plan	Aggregate Borrow Area and Fresh Water Reservoir Area - Start of Year 2015
D0136	0	29NOV'13	Sediment and Erosion Control Plan	Erosion Control BMP - Sections and Details - Sheet 1 of 3
D0137	0	29NOV'13	Sediment and Erosion Control Plan	Erosion Control BMP - Sections and Details - Sheet 2 of 3
D0138	0	29NOV'13	Sediment and Erosion Control Plan	Erosion Control BMP - Sections and Details - Sheet 3 of 3
D0140	0	04DEC'13	Tailings Dam Construction	TSF - Site C - Year -2 Construction Plan
D0150	0	04DEC'13	Tailings Dam Construction	TSF - Site C - Year -1 Construction Plan
D0170	0	04DEC'13	Tailings Dam Construction	TSF - Site D - Year -1 Construction Plan
D0171	0	04DEC'13	Tailings Dam Construction	TSF - Site D Stage 1 Cut-off Trench - Excavation Plan and Sections
D0180	0	04DEC'13	TSF Instrumentation	Tailings Storage Facility - Instrumentation Plan
D0181	0	04DEC'13	TSF Instrumentation	Tailings Storage Facility - Site C Main Dam and West Dam - Instrumentation Sections 1 and 2
D0182	0	04DEC'13	TSF Instrumentation	Tailings Storage Facility - Site D Main Dam - Instrumentation Sections 3 and 4
D0183	0	04DEC'13	TSF Instrumentation	Tailings Storage Facility - Site D Main Dam - Instrumentation Sections 5 and 6
D0184	0	04DEC'13	TSF Instrumentation	Tailings Storage Facility - Site D Main Dam and Fresh Water Reservoir - Instrumentation Sections 7 and 8
D0185	0	04DEC'13	TSF Instrumentation	Tailings Storage Facility - Instrumentation - Typical Sections and Details
D0186	0	04DEC'13	TSF Instrumentation	Tailings Storage Facility - Instrumentation - Instrumentation Sea-Can
D0190	0	04DEC'13	LGO Stockpile Preparation	Mine Site Preparation - Low-Grade Ore Stockpile - Plan and Typical Sections
D0200	0	04DEC'13	Fresh Water Supply System	Fresh Water Supply Pipeline - General Arrangement and Profile
D0201	0	04DEC'13	Fresh Water Supply System	Process Flow Schematic
D0202	0	04DEC'13	Fresh Water Supply System	Intake Structure - Plan and Section
D0203	0	04DEC'13	Fresh Water Supply System	Pump Station - Plan and Section
D0204	0	04DEC'13	Fresh Water Supply System	Booster Station 1
D0205	0	04DEC'13	Fresh Water Supply System	Booster Station 2 & 3
D0206	0	04DEC'13	Fresh Water Supply System	Booster Station 4
D0207	0	04DEC'13	Fresh Water Supply System	Booster Station Tank System
D0208	0	04DEC'13	Fresh Water Supply System	Fresh Water Reservoir Plan and Section
D0209	0	04DEC'13	Fresh Water Supply System	Temperature and Flow Control System
D0210	0	04DEC'13	Fresh Water Supply System	Temperature and Flow Control System - Process and Instrumentation Diagram
D0221	0	04DEC'13	Environmental Control Dam	ECD - Plan and Section
D0222	0	04DEC'13	Environmental Control Dam	ECD - Interception Trench - Plan and Sections
D0223	0	04DEC'13	Environmental Control Dam	ECD - Pump Station - Plans
D0224	0	04DEC'13	Environmental Control Dam	ECD - Pump Station - Section
D0225	0	04DEC'13	Environmental Control Dam	ECD - Pump Station Intake - Plan and Section
D0227	0	04DEC'13	Water Management Systems	TSF Water Management - Process Flow Schematic
D0241	0	04DEC'13	Reclaim Water System	Reclaim Water System - Year 1 and 2 - Process Flow Schematic
D0242	0	04DEC'13	Reclaim Water System	Reclaim Water System - Year 3 to 17 - Process Flow Schematic
D0243	0	04DEC'13	Reclaim Water System	Reclaim Pipelines - General Arrangement - Initial
D0244	0	04DEC'13	Reclaim Water System	Reclaim Pipelines - General Arrangement - Final
D0245	0	04DEC'13	Reclaim Water System	Reclaim Water System - Site C Decant Structure - Plans
D0246	0	04DEC'13	Reclaim Water System	Reclaim Water System - Site C Decant Structure - Section
D0260	0	04DEC'13	Tailings Distribution System	Tailings Pipelines Site C - General Arrangement - Initial
D0261	0	04DEC'13	Tailings Distribution System	Tailings Pipelines Site C and Site D - General Arrangement - Final
D0262	0	04DEC'13	Tailings Distribution System	Tailings Pipelines Site C - Process Flow Schematic - Initial
D0263	0	04DEC'13	Tailings Distribution System	Tailings Pipelines Site C and Site D - Process Flow Schematic - Final
D0264	0	04DEC'13	Tailings Distribution System	Tailings Pipelines Site C - Hydraulic Gradelines for Year 1 and 2 - Main and West Distribution Lines
D0266	0	04DEC'13	Tailings Distribution System	Tailings Pipelines Site D - Hydraulic Gradelines for Year 2 and 8 - Main and West Distribution Lines
D0267	0	04DEC'13	Tailings Distribution System	Tailings Pipelines Site D - Hydraulic Gradelines for Year 17 - Main and West Distribution Lines
D0268	0	04DEC'13	Tailings Distribution System	Tailings Pipelines - Drop Box and Choke Station - Plans, Section and Detail
D0269	0	04DEC'13	Tailings Distribution System	Tailings Pipelines - Sections and Details - Typical Restraint Options
E0279	0	04DEC'13	Water Management Systems	Electrical Equipment Locations
E0280	0	04DEC'13	Water Management Systems	Single Line Diagram
E0281	0	04DEC'13	Water Management Systems	Intake Station - MCC - Single Line Diagram
E0282	0	04DEC'13	Water Management Systems	Booster Pump Station #1 - MCC - Single Line Diagram
E0283	0	04DEC'13	Water Management Systems	Booster Pump Station #2 - MCC - Single Line Diagram
E0284	0	04DEC'13	Water Management Systems	Booster Pump Station #3 - MCC - Single Line Diagram
E0285	0	04DEC'13	Water Management Systems	Booster Pump Station #4 - MCC - Single Line Diagram
E0286	0	04DEC'13	Water Management Systems	Environmental Control Dam - MCC - Single Line Diagram
E0287	0	04DEC'13	Water Management Systems	Control Block Diagram
E0288	0	04DEC'13	Water Management Systems	Reclaim Barge - MCC - Single Line Diagram
D0300	0	04DEC'13	Open Pit Dewatering	Open Pit Dewatering Plan - In-Pit Water Management
D0301	0	04DEC'13	Open Pit Dewatering	Open Pit Dewatering Plan - Initial
D0303	0	04DEC'13	Open Pit Dewatering	Open Pit Dewatering - Process Flow Schematic - Year 1 to 14



LEGEND:

- MINE WATER
- FRESH WATER
- EMBANKMENT FILL
- BORROW AREA (ZONES S, C, AND ROCKFILL)
- NAG WASTE ROCK / OVERBURDEN
- BORROW AREA (ZONES F AND T)
- PUMPSTATION
- WATER SUPPLY PIPELINE SERVICE ROAD
- TRANSMISSION LINE
- NEW GOLD PROPERTY BOUNDARY

NOTES:

1. CONTOUR INTERVAL IS 5 METRES.
2. DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
3. SCP STANDS FOR SEDIMENT CONTROL POND.

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		APP	SRM	04DEC13

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SUBJECT: GENERAL ARRANGEMENT END OF YEAR -2 PLAN

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AREA

CLIENT DWG. NO. FIGURE 7-1

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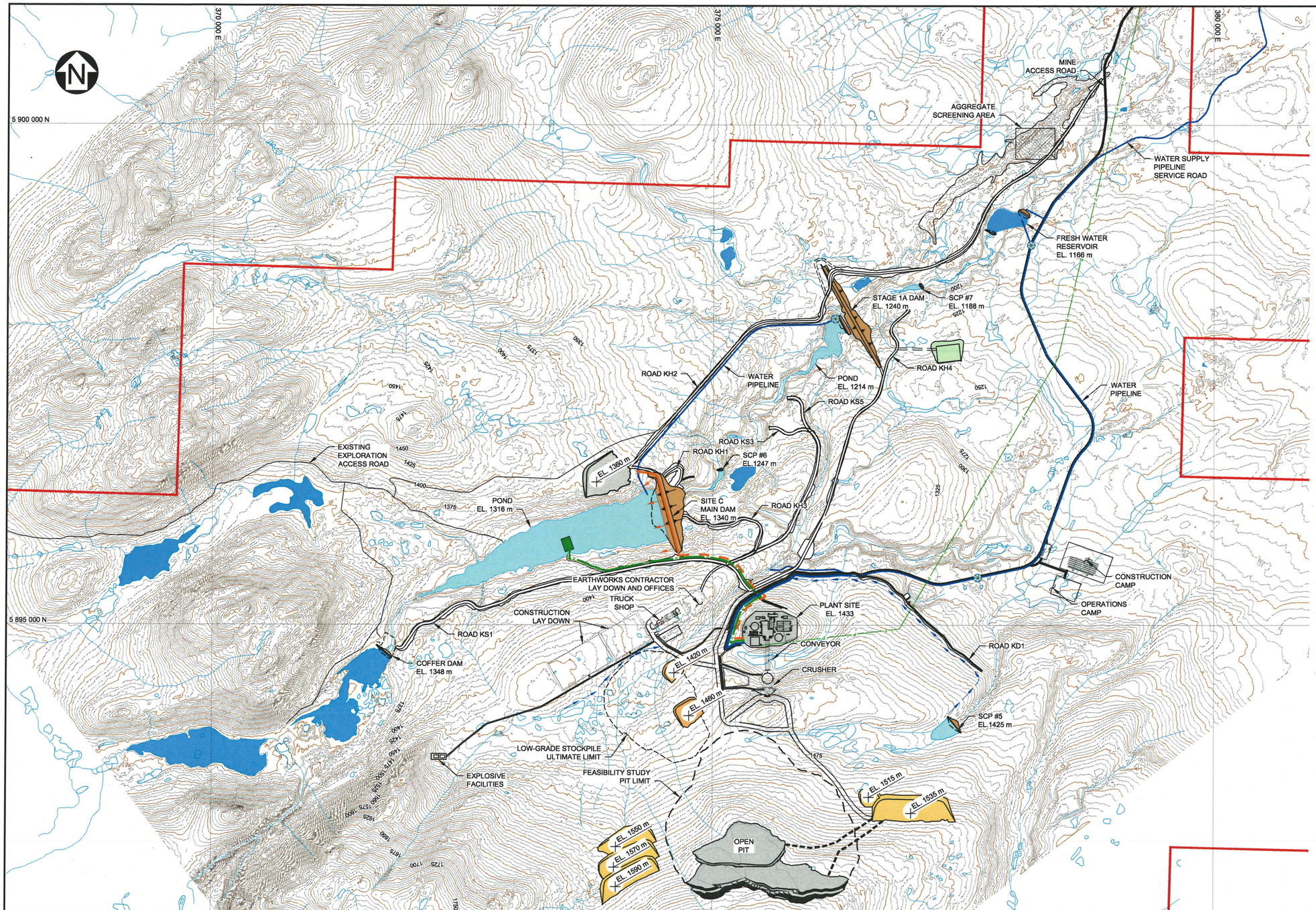

LEGEND:

- MINE WATER
- FRESH WATER
- EMBANKMENT FILL
- NAG WASTE ROCK / OVERBURDEN
- LOW-GRADE ORE
- TOPSOIL
- BORROW AREA (ZONES S, C, AND ROCKFILL)
- RECLAIM SYSTEM
- PUMPSTATION
- MINE ACCESS ROAD
- PIPELINE SERVICE ROAD
- EXISTING ACCESS TRAILS
- WATER RECLAIM PIPELINE
- TRANSMISSION LINE
- NEW GOLD PROPERTY BOUNDARY
- TAILINGS PIPELINE
- TAILINGS DEPOSIT
- DIVERSION CHANNEL

NOTES:

1. CONTOUR INTERVAL IS 5 METRES.
2. DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
3. SCP STANDS FOR SEDIMENT CONTROL POND.

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		REFERENCES

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VA101-457/6		DES	DDF	08NOV13
SCALE	PACKAGE CODE	DRN	AN	08NOV13
1:20000		CHK	RR	04DEC13
		APP	SRM	04DEC13

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SUBJECT: GENERAL ARRANGEMENT END OF YEAR –1 PLAN

Knight Piésold CONSULTING

AREA

CLIENT DWG. NO. FIGURE 7-2

DRAWING NO. D0102 REV. 0

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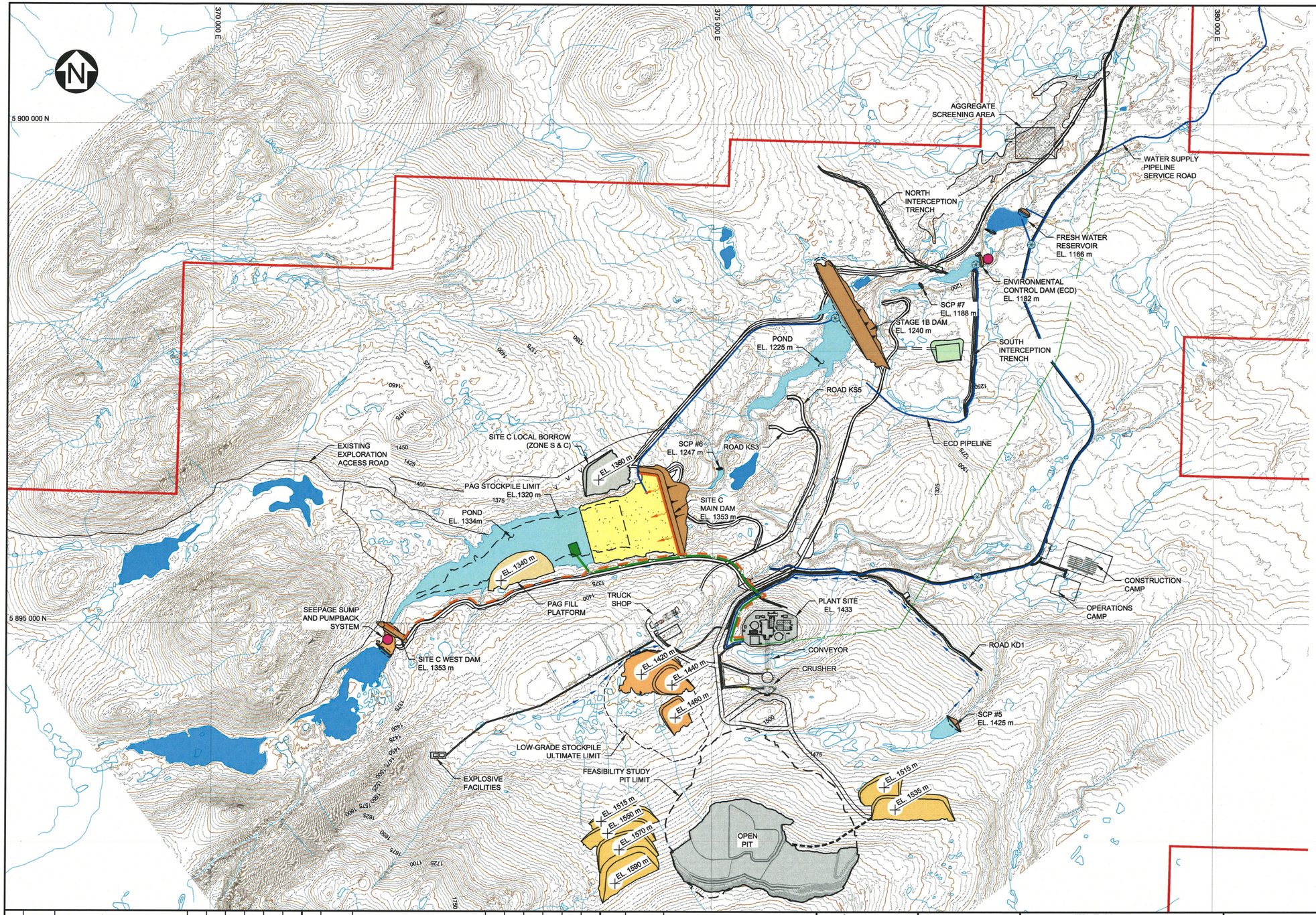

LEGEND:

- TAILINGS BEACH
- MINE WATER
- FRESH WATER
- EMBANKMENT
- PAG WASTE ROCK
- NAG WASTE ROCK / OVERBURDEN
- LOW-GRADE ORE
- TOPSOIL
- BORROW AREA (ZONES S, C, AND ROCKFILL)
- RECLAIM SYSTEM
- PUMPSTATION
- SEEPAGE SUMP AND PUMPBACK SYSTEM
- MINE ACCESS ROAD
- PIPELINE SERVICE ROAD
- EXISTING ACCESS TRAILS
- DIVERSION CHANNEL
- WATER RECLAIM PIPELINE
- NEW GOLD PROPERTY BOUNDARY
- TAILINGS PIPELINE
- TAILINGS DEPOSIT

NOTES:

1. CONTOUR INTERVAL IS 5 METRES.
2. DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
3. SCP STAND FOR SEDIMENT CONTROL POND.

NOT FOR CONSTRUCTION

SCALE A 400 200 0 400 800 1200 1600 2000 m

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP

REF	NUMBER	TITLE
REFERENCES		

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VA101-457/6		DES	DDF	08NOV13
SCALE	PACKAGE CODE	DRN	AN	08NOV13
1:20000		CHK	BB	04DEC13
		APP	[signature]	04DEC13

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SUBJECT: GENERAL ARRANGEMENT END OF YEAR 1 PLAN

AREA

CLIENT DWG. NO. FIGURE 7-3

DRAWING NO. D0103 REV. 0

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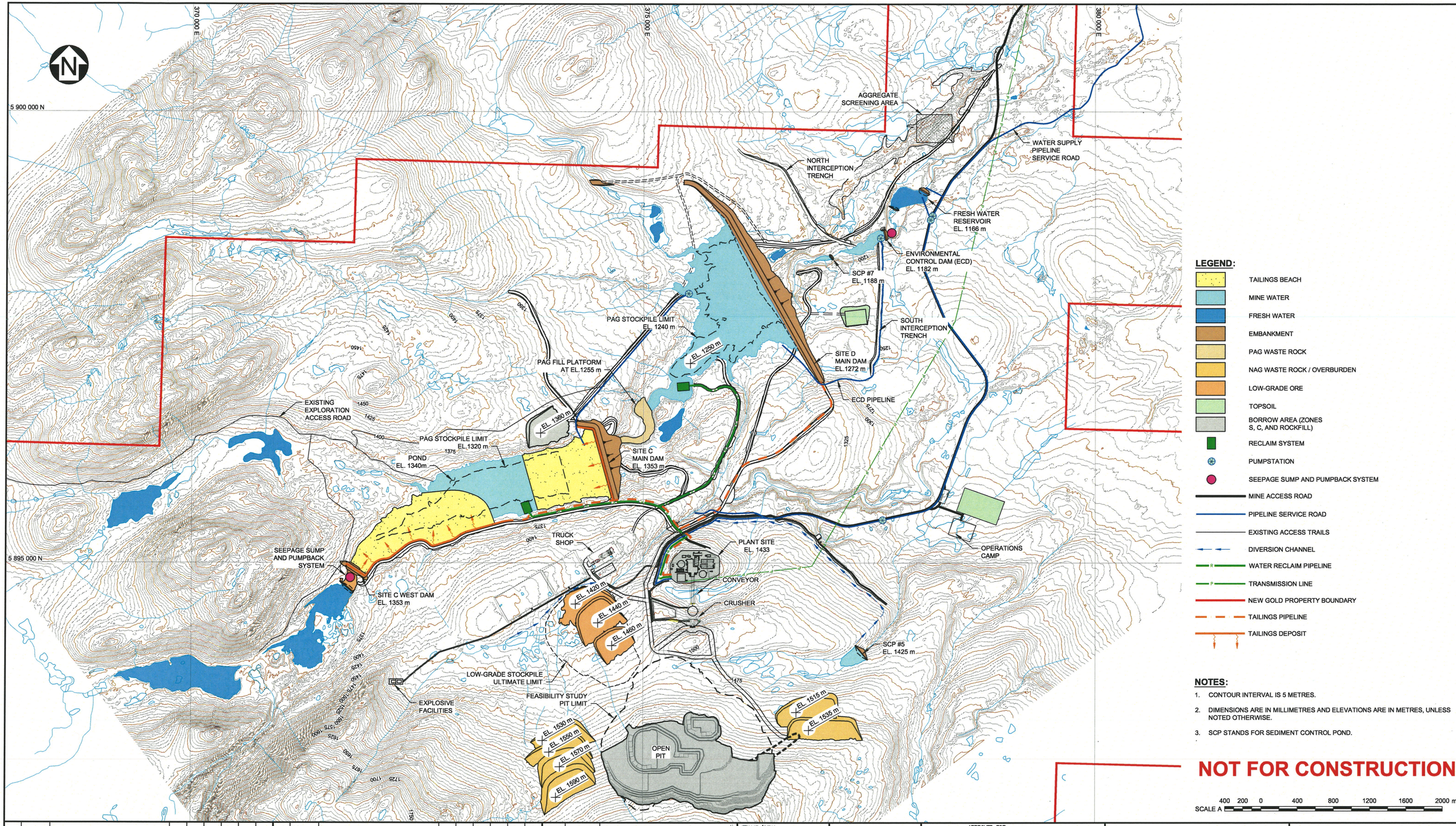

LEGEND:

- TAILINGS BEACH
- MINE WATER
- FRESH WATER
- EMBANKMENT
- PAG WASTE ROCK
- NAG WASTE ROCK / OVERBURDEN
- LOW-GRADE ORE
- TOPSOIL
- BORROW AREA (ZONES S, C, AND ROCKFILL)
- RECLAIM SYSTEM
- PUMPSTATION
- SEEPAGE SUMP AND PUMPBACK SYSTEM
- MINE ACCESS ROAD
- PIPELINE SERVICE ROAD
- EXISTING ACCESS TRAILS
- DIVERSION CHANNEL
- WATER RECLAIM PIPELINE
- TRANSMISSION LINE
- NEW GOLD PROPERTY BOUNDARY
- TAILINGS PIPELINE
- TAILINGS DEPOSIT

NOTES:

1. CONTOUR INTERVAL IS 5 METRES.
2. DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
3. SCP STANDS FOR SEDIMENT CONTROL POND.

NOT FOR CONSTRUCTION

SCALE A 400 200 0 400 800 1200 1600 2000 m

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP

REF	NUMBER	TITLE
REFERENCES		

STAMP/SEAL

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA D. D. FONTAINE # 36208 DEC 4 2013

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APPROVED FOR _____

CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE
FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	DDF	08NOV13
SCALE	PACKAGE CODE	DRN	AN	08NOV13
1:20000		CHK		04DEC13
		APP		04DEC13

newgold

Knight Piésold CONSULTING

SUBJECT
GENERAL ARRANGEMENT
END OF YEAR 2
PLAN

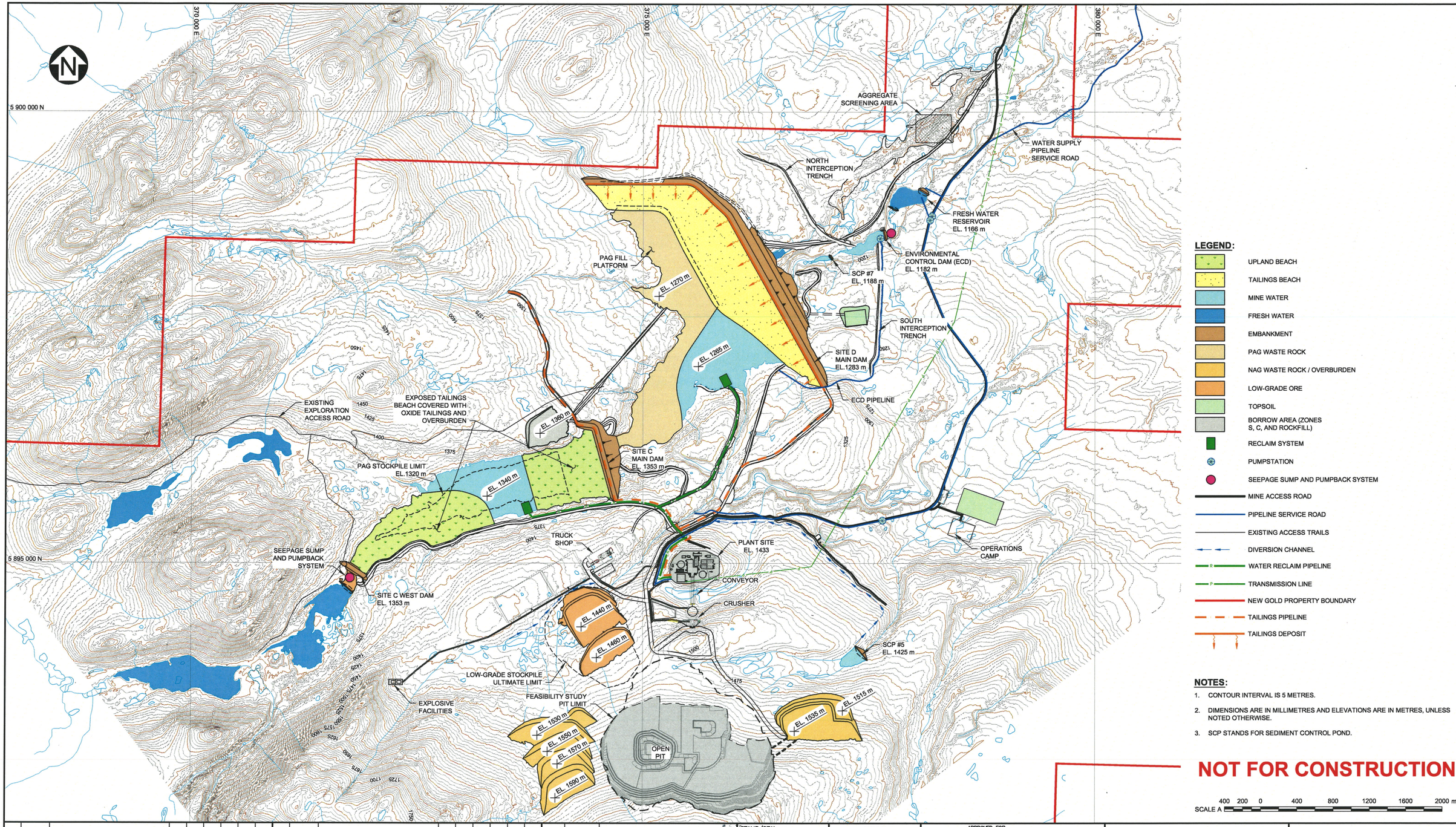
AREA

CLIENT DWG. NO.

DRAWING NO. D0104 REV. 0

CAD FILE: M:\1\01\00457\GR\A\ACAD\DWGS\D0104\D0104_R0.DWG

SAVED: 03-Dec-13 9:27 AM PLOTTED: 03-Dec-13 10:52 AM USER: ABBAS NASIRI



LEGEND:

- UPLAND BEACH
- TAILINGS BEACH
- MINE WATER
- FRESH WATER
- EMBANKMENT
- PAG WASTE ROCK
- NAG WASTE ROCK / OVERBURDEN
- LOW-GRADE ORE
- TOPSOIL
- BORROW AREA (ZONES S, C, AND ROCKFILL)
- RECLAIM SYSTEM
- PUMPSTATION
- SEEPAGE SUMP AND PUMPBACK SYSTEM
- MINE ACCESS ROAD
- PIPELINE SERVICE ROAD
- EXISTING ACCESS TRAILS
- DIVERSION CHANNEL
- WATER RECLAIM PIPELINE
- TRANSMISSION LINE
- NEW GOLD PROPERTY BOUNDARY
- TAILINGS PIPELINE
- TAILINGS DEPOSIT

NOTES:

1. CONTOUR INTERVAL IS 5 METRES.
2. DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
3. SCP STANDS FOR SEDIMENT CONTROL POND.

NOT FOR CONSTRUCTION

SCALE A 400 200 0 400 800 1200 1600 2000 m

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP

REF	NUMBER	TITLE
		REFERENCES

STAMP/SEAL

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA D. D. FONTAINE # 36208 Dec 4, 2013

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APPROVED FOR _____

CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE: FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	DDF	08NOV13
SCALE	PACKAGE CODE	DRN	AN	08NOV13
1:20000		CHK	RBS	04DEC13
		APP	[illegible]	04DEC13

newgold

Knight Piésold CONSULTING

SUBJECT: GENERAL ARRANGEMENT END OF YEAR 3 PLAN

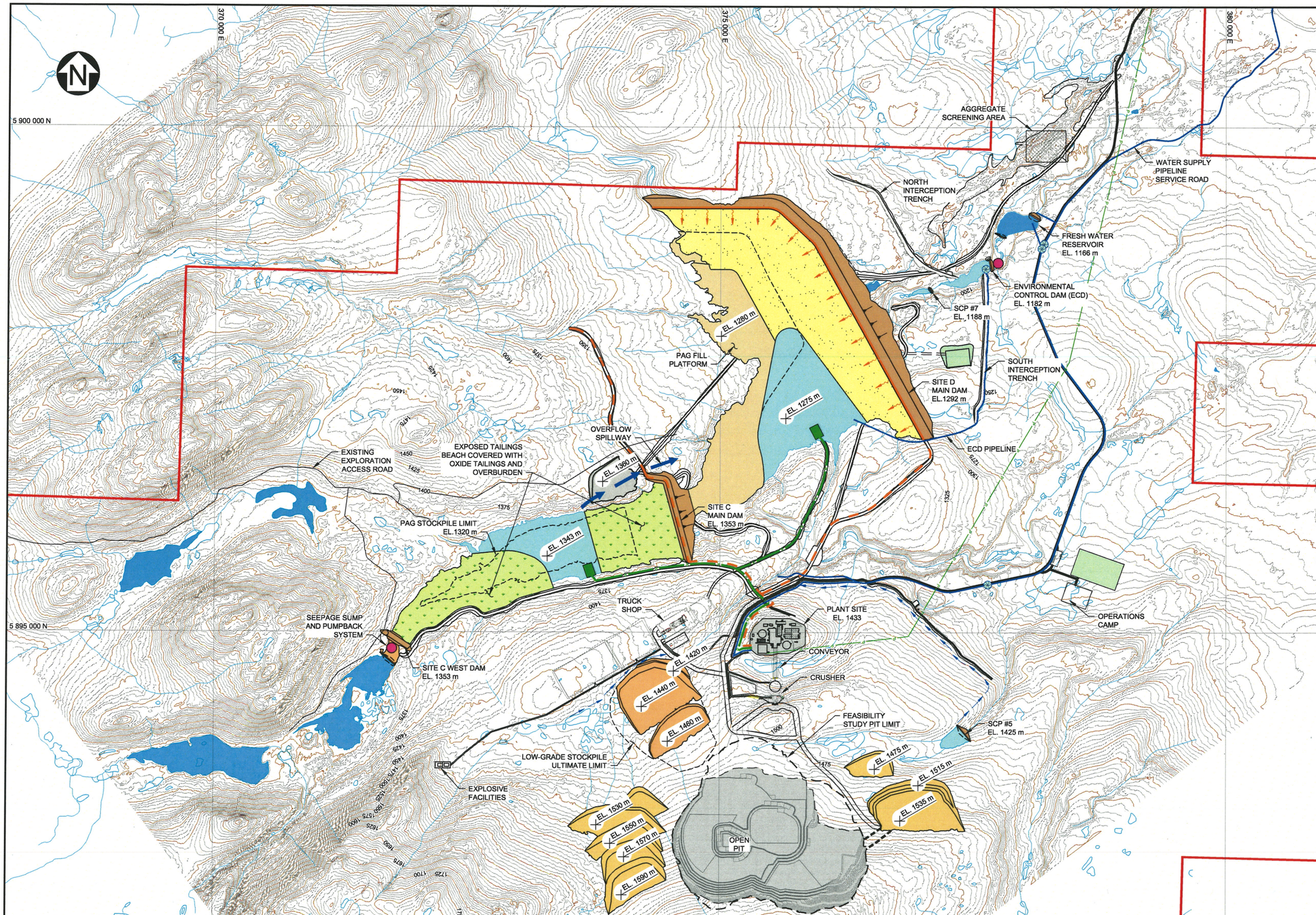
AREA

CLIENT DWG. NO. FIGURE 7-4

DRAWING NO. D0105 REV. 0

CAD FILE: \\V_\01\00457\06\VA\CAD\DWGS\D0105\D0105_R0.DWG

SAVED: 03-Dec-13 9:41 AM PLOTTED: 03-Dec-13 10:53 AM USER: ABBAS NASIRI



LEGEND:

- UPLAND BEACH
- TAILINGS BEACH
- MINE WATER
- FRESH WATER
- EMBANKMENT
- PAG WASTE ROCK
- NAG WASTE ROCK / OVERBURDEN
- LOW-GRADE ORE
- TOPSOIL
- BORROW AREA (ZONES S, C, AND ROCKFILL)
- RECLAIM SYSTEM
- PUMPSTATION
- SEEPAGE SUMP AND PUMPBACK SYSTEM
- MINE ACCESS ROAD
- PIPELINE SERVICE ROAD
- EXISTING ACCESS TRAILS
- DIVERSION CHANNEL
- WATER RECLAIM PIPELINE
- TRANSMISSION LINE
- NEW GOLD PROPERTY BOUNDARY
- SPILLWAY
- TAILINGS PIPELINE
- TAILINGS DEPOSIT

NOTES:

1. CONTOUR INTERVAL IS 5 METRES.
2. DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
3. SCP STANDS FOR SEDIMENT CONTROL POND.

NOT FOR CONSTRUCTION

SCALE A 400 200 0 400 800 1200 1600 2000 m

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP	REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP	REF	NUMBER	TITLE

REFERENCES

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PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — D. D. FONTAINE # 36208 — Dec 11, 2013

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APPROVED FOR _____

CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE: FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	DDF	08NOV13
		DRN	AN	08NOV13
SCALE	PACKAGE CODE	CHK	BB	04DEC13
1:20000		APP	SRM	04DEC13

newgold

Knight Piésold CONSULTING

SUBJECT: GENERAL ARRANGEMENT END OF YEAR 4 PLAN

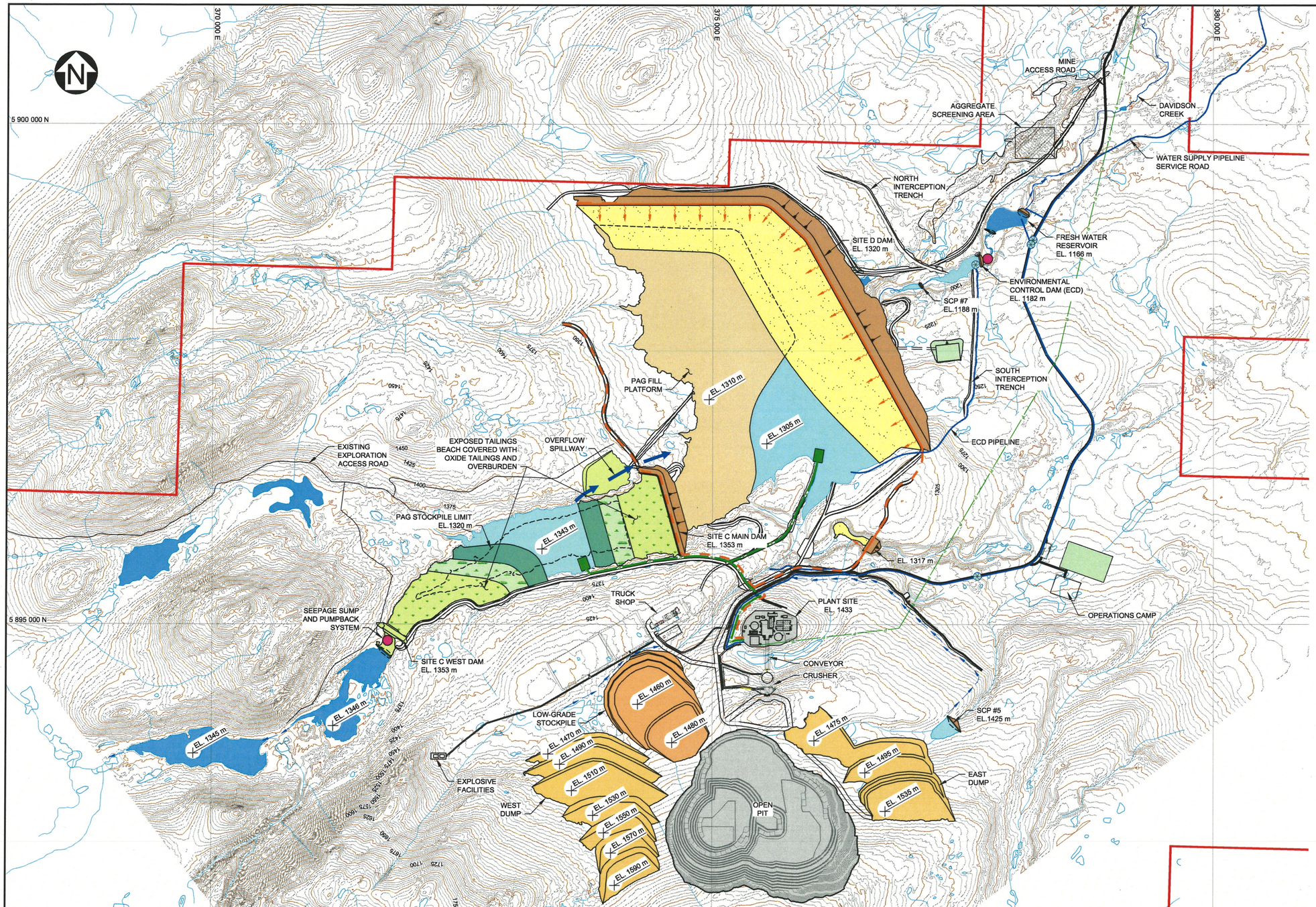
AREA

CLIENT DWG. NO.

DRAWING NO. D0106 REV. 0

CAD FILE: M:\1\01\00457\06\A\ACAD\DWGS\D0106\D0106_R0.DWG

SAVED: 03-Dec-13 9:34 AM PLOTTED: 03-Dec-13 10:53 AM USER: ABBAS NASIRI



LEGEND:

- UPLAND BEACH
- BOG / WETLAND AREA
- EMERGENT VEGETATION WETLAND
- UPLAND SLOPE
- TAILINGS BEACH
- MINE WATER
- FRESH WATER
- EMBANKMENT FILL
- PAG WASTE ROCK
- NAG WASTE ROCK / OVERBURDEN
- LOW-GRADE ORE
- TOPSOIL
- BORROW AREA (ZONES S, C, AND ROCKFILL)
- RECLAIM SYSTEM
- PUMPSTATION
- SEEPAGE SUMP AND PUMPBACK SYSTEM
- MINE ACCESS ROAD
- PIPELINE SERVICE ROAD
- DIVERSION CHANNEL
- WATER RECLAIM PIPELINE
- NEW GOLD PROPERTY BOUNDARY
- TRANSMISSION LINE
- SPILLWAY
- TAILINGS PIPELINE
- TAILINGS DEPOSITION

NOTES:

1. DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
2. SCP STANDS FOR SEDIMENT CONTROL POND.

NOT FOR CONSTRUCTION

SCALE A 400 200 0 400 800 1200 1600 2000 m

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP	REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP	REF	NUMBER	TITLE

REFERENCES

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PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — D. D. FONTAINE # 36208 — Dec 4, 2013

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CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE: FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	DDF	08NOV13
		DRN	AN	08NOV13
SCALE	PACKAGE CODE	CHK	RR	04DEC13
1:20000		APP	SRM	04DEC13

newgold

SUBJECT: GENERAL ARRANGEMENT END OF YEAR 8 PLAN

Knight Piésold CONSULTING

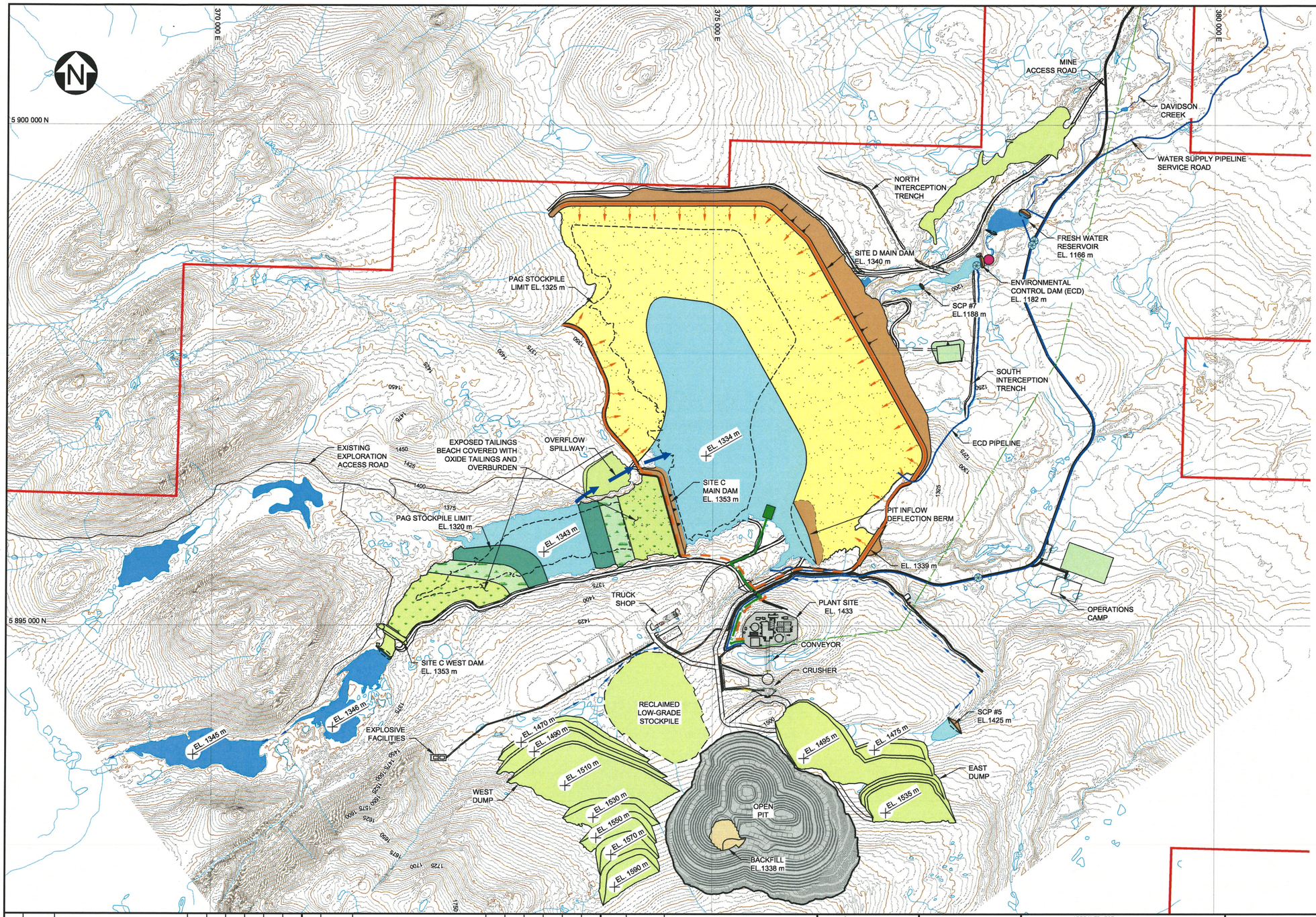
AREA

CLIENT DWG. NO.: FIGURE 7-5

DRAWING NO.: D0107 REV. 0

CAD FILE: M:\1\01\00457\06\A\ACAD\DWGS\D0107\D0107 R0.DWG

SAVED: 03-Dec-13 9:44 AM PLOTTED: 03-Dec-13 10:53 AM NASIRI USER: ABBAS



NOTES:

1. DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
2. SCP STANDS FOR SEDIMENT CONTROL POND.

NOT FOR CONSTRUCTION

SCALE A 400 200 0 400 800 1200 1600 2000 m

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP

REF	NUMBER	TITLE

REFERENCES

STAMP/SEAL

PROFESSIONAL ENGINEER — D. D. FONTAINE — # 36208 — BRITISH COLUMBIA — Dec 4/2013

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CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE
FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	DDF	08NOV13
SCALE	PACKAGE CODE	DRN	AN	08NOV13
1:20000		CHK	BR	04DEC13
		APP	SRM	04DEC13

newgold

Knight Piésold CONSULTING

SUBJECT
GENERAL ARRANGEMENT
END OF YEAR 17
PLAN

AREA

CLIENT DWG. NO.
FIGURE 7-6

DRAWING NO. D0108 REV. 0

CAD FILE: M:\1\101\00457\08\A\ACAD\DWGS\201108\D0108_R0.DWG

SAVED: 03-Dec-13 9:48 AM PLOTTED: 03-Dec-13 10:53 AM USER: ABBAS NASIRI

370 000 E
375 000 E
380 000 E
5 900 000 N
5 895 000 N

EXPOSED TAILINGS BEACH COVERED WITH OXIDE TAILINGS AND OVERBURDEN
NORTH INTERCEPTION TRENCH
MINE ACCESS ROAD
CONTINGENCY WETLAND AREA
WATER SUPPLY PIPELINE SERVICE ROAD
FRESH WATER RESERVOIR EL. 1166 m
ENVIRONMENTAL CONTROL DAM (ECD) EL. 1182 m
SCP #7 EL. 1188 m
SOUTH INTERCEPTION TRENCH
ECD PIPELINE
EMERGENCY SPILLWAY CONSTRUCTED BUT NOT OPERATING
PIT INFLOW DEFLECTION BERM
PAG STOCKPILE LIMIT EL.1325 m
EXISTING EXPLORATION ACCESS ROAD
EXPOSED TAILINGS BEACH COVERED WITH OXIDE TAILINGS AND OVERBURDEN
OVERFLOW SPILLWAY
PAG STOCKPILE LIMIT EL.1320 m
EL. 1343 m
PLANT SITE EL. 1425
RECLAIMED LOW-GRADE STOCKPILE
EL. 1470 m
EL. 1490 m
EL. 1510 m
EL. 1530 m
EL. 1550 m
EL. 1570 m
EL. 1590 m
WEST DUMP
EL. 1475 m
EL. 1495 m
EL. 1535 m
EAST DUMP
PIT LAKE
WASTE ROCK BACKFILL EL.1255 m

LEGEND:

- UPLAND BEACH
- UPLAND SLOPE
- BOG / WETLAND AREA
- EMERGENT VEGETATION WETLAND
- PAG WASTE ROCK
- MINE WATER
- FRESH WATER
- ROCK SLOPES
- RECLAIM SYSTEM
- PUMPSTATION
- SEEPAGE SUMP AND PUMPBACK SYSTEM
- MINE ACCESS ROAD
- PIPELINE SERVICE ROAD
- WATER RECLAIM PIPELINE
- TRANSMISSION LINE
- DIVERSION CHANNEL
- SPILLWAY

NOTES:

1. DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.

NOT FOR CONSTRUCTION

SCALE A 400 200 0 400 800 1200 1600 2000 m

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP

REF	NUMBER	TITLE
REFERENCES		

STAMP/SEAL
PROFESSIONAL ENGINEER
D.D. FONTAINE
36208
BRITISH COLUMBIA
Dec 9, 2013

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CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE: FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	DDF	08NOV13
SCALE	PACKAGE CODE	DRN	AN	08NOV13
1:20000		CHK	BS	04DEC13
		APP	RM	04DEC13

newgold

Knight Piésold CONSULTING

SUBJECT: GENERAL ARRANGEMENT CLOSURE – END OF YEAR 20 PLAN

AREA
CLIENT DWG. NO.
DRAWING NO. D0109
REV. 0

SAVED: 03-Dec-13 9:54 AM PLOTTED: 03-Dec-13 10:53 AM USER: ABBAS NASIRI
CAD FILE: M:\1\01\00457\08\VA\CAD\DWGS\D0109\D0109_RO.DWG

370 000 E
375 000 E
380 000 E
5 900 000 N
5 895 000 N
EXPOSED TAILINGS BEACH COVERED WITH OXIDE TAILINGS AND OVERBURDEN
NORTH INTERCEPTION TRENCH
MINE ACCESS ROAD
CONTINGENCY WETLAND AREA
PLUNGE POOL
DOWNSTREAM WETLAND AREA
OUTLET CHANNEL TO DAVIDSON CREEK
SOUTH INTERCEPTION TRENCH
PAG STOCKPILE LIMIT EL.1325 m
EXISTING EXPLORATION ACCESS ROAD
EXPOSED TAILINGS BEACH COVERED WITH OXIDE TAILINGS AND OVERBURDEN
OVERFLOW SPILLWAY
PAG STOCKPILE LIMIT EL.1320 m
EL. 1343 m
PIT INFLOW DEFLECTION BERM
SPILLWAY
PLANT SITE EL. 1425
EL. 1470 m
EL. 1490 m
EL. 1510 m
EL. 1530 m
EL. 1550 m
EL. 1570 m
EL. 1590 m
WEST DUMP
OUTLET CHANNEL TO TSF EL.1475 m
PIT LAKE
EL. 1495 m
EL. 1475 m
EAST DUMP
EL. 1535 m

LEGEND:

- UPLAND BEACH
- UPLAND SLOPE
- BOG / WETLAND AREA
- EMERGENT VEGETATION WETLAND
- MINE WATER
- FRESH WATER
- ROCK SLOPES
- MINE ACCESS ROAD
- DIVERSION CHANNEL
- SPILLWAY

NOTES:

1. DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.

NOT FOR CONSTRUCTION

SCALE A: 400 200 0 400 800 1200 1600 2000 m

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP
0	04DEC13	ISSUED FOR USE	DDF	AN	BR	SRM		

REF	NUMBER	TITLE
		REFERENCES

STAMP / SEAL: PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — D.D. FONTAINE # 36208 — Dec 4/2013

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APPROVED FOR _____
CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE: FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	DDF	08NOV13
SCALE	PACKAGE CODE	DRN	AN	08NOV13
1:20000		CHK	BR	04DEC13
		APP	SRM	04DEC13

newgold

Knight Piésold CONSULTING

SUBJECT: GENERAL ARRANGEMENT POST CLOSURE PLAN

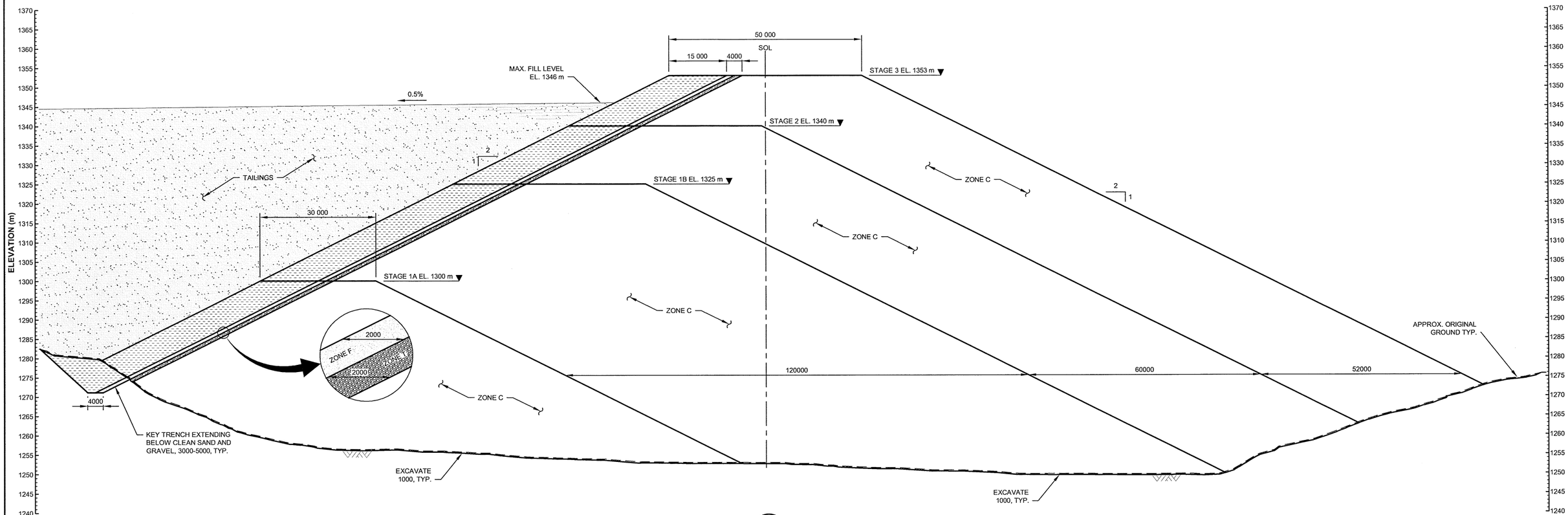
AREA

CLIENT DWG. NO. FIGURE 7-7

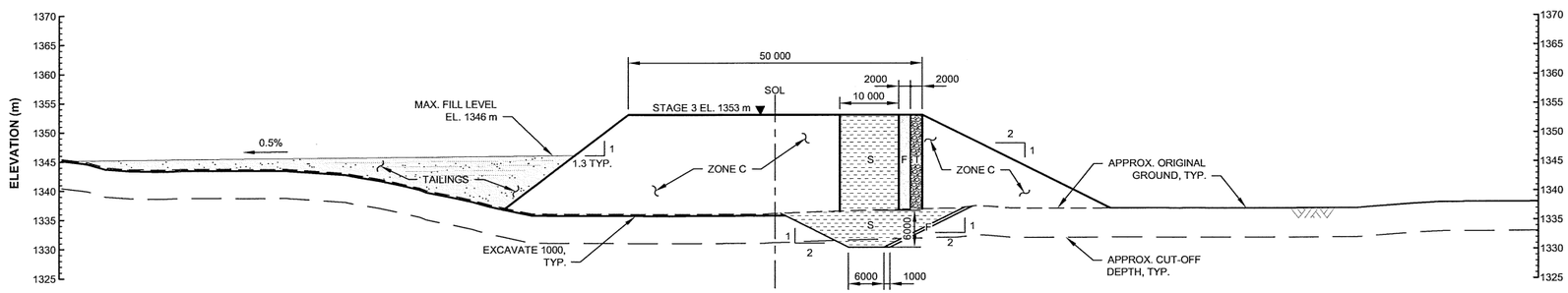
DRAWING NO. D0110 REV. 0

CAD FILE: M:\1\101\00457\08\vA\CAD\DWGS\D0110\D0110_R0.DWG

SAVED: 03-Dec-13 9:57 AM PLOTTED: 03-Dec-13 10:54 AM USER: ABBAS NASIRI



1 TYPICAL SECTION
SITE C MAIN DAM
SCALE A



2 TYPICAL SECTION
WEST DAM
SCALE A

LEGEND:

- ZONE S (CORE ZONE)
- ZONE F (FILTER)
- ZONE T (TRANSITION)
- ZONE C
- TAILINGS

NOTES:

1. DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.

NOT FOR CONSTRUCTION

SCALE A 10 5 0 10 20 30 40 50 m

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP	REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP	REF	NUMBER	TITLE

REFERENCES

STAMP/SEAL

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
D. D. FONTAINE
36208
Dec 4, 2013

– DISCLAIMER –
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CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE
FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	DDF	08NOV13
		DRN	AN	08NOV13
SCALE	PACKAGE CODE	CHK	BR	04DEC13
1:500		APP	SRM	04DEC13

newgold

SUBJECT
TAILINGS STORAGE FACILITY
SITE C
MAIN DAM AND WEST DAM SECTIONS

Knight Piésold
CONSULTING

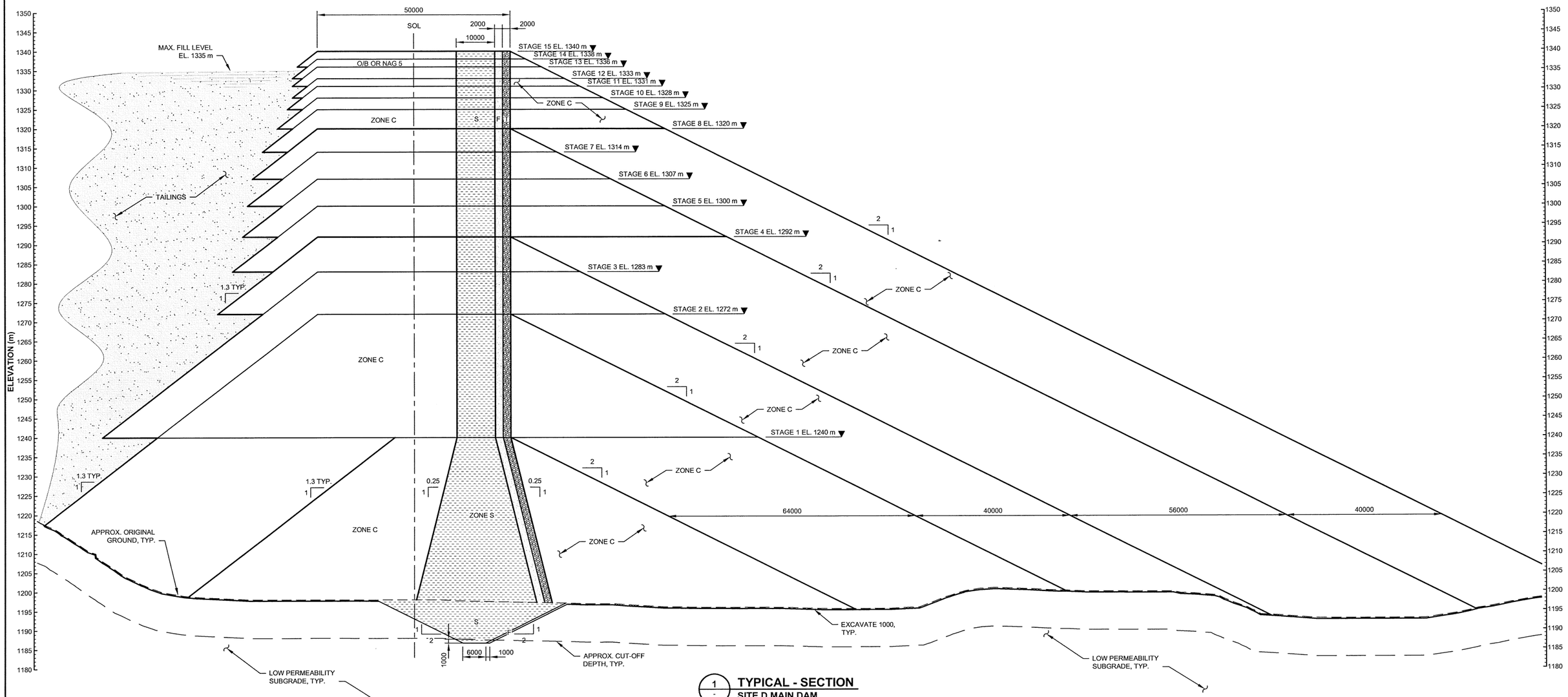
AREA

CLIENT DWG. NO.

DRAWING NO. D0115 REV. 0

CAD FILE: M:\1\01\00457\06\A\ACAD\DWGS\D0115\D0115_R0.DWG

SAVED: 03-Dec-13 10:08 AM PLOTTED: 03-Dec-13 10:26 AM USER: ABBAS NASIRI



1 - **TYPICAL - SECTION**
SITE D MAIN DAM
SCALE A

LEGEND:

- ZONE S (CORE ZONE)
- ZONE F (FILTER)
- ZONE T (TRANSITION)
- ZONE C
- TAILINGS

NOTES:

1. DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.

NOT FOR CONSTRUCTION

SCALE A 10 5 0 10 20 30 40 50 m

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP
REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP

REF	NUMBER	TITLE
REFERENCES		

STAMP/SEAL: D. D. FONTAINE # 36208 PROFESSIONAL ENGINEER Dec 4, 2013

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APPROVED FOR _____
CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE: FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	DDF	08NOV13
SCALE	PACKAGE CODE	DRN	AN	08NOV13
1:500		CHK	BB	4Dec13
		APP	JM	4Dec13

newgold

Knight Piésold CONSULTING

SUBJECT: TAILINGS STORAGE FACILITY
SITE D
MAIN DAM SECTION

AREA
CLIENT DWG. NO.
DRAWING NO. D0116
REV. 0

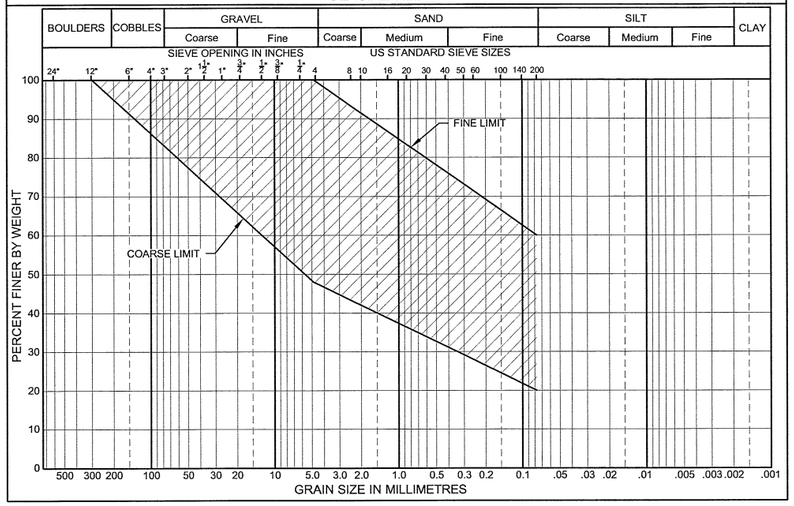
SAVED: 03-Dec-13 10:12 AM PLOTTED: 03-Dec-13 10:26 AM USER: ABBAS NASRI

CAD FILE: M:\1\01\00457\05\A\CAD\DWGS\D0116\D0116_BCL.DWG

UNIFIED SOIL CLASSIFICATION SYSTEM

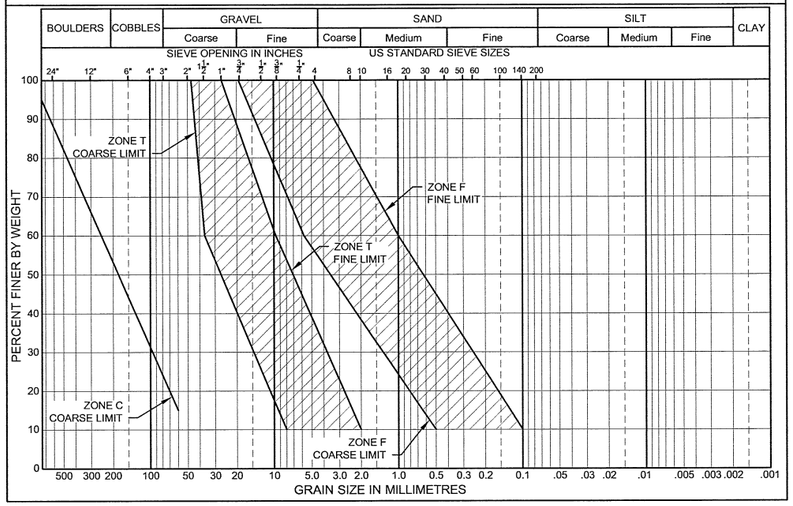
ZONE - S

GLACIAL TILL



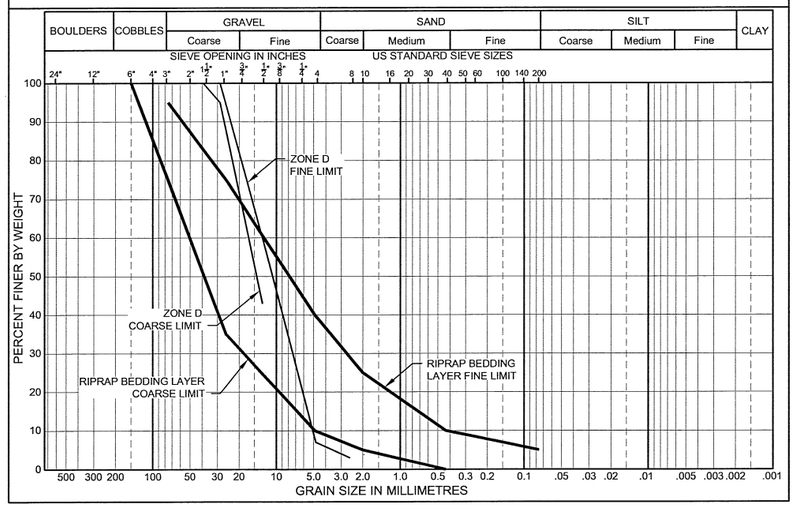
UNIFIED SOIL CLASSIFICATION SYSTEM

ZONE - F,T



UNIFIED SOIL CLASSIFICATION SYSTEM

ZONE - D, RIPRAP BEDDING LAYER



MATERIAL PLACEMENT AND COMPACTION REQUIREMENTS

ZONE	MATERIAL TYPE	LOCATIONS	PLACING AND COMPACTION REQUIREMENTS
S	GLACIAL TILL	CORE ZONE	PLACED, MOISTURE CONDITIONED AND SPREAD IN MAXIMUM 300 MM THICK LAYERS (AFTER COMPACTION). VIBRATORY COMPACTION TO 95% OF STANDARD PROCTOR MAXIMUM DRY DENSITY OR AS APPROVED BY THE ENGINEER
F	FILTER SAND	CHIMNEY DRAIN	PLACED AND SPREAD IN MAXIMUM 600 MM THICK LAYERS AND COMPACTED WITH MINIMUM 4 TO 6 PASSES OF 10 TON SMOOTH DRUM VIBRATORY ROLLER, OR AS APPROVED BY THE ENGINEER
T	GRAVEL	TRANSITION ZONE	PLACED AND SPREAD IN MAXIMUM 600 MM THICK LAYERS AND COMPACTED WITH MINIMUM 4 TO 6 PASSES OF 10 TON SMOOTH DRUM VIBRATORY ROLLER, OR AS APPROVED BY THE ENGINEER.
C	WASTE ROCK OVER BURDEN	SHELL ZONE	CONTRACTOR FLEET TO PLACE AND SPREAD IN MAXIMUM 1000 mm THICK LAYERS. MINING FLEET TO PLACE AND SPREAD IN MAXIMUM 2000 mm THICK LAYERS. UNIFORMLY COMPACTED BY SELECTIVE ROUTING OF HAUL TRUCK TRAFFIC ON MAIN FILL AND BY VIBRATORY ROLLER ON THE FILL EDGES.
D	DRAINAGE GRAVEL	DRAINS	PLACED AROUND DRAINAGE PIPES AND WRAPPED WITH GEOTEXTILE.

NOTES:

1. DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
2. RIPRAP TO BE HARD, DENSE AND DURABLE TO WITHSTAND LONG EXPOSURE TO WEATHERING.
3. RIPRAP SIZE TO MEET OR EXCEED THE SIZE DIMENSIONS SPECIFIED ON THE ROCK INTERMEDIATE DIMENSION (SECONDARY AXIS).
4. RIPRAP STONES SHALL BE ANGULAR IN SHAPE. NO STONE SHALL EXCEED A LENGTH TO BREADTH OR THICKNESS OF 3.
5. WEARING COURSE SHALL BE FREE OF ALL ORGANIC MATTER, AND SOFT FRIABLE PARTICLES, EACH LAYER SHALL BE COMPACTED BY A MINIMUM OF FOUR PASSES OVER THE ENTIRE SURFACE WITH THE SPECIFIED STEEL DRUM VIBRATING ROLLER. WEARING COURSE MATERIAL SHALL CONFORM TO THE FOLLOWING GRADATION:

SIEVE SIZE	PERCENT PASSING
75 MM	100
19 MM	60 - 100
9.5 MM	40 - 83
4.75 MM	20 - 50
2 MM	12 - 30
0.075 MM	5 - 15

RIPRAP REQUIREMENTS

RIPRAP DATA *		APPROXIMATE % OF TOTAL MASS SMALLER THAN GIVEN			
		RIPRAP TYPE			
MASS	SIZE	1	2	3	4
(KG)	(MM)				
2600	1000				100
900	750				50
450	600			100	30
180	450		100	50	
55	300		50	30	10
22	225		30		
7	150			10	
2	100	100	10		
1	75	50			
	50	30			
	25	10			

* MASS TO APPROXIMATE SIZE CONVERSION BASED ON A SPECIFIC GRAVITY OF 2.6 AND A VOLUME AVERAGE BETWEEN A SPHERE AND CUBE.

NOT FOR CONSTRUCTION

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP
REF	NUMBER	TITLE
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		REFERENCES

STAMP/SEAL: PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — D. D. FONTAINE — # 36208 — Dec 4, 2013

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CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE: FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	DDF	20NOV13
		DRN	AN	20NOV13
SCALE: NTS	PACKAGE CODE	CHK	GG	04DEC13
		APP		04DEC13

SUBJECT: CONSTRUCTION MATERIAL SPECIFICATIONS

newgold

Knight Piésold CONSULTING

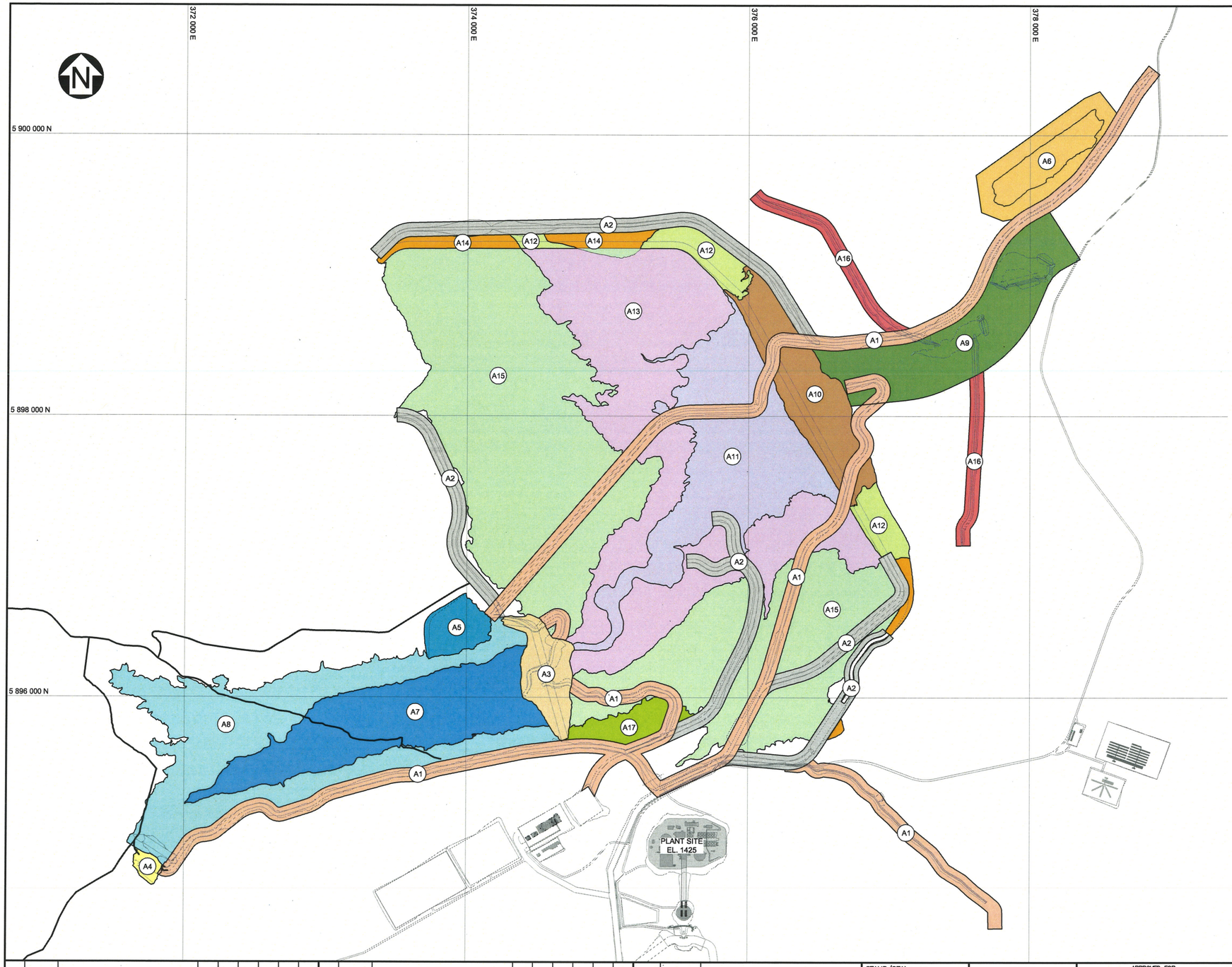
AREA

CLIENT DWG. NO.

DRAWING NO. D0117 — REV. 0

CAD FILE: VA101\200457\06\VA-CAD\DWGS\D0117\D0117_RG.DWG

SAVED: 03-Dec-13 10:15 AM PLOTTED: 03-Dec-13 10:28 AM USER: ABBAS NASIRI



TSF LOGGING PLAN

	DESCRIPTION	AREA (ha)
A1	ROAD PACKAGE 1	182
A2	ROAD PACKAGE 2	105
A3	SITE C MAIN DAM	24
A4	SITE C WEST DAM	4
A5	SITE C LOCAL BORROW	15
A6	AGGREGATE SCREENING AREA	41
A7	TSF SITE C FOOTPRINT - STAGE 1	100
A8	TSF SITE C FOOTPRINT - FINAL	142
A9	TSF SITE D DOWNSTREAM	83
A10	SITE D MAIN DAM - STAGE 1	48
A11	TSF SITE D FOOTPRINT - STAGE 1	131
A12	SITE D MAIN DAM - STAGE 2	30
A13	TSF SITE D FOOTPRINT - STAGE 2	240
A14	SITE D MAIN DAM - STAGE 3	20
A15	TSF SITE D FOOTPRINT - STAGE 3	467
A16	ECD INTERCEPTION TRENCH	27
A17	SITE C SOUTH BORROW	14

NOTES:

1. DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.

NOT FOR CONSTRUCTION

SCALE A 300 150 0 500 1000 1500 m

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP

REF	NUMBER	TITLE

REFERENCES

STAMP/SEAL

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA
D. D. FONTAINE
36208
Dec 4, 2013

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CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE
FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	DDF	20NOV13
SCALE	PACKAGE CODE	DRN	AN	20NOV13
1:15000		CHK	BB	04DEC13
		APP	[illegible]	04DEC13

newgold

SUBJECT
TAILINGS STORAGE FACILITY
SITE PREPARATION
LOGGING

Knight Piésold CONSULTING

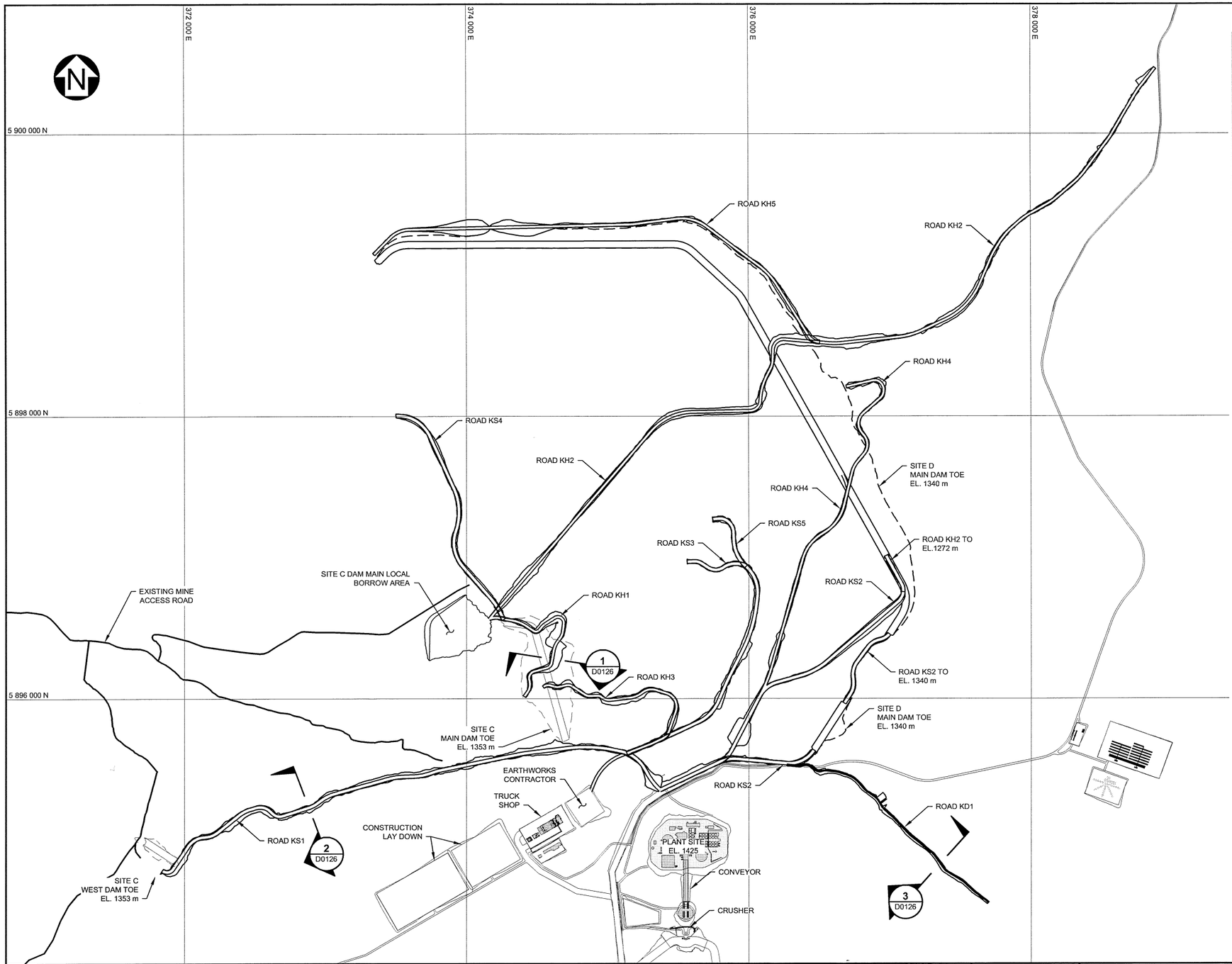
AREA

CLIENT DWG. NO.

DRAWING NO. D0120 REV. 0

CAD FILE: M:\1\01\00457\08\VA\CAD\DWGS\00120\00120_R0.DWG

SAVED: 03-Dec-13 10:19 AM PLOTTED: 03-Dec-13 10:26 AM USER: ABBAS NASIRI



TSF ROAD VOLUMETRICS				
ROAD	CUT (m³)	FILL (m³)	LENGTH (m)	WIDTH (m)
KD1	99,900	11,600	2,024	6
KH1	217,200	163,100	1,259	20
KH2	754,800	535,400	6,636	20
KH3	100,900	68,300	1,581	20
KH4	79,200	473,100	3,788	20
KH5	505,500	370,200	3,607	20
KS1	240,800	477,500	3,927	25
KS2 TO EL. 1272	186,300	8,500	1,580	25
KS2 TO EL. 1340	46,000	29,000	1,339	25
KS3	103,000	73,000	2,350	25
KS4	27,000	113,000	1,758	25
KS5	13,600	4,000	468	25

NOTES:

1. DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
2. ROAD LAYOUT WAS COMPLETED TARGETING BALANCE OF 30% MORE CUT THAN FILL.
3. ROAD FILL ASSUMED TO BE SUPPLIED FROM EXCAVATION WITHIN 500 m,
4. ADDITIONAL BORROW MATERIAL IS REQUIRED FROM WITHIN 500 m HAUL DISTANCE WHERE FILL REQUIRED EXCEEDS CUT VOLUME.
5. ALL ROADS REQUIRE 300 mm WEARING COURSE ABOVE ROUGH GRADE SURFACE.

NOT FOR CONSTRUCTION

SCALE A 300 150 0 500 1000 1500 m

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP

REF	NUMBER	TITLE

REFERENCES

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CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE
FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	DDF	15NOV13
SCALE	PACKAGE CODE	DRN	AN	15NOV13
1:15000		CHK	BB	04DEC13
		APP	SRM	04DEC13

newgold

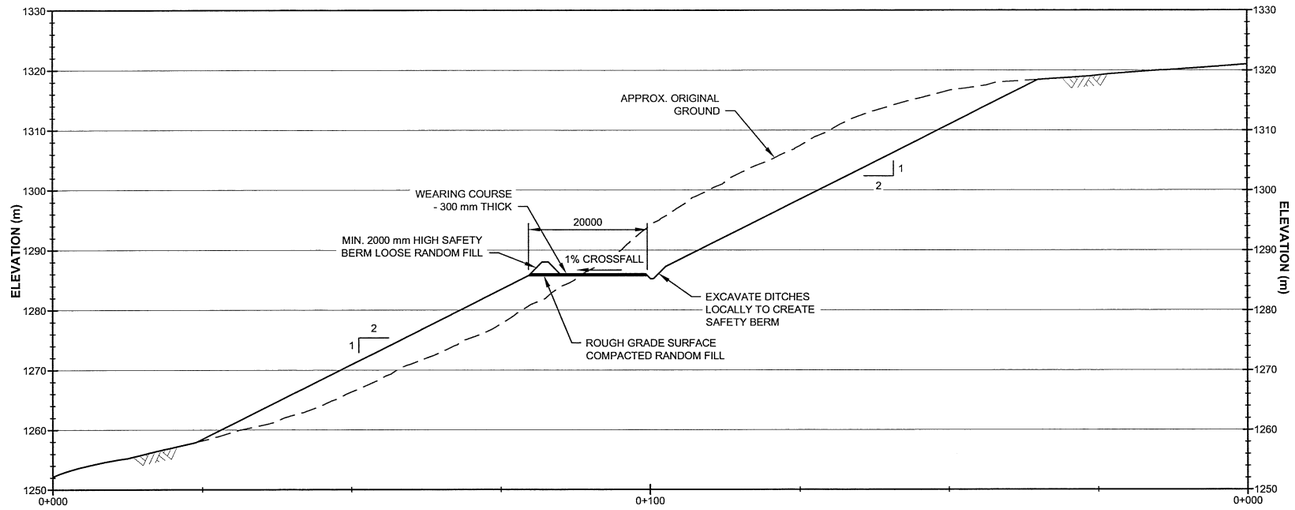
SUBJECT
TAILINGS STORAGE FACILITY
SITE PREPARATION
ROADS

Knight Piésold CONSULTING

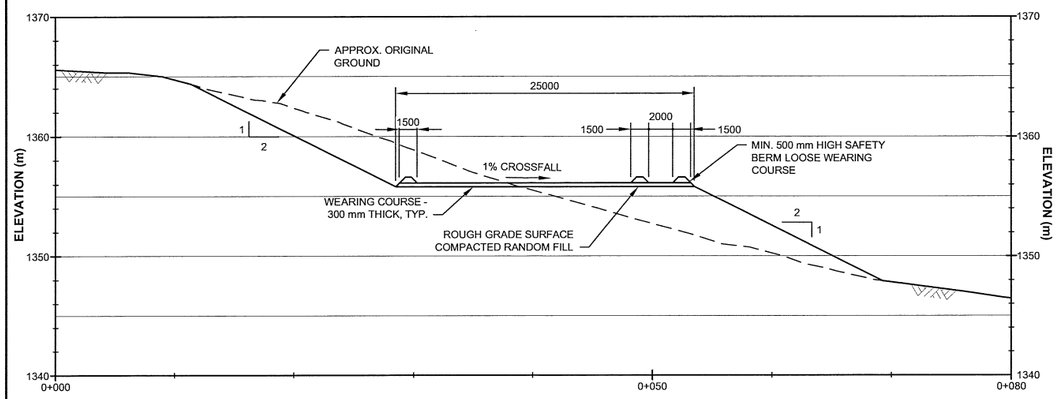
AREA
CLIENT DWG. NO.
DRAWING NO. D0125
REV. 0

CAD FILE: M:\1101\00457\08\A\CAD\DWGS\D0125\D0125_RLD.DWG

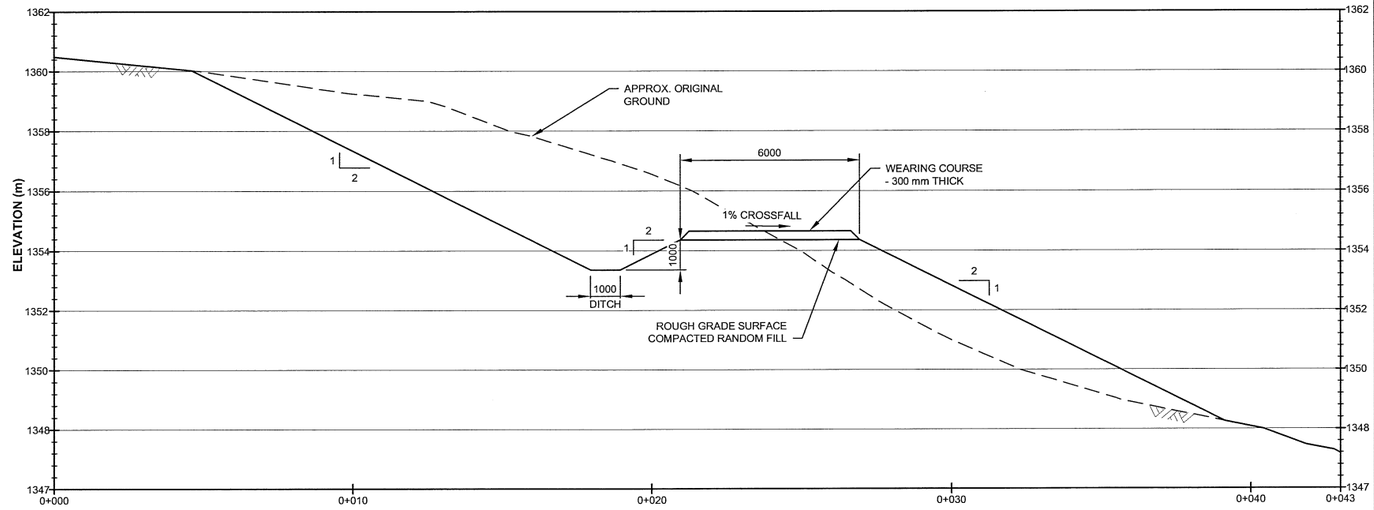
SAVED: 03-Dec-13 10:22 AM PLOTTED: 03-Dec-13 10:26 AM USER: ABBAS NASIRI



1 D0125 **TYPICAL SECTION**
KP HAUL ROAD (KH)
SCALE A



2 D0125 **TYPICAL SECTION**
KP PIPELINE SERVICE ROAD (KS)
SCALE B



3 D0125 **TYPICAL SECTION**
KP DIVERSION ROAD (KD)
SCALE C

SCALE C: 2 1 0 2 4 6 8 10 m
SCALE B: 5 2.5 0 5 10 15 20 25 m
SCALE A: 10 5 0 10 20 30 40 50 m

NOTES:

1. DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.

NOT FOR CONSTRUCTION

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP	REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP	REF	NUMBER	TITLE

REFERENCES

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CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE: FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	DDF	20NOV13
SCALE	PACKAGE CODE	DRN	AN	20NOV13
VARIES		CHK	BB	04DEC13
		APP	SRM	04DEC13

newgold

SUBJECT: TAILINGS STORAGE FACILITY SITE PREPARATION ROAD TYPICAL SECTIONS

Knight Piésold CONSULTING

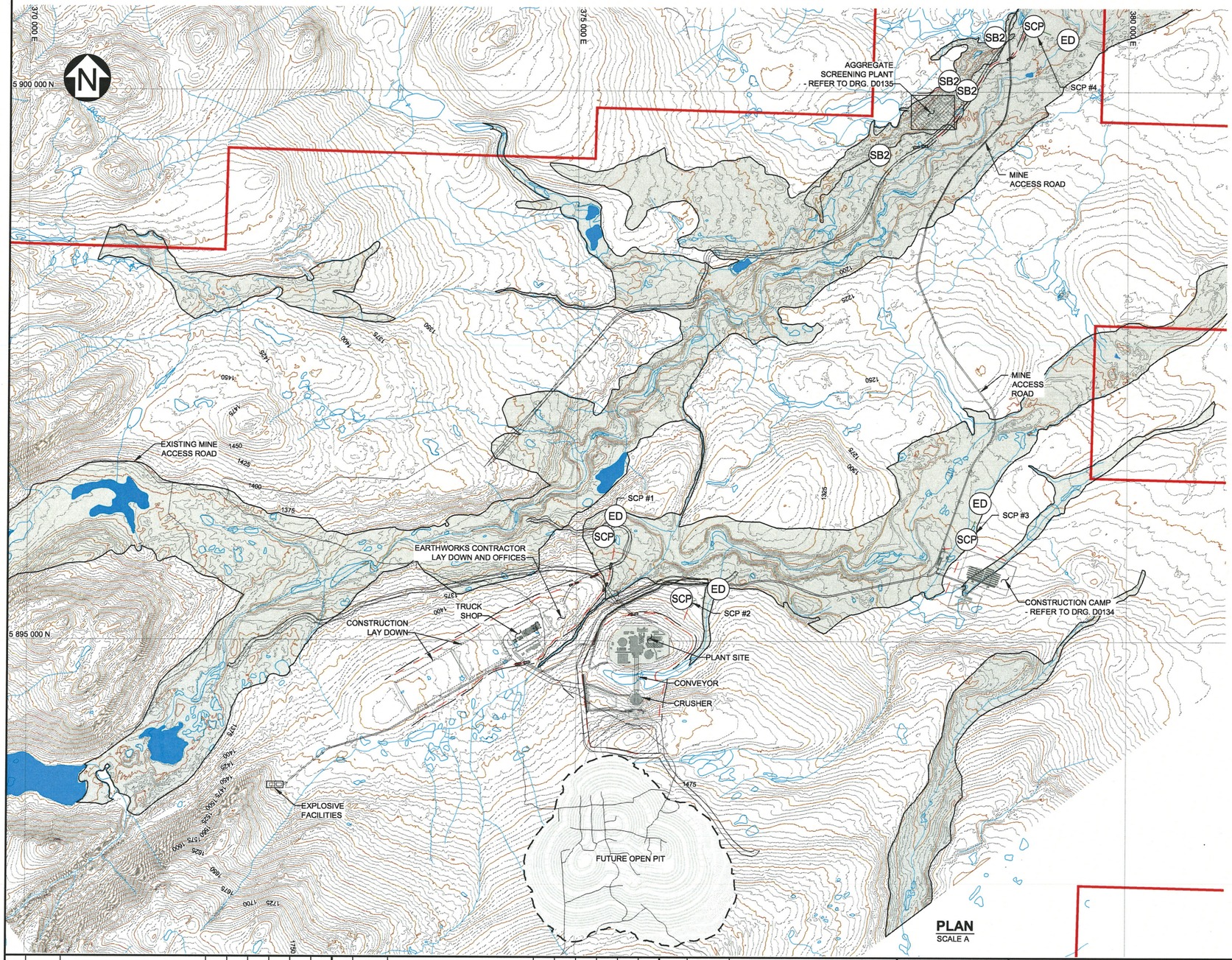
AREA

CLIENT DWG. NO.

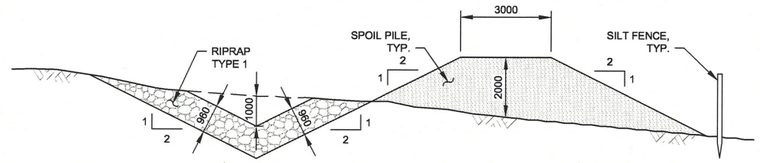
DRAWING NO. D0126 REV. 0

CAD FILE: M:\1\01\00457\06\A\ACAD\DWGS\D0126\D0126_R0.DWG

SAVED: 03-Dec-13 10:25 AM PLOTTED: 03-Dec-13 10:26 AM USER: ABBAS NASIRI



PLAN
SCALE A



(CD) TYPICAL SECTION
COLLECTION CHANNEL
SCALE NTS

SEDIMENT CONTROL POND				
NO.	DIMENSIONS (m) (W X L X D)	SURFACE AREA AT PRIMARY OUTLET INVERT (m²)	POND INVERT ELEVATION (m)	BERM ELEVATION (m)
SCP #1	25 X 125 X 5	5,600	1340	1345
SCP #2	35 X 175 X 50	9,000	1360	1365
SCP #3	15 X 170 X 5	4,900	1245	1250
SCP #4	30 X 140 X 5	6,800	1125	1130

LEGEND:

- MELTWATER CHANNEL (SUFICIAL SAND AND GRAVEL DEPOSITS, GLACIAL FLUVIAL DEPOSITS)
- SCP OUTLET
- COLLECTION CHANNEL
- SILT FENCE
- NEW GOLD PROPERTY BOUNDARY
- SCP — SEDIMENT CONTROL POND
- SB — SEDIMENT BASIN
- ED — ENERGY DISSIPATER

NOTES:

1. CONTOUR INTERVAL IS 5 METRES.
2. DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.

NOT FOR CONSTRUCTION

SCALE A 400 200 0 400 800 1200 1600 2000 m

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP
REF	NUMBER	TITLE						
		REFERENCES						

STAMP/SEAL: PROFESSIONAL ENGINEER, PROVINCE OF BRITISH COLUMBIA, 29 NOV 2013

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CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE: FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	MH	20SEP13
SCALE: AS SHOWN	PACKAGE CODE	DRN	AT	20SEP13
		CHK	RR	29Nov13
		APP	KJB	29Nov13

newgold

Knight Piésold CONSULTING

SUBJECT: SEDIMENT AND EROSION CONTROL PLAN YEAR -2

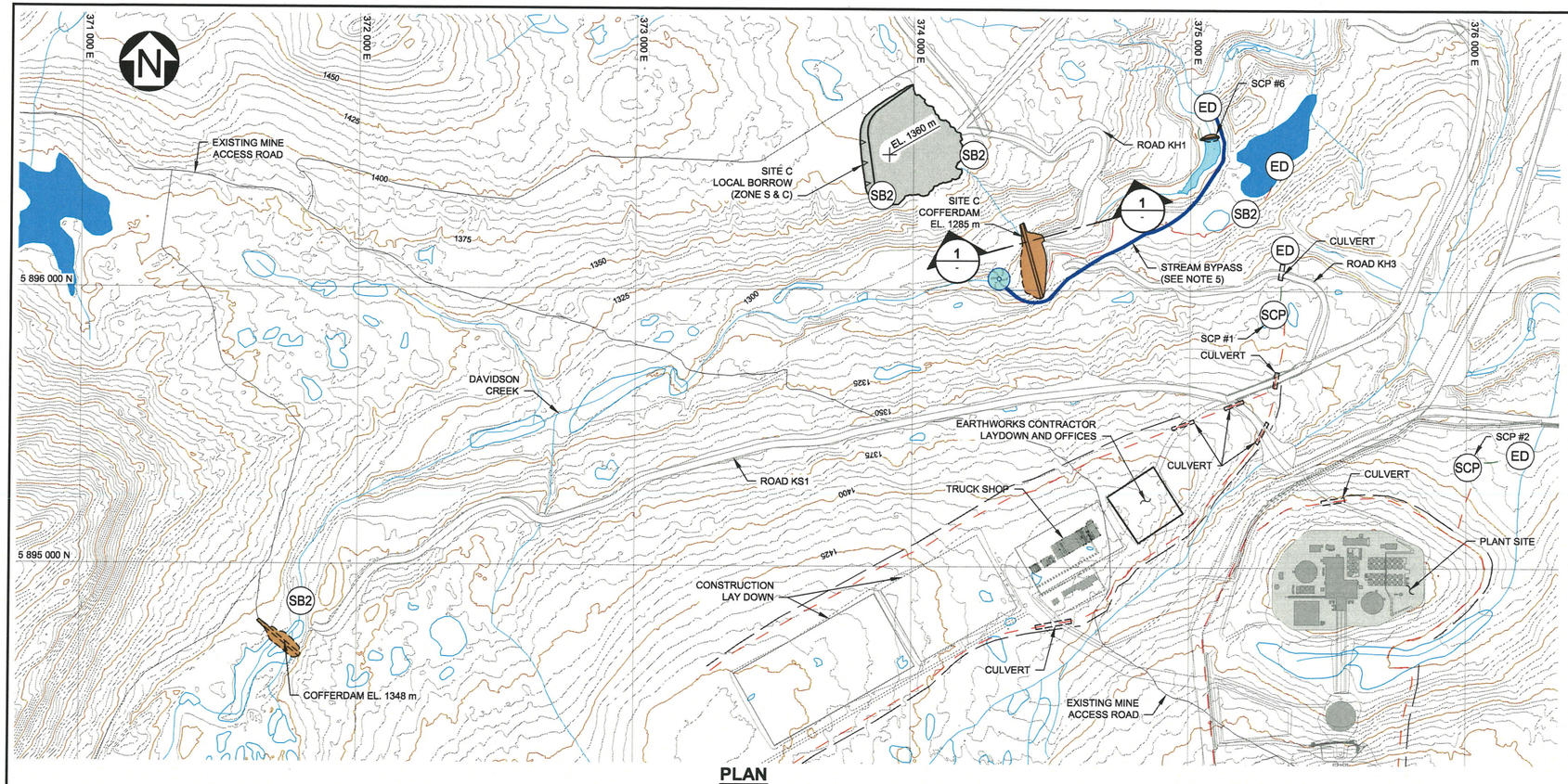
AREA

CLIENT DWG. NO.

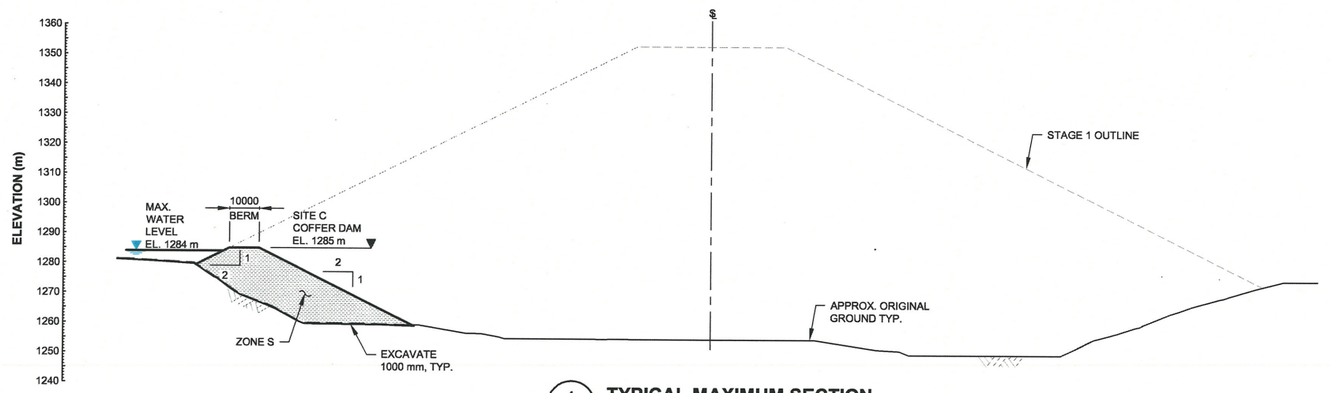
DRAWING NO. D0130 REV. 0

CAD FILE: M:\1\01\00457\08\A\ACAD\DWGS\D0130\D0130_R0.DWG

SAVED: 29-Nov-13 4:04 PLOTTED: 29-Nov-13 4:04 PM USER: ABBAS NASIR



PLAN
SITE C COFFERDAM AT EL. 1285 m
SCALE A



TYPICAL MAXIMUM SECTION
SITE C COFFERDAM
SCALE B

SITE C - COFFERDAM DESIGN CRITERIA		
PARAMETER	VALUE	UNITS
1 IN 10 YEAR, 24 HOUR STORM	50	mm
1 IN 10 YEAR, 24 HOUR STORM VOLUME	68,000	m^3
1 IN 10 YEAR, WET AUGUST VOLUME	112,000	m^3
1 IN 10 YEAR, WET SEPTEMBER VOLUME	99,000	m^3
1 IN 10 YEAR, WET OCTOBER VOLUME	103,000	m^3
TOTAL DESIGN VOLUME	382,000	m^3
DESIGN COFFERDAM CAPACITY (EL. 1283 m)	400,000	m^3
MAXIMUM COFFERDAM CAPACITY (EL.1285 m)	550,000	m^3

SEDIMENT CONTROL POND				
NO.	DIMENSIONS (m) (W X L X D)	SURFACE AREA AT PRIMARY OUTLET INVERT (m^2)	POND INVERT ELEVATION (m)	BERM ELEVATION (m)
SCP #1	25 X 125 X 5	5,600	1340	1345
SCP #2	35 X 175 X 5	9,000	1360	1365
SCP #6	-	9,600	1242.5	1247

SEDIMENT CONTROL POND OUTLETS				
NO.	1 IN 10 YEAR STORM EVENT		1 IN 200 YEAR STORM EVENT	
	TYPE	INVERT ELEVATION (m)	TYPE	INVERT ELEVATION (m)
SCP #1	1 X 0.30 m DIAMETER RISER PIPE	1343.7	5 m WIDE SPILLWAY	1344.0
SCP #2	1 X 0.30 m DIAMETER RISER PIPE	1363.3	5 m WIDE SPILLWAY	1364.0
SCP #6	V-NOTCH WEIR SPILLWAY	1246.0	2 m WIDE COMPOUND WEIR SPILLWAY	1246.4

LEGEND:

- MINE WATER
- FRESH WATER
- EMBANKMENT FILL
- BORROW AREA (ZONE S & C)
- ZONE S (OVERBURDEN / GLACIAL TILL)
- COLLECTION DITCH
- SCP OUTLET
- EXISTING ACCESS TRAILS
- ED — ENERGY DISSIPATER
- SCP — SEDIMENT CONTROL POND
- SB — SEDIMENT BASIN
- SILT FENCE
- PUMP

NOTES:

1. CONTOUR INTERVAL IS 5 m.
2. DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
3. EXPECTED EXPOSURE TIME OF COFFERDAM IS THREE MONTHS (AUGUST - OCTOBER, 2015.)
4. SEE DRAWINGS D0136, D0137, D0138 FOR EROSION CONTROL BMP SECTION AND DETAILS.
5. THE PRESSURIZED SECTION OF PIPE IS 18" DIAMETER AND THE GRAVITY SECTION IS 20" DIAMETER. THE PIPELINE TRANSITION TO GRAVITY FLOW APPROXIMATELY THE CREST OF THE COFFERDAM.

SCALE B: 20 10 0 20 40 60 80 100 m
SCALE A: 200 100 0 200 400 600 800 1000 m

NOT FOR CONSTRUCTION

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP
REF	NUMBER	TITLE
		REFERENCES

STAMP/SEAL: PROFESSIONAL ENGINEER OF BRITISH COLUMBIA — M. HODZIC — 39092 — July 29, 2015

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APPROVED FOR _____
CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE: FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	DDF	15NOV13
SCALE	PACKAGE CODE	DRN	AN	15NOV13
AS SHOWN		CHK	BB	29Nov13
		APP	KB	29Nov13

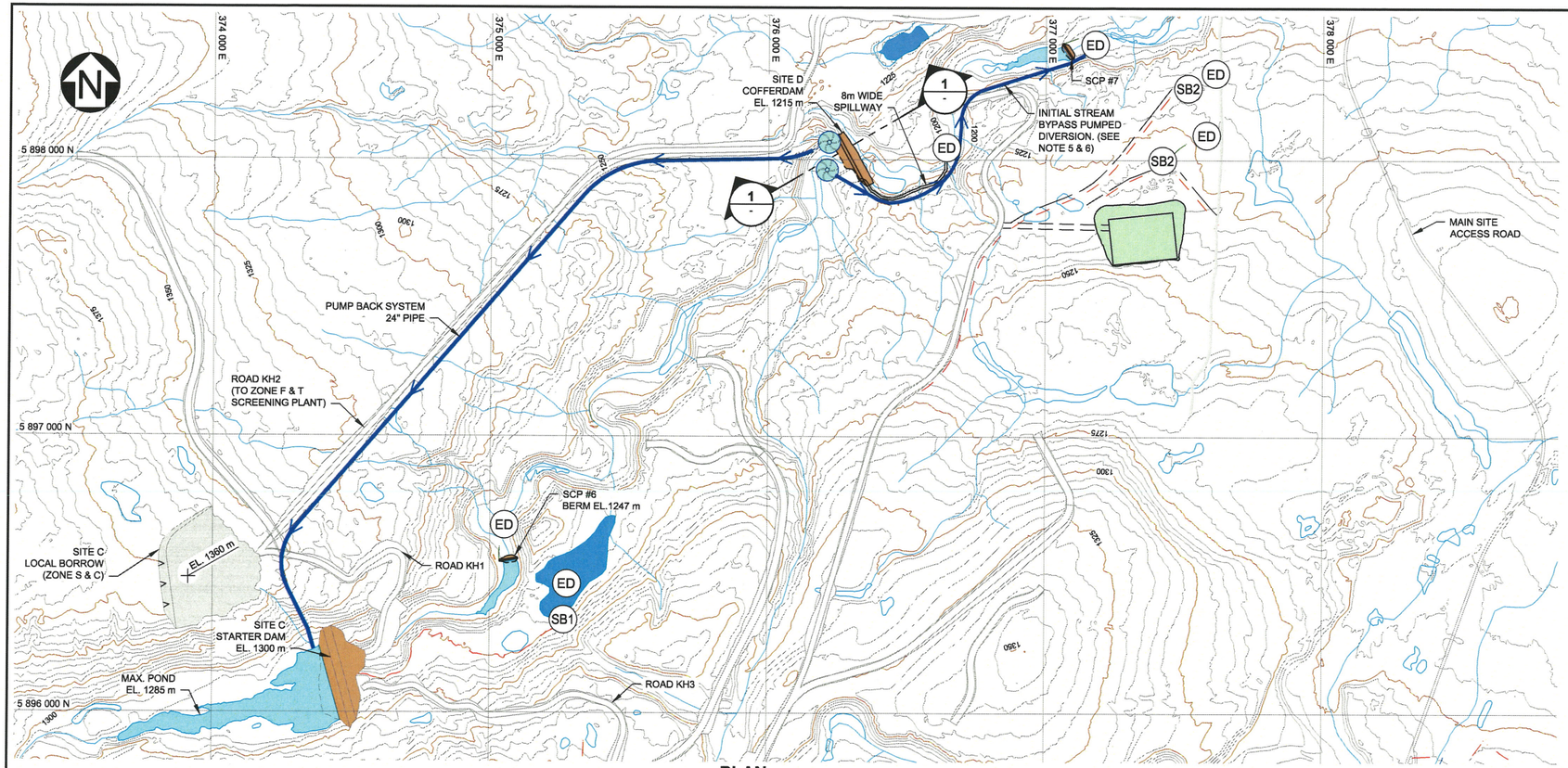
newgold

SUBJECT: SEDIMENT AND EROSION CONTROL PLAN TAILINGS STORAGE FACILITY SITE C COFFERDAM YEAR –2

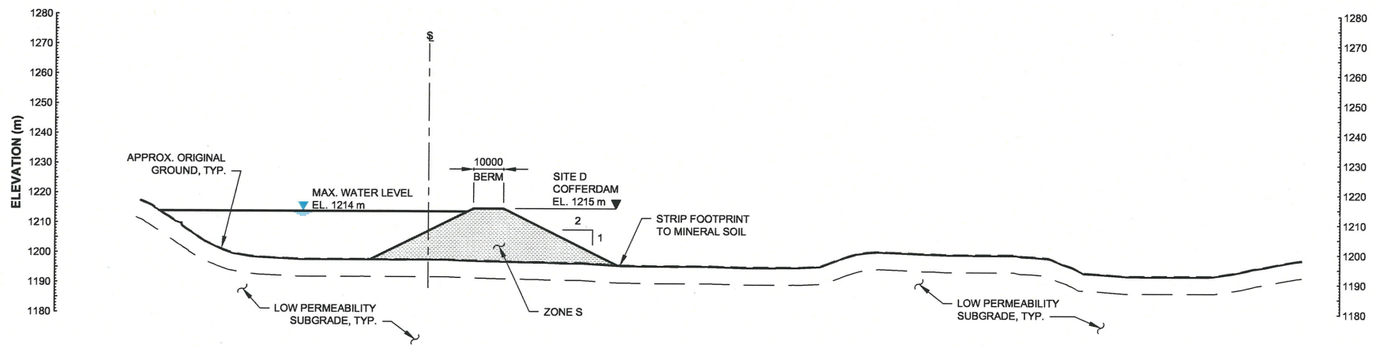
Knight Piésold CONSULTING

AREA
CLIENT DWG. NO.
DRAWING NO. D0131
REV. 0

CAD FILE: M:\1\101\00457\05\A\ACAD\DWGS\D0131\D0131.RO.DWG
SAVED: 29-Nov-13 4:02 PM PLOTTED: 29-Nov-13 4:05 PM USER: ABBAS NASIRI



PLAN
SITE D COFFERDAM AT EL. 1215 m
SCALE A



1 - **TYPICAL SECTION**
SITE D COFFERDAM
SCALE B

SITE D - COFFERDAM DESIGN CRITERIA

PARAMETER	VALUE	UNITS
1 IN 10 YEAR, 24 HOUR STORM	50	mm
1 IN 10 YEAR, 24 HOUR STORM VOLUME	57,000	m^3
1 IN 10 YEAR, WET OCTOBER VOLUME	88,000	m^3
1 IN 10 YEAR, WET NOVEMBER VOLUME	60,000	m^3
1 IN 10 YEAR, WET DECEMBER VOLUME	38,000	m^3
TOTAL DESIGN VOLUME	243,000	m^3
DESIGN COFFERDAM CAPACITY (EL. 1214 m)	250,000	m^3
MAXIMUM COFFERDAM CAPACITY (EL.1215 m)	360,000	m^3

SEDIMENT CONTROL POND

NO.	DIMENSIONS (m) (W X L X D)	SURFACE AREA AT PRIMARY OUTLET INVERT (m^2)	POND INVERT ELEVATION (m)	BERM ELEVATION (m)
SCP #1	25 X 125 X 5	5,600	1340	1345
SCP #3	15 X 170 X 5	4,900	1245	1250
SCP #6	-	9,600	1242.5	1247
SCP #7	-	14,000	1182	1188

SEDIMENT CONTROL POND OUTLETS

NO.	1 IN 10 YEAR STORM EVENT		1 IN 200 YEAR STORM EVENT	
	TYPE	INVERT ELEVATION (m)	TYPE	INVERT ELEVATION (m)
SCP #1	1 X 0.30 m DIAMETER RISER PIPE	1343.7	5 m WIDE SPILLWAY	1344.0
SCP #3	1 X 0.10 m DIAMETER RISER PIPE	1248.0	5 m WIDE SPILLWAY	1249.0
SCP #6	V-NOTCH WEIR SPILLWAY	1246.0	2 m WIDE COMPOUND WEIR SPILLWAY	1246.4
SCP #7	V-NOTCH WEIR SPILLWAY	1186.5	2 m WIDE COMPOUND WEIR SPILLWAY	1186.9

LEGEND:

- TOPSOIL
- MINE WATER
- FRESH WATER
- EMBANKMENT FILL
- ZONE S (OVERBURDEN / GLACIAL TILL)
- COLLECTION DITCH
- SCP OUTLET
- ED — ENERGY DISSIPATER
- SCP — SEDIMENT CONTROL POND
- SB — SEDIMENT BASIN
- SILT FENCE
- PUMP

NOTES:

1. CONTOUR INTERVAL IS 5 m.
2. DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
3. EXPECTED EXPOSURE TIME OF COFFERDAM IS THREE MONTHS (AUGUST - OCTOBER, 2015.)
4. SEE DRAWINGS D0136, D0137, D0138 FOR EROSION CONTROL BMP SECTION AND DETAILS.
5. THE INITIAL STREAM BYPASS PUMPED DIVERSION SYSTEM WILL BE INSTALLED PRIOR TO COFFERDAM CONSTRUCTION. THIS PIPELINE WILL BE REMOVED ONCE THE PUMP BACK SYSTEM PIPELINE IS OPERATIONAL.
6. THE PRESSURIZED SECTION OF PIPE IS 18" DIAMETER AND THE GRAVITY SECTION IS 20" DIAMETER. THE PIPELINE TRANSITIONS TO GRAVITY AT FLOW APPROXIMATELY THE CREST OF THE COFFERDAM.

NOT FOR CONSTRUCTION

SCALE B: 20 10 0 20 40 60 80 100 m
SCALE A: 200 100 0 200 400 600 800 1000 m

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP

REF	NUMBER	TITLE
		REFERENCES

STAMP / SEAL: PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — M. HODZIC — Nov. 29 2013

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APPROVED FOR _____
CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.
PROJECT PHASE: FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	DDF	15NOV13
SCALE: PLAN	PACKAGE CODE	DRN	AN	15NOV13
		CHK	BS	29Nov13
		APP	KB	29Nov13

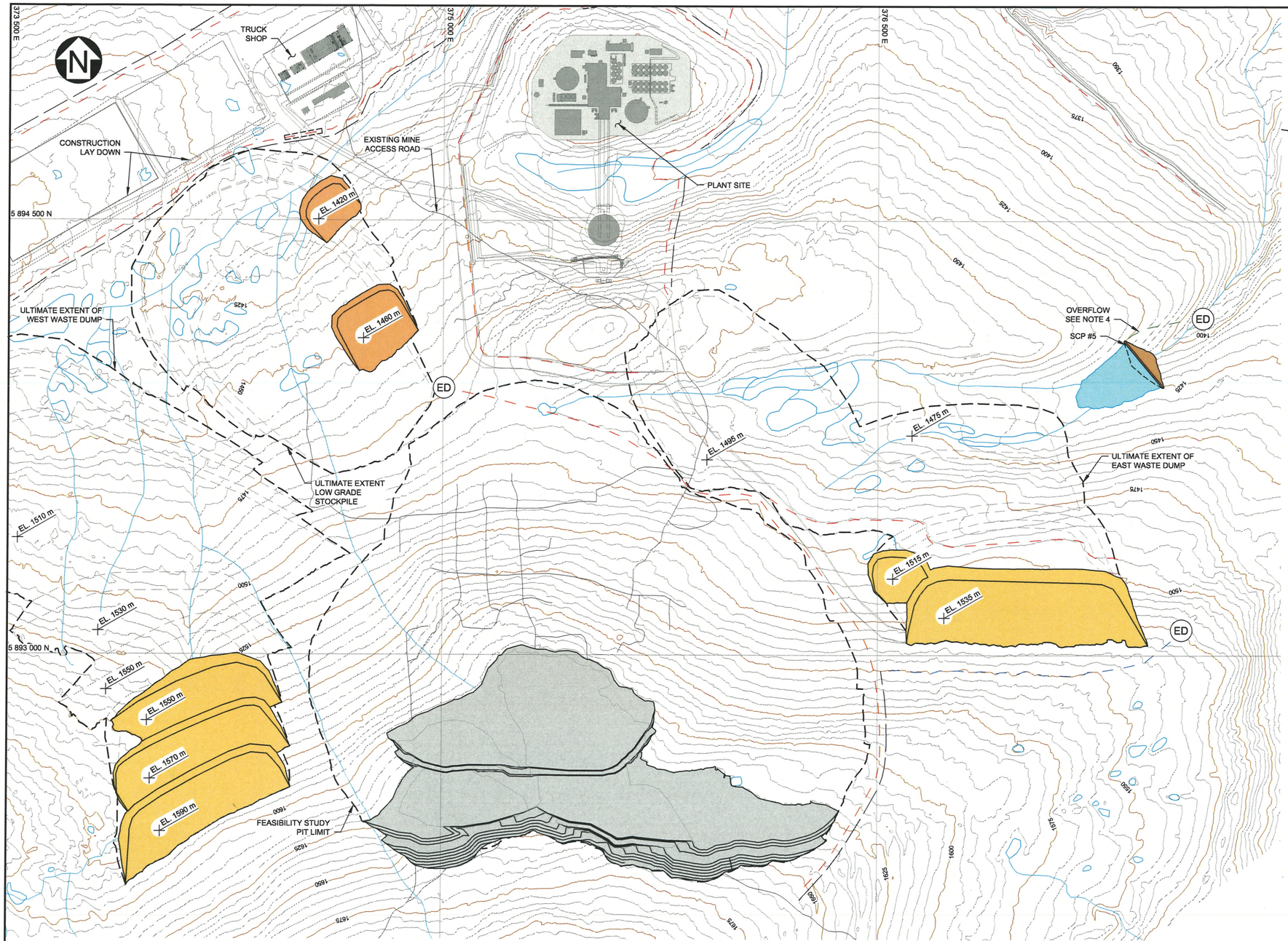
newgold

Knight Piésold CONSULTING

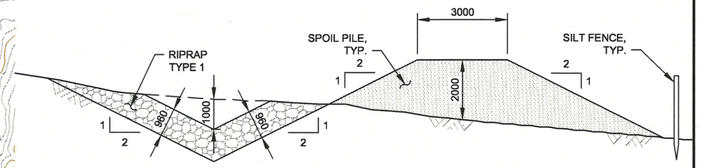
SUBJECT: SEDIMENT AND EROSION CONTROL PLAN TAILINGS STORAGE FACILITY SITE D COFFERDAM YEAR –2

AREA
CLIENT DWG. NO.
DRAWING NO. D0132
REV. 0

CAD FILE: M:\1101\VA00457\06\A\ACAD\DWGS\D0132\D0132 R0.DWG
SAVED: 29-Nov-13 4:01 PM PLOTTED: 29-Nov-13 4:05 PM USER: ABBAS NASIRI



PLAN
SCALE A



(CD) TYPICAL SECTION
COLLECTION DITCH
SCALE NTS

SEDIMENT CONTROL POND OUTLETS

NO.	BERM ELEVATION (m)	SURFACE AREA AT PRIMARY OUTLET INVERT (m²)	1 IN 10 YEAR STORM EVENT		1 IN 200 YEAR STORM EVENT	
			TYPE	INVERT ELEVATION (m)	TYPE	INVERT ELEVATION (m)
SCP #5	1426	32,000	0.15 m WIDE COMPOUND WEIR SPILLWAY	1424.6	2.0 m WIDE COMPOUND WEIR SPILLWAY	1425.1

LEGEND:

- BORROW AREA (ZONES S, C, AND ROCKFILL)
- MINE WATER
- EMBANKMENT FILL
- COLLECTION DITCH
- DIVERSION DITCH
- SCP OUTLET
- SILT FENCE
- EXISTING ACCESS TRAILS
- OPEN PIT BOUNDARY
- (ED) ENERGY DISSIPATER
- (SB) SEDIMENT BASIN

NOTES:

1. CONTOUR INTERVAL IS 5 METRES.
2. DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
3. SEE DRAWINGS D0136, D0137, D0138 FOR EROSION CONTROL BMP SECTION AND DETAILS.
4. DURING OPERATION OVERFLOW TO BE ROUTED TO COLLECTION DITCH DRAINING TO TSF.

NOT FOR CONSTRUCTION

SCALE A 150 75 0 250 500 750 m

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP

REF	NUMBER	TITLE
		REFERENCES

STAMP/SEAL: PROFESSIONAL ENGINEER, PROVINCE OF BRITISH COLUMBIA, M. HODZIC, No. 39224, Nov 29, 2013

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APPROVED FOR _____
CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE: FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	MH	04OCT13
SCALE: AS SHOWN	PACKAGE CODE	DRN	AT	04OCT13
		CHK	BB	29Nov13
		APP	EGB	29Nov13

newgold

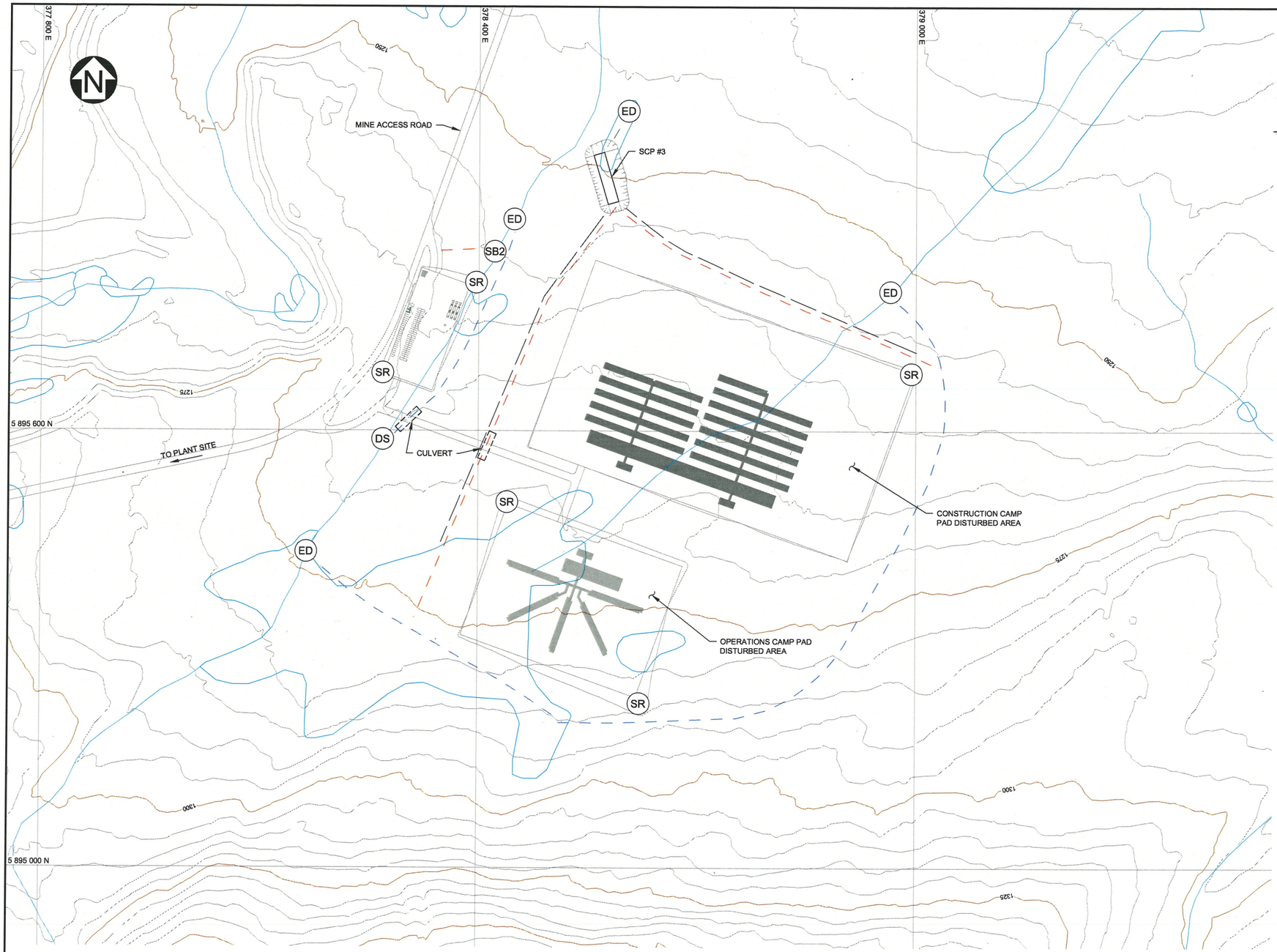
SUBJECT: SEDIMENT AND EROSION CONTROL PLAN WASTE DUMPS & OPEN PIT YEAR -2

Knight Piésold CONSULTING

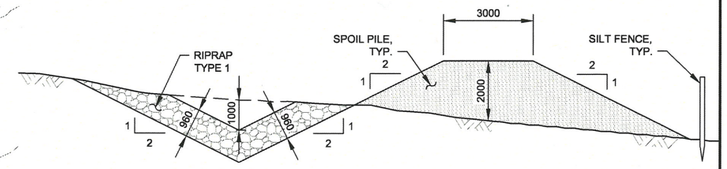
AREA
CLIENT DWG. NO.
DRAWING NO. D0133
REV. 0

CAD FILE: M:\1\01\00457\06\A\ACAD\DWGS\D0133D0133_R2.DWG

SAVED: 29-Nov-13 4:00 PLOTTED: 29-Nov-13 4:06 PM USER: ABBAS NAS PM



PLAN
SCALE A



CD **TYPICAL SECTION**
COLLECTION DITCH
SCALE NTS

SEDIMENT CONTROL POND OUTLETS						
NO.	DIMENSIONS (m) (W X L X D)	POND INVERT ELEVATION (m)	1 IN 10 YEAR STORM EVENT		1 IN 200 YEAR STORM EVENT	
			TYPE	INVERT ELEVATION (m)	TYPE	INVERT ELEVATION (m)
SCP #3	15 X 170 X 5	1245	1 X 0.10 m DIAMETER RISER PIPE	1248	5 m WIDE SPILLWAY	1249

LEGEND:

- DIVERSION DITCH
- COLLECTION DITCH
- SCP OUTLET
- SILT FENCE
- DS DIVERSION STRUCTURE
- ED ENERGY DISSIPATER
- SR SLOPE ROUGHENING
- SB SEDIMENT BASIN

NOTES:

1. CONTOUR INTERVAL IS 5 METRES.
2. DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
3. SEE DRAWINGS D0136, D0137, D0138 FOR EROSION CONTROL BMP SECTION AND DETAILS.

NOT FOR CONSTRUCTION

SCALE A 60 30 0 100 200 300 m

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP	REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP	REF	NUMBER	TITLE

REFERENCES

STAMP/SEAL

PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — M. HODZIC — # 29224 — Nov. 29, 2013

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CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE: FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	MH	20SEP13
		DRN	AT	20SEP13
SCALE	PACKAGE CODE	CHK	BB	3Nov13
AS SHOWN		APP	KJS	2Dec13

newgold

SUBJECT: SEDIMENT AND EROSION CONTROL PLAN CAMP AREA YEAR –2

Knight Piésold CONSULTING

AREA

CLIENT DWG. NO.

DRAWING NO. D0134 REV. 0

CAD FILE: M:\1\01\00457\06\A\ACAD\DWGS\D0134\D0134 R0.DWG

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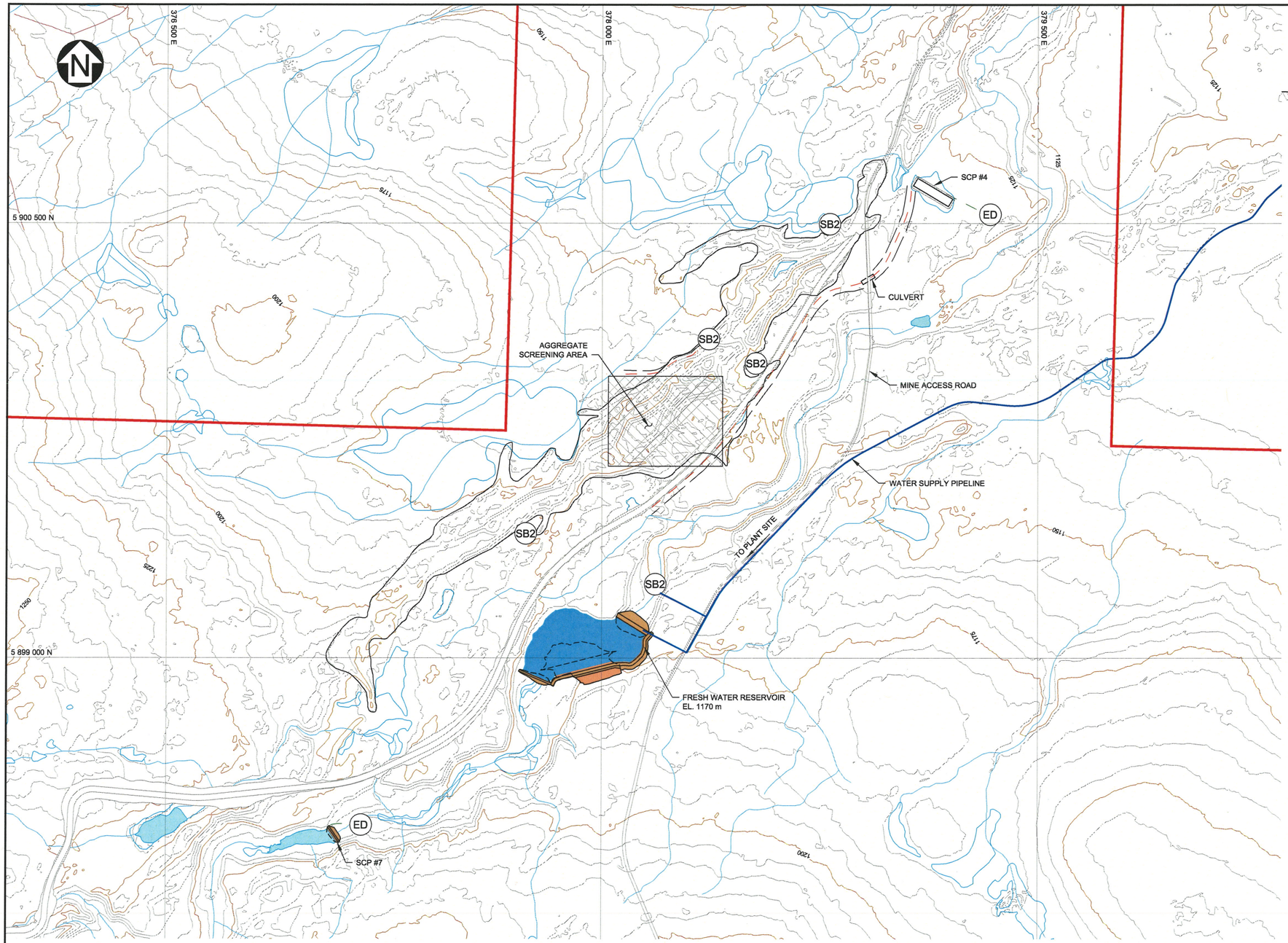
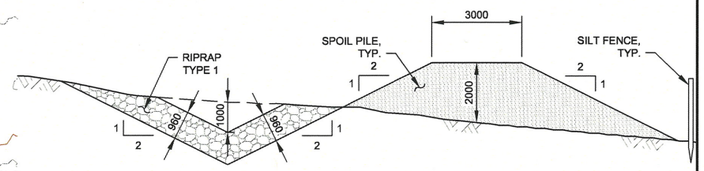


PLAN
SCALE A



CD **TYPICAL SECTION**
COLLECTION CHANNEL
SCALE NTS

SEDIMENT CONTROL POND				
NO.	DIMENSIONS (m) (W X L X D)	SURFACE AREA AT PRIMARY OUTLET INVERT (m²)	POND INVERT ELEVATION (m)	BERM ELEVATION (m)
SCP #4	30 X 140 X 5	6,800	1125	1130
SCP #7	-	14,000	1182	1188

SEDIMENT CONTROL POND OUTLETS				
NO.	1 IN 10 YEAR STORM EVENT		1 IN 200 YEAR STORM EVENT	
	TYPE	INVERT ELEVATION (m)	TYPE	INVERT ELEVATION (m)
SCP #4	1 X 0.40 m DIAMETER RISER PIPE	1128.5	5 m WIDE SPILLWAY	1129
SCP #7	0.15 m WIDE COMPOUND WEIR SPILLWAY	1186.5	2 m WIDE COMPOUND WEIR SPILLWAY	1186.9

LEGEND:

- MINE WATER
- FRESH WATER
- EMBANKMENT FILL
- COLLECTION CHANNEL
- SCP OUTLET
- SILT FENCE
- NEW GOLD PROPERTY BOUNDARY
- ED ENERGY DISSIPATER
- SB SEDIMENT BASIN

NOTES:

1. CONTOUR INTERVAL IS 5 METRES.
2. DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
3. SEE DRAWINGS D0136, D0137, D0138 FOR EROSION CONTROL BMP SECTION AND DETAILS.

NOT FOR CONSTRUCTION

SCALE A 150 75 0 250 500 750 m

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP	REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP	REF	NUMBER	TITLE

REFERENCES

STAMP/SEAL

PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — M. HODZIC — #39224 — Nov. 29, 2013

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APPROVED FOR _____

CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE: FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	MH	20SEP13
SCALE	PACKAGE CODE	DRN	AT	20SEP13
AS SHOWN		CHK	RB	20Nov13
		APP	KIB	20Nov13

newgold

SUBJECT
SEDIMENT AND EROSION CONTROL PLAN
AGGREGATE BORROW AND
FRESH WATER RESERVOIR AREA
YEAR -2

Knight Piésold CONSULTING

AREA

CLIENT DWG. NO.

DRAWING NO. D0135 REV. 0

CAD FILE: M:\1\01\00457\06\A\ACAD\DWGS\D0135\D0135 R0.DWG

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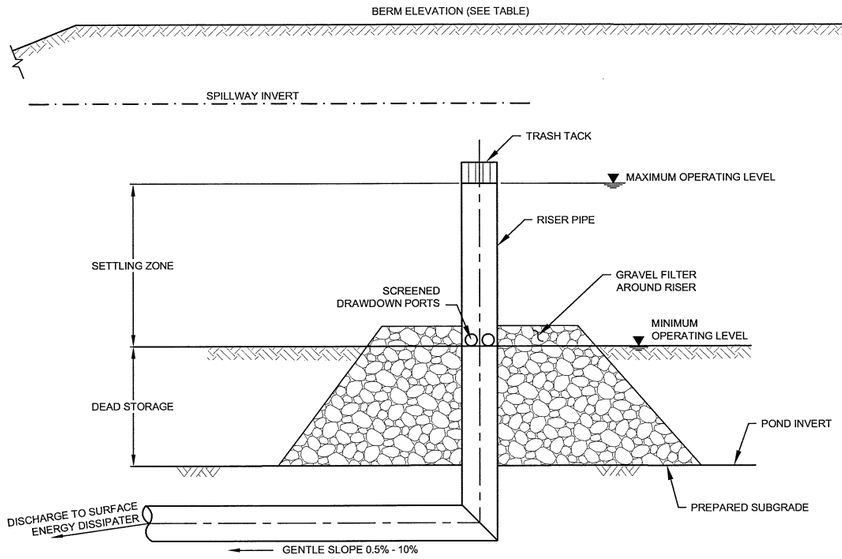
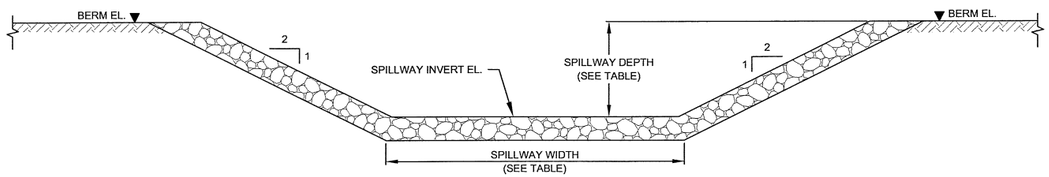
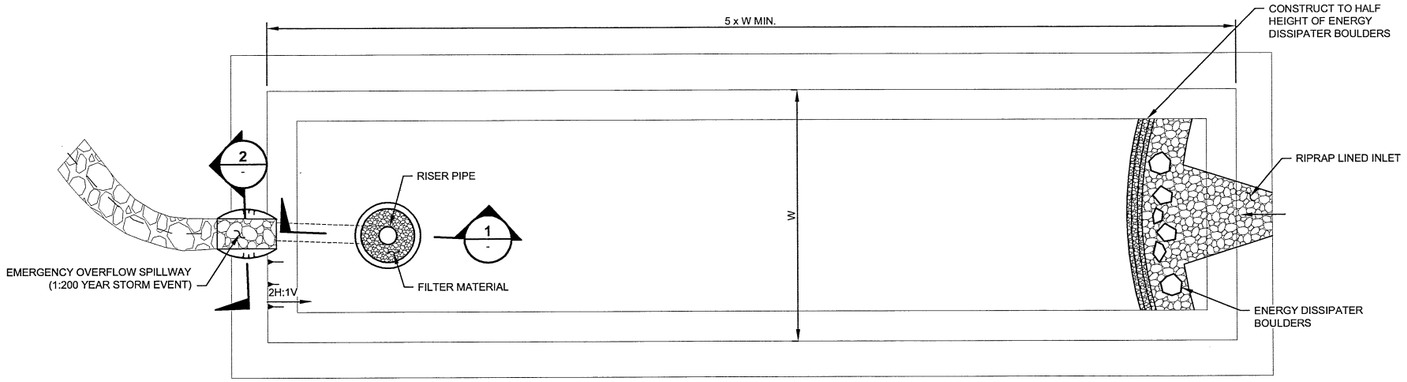


1 - RISER SECTION
NTS



2 - SPILLWAY SECTION
NTS



PLAN VIEW
SCALE A

SEDIMENT CONTROL POND OUTLETS

NO.	DIMENSION (m) (W x L x D)	POND INVERT ELEVATION (m)	BERM ELEVATION (m)	1 IN 10 YEAR STORM EVENT		1 IN 200 YEAR STORM EVENT	
				TYPE	INVERT ELEVATION (m)	TYPE	INVERT ELEVATION (m)
SCP #1	25 x 125 x 5	1340	**1345**	1 X 0.30 m DIAMETER RISER PIPE	1343.7	5 m WIDE SPILLWAY	1344
SCP #2	35 x 175 x 5	1360	**1365**	1 X 0.30 m DIAMETER RISER PIPE	1363.3	5 m WIDE SPILLWAY	1364
SCP #3	15 x 170 x 5	1245	**1250**	1 X 0.10 m DIAMETER RISER PIPE	1248	5 m WIDE SPILLWAY	1249
SCP #4	30 x 140 x 5	1125	**1130**	1 X 0.40 m DIAMETER RISER PIPE	1128.5	5 m WIDE SPILLWAY	1129
SCP #5	-	**1410**	1426	0.15 m WIDE COMPOUND WEIR SPILLWAY	1424.6	2 m WIDE COMPOUND WEIR SPILLWAY	1425.1
SCP #6	-	**1242.5**	1247	V-NOTCH WEIR SPILLWAY	1246	2 m WIDE COMPOUND WEIR SPILLWAY	1246.4
SCP #7	-	1182	1188	V-NOTCH WEIR SPILLWAY	1186.5	2 m WIDE COMPOUND WEIR SPILLWAY	1186.9

NOTES:

1. POND LINING SUBJECT TO ENGINEER'S REVIEW OF FOUNDATION MATERIAL.
2. DIMENSIONS AND ELEVATIONS ARE IN METERS, UNLESS NOTED OTHERWISE.

NOT FOR CONSTRUCTION

SCALE A 10 5 0 10 20 30 40 50 m

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP

REF	NUMBER	TITLE
		REFERENCES

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CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE: FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	MH	10SEP13
SCALE: AS SHOWN	PACKAGE CODE	DRN	AT	10SEP13
		CHK	BR	20NOV13
		APP	KJS	20Nov13

newgold

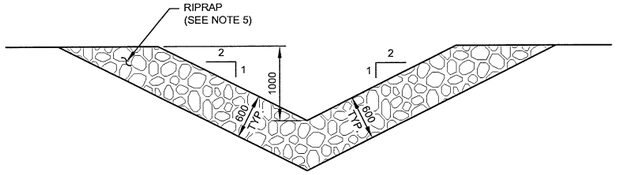
SUBJECT: EROSION CONTROL BMP SECTIONS AND DETAILS SHEET 1 OF 3

Knight Piésold CONSULTING

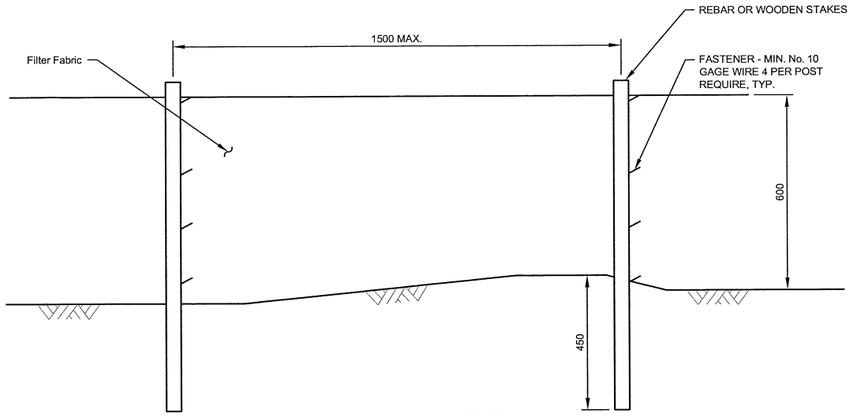
AREA
CLIENT DWG. NO.
DRAWING NO. D0136
REV. 0

CAD FILE: M:\1\01\00\457\06\VA\CAD\DWG\D0136\D0136_RD.DWG

SAVED: 29-Nov-13 3:56 PM PLOTTED: 29-Nov-13 4:07 PM USER: ABBAS NASIR



CD DD **COLLECTION AND DIVERSION DITCH**
NTS



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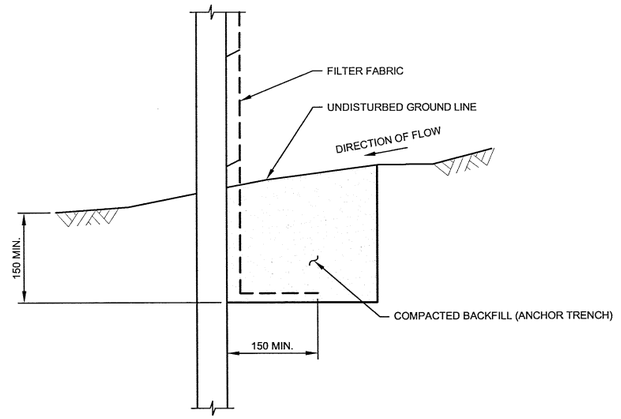
SCALE A



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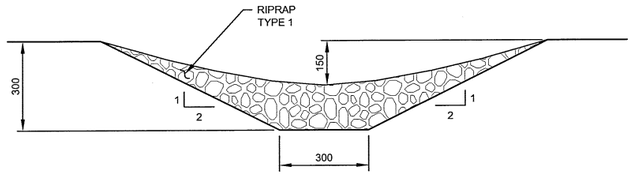
SCALE B



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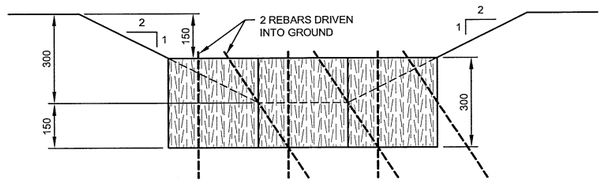
SCALE A



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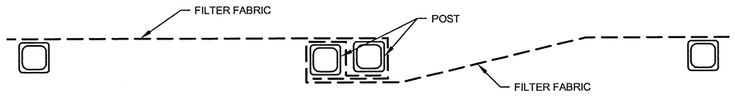
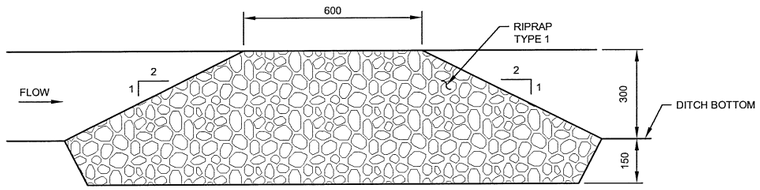
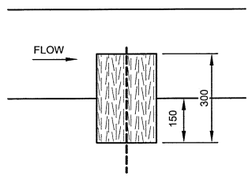


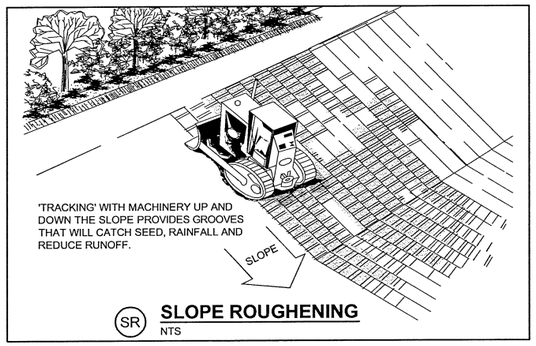
SF **ATTACHING TWO SILT FENCES**
SCALE B



RD **ROCK DAM PROFILE**
SCALE A



ST **STRAW BALE PROFILE**
SCALE A



SR **SLOPE ROUGHENING**
NTS

NOTES:

1. ALL SEDIMENT AND EROSION CONTROL MEASURES MUST BE CONSTRUCTED, STABILIZED AND FUNCTIONAL BEFORE SITE DISTURBANCE BEGINS.
2. SITE GRADING SURFACE WATER RUNOFF TO BE DIRECTED TO THE SEDIMENT TRAPS AT ALL TIMES DURING SITE DISTURBANCE ACTIVITIES UNTIL FINAL STABILIZATION IS ACHIEVED.
3. THE CONTRACTOR SHALL INSPECT ALL EROSION CONTROL MEASURES PERIODICALLY AND AFTER EACH RUNOFF-PRODUCING RAINFALL EVENT. ANY NECESSARY REPAIRS OR CLEANUP TO MAINTAIN THE EFFECTIVENESS OF THE EROSION CONTROL DEVICES SHALL BE MADE IMMEDIATELY.
4. AN AREA IS CONSIDERED TO HAVE ACHIEVED FINAL STABILIZATION WHEN IT HAS A MINIMUM UNIFORM 70% VEGETATIVE COVER OR OTHER PERMANENT NON-VEGETATIVE COVER TO RESIST ACCELERATED SURFACE EROSION.
5. ONLY REQUIRED WHEN ERODIBLE SOILS HAVE BEEN EXPOSED.

NOT FOR CONSTRUCTION

100 50 0 100 200 300 400 500 m
SCALE B

200 100 0 200 400 600 800 1000 m
SCALE A

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP
REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP

REF	NUMBER	TITLE
		REFERENCES

STAMP/SEAL

PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — M. HODZIC — Nov. 29, 2013

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CLIENT PROJECT MGR.	DEPARTMENT MGR.	PROJECT MGR.

PROJECT PHASE
FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	MH	20SEP13
SCALE	PACKAGE CODE	DRN	AT	20SEP13
AS SHOWN		CHK	SR	29Nov13
		APP	KBS	29Nov13

newgold

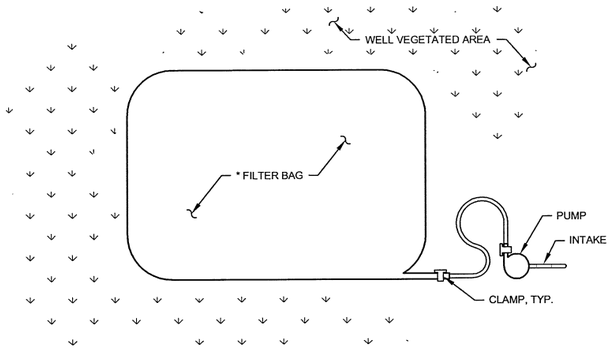
SUBJECT
EROSION CONTROL BMP
SECTIONS AND DETAILS
SHEET 2 OF 3

Knight Piésold CONSULTING

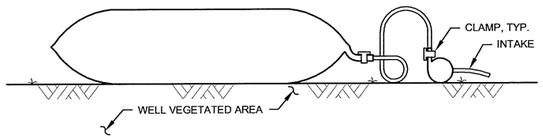
AREA
CLIENT DWG. NO.
DRAWING NO. D0137
REV. 0

CAD FILE: N:\V101\00457\08\VA2AD\DWG\VD0137\D0137_RLDWG

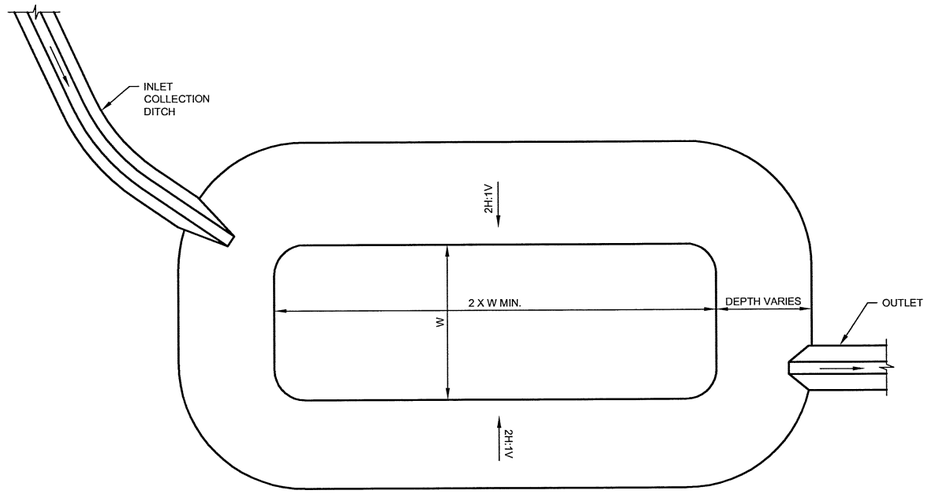
SAVED: 29-Nov-13 3:55 PM PLOTTED: 29-Nov-13 4:07 PM USER: ABBAS NASH



FB **FILTER BAG PLAN**
SCALE A



FB **FILTER BAG ELEVATION**
SCALE A



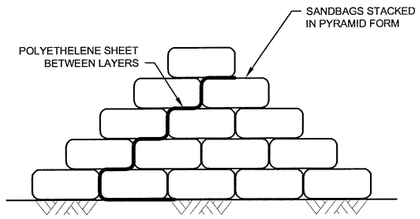
SB **SEDIMENT BASIN PLAN**
SCALE B

SEDIMENT BASIN GENERAL NOTES:

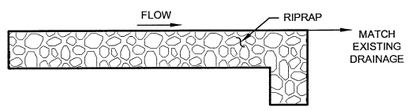
1. SEDIMENT BASINS DETAIN STORMWATER RUNOFF FROM A DISTURBED AREA FOR AN EXTENDED TIME, ALLOWING SEDIMENT TO SETTLE.
2. SEDIMENT BASINS MAY REMAIN IN PLACE DURING OPERATIONS, AS INDICATED IN THE PLANS OR AS DIRECTED BY THE ENGINEER, OR SITE EMT.
3. SEDIMENT BASINS MAY HAVE PUMP OR OUTLET CHANNEL TO COLLECTION DITCH.
4. RELEASES FROM SEDIMENT BASINS REQUIRE FURTHER WATER MANAGEMENT/BMPS (EX. PUMPBACK, DISCHARGE TO COLLECTION DITCHES, FILTER BAGS, AND VEGETATED BUFFER STRIPS.)
5. SEDIMENT BASINS TO BE FIELD FIT TO OPTIMIZE CUT AND FILL QUANTITIES TO ACHIEVE MINIMUM SPECIFIED DIMENSIONS.

SEDIMENT FILTER BAG GENERAL NOTES:

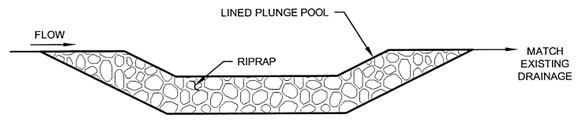
1. NON-WOVEN GEOTEXTILE FILTER BAG WHICH RETAINS ALL SEDIMENT PARTICLES LARGER THAN 150 MICRONS.
2. PLACE FILTER BAGS ON STABLE OR WELL VEGETATED AREAS WHICH ARE FLATTER THAN 5% AND WILL NOT ERODE WHEN SUBJECTED TO BAG DISCHARGE
3. CLAMP PUMP DISCHARGE HOSE SECURELY INTO FILTER BAGS.
4. THE PUMPING RATE SHALL BE NO GREATER THAN 750 gpm OR ½ THE MAXIMUM SPECIFIED BY THE MANUFACTURER, WHICHEVER IS LESS. PUMP INTAKES SHOULD BE FLOATING AND SCREENED.
5. WHEN SEDIMENTS FILL ½ THE VOLUME OF A FILTER BAG. IMMEDIATELY REMOVE THAT BAG FROM SERVICE. PROPERLY DISPOSE OF SPENT BAGS WITH THEIR SEDIMENTS. SPARE BAGS SHALL BE KEPT AVAILABLE FOR REPLACEMENT OF THOSE THAT HAVE FILLED.
6. THE DISCHARGE FROM THE FILTER BAG SHOULD NOT PASS THROUGH A DISTURBED AREA OR CAUSE AN EROSION PROBLEM DOWN SLOPE.
7. VEGETATED BUFFER STRIP WILL BE LEFT DOWNSTREAM OF THE FILTER BAG.
8. FILTER BAGS SHALL BE INSPECTED DAILY. IF ANY PROBLEM IS DETECTED PUMPING SHALL CEASE AND NOT RESUME UNTIL THE PROBLEM IS CORRECTED.



DS **TEMPORARY STREAM DIVERSION STRUCTURE**
NTS



TYPE 1
SMALL DRAINAGES (FLOWS < 0.5 m³/s)



TYPE 2
LARGER DRAINAGES (FLOWS > 0.5 m³/s)

ED **ROCK ENERGY DISSIPATER**
NTS

NOT FOR CONSTRUCTION

SCALE B: 5 2.5 0 5 10 15 20 25 m

SCALE A: 2 1 0 2 4 6 8 10 m

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP
REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP

REF	NUMBER	TITLE
		REFERENCES

STAMP/SEAL: PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — M. HODZIC — # 20224 — Nov 29, 2013

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APPROVED FOR _____
CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE: FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	MH	20SEP13
SCALE: AS SHOWN	PACKAGE CODE	DRN	AT	20SEP13
		CHK	AB	20DEC13
		APP	KJB	20DEC13

newgold

SUBJECT: EROSION CONTROL BMP SECTIONS AND DETAILS SHEET 3 OF 3

Knight Piésold CONSULTING

AREA
CLIENT DWG. NO.
DRAWING NO. D0138
REV. 0

SAVED: 29-Nov-13 3:53 PM PLOTTED: 29-Nov-13 4:08 PM USER: ABBAS NASR

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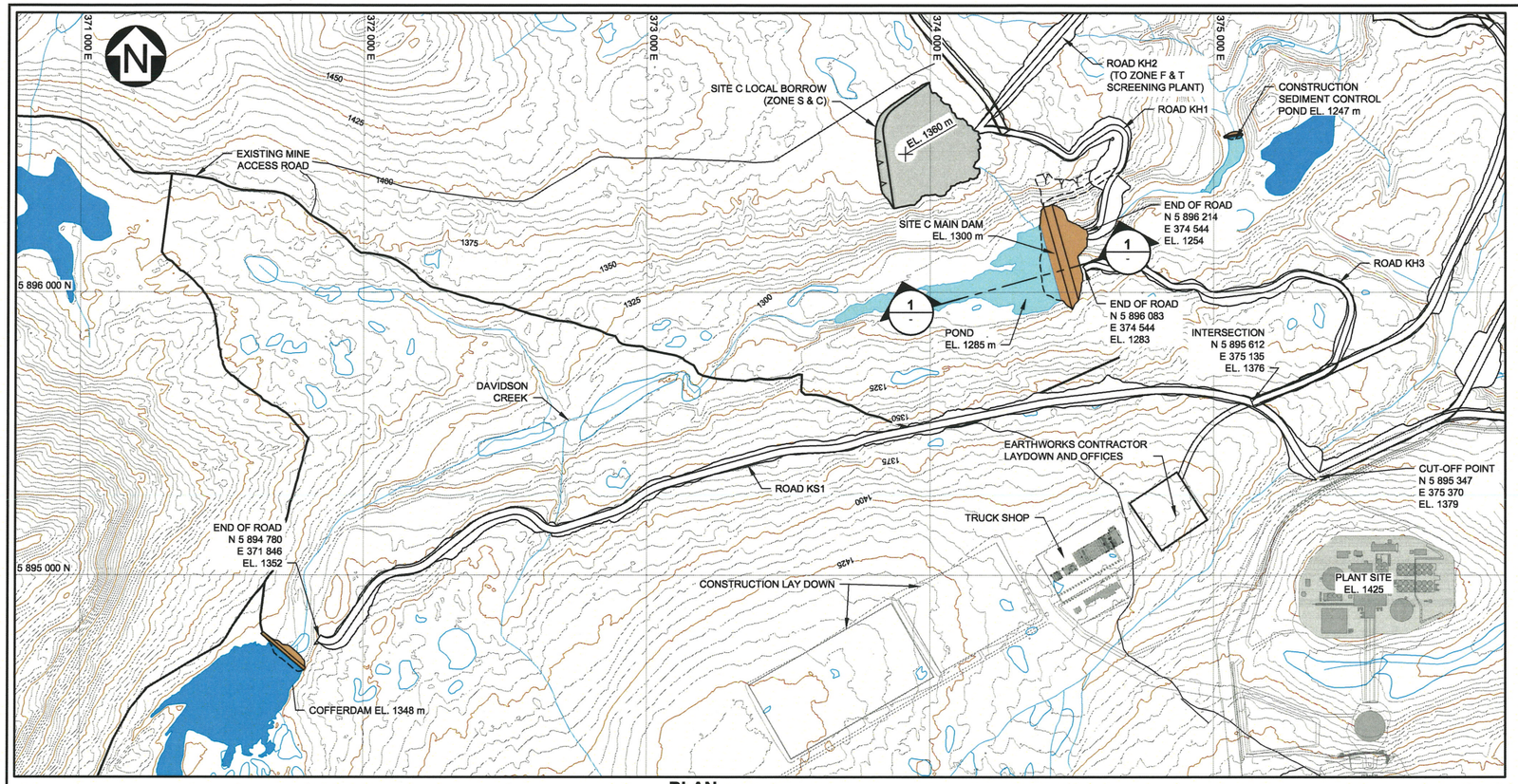
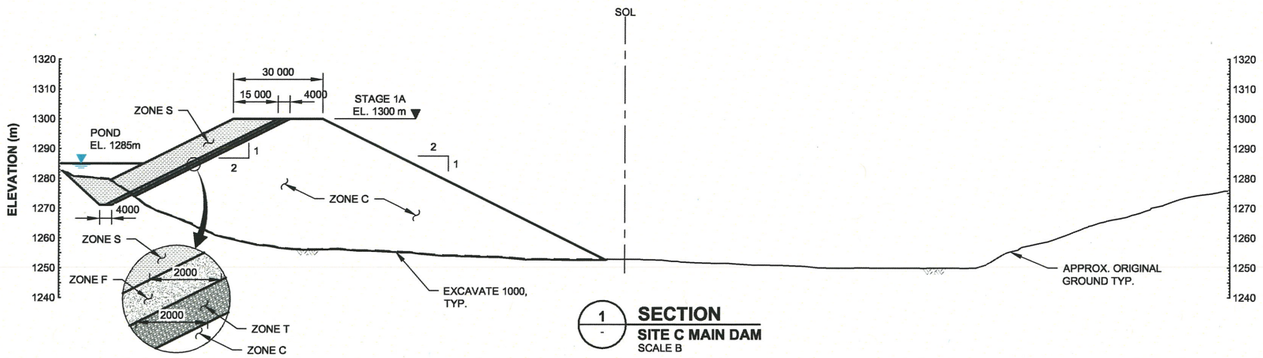


PLAN
SITE C ELEVATION 1300 m
SCALE A



1 - **SECTION**
SITE C MAIN DAM
SCALE B

ROAD VOLUMETRICS

ROAD	CUT (m^3)	FILL (m^3)	LENGTH (m)
KH1	217,200	163,100	1,259
KH2	754,800	535,400	6,636
KH3	100,900	68,300	1,581
KS1	240,800	477,500	3,927

ROAD GRADING

ROAD	WIDTH (m)	FROM	TO	LENGTH (m)	GRADE (%)
KH1	20	0+000	1+023	1,023	-9.7
KH1	20	1+023	1+259	236	-0.4
KH2	20	0+000	4+458	4,458	-5.4
KH2	20	4+458	6+636	2,178	-2.5
KH3	20	0+000	0+997	997	-5.7
KH3	20	0+997	1+581	584	-6.2
KS1	25	0+419	2+163	1,744	-1.2
KS1	25	2+163	4+346	2,183	-0.2

LEGEND:

- MINE WATER
- FRESH WATER
- EMBANKMENT FILL
- BORROW AREA (ZONE S & C)

NOTES:

1. CONTOUR INTERVAL IS 5 m.
2. DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
3. CHAINAGE FOR ROADS KH1 AND KH2 BEGINS AT SITE C LOCAL BORROW.
4. CHAINAGE FOR ROAD KH3 BEGINS AT INTERSECTION WITH ROAD KS1
5. CHAINAGE FOR ROAD KS1 BEGINS AT KP SCOPE CUT-OFF POINT AND IS PRECEDED BY AMEC ROAD AS7.

NOT FOR CONSTRUCTION

SCALE A 20 10 0 20 40 60 80 100 m
SCALE A 200 100 0 200 400 600 800 1000 m

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REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP
0	04DEC13	ISSUED FOR USE	AN	BB	SRM			

REF	NUMBER	TITLE

REFERENCES

STAMP/SEAL: PROFESSIONAL ENGINEER, PROVINCE OF BRITISH COLUMBIA, D. D. FONTAINE, # 36208, DEC 4, 2013

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CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE
FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	DDF	08NOV13
SCALE	PACKAGE CODE	DRN	AN	08NOV13
VARIES		CHK	BB	04DEC13
		APP	SRM	04DEC13

newgold

Knight Piésold CONSULTING

SUBJECT
TAILINGS STORAGE FACILITY
SITE C
YEAR -2 CONSTRUCTION PLAN

AREA
CLIENT DWG. NO.
DRAWING NO. D0140
REV. 0

CAD FILE: M:\1\01100457\06\A\CAD\DWGS\D0140\D0140_RL0.DWG

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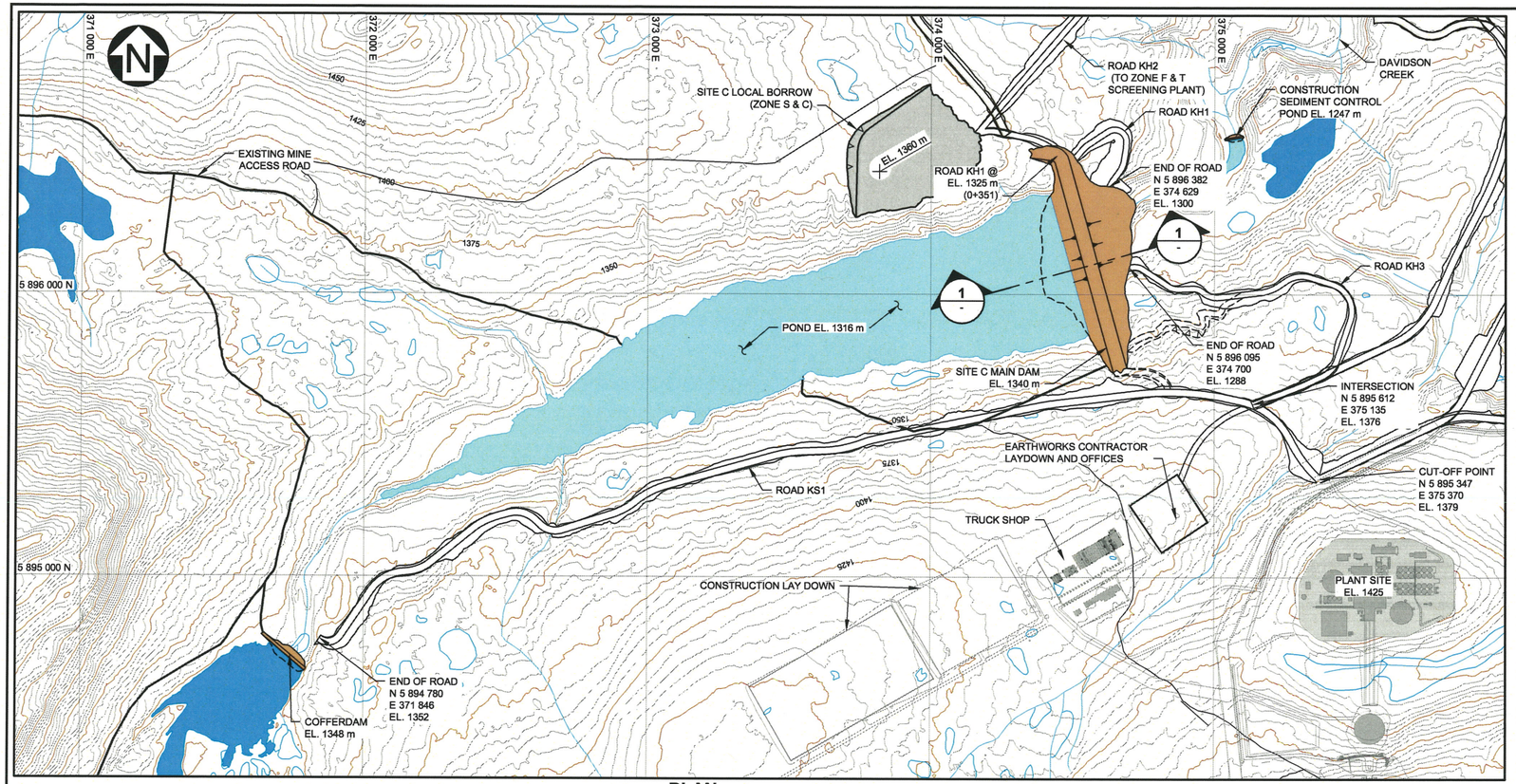
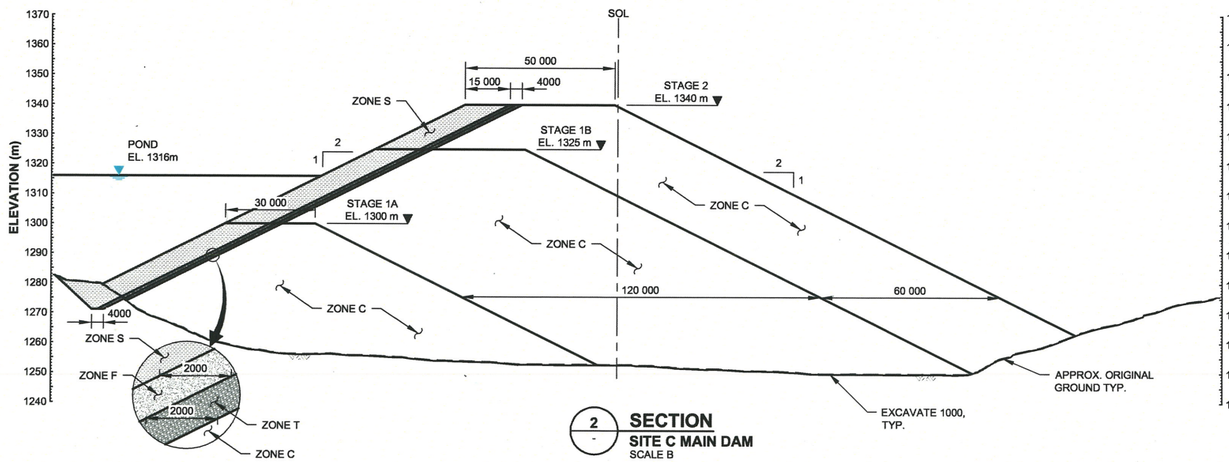


PLAN
SITE C ELEVATION 1340 m
SCALE A



2 — **SECTION**
SITE C MAIN DAM
SCALE B

ROAD VOLUMETRICS

ROAD	CUT (m^3)	FILL (m^3)	LENGTH (m)
KH1	217,200	163,100	1,259
KH2	754,800	535,400	6,636
KH3	100,900	68,300	1,581
KS1	240,800	477,500	3,927

ROAD GRADING

ROAD	WIDTH (m)	FROM	TO	LENGTH (m)	GRADE (%)
KH1	20	0+000	0+351	351	-9.7
KH1	20	0+351	0+781	410	-9.7
KH2	20	0+000	4+458	4,458	-5.4
KH2	20	4+458	6+636	2,178	-2.5
KH3	20	0+000	0+977	977	-5.7
KH3	20	0+977	1+418	441	-6.2
KS1	25	0+419	2+163	1,744	-1.2
KS1	25	2+163	4+346	2,183	-0.2

LEGEND:

- MINE WATER
- FRESH WATER
- EMBANKMENT FILL
- BORROW AREA (ZONE S & C)

NOTES:

1. CONTOUR INTERVAL IS 5 m.
2. DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
3. CHAINAGE FOR ROADS KH1 AND KH2 BEGINS AT SITE C LOCAL BORROW.
4. CHAINAGE FOR ROAD KH3 BEGINS AT INTERSECTION WITH ROAD KS1
5. CHAINAGE FOR ROAD KS1 BEGINS AT KP SCOPE CUT-OFF POINT AND IS PRECEDED BY AMEC ROAD AS7.

NOT FOR CONSTRUCTION

20 10 0 20 40 60 80 100 m
SCALE A
200 100 0 200 400 600 800 1000 m
SCALE A

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP
REF	NUMBER	TITLE
		REFERENCES

STAMP/SEAL: PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — B. D. FONTAINE # 36208 — Dec 4, 2013

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APPROVED FOR _____
CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.
PROJECT PHASE: FEASIBILITY STUDY
PROJECT NO.: VA101-457/6
ACTIVITY NO.:
SCALE: VARIES
PACKAGE CODE:

	BY	DDMMMYY
DES	DDF	08NOV13
DRN	AN	08NOV13
CHK	RR	04DEC13
APP	SRM	04DEC13

newgold

SUBJECT: TAILINGS STORAGE FACILITY SITE C YEAR –1 CONSTRUCTION PLAN

Knight Piésold CONSULTING

AREA:
CLIENT DWG. NO.:
DRAWING NO.: D0150
REV.: 0

SAVED: 03-Dec-13 11:01 AM PLOTTED: 03-Dec-13 11:15 AM USER: ABBAS NASIRI
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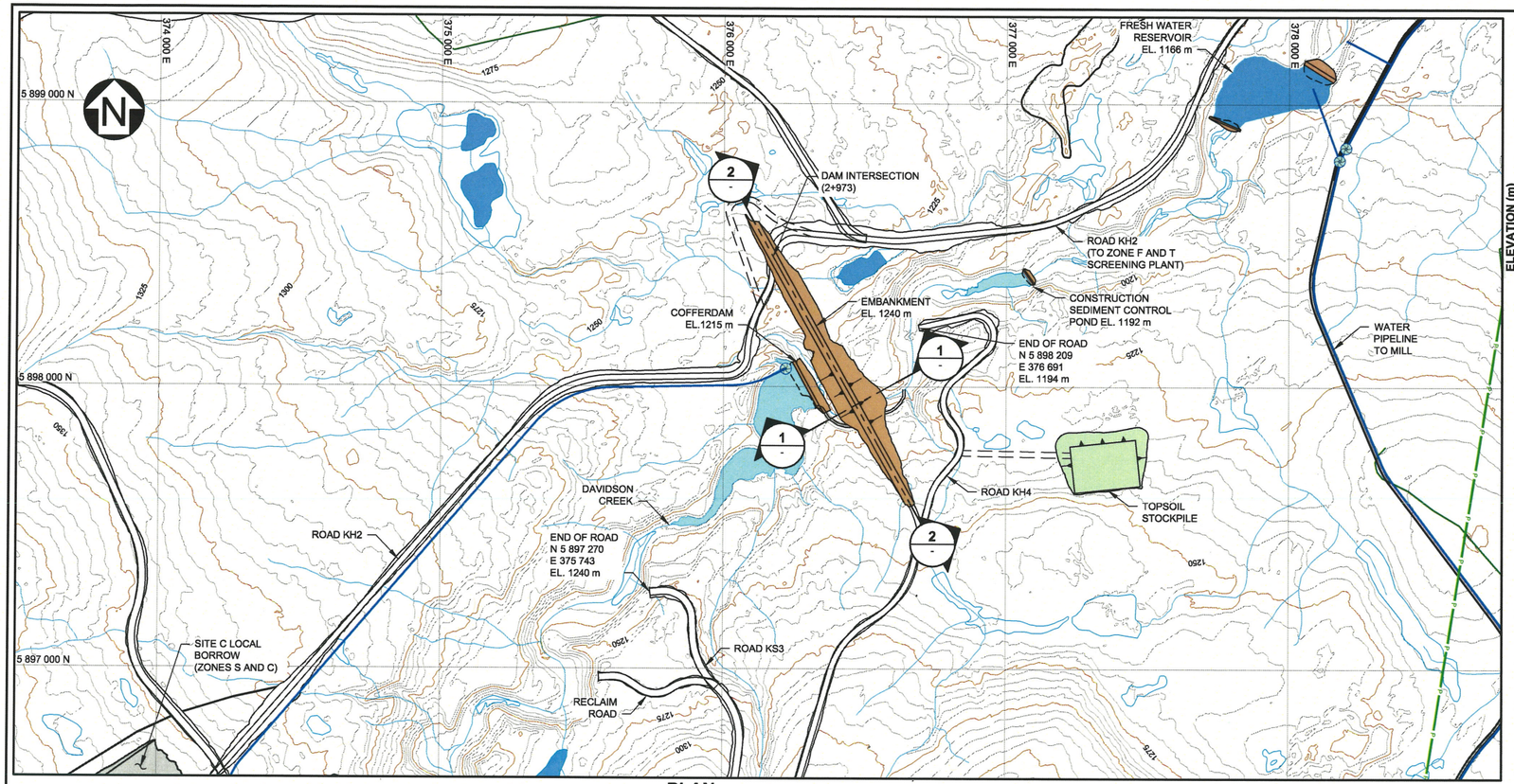
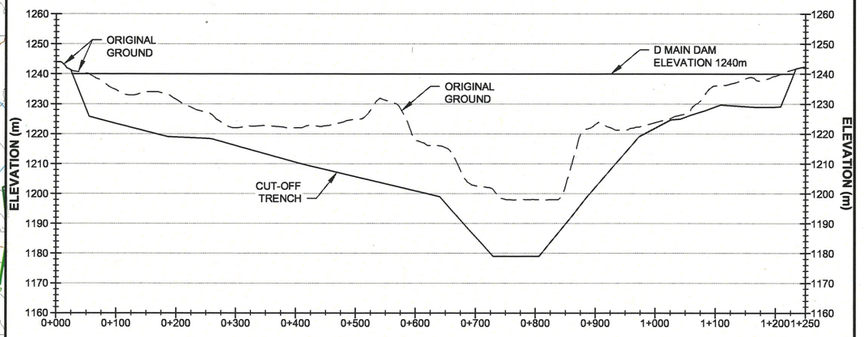
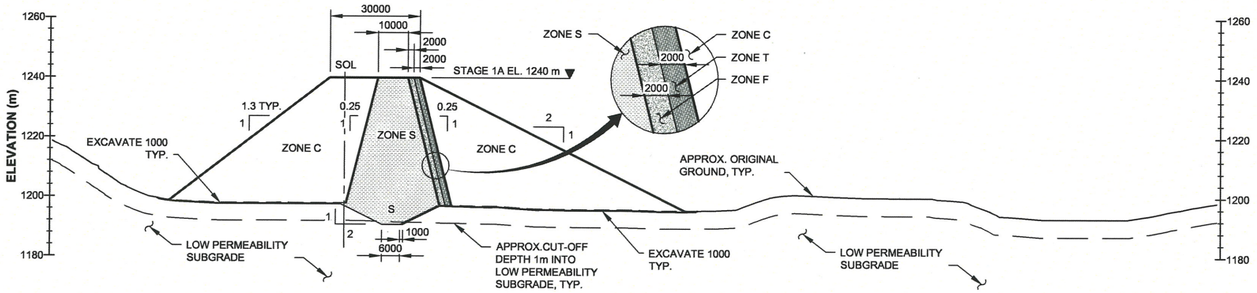


PLAN
SITE D ELEVATION 1240 m
SCALE A



2 - SECTION
SITE D MAIN DAM PROFILE
HORIZONTAL: SCALE C
VERTICAL: SCALE D



1 - SECTION
SITE D MAIN DAM
SCALE B

ROAD GRADING					
ROAD	WIDTH (m)	FROM	TO	LENGTH (m)	GRADE (%)
KH2	20	0+000	2+178	2,178	-5.39
KH2	20	2+178	2+973	795	-2.46
KH2	20	2+973	6+636	3,663	-2.46

LEGEND:
- MINE WATER
- FRESH WATER
- EMBANKMENT FILL
- TOPSOIL

NOTES:
1. CONTOUR INTERVAL IS 5 m.
2. DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
3. CHAINAGE FOR ROAD KH2 BEGINS AT SITE C LOCAL BORROW.

NOT FOR CONSTRUCTION

SCALE B: 20 10 0 20 40 60 80 100 m
SCALE A: 200 100 0 200 400 600 800 1000 m

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP

REF	NUMBER	TITLE
		REFERENCES

STAMP/SEAL: PROFESSIONAL ENGINEER — D. D. FONTAINE # 36208 — Dec 4, 2013

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APPROVED FOR _____
CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.
PROJECT PHASE: FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	DDF	08NOV13
SCALE: VARIES	PACKAGE CODE	DRN	AN	08NOV13
		CHK	BB	04DEC13
		APP	SKM	04DEC13

newgold

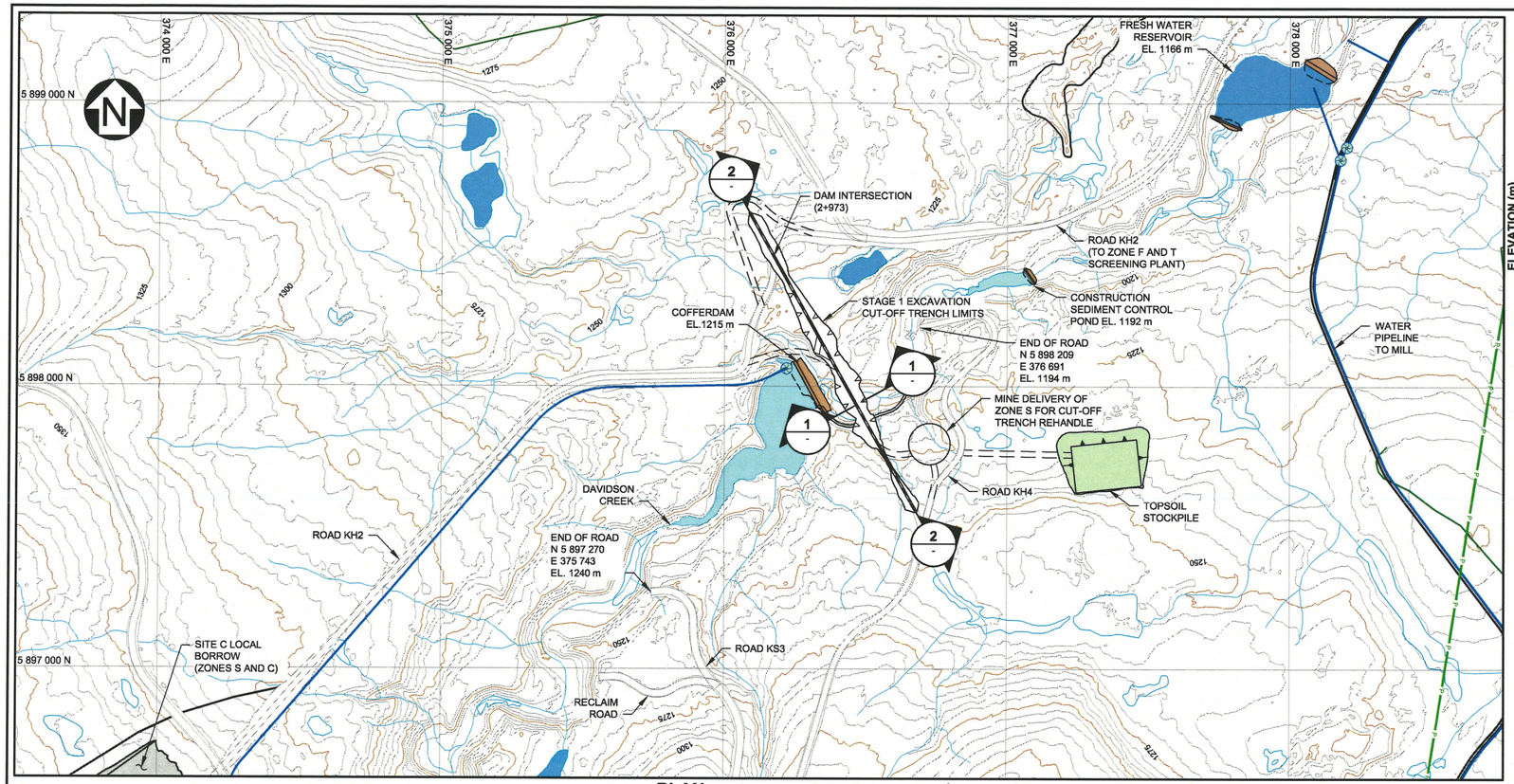
SUBJECT: TAILINGS STORAGE FACILITY SITE D YEAR –1 CONSTRUCTION PLAN

Knight Piésold CONSULTING

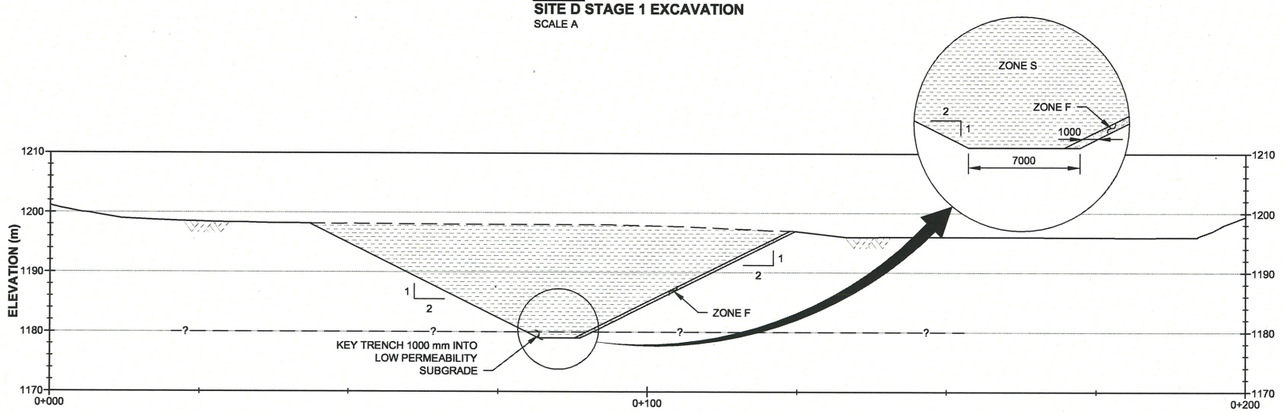
AREA
CLIENT DWG. NO.
DRAWING NO. D0170 — REV. 0

CAD FILE: M:\11\01\00457\06\A\ACAD\DWGS\D0170\D0170_R0.DWG

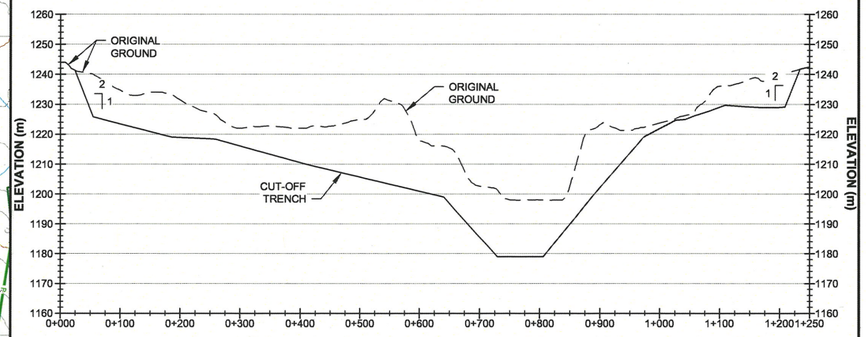
SAVED: 03-Dec-13 11:04 AM PLOTTED: 03-Dec-13 11:15 AM USER: ABBAS NASIRI



PLAN
SITE D STAGE 1 EXCAVATION
SCALE A



1 SECTION
SITE D CUT-OFF TRENCH EXCAVATION
SCALE B



2 SECTION
SITE D CUT-OFF TRENCH EXCAVATION PROFILE
HORIZONTAL: SCALE C
VERTICAL: SCALE D

ROAD GRADING

ROAD	WIDTH (m)	FROM	TO	LENGTH (m)	GRADE (%)
KH2	20	0+000	2+178	2,178	-5.39
KH2	20	2+178	2+973	795	-2.46
KH2	20	2+973	6+636	3,663	-2.46

LEGEND:

- MINE WATER
- FRESH WATER
- EMBANKMENT FILL
- BORROW AREA (ZONE S & C)
- TOPSOIL STOCKPILE

NOTES:

1. CONTOUR INTERVAL IS 5 m.
2. DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
3. CHAINAGE FOR ROAD KH2 BEGINS AT SITE C LOCAL BORROW.

NOT FOR CONSTRUCTION

SCALE D: 20 10 0 20 40 60 80 100 m
SCALE C: 100 50 0 100 200 300 400 500 m
SCALE B: 10 5 0 10 20 30 40 50 m
SCALE A: 200 100 0 200 400 600 800 1000 m

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP

REF	NUMBER	TITLE
		REFERENCES

STAMP/SEAL: PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — D. D. FONTAINE # 36208 — Dec. 4, 2013

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APPROVED FOR _____
CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE: FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	DDF	08NOV13
SCALE	PACKAGE CODE	DRN	AN	08NOV13
VARIES		CHK	BB	04DEC13
		APP	SKMY	04DEC13

newgold

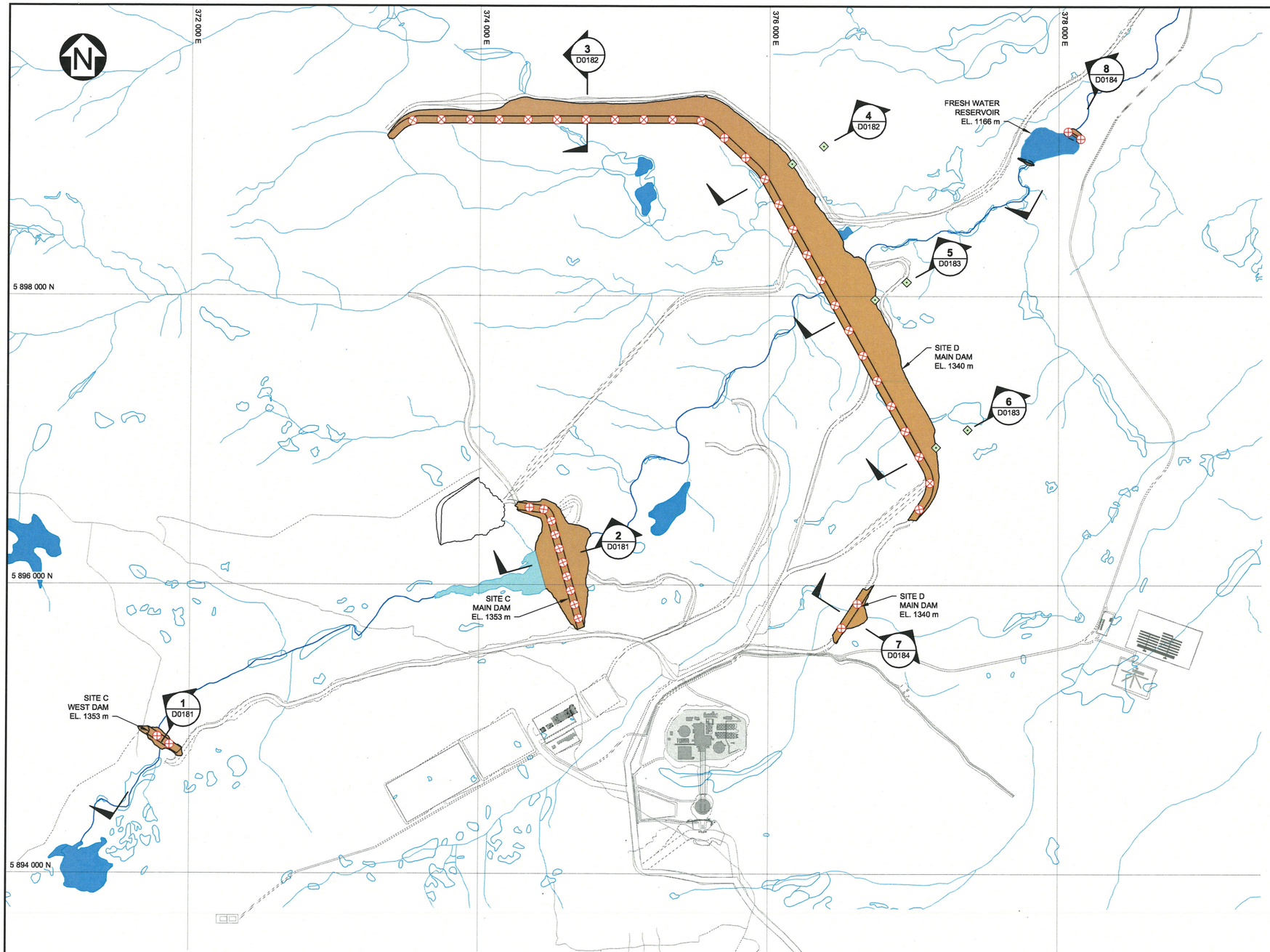
Knight Piésold CONSULTING

SUBJECT: TAILINGS STORAGE FACILITY
SITE D STAGE 1 CUT-OFF TRENCH
EXCAVATION PLAN AND SECTIONS

AREA
CLIENT DWG. NO.
DRAWING NO. D0171
REV. 0

CAD FILE: M:\1101\004\57\06\A\ACAD\DWGS\D0171\D0171_R0.DWG

SAVED: 03-Dec-13 11:11 PLOTTED: 03-Dec-13 11:15 AM USER: ABBAS AM NASIRI



PLAN
SCALE A

LEGEND:

- SURFACE MOVEMENT MONUMENT
- SLOPE INCLINOMETER
- 6 / D0183 — INSTRUMENTATION PLANE

NOTES:

1. DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
2. PIEZOMETERS TO BE INSTALLED AT ALL INSTRUMENTATION PLANES.
3. SURFACE MOVEMENT MONUMENTS TO BE INSTALLED AT ALL INSTRUMENTATION PLANES.
4. TYPICAL SECTIONS AND DETAILS FOUND ON DRAWING D0185.

NOT FOR CONSTRUCTION

SCALE A 300 150 0 500 1000 1500 m

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP	REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP	REF	NUMBER	TITLE

REFERENCES

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APPROVED FOR _____

CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE: FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	CBN	08NOV13
		DRN	AN	08NOV13
SCALE	PACKAGE CODE	CHK	DDF	04DEC13
AS SHOWN		APP	SRM	04DEC13

newgold

SUBJECT: TAILINGS STORAGE FACILITY INSTRUMENTATION PLAN

Knight Piésold CONSULTING

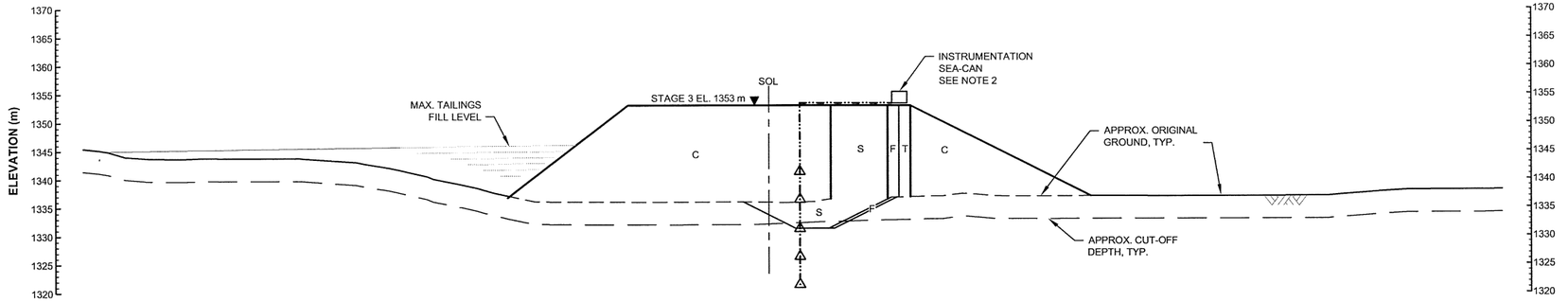
AREA

CLIENT DWG. NO.

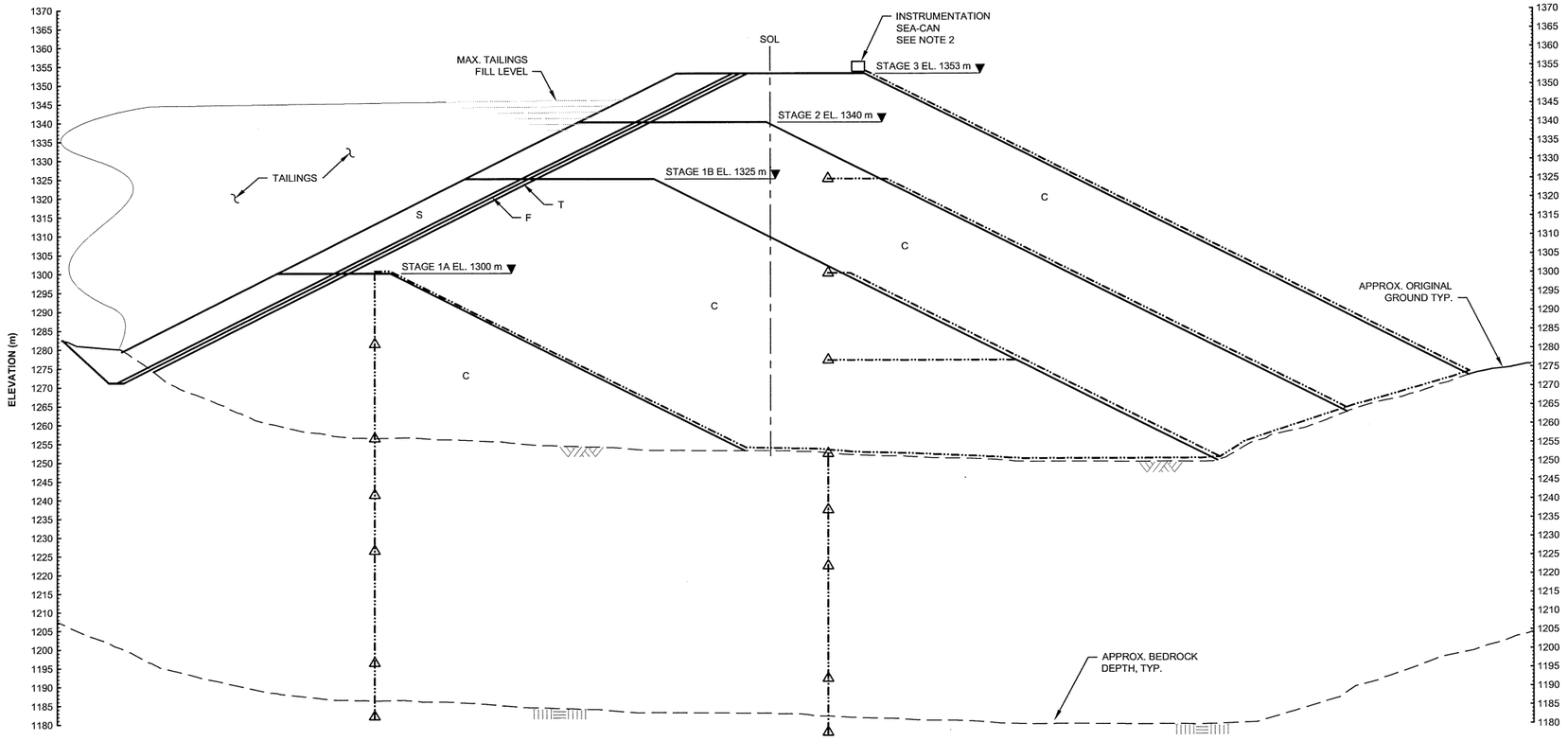
DRAWING NO. D0180 — REV. 0

CAD FILE: M:\1\01\00457\06\A\ACAD\DWGS\D0180\D0180 R0.DWG

SAVED: 03-Dec-13 11:20 AM PLOTTED: 03-Dec-13 11:40 AM USER: ABBAS NASIRI



1 D0180 **SECTION**
INSTRUMENTATION SECTION
SITE C WEST DAM
SCALE B



2 D0180 **SECTION**
INSTRUMENTATION SECTION
SITE C MAIN DAM
SCALE A

LEGEND:

VIBRATING WIRE PIEZOMETER

NOTES:

1. DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
2. READ OUT BOX WITH REMOTE MONITORING CAPABILITY.
3. PIEZOMETERS TO BE INSTALLED AS SHOWN ON DRAWING D0180.

NOT FOR CONSTRUCTION

SCALE B: 10 5 0 10 20 30 40 50 m

SCALE A: 15 7.5 0 25 50 75 m

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP	REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP	REF	NUMBER	TITLE

REFERENCES

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PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — D. D. FONTAINE # 36208 — Dec 4, 2013

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APPROVED FOR _____

CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE: FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	CBN	08NOV13
		DRN	AN	08NOV13
SCALE	PACKAGE CODE	CHK	DDF	04DEC13
AS SHOWN		APP	SRM	04DEC13

newgold

SUBJECT: TAILINGS STORAGE FACILITY SITE C INSTRUMENTATION SECTIONS 1 & 2

Knight Piésold CONSULTING

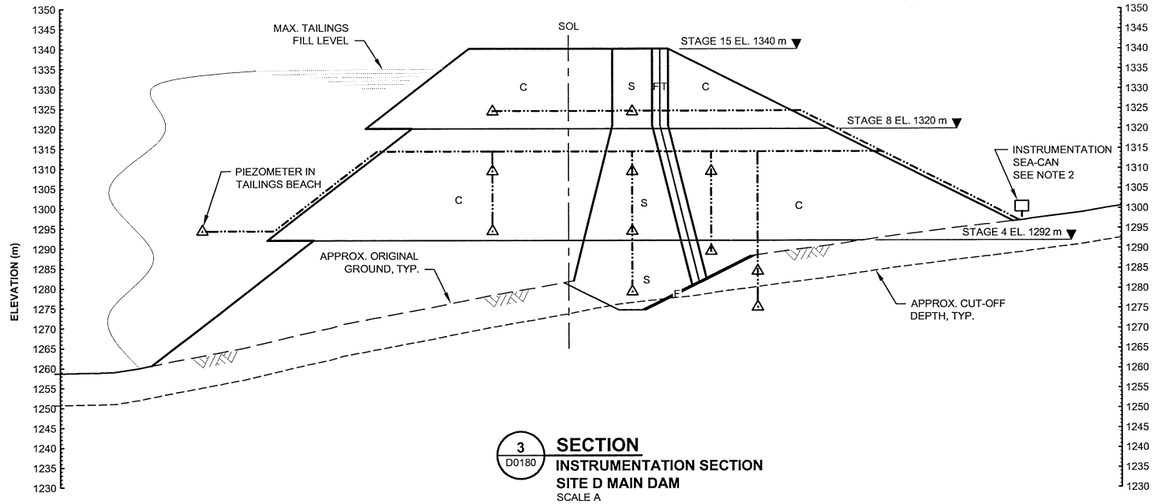
AREA

CLIENT DWG. NO.

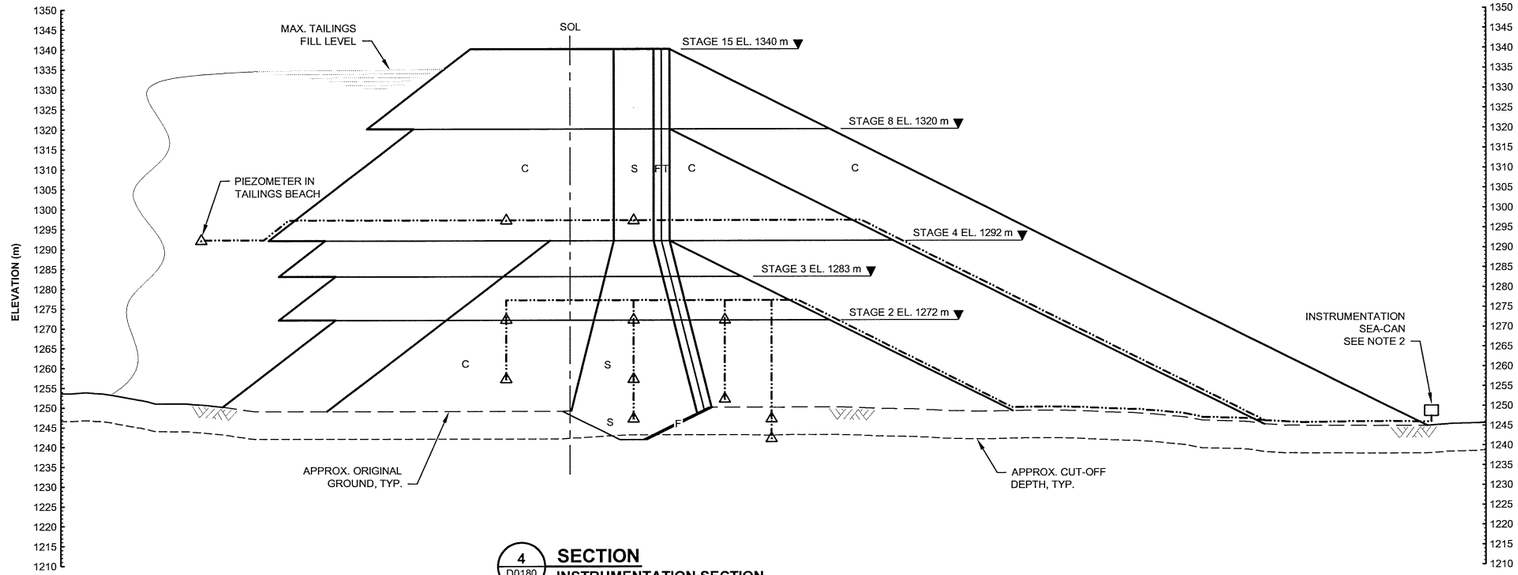
DRAWING NO. D0181 REV. 0

SAVED: 03-Dec-13 11:23 AM PLOTTED: 03-Dec-13 11:37 AM USER: ABBAS NASIRI

CAD FILE: M:\1\01\00457\06\A\ACAD\DWGS\D0181\D0181_R0.DWG



3 D0180 **SECTION**
INSTRUMENTATION SECTION
SITE D MAIN DAM
SCALE A



4 D0180 **SECTION**
INSTRUMENTATION SECTION
SITE D MAIN DAM
SCALE A

LEGEND:

VIBRATING WIRE PIEZOMETER

NOTES:

1. DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
2. READ OUT BOX WITH REMOTE MONITORING CAPABILITY.
3. PIEZOMETERS TO BE INSTALLED AS SHOWN ON DRAWING D0180.

NOT FOR CONSTRUCTION

SCALE A 15 7.5 0 25 50 75 m

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP	REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP	REF	NUMBER	TITLE

REFERENCES

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PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
D. D. FONTAINE
36208
Dec 9, 2013

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APPROVED FOR _____

CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE
FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	CBN	08NOV13
		DRN	AN	08NOV13
SCALE	PACKAGE CODE	CHK	DDF	04DEC13
AS SHOWN		APP	SAM	04DEC13

newgold

Knight Piésold CONSULTING

SUBJECT
TAILINGS STORAGE FACILITY
SITE D
INSTRUMENTATION SECTIONS 3 & 4

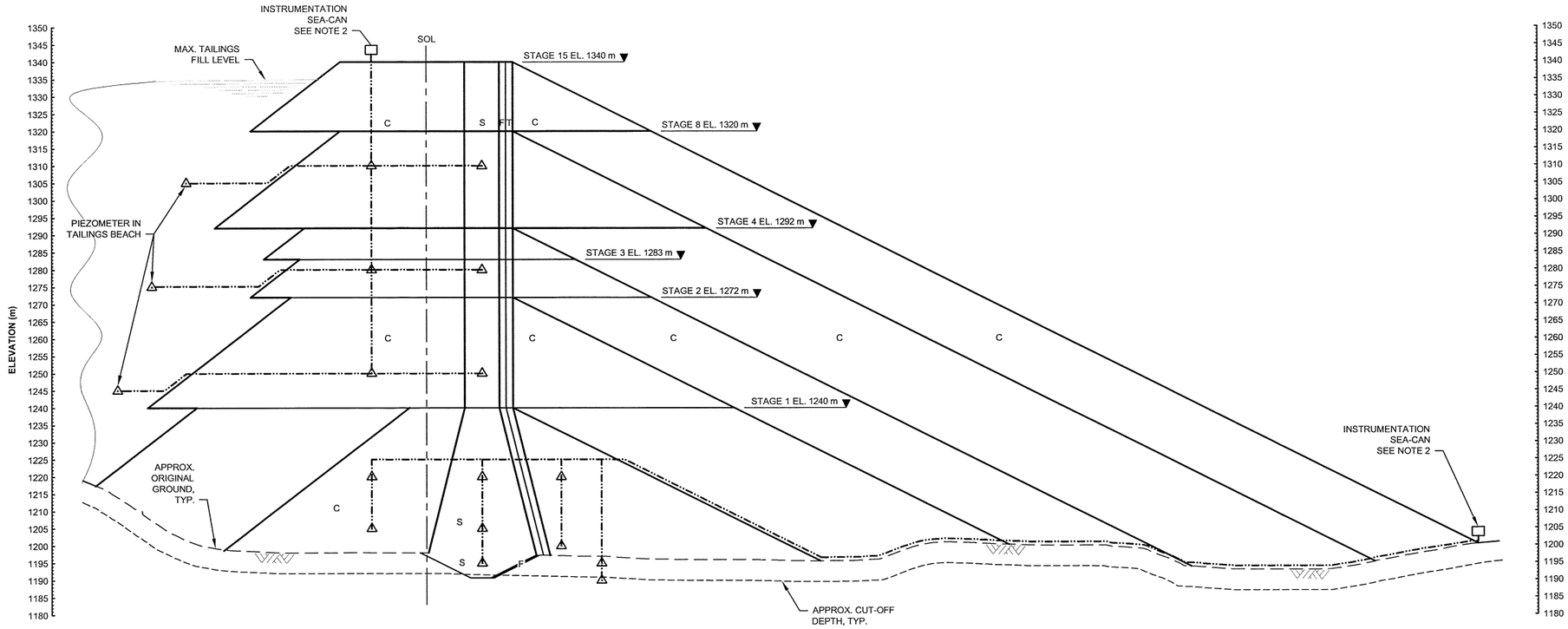
AREA

CLIENT DWG. NO.

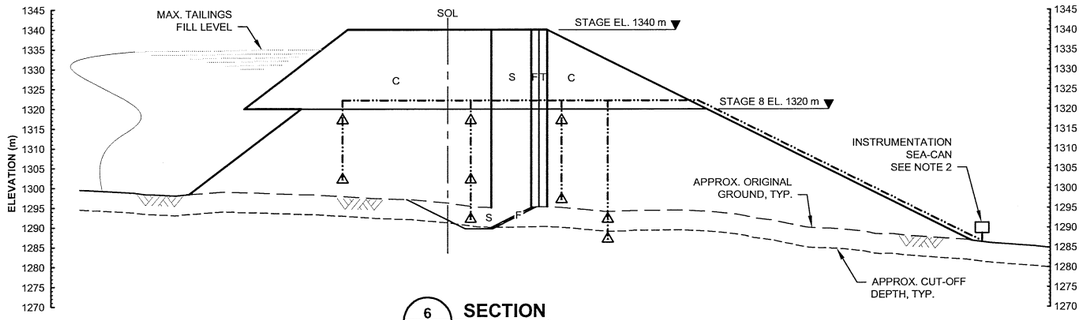
DRAWING NO. D0182 REV. 0

CAD FILE: M:\1\01\00457\06\A\ACAD\DWGS\D0182\D0182_R0.DWG

SAVED: 03-Dec-13 11:25 AM PLOTTED: 03-Dec-13 11:41 AM USER: ABBAS NASIRI



5 / D0180 **SECTION**
INSTRUMENTATION SECTION
SITE D MAIN DAM
SCALE A



6 / D0180 **SECTION**
INSTRUMENTATION SECTION
SITE D MAIN DAM
SCALE A

LEGEND:

VIBRATING WIRE PIEZOMETER

NOTES:

1. DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
2. READ OUT BOX WITH REMOTE MONITORING CAPABILITY.
3. FOR ADDITIONAL NOTES, REFER TO DRG. D0180.

NOT FOR CONSTRUCTION

SCALE A 15 7.5 0 25 50 75 m

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP
REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP

REF	NUMBER	TITLE
		REFERENCES

STAMP/SEAL: PROFESSIONAL ENGINEER — D. D. FONTAINE # 36208 — BRITISH COLUMBIA — Dec 4, 2013

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APPROVED FOR _____
CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE: FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	CBN	08NOV13
SCALE	PACKAGE CODE	DRN	AN	08NOV13
AS SHOWN		CHK	DDF	04DEC13
		APP	RM	04DEC13

newgold

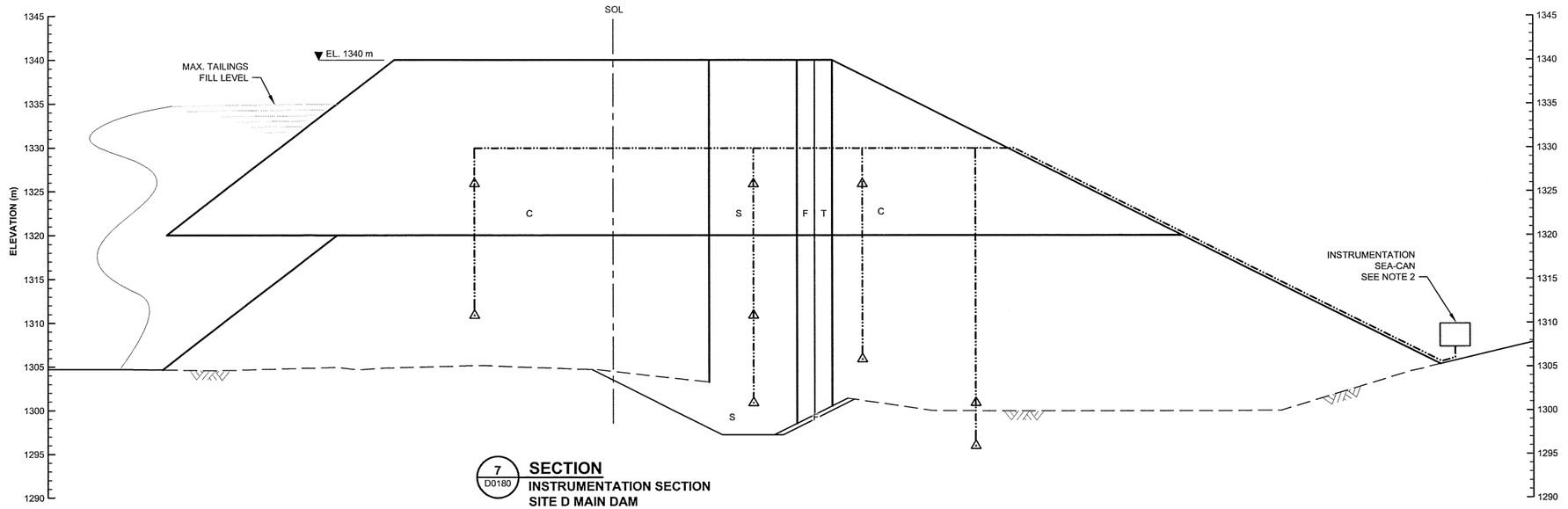
SUBJECT: TAILINGS STORAGE FACILITY
SITE D
INSTRUMENTATION SECTIONS 5 & 6

Knight Piésold CONSULTING

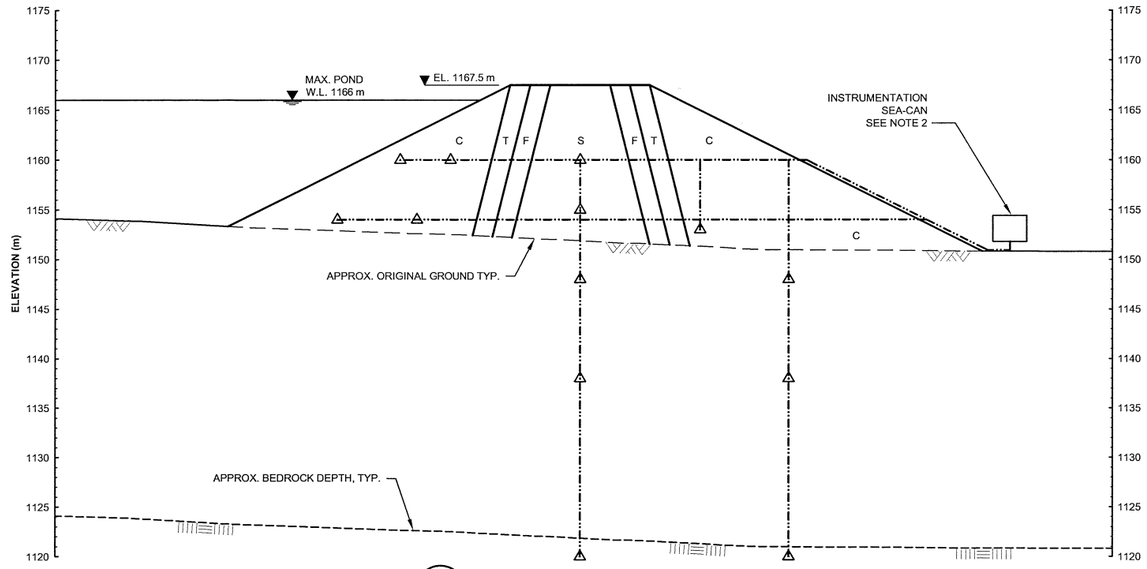
AREA
CLIENT DWG. NO.
DRAWING NO. D0183 — REV. 0

SAVED: 03-Dec-13 11:28 PLOTTED: 03-Dec-13 11:37 AM USER: ABBAS
AM MASIRI

CAD FILE M:\101\00457\VA\CAD\DWGS\D0183\D0183_R0.DWG



7 D0180 **SECTION**
INSTRUMENTATION SECTION
SITE D MAIN DAM
SCALE A



8 D0180 **SECTION**
INSTRUMENTATION SECTION
FRESH WATER RESERVOIR DAM
SCALE A

LEGEND:

VIBRATING WIRE PIEZOMETER

NOTES:

1. DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
2. READ OUT BOX WITH REMOTE MONITORING CAPABILITY.
3. FOR ADDITIONAL NOTES, REFER TO DRG. D0180.

NOT FOR CONSTRUCTION

SCALE A 6 3 0 10 20 30 m

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP	REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP	REF	NUMBER	TITLE

REFERENCES

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PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
D. D. FONTAINE
36208
Dec 4, 2013

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APPROVED FOR _____

CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE: FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	CBN	08NOV13
		DRN	AN	08NOV13
SCALE	PACKAGE CODE	CHK	DDF	04DEC13
AS SHOWN		APP	RM	04DEC13

newgold

SUBJECT: TAILINGS STORAGE FACILITY SITE D AND FRESH WATER RESERVOIR INSTRUMENTATION SECTIONS 7 & 8

Knight Piésold CONSULTING

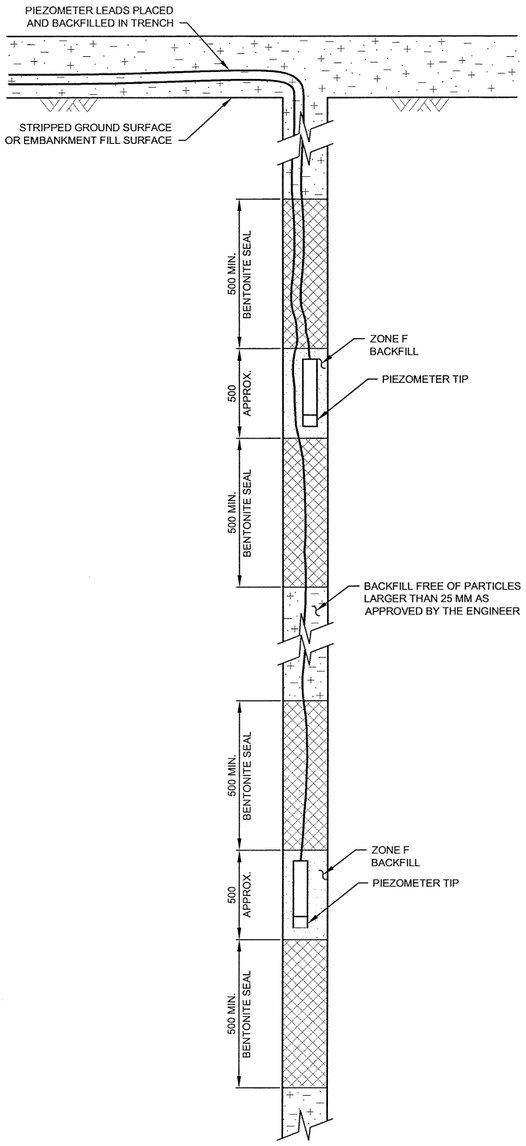
AREA

CLIENT DWG. NO.

DRAWING NO. D0184 REV. 0

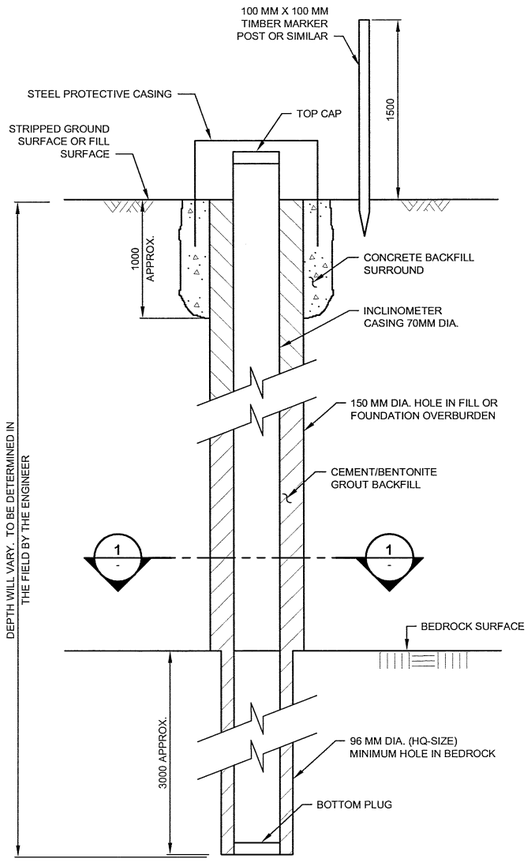
SAVED: 03-Dec-13 11:31 AM PLOTTED: 03-Dec-13 11:37 AM USER: ABBAS NASIRI

CAD FILE: M:\1\01\00457\06\A\ACAD\DWGS\D0184\D0184_RO.DWG



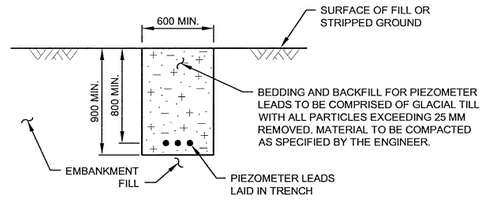
TYPICAL INSTALLATION OF PIEZOMETERS IN BOREHOLES

SCALE C



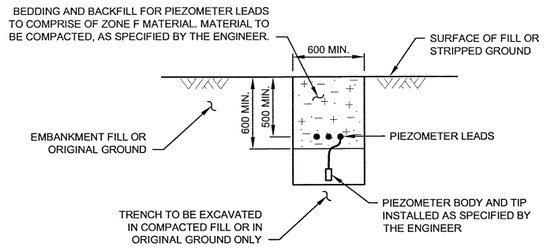
TYPICAL INCLINOMETER INSTALLATION IN BOREHOLE

SCALE A



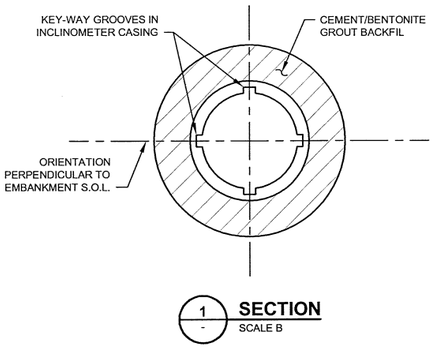
TYPICAL SECTION THROUGH PIEZOMETER LEADS TRENCH IN ZONE S FILL

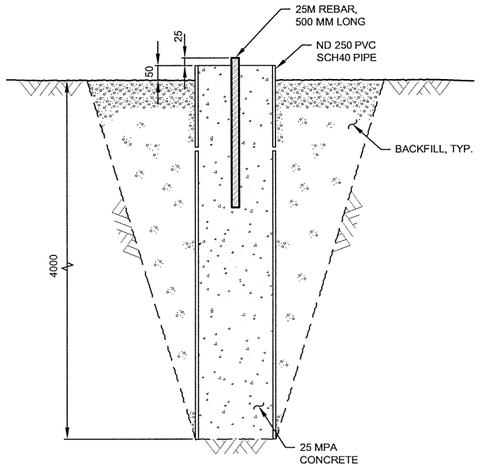
SCALE A



TYPICAL SECTION THROUGH PIEZOMETER LEADS TRENCH IN ZONE C, F AND T FILL OR ORIGINAL GROUND

SCALE A





TYPICAL MOVEMENT MONUMENT

SCALE C

NOTES:

1. DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
2. DEPTH AND NUMBER OF PIEZOMETERS TO BE DETERMINED BY THE ENGINEER.
3. BENTONITE POWDER TO BE MIXED INTO THE GLACIAL TILL BACKFILL ALONG LEADS WHEN EXTENDED THROUGH ZONE S.

NOT FOR CONSTRUCTION

SCALE C: 200 100 0 200 400 600 800 1000 mm
SCALE B: 250 125 0 250 500 750 1000 1250 mm
SCALE A: 500 250 0 500 1000 1500 2000 2500 mm

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP
REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP

STAMP/SEAL: PROFESSIONAL ENGINEER — D. D. FONTAINE # 36208 — DEC 11 2013

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APPROVED FOR _____
CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE: FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	CBN	08NOV13
SCALE	PACKAGE CODE	DRN	AN	08NOV13
AS SHOWN		CHK	DDF	04DEC13
		APP	RM	04DEC13

newgold

Knight Piésold CONSULTING

SUBJECT: TAILINGS STORAGE FACILITY INSTRUMENTATION TYPICAL SECTIONS AND DETAILS

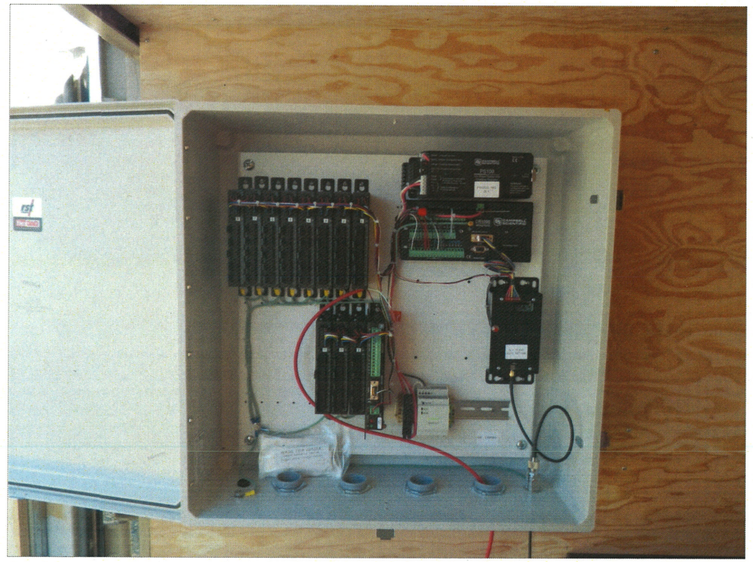
AREA
CLIENT DWG. NO.
DRAWING NO. D0185 REV. 0

SAVED: 03-Dec-13 11:33 PLOTTED: 03-Dec-13 11:37 AM USER: ABRAS
AM MASRI

CAD FILE: M:\101\00457\DRV\VA00457DRWGS\D0185\D0185_R0.DWG



TYPICAL INSTRUMENTATION SEA-CAN



TYPICAL INSTRUMENTATION SEA-CAN READ OUT PANEL BOX



TYPICAL INSTRUMENTATION SEA-CAN INTERIOR

NOT FOR CONSTRUCTION

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP	REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP

STAMP/SEAL

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
D. D. FONTAINE
36208
Dec 4, 2013

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CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE
FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	CBN	08NOV13
		DRN	SB	08NOV13
SCALE	PACKAGE CODE	CHK	DDF	04DEC13
NTS		APP	SRM	04DEC13

newgold

SUBJECT
TAILINGS STORAGE FACILITY
INSTRUMENTATION
INSTRUMENTATION SEA-CAN

Knight Piésold CONSULTING

AREA

CLIENT DWG. NO.

DRAWING NO. D0186 REV. 0

CAD FILE: M:\1\01\00457\06\A\ACAD\DWGS\D0186\D0186 R0.DWG

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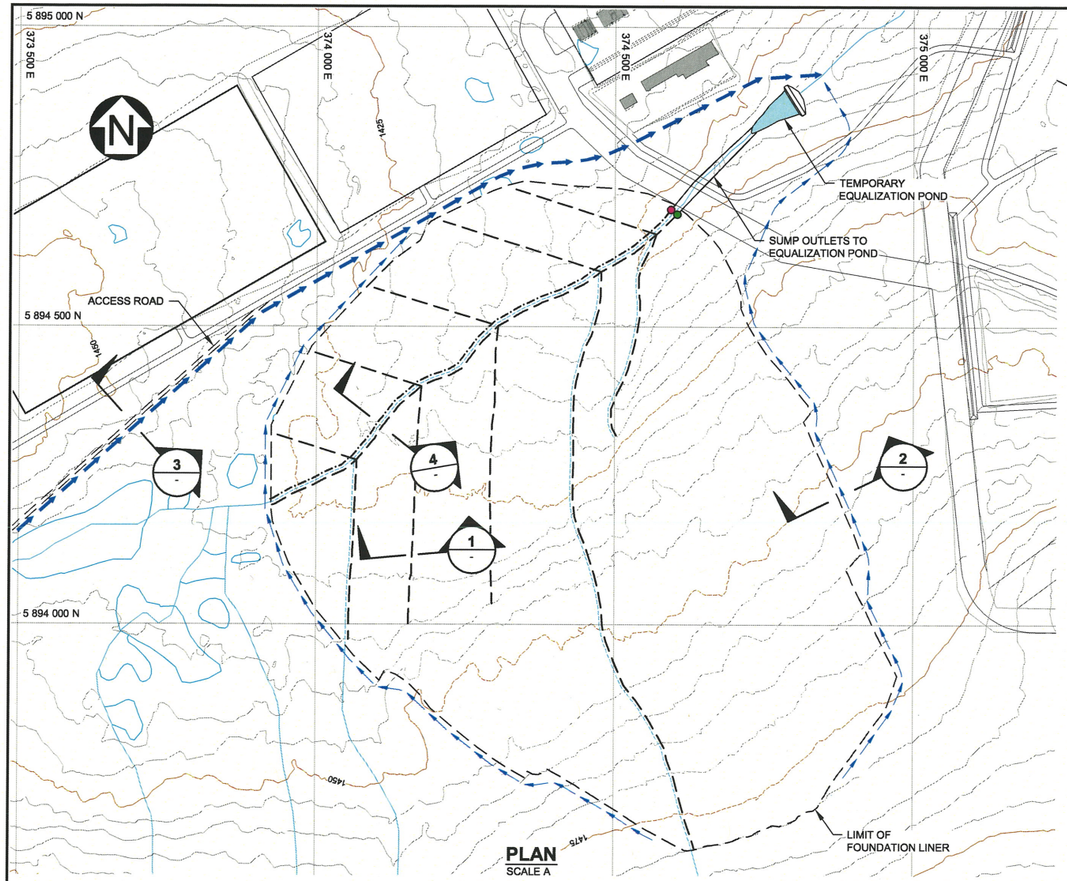
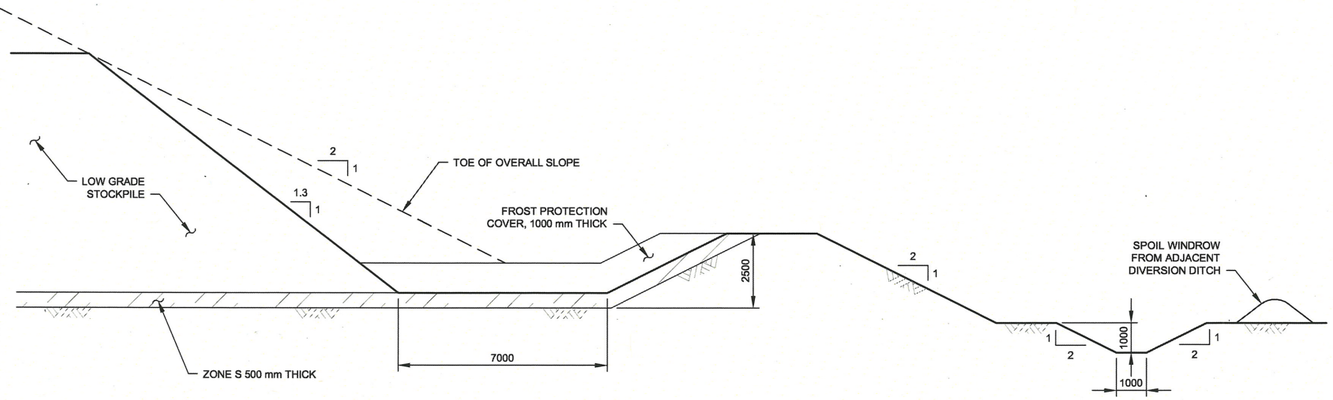
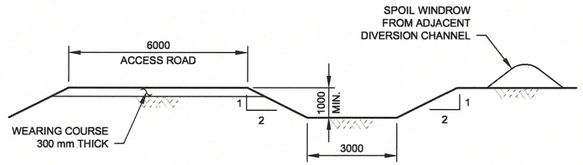


PLAN
SCALE A



2 - **SECTION**
STOCKPILE PERIMETER
SCALE C



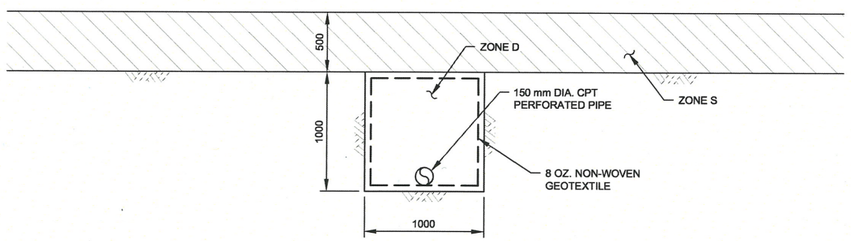
3 - **SECTION**
DIVERSION CHANNEL
SCALE C

LEGEND:

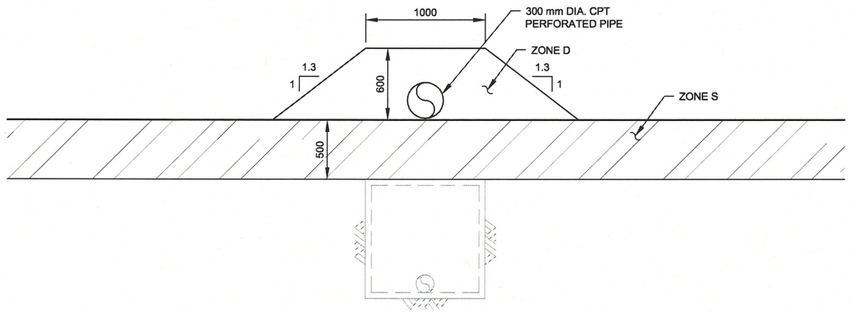
- DIVERSION DITCH
- DIVERSION CHANNEL
- FOUNDATION DRAIN
- FOUNDATION DRAIN SUMP AND MONITORING DEVICE
- LGO COLLECTION DRAIN (300 mm DIA. PERFORATED CPT)
- LGO COLLECTION DRAIN SUMP AND MONITORING DEVICE

NOTES:

1. CONTOUR INTERVAL IS 5 METRES.
2. DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
3. FIRST LIFT OF LOW-GRADE ORE (LGO) STOCKPILE ON FOUNDATION TO BE MAX. 10 m.



1 - **SECTION**
FOUNDATION DRAINS
SCALE B



4 - **SECTION**
LGO COLLECTION DRAIN
SCALE B

NOT FOR CONSTRUCTION

SCALE C: 2 1 0 2 4 6 8 10 m
SCALE B: 0.5 0.25 0 0.5 1.0 1.5 2.0 2.5 m
SCALE A: 100 50 0 100 200 300 400 500 m

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP

REF	NUMBER	TITLE
		REFERENCES

STAMP / SEAL
PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
D. D. FONTAINE
36208
BRITISH COLUMBIA, CANADA
Dec 4/2013

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CLIENT PROJECT MGR.	DEPARTMENT MGR.	PROJECT MGR.

PROJECT PHASE: FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	DDF	08NOV13
SCALE: VARIES	PACKAGE CODE	DRN	AN	08NOV13
		CHK	BB	04DEC13
		APP	SRM	04DEC13

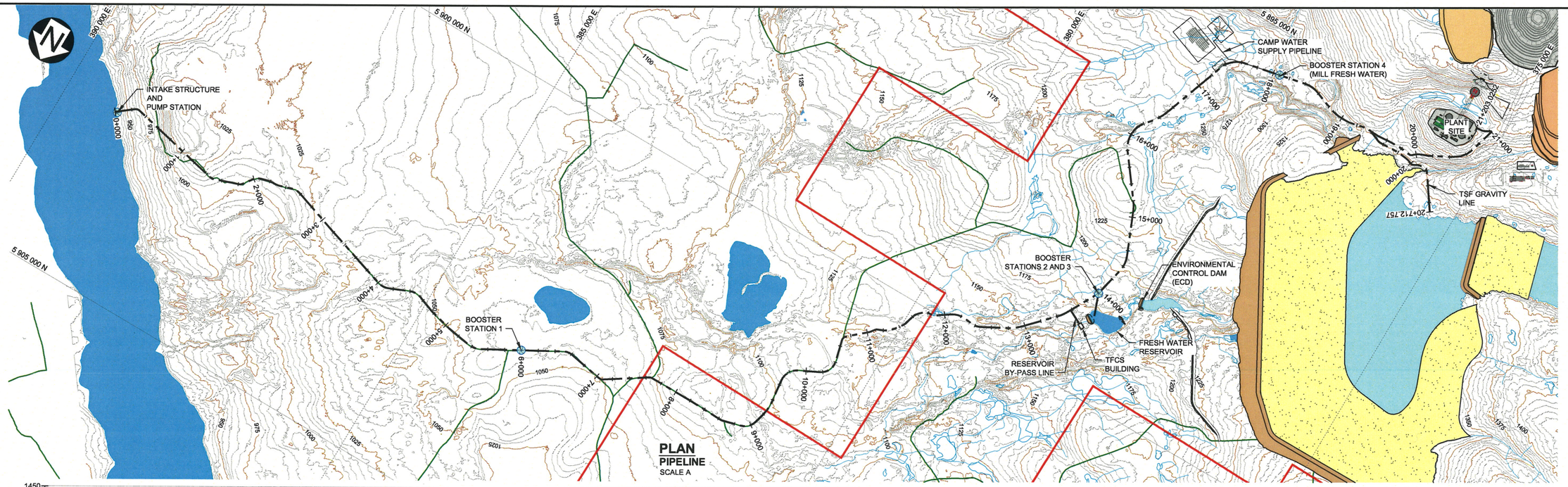
newgold

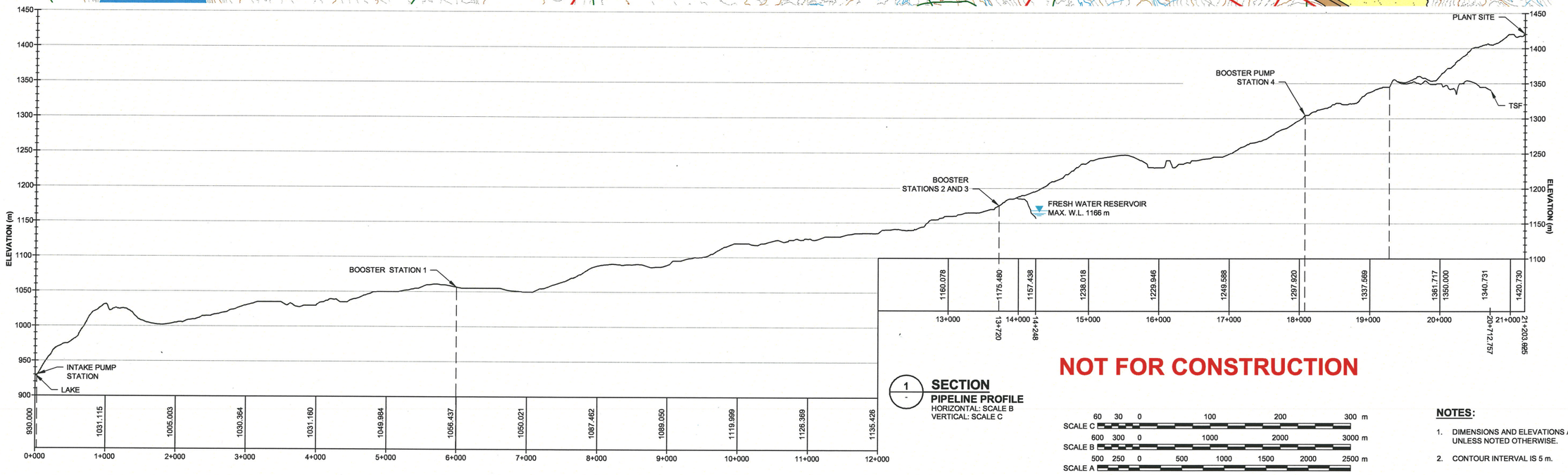
SUBJECT
MINE SITE PREPARATION
LOW-GRADE ORE STOCKPILE
PLAN AND TYPICAL SECTIONS

Knight Piésold CONSULTING

AREA
CLIENT DWG. NO.
DRAWING NO. D0190
REV. 0

CAD FILE: M:\1\01\00457\06\A\CAD\DWGS\D0190\D0190 R0.DWG
SAVED: 03-Dec-13 11:14 AM PLOTTED: 03-Dec-13 11:15 AM USER: ABBAS NASIRI





NOT FOR CONSTRUCTION

1 - **SECTION**
PIPELINE PROFILE
HORIZONTAL: SCALE B
VERTICAL: SCALE C

SCALE C: 60 30 0 100 200 300 m
SCALE B: 600 300 0 1000 2000 3000 m
SCALE A: 500 250 0 500 1000 1500 2000 2500 m

NOTES:

1. DIMENSIONS AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
2. CONTOUR INTERVAL IS 5 m.

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP

REF	NUMBER	TITLE
		REFERENCES

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CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE: FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	RSS	08NOV13
SCALE	PACKAGE CODE	DRN	AN	08NOV13
VARIES		CHK	DDF	04DEC13
		APP	[illegible]	04DEC13

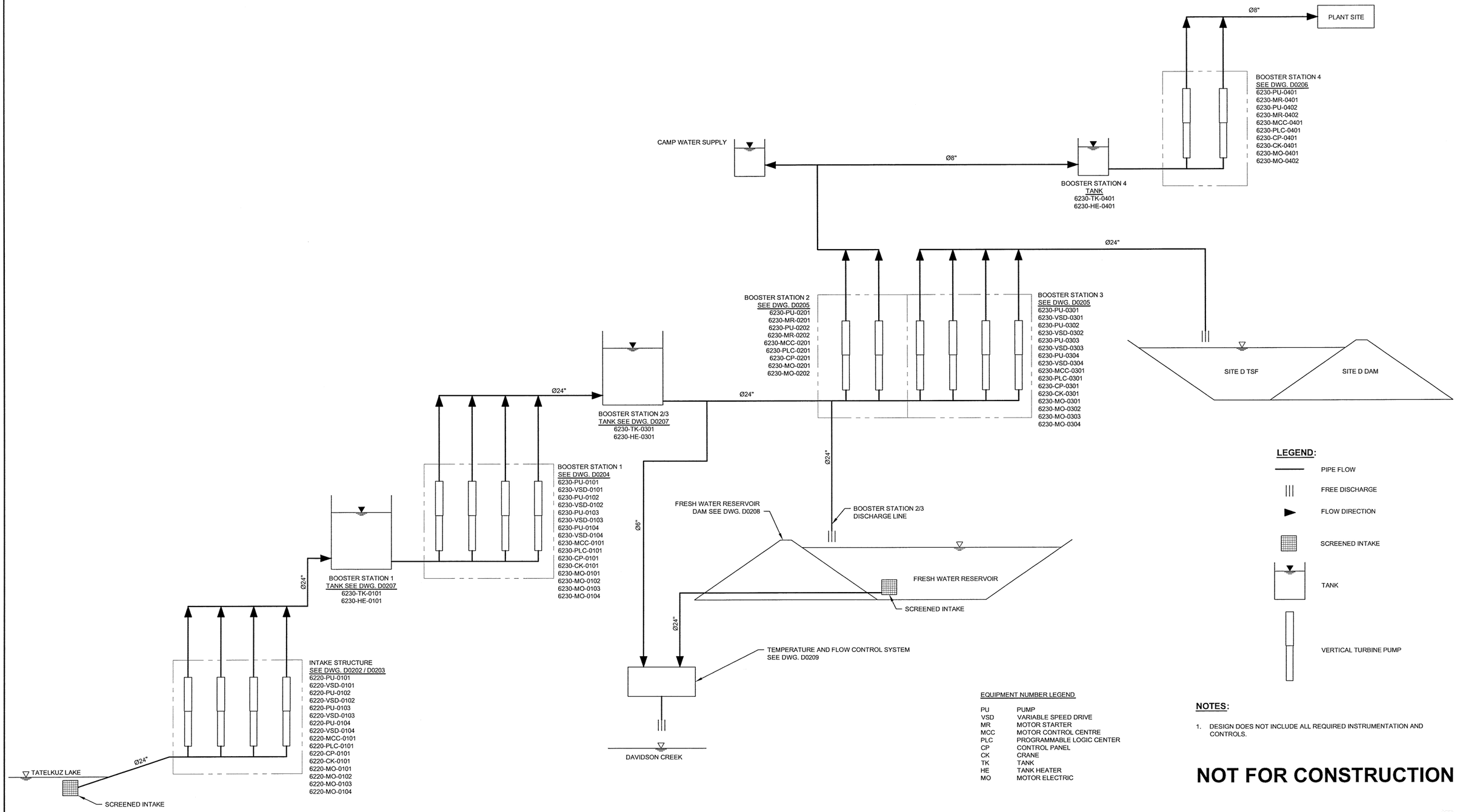
newgold

Knight Piésold CONSULTING

SUBJECT: FRESH WATER SUPPLY SYSTEM
FRESH WATER SUPPLY PIPELINE
GENERAL ARRANGEMENT AND PROFILE

AREA
CLIENT DWG. NO.
DRAWING NO. D0200
REV. 0

CAD FILE: M:\1\01\00457\08\A\ACAD\DWGS\D0200\D0200 R0.DWG
SAVED: 03-Dec-13 12:00 PLOTTED: 03-Dec-13 1:35 PM USER: ABBAS NASIRI



LEGEND:

- PIPE FLOW
- FREE DISCHARGE
- FLOW DIRECTION
- SCREENED INTAKE
- TANK
- VERTICAL TURBINE PUMP

EQUIPMENT NUMBER LEGEND

PU	PUMP
VSD	VARIABLE SPEED DRIVE
MR	MOTOR STARTER
MCC	MOTOR CONTROL CENTRE
PLC	PROGRAMMABLE LOGIC CENTER
CP	CONTROL PANEL
CK	CRANE
TK	TANK
HE	TANK HEATER
MO	MOTOR ELECTRIC

NOTES:

1. DESIGN DOES NOT INCLUDE ALL REQUIRED INSTRUMENTATION AND CONTROLS.

NOT FOR CONSTRUCTION

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP
REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP

REF	NUMBER	TITLE
		REFERENCES

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CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE: FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	DBR	08NOV'13
SCALE: NTS	PACKAGE CODE	DRN	KJM	08NOV'13
		CHK	DDF	04DEC13
		APP		04DEC13

newgold

SUBJECT: FRESH WATER SUPPLY SYSTEM PROCESS FLOW SCHEMATIC

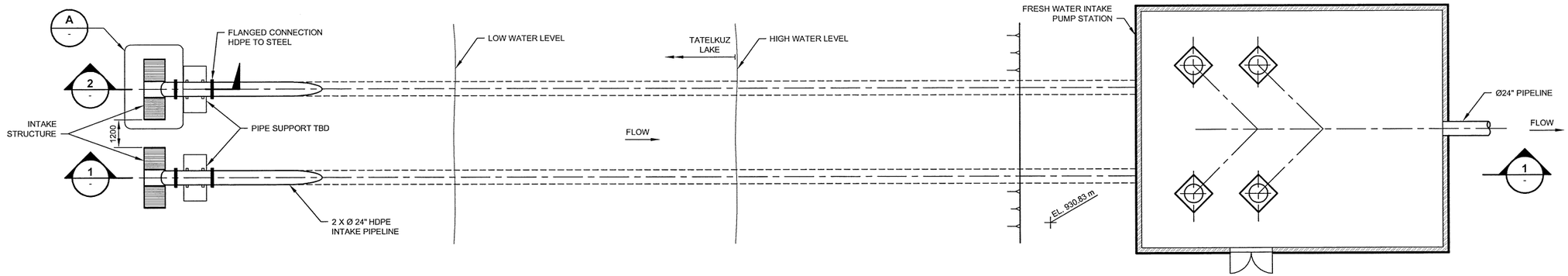
Knight Piésold CONSULTING

AREA

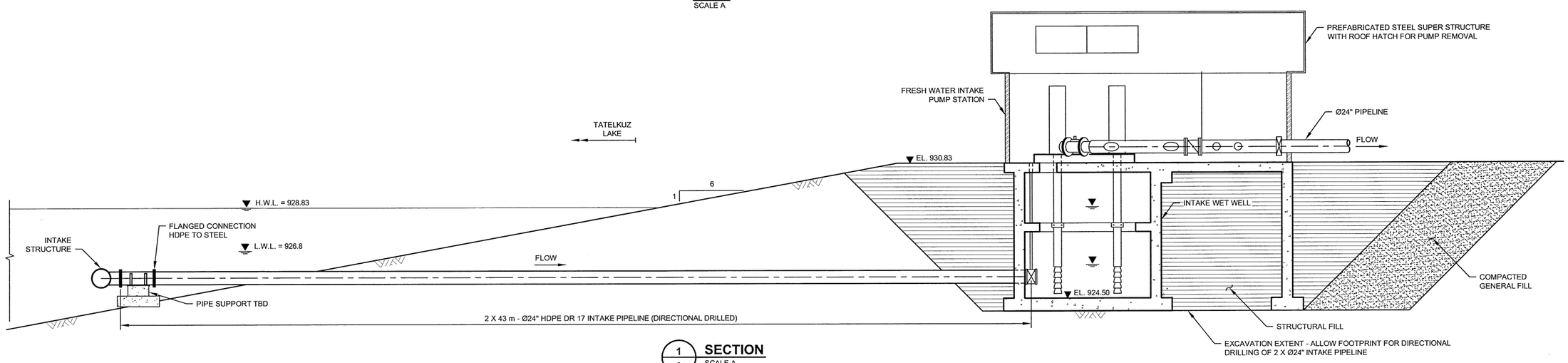
CLIENT DWG. NO.

DRAWING NO. D0201 — REV. 0

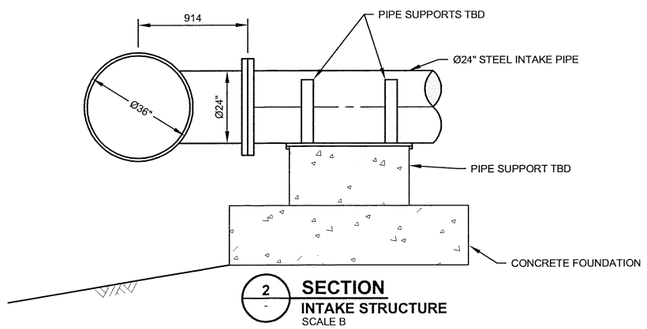
SAVED: 03-Dec-13 1:04 PM PLOTTED: 03-Dec-13 1:35 PM USER: ABBAS NASH
CAD FILE: M:\1\01\00467\08\VA\CAD\DWGS\D0201.DWG



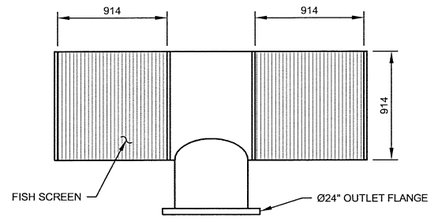
PLAN
SCALE A



1 **SECTION**
SCALE A



2 **SECTION**
INTAKE STRUCTURE
SCALE B



A **DETAIL**
INTAKE STRUCTURE - PLAN
SCALE B

NOTES:

1. DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
2. INTAKE PUMP STATION SIZING FOR FOUR PEERLESS PUMPS.
3. ALL FLANGES TO MEET ASTM A516 GRADE 70 CLASS 150, UNLESS NOTED OTHERWISE.

NOT FOR CONSTRUCTION

SCALE B 0.5 0.25 0 0.5 1.0 1.5 2.0 2.5 m

SCALE A 2 1 0 2 4 6 8 10 m

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP	REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP	REF	NUMBER	TITLE

REFERENCES

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PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
D. D. FONTAINE
36208
Dec 4, 2013

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CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE
FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	RSS	20NOV13
		DRN	AN	20NOV13
SCALE	PACKAGE CODE	CHK	DDF	04DEC13
VARIES		APP	SRM	04DEC13

newgold

SUBJECT
FRESH WATER SUPPLY SYSTEM
INTAKE STRUCTURE
PLAN AND SECTION

Knight Piésold CONSULTING

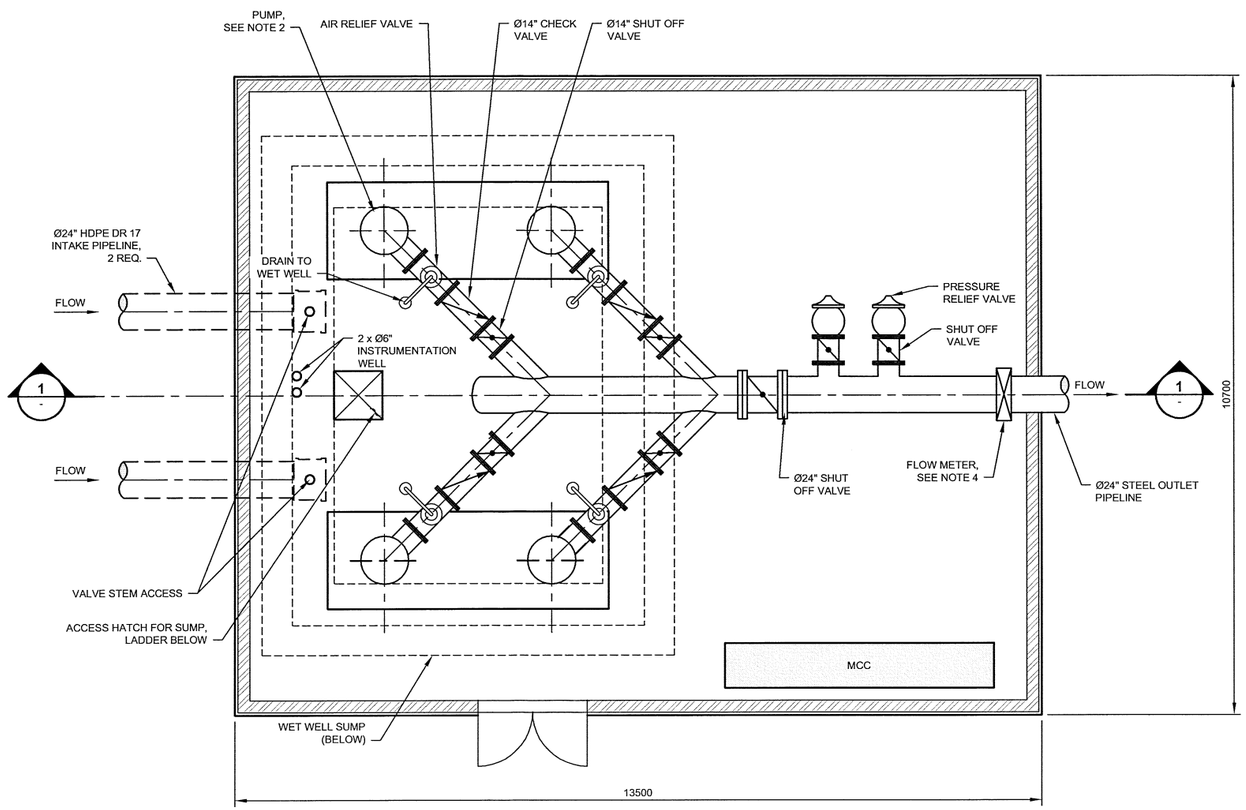
AREA

CLIENT DWG. NO.

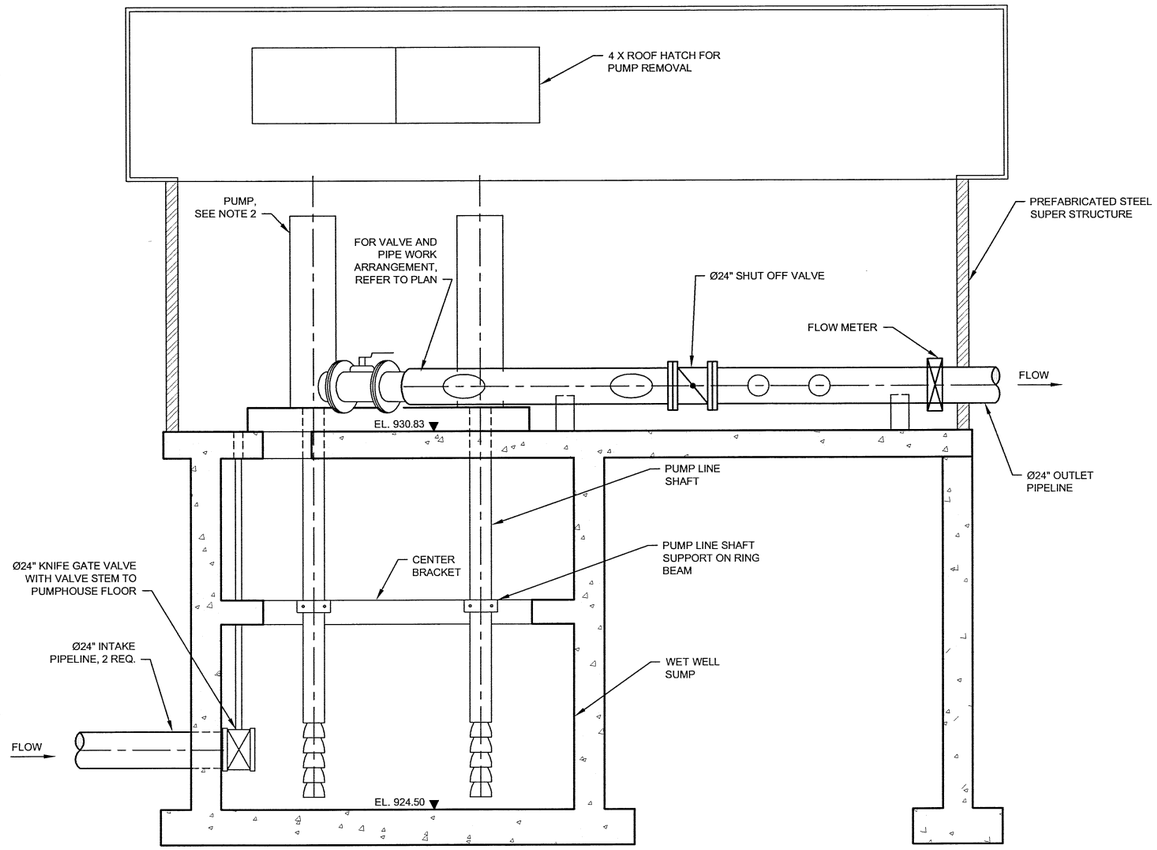
DRAWING NO. D0202 REV. 0

CAD FILE: M:\1\01\00457\06\A\ACAD\DWGS\D0202\D0202_R0.DWG

SAVED: 03-Dec-13 1:07 PM PLOTTED: 03-Dec-13 1:35 PM USER: ABBAS NASIRI



PLAN
SCALE A



1 SECTION
PUMP STATION
SCALE A

NOTES:

1. DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
2. INTAKE PUMP STATION SIZING FOR FOUR PEERLESS PUMPS.
3. ALL FLANGES TO MEET ASTM A516 GRADE 70 CLASS 150, UNLESS NOTED OTHERWISE.
4. FLOW METER TO BE INSTALLED AS PER MANUFACTURER'S INSTRUCTION.

NOT FOR CONSTRUCTION

SCALE A 1 0.5 0 1 2 3 4 5 m

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP	REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP	REF	NUMBER	TITLE

REFERENCES

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D. D. FONTAINE
36208
Dec 4, 2013

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APPROVED FOR _____

CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE: FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	RSS	20NOV13
		DRN	AN	20NOV13
SCALE	PACKAGE CODE	CHK	DDF	04DEC13
1:50		APP	SRM	04DEC13

newgold

SUBJECT
FRESH WATER SUPPLY SYSTEM
PUMP STATION
PLAN AND SECTION

Knight Piésold CONSULTING

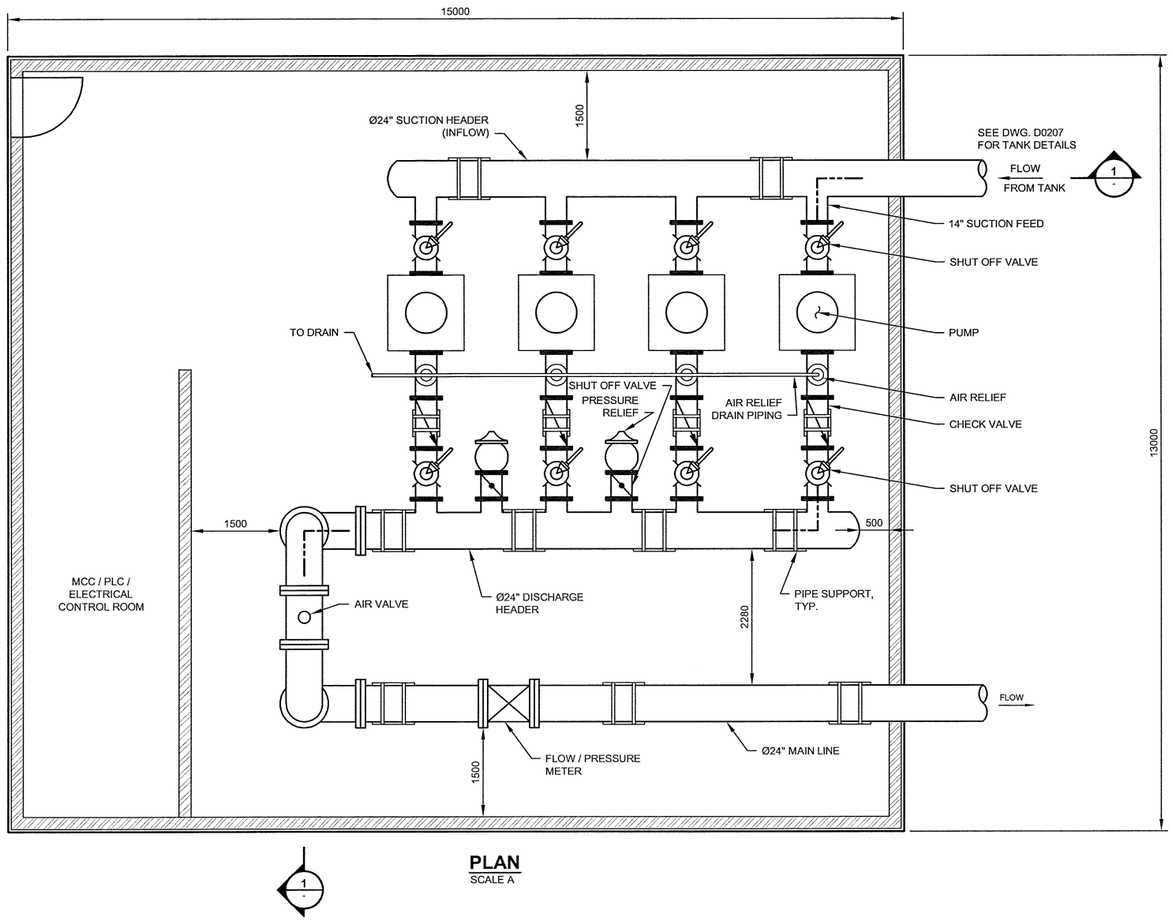
AREA

CLIENT DWG. NO.

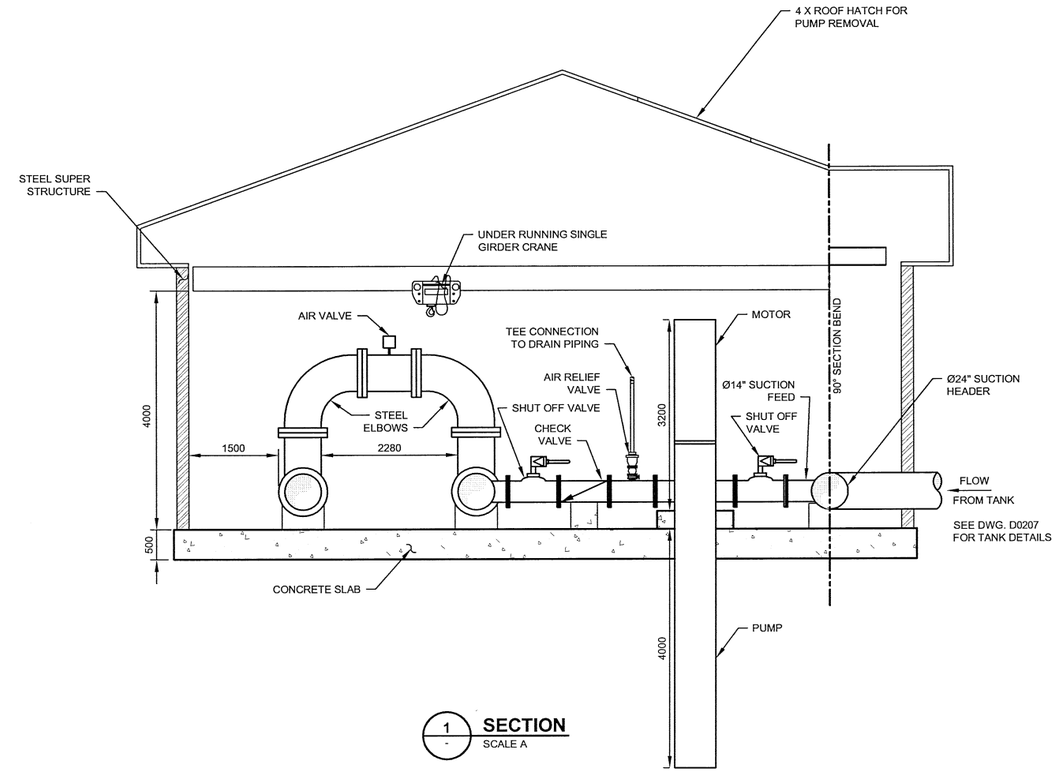
DRAWING NO. D0203 REV. 0

SAVED: 03-Dec-13 1:10 PM PLOTTED: 03-Dec-13 1:35 PM USER: ABBAS NASIRI

CAD FILE: M:\1\01\00457\06\A\ACAD\DWGS\D0203\D0203_R0.DWG



1 - **PLAN**
SCALE A



1 - **SECTION**
SCALE A

NOTES:

1. DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METERS UNLESS NOTED OTHERWISE.
2. ALL FLANGES TO MEET ASTM A516 GRADE 70 CLASS 150, UNLESS NOTED OTHERWISE.

NOT FOR CONSTRUCTION

SCALE A 1 0.5 0 1 2 3 4 5 m

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP
0	04DEC13	ISSUED FOR USE	AN	DDF	SRM			

REF	NUMBER	TITLE
		REFERENCES

STAMP/SEAL: PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA D. D. FONTAINE # 36208 Dec. 4, 2013

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APPROVED FOR _____

CLIENT PROJECT MGR.	DEPARTMENT MGR.	PROJECT MGR.

PROJECT PHASE: FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	RSS	20NOV13
SCALE 1:50	PACKAGE CODE	DRN	AN	20NOV13
		CHK	DDF	04DEC13
		APP	SRM	04DEC13

newgold

SUBJECT: FRESH WATER SUPPLY SYSTEM BOOSTER PUMP STATION #1

Knight Piésold CONSULTING

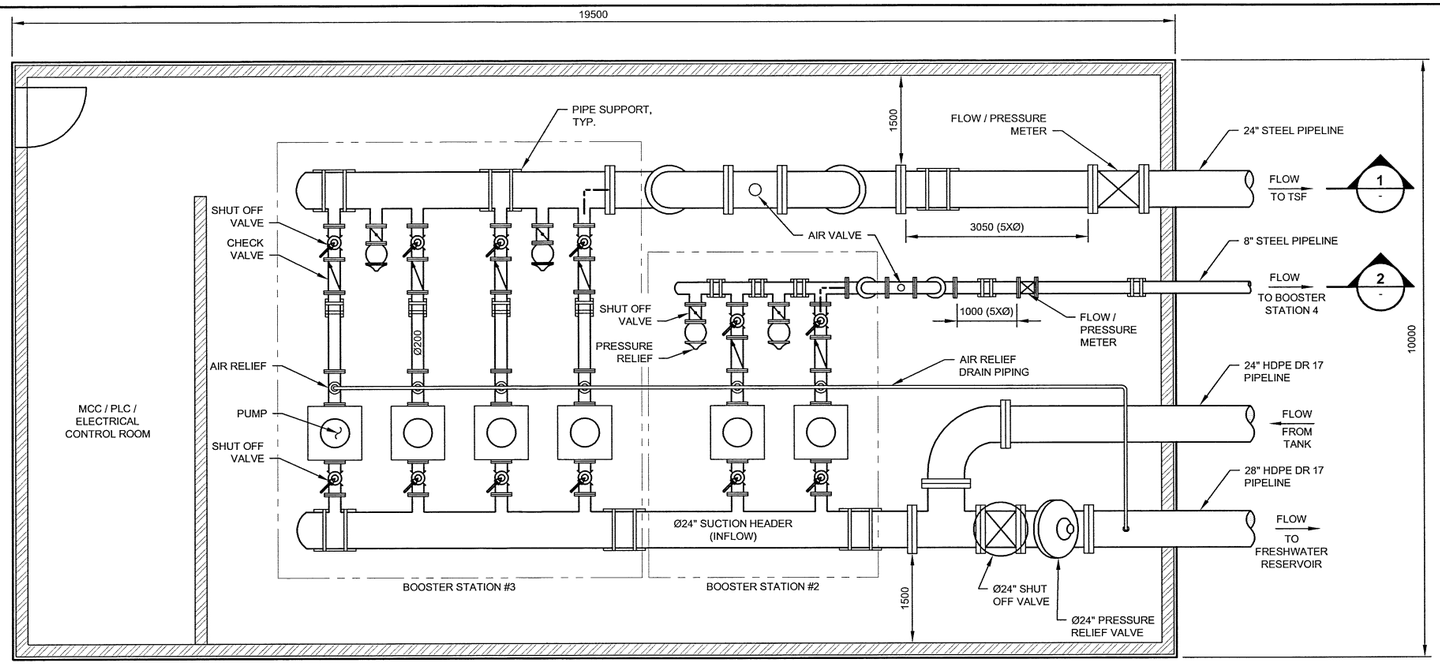
AREA

CLIENT DWG. NO.

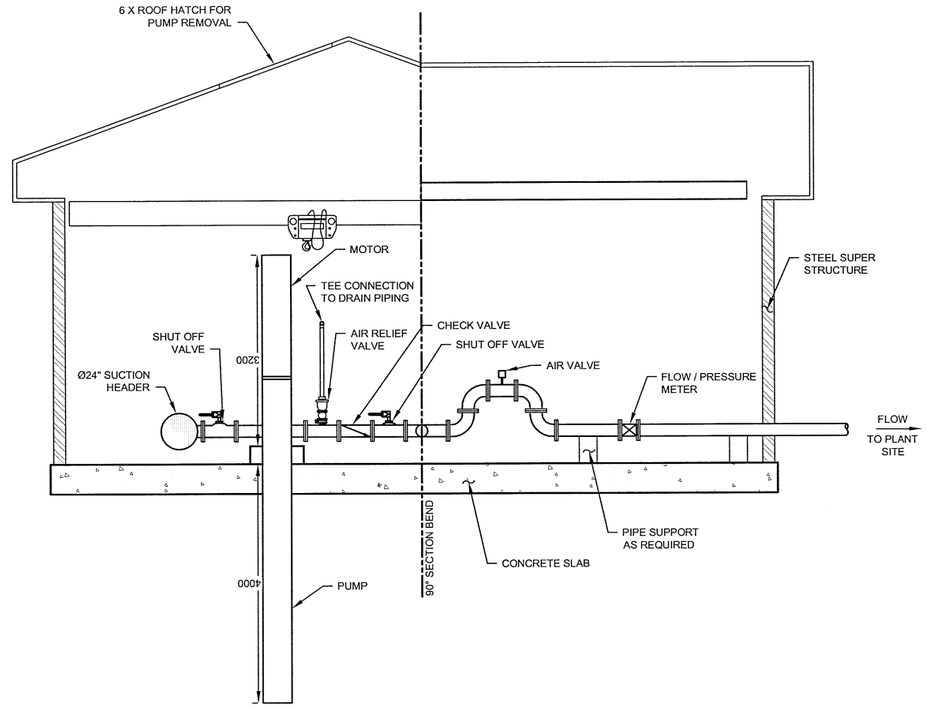
DRAWING NO. D0204 REV. 0

CAD FILE: M:\1\101\00457\00\VA\VA00457-00-D0204-0001-RevA.DWG

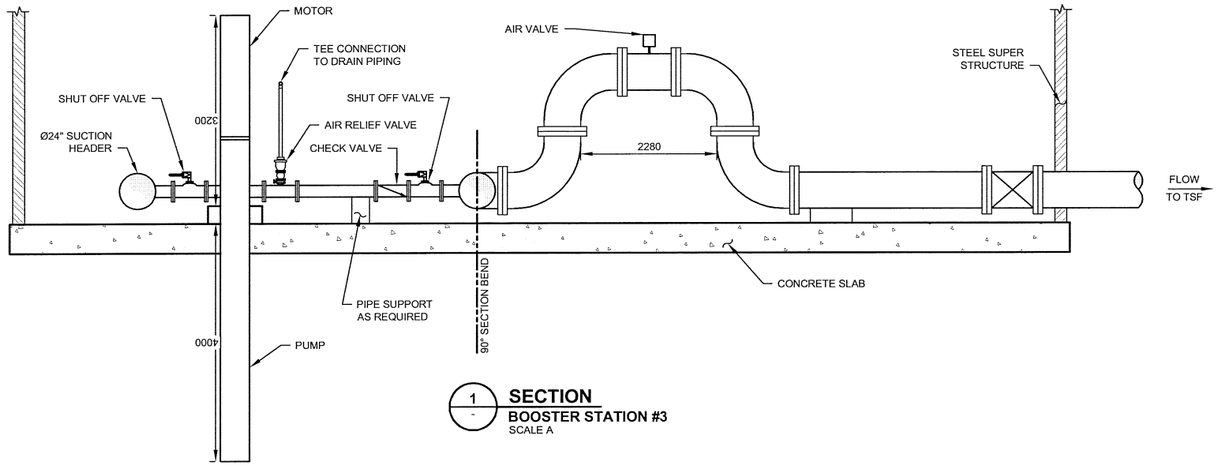
SAVED: 03-Dec-13 1:13 PLOTTED: 03-Dec-13 1:35 PM USER: ABBAS NASH



PLAN
SCALE A



2 SECTION
BOOSTER STATION #2
SCALE A



1 SECTION
BOOSTER STATION #3
SCALE A

NOTES:

1. DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METERS UNLESS NOTED OTHERWISE.
2. ALL FLANGES TO MEET ASTM A516 GRADE 70 CLASS 150, UNLESS NOTED OTHERWISE.
3. ALL FLANGES FOR BOOSTER STATION #3 DOWN STREAM OF PUMPS MUST MEET FLANGE CLASS 300.

SCALE A 1 0.5 0 1 2 3 4 5 m

NOT FOR CONSTRUCTION

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP	REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP	REF	NUMBER	TITLE

REFERENCES

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PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
D. D. FONTAINE
36208
Dec 4, 2013

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CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE: FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	RSS	20NOV13
SCALE	PACKAGE CODE	DRN	AN	20NOV13
1:50		CHK	DDF	04DEC13
		APP	RM	04DEC13

newgold

Knight Piésold CONSULTING

SUBJECT: FRESH WATER SUPPLY SYSTEM BOOSTER PUMP STATION 2 & 3 PLAN AND SECTIONS

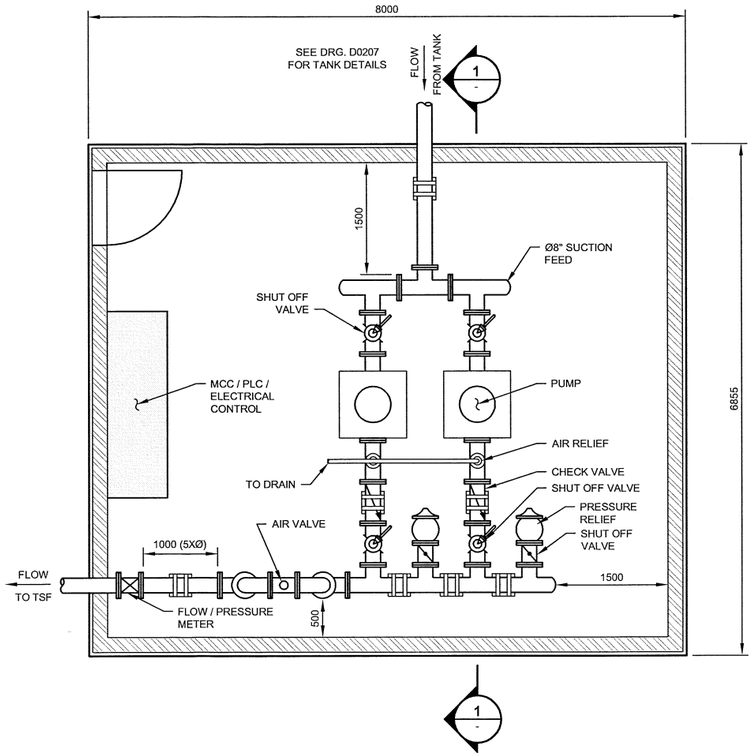
AREA

CLIENT DWG. NO.

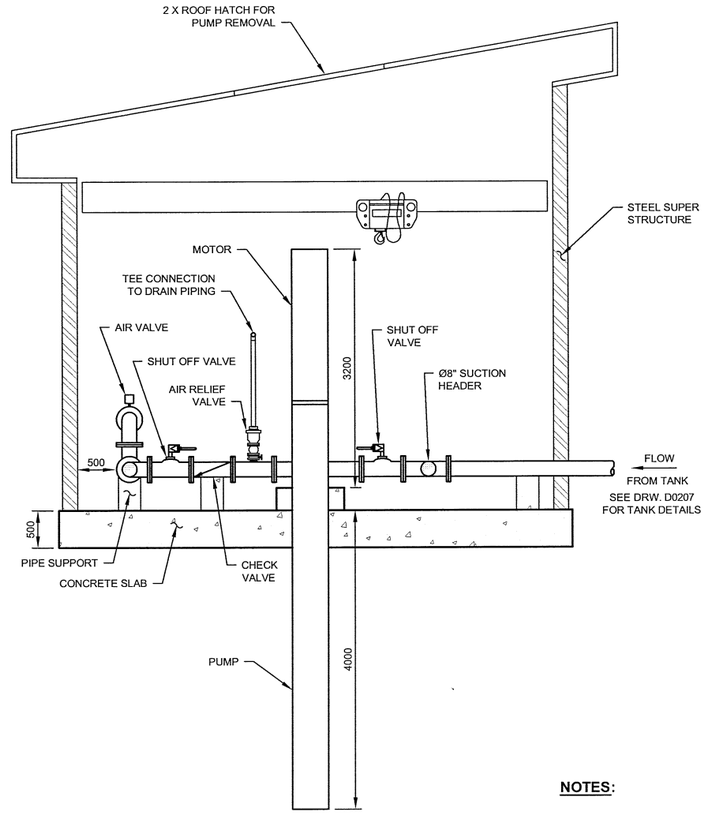
DRAWING NO. D0205 REV. 0

CAD FILE: M:\1\01\00457\06\A\ACAD\DWGS\D0205\D0205_R0.DWG

SAVED: 03-Dec-13 1:15 PLOTTED: 03-Dec-13 1:34 PM USER: ABBAS NASIR PM



PLAN
SCALE A



1 **SECTION**
SCALE A

NOTES:

1. DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES UNLESS NOTED OTHERWISE.
2. ALL FLANGES TO MEET ASTM A516 GRADE 70 CLASS 150, UNLESS NOTED OTHERWISE.

NOT FOR CONSTRUCTION

SCALE A 0.8 0.4 0 1 2 3 4 m

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP	REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP	REF	NUMBER	TITLE

REFERENCES

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PROVINCE OF BRITISH COLUMBIA
D. D. FONTAINE
36208
Dec 4, 2013

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CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE
FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	RSS	20NOV13
SCALE	PACKAGE CODE	DRN	AN	20NOV13
1:40		CHK	DDF	04DEC13
		APP	RM	04DEC13

newgold

SUBJECT
FRESH WATER SUPPLY SYSTEM
BOOSTER PUMP STATION #4

Knight Piésold
CONSULTING

AREA

CLIENT DWG. NO.

DRAWING NO. D0206 REV. 0

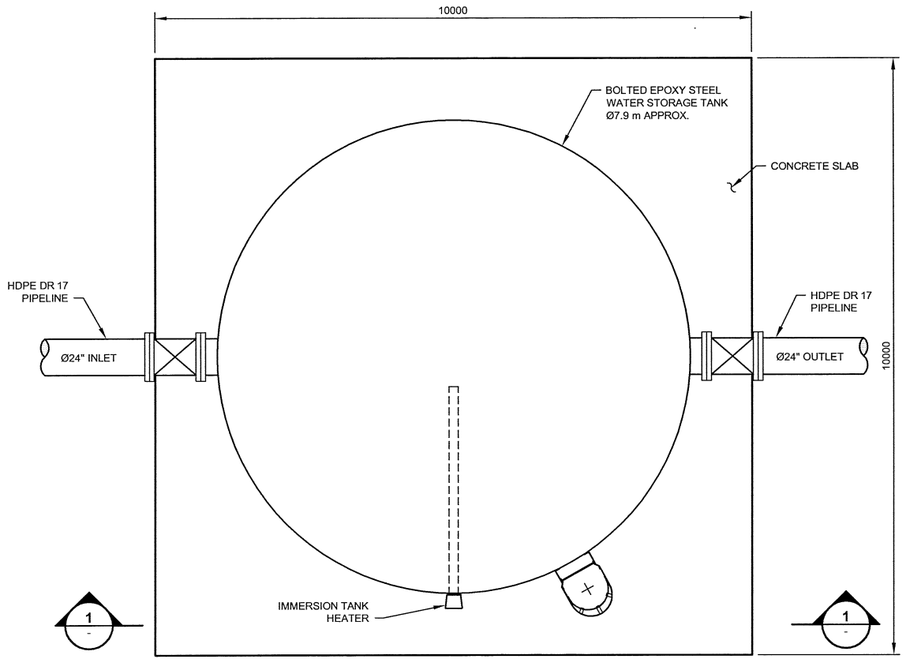
CAD FILE: M:\1\01\00457\06\A\ACAD\DWGS\D0206\D0206_R0.DWG

SAVED: 03-Dec-13 1:19 PM PLOTTED: 03-Dec-13 1:34 PM USER: ABBAS NASIF

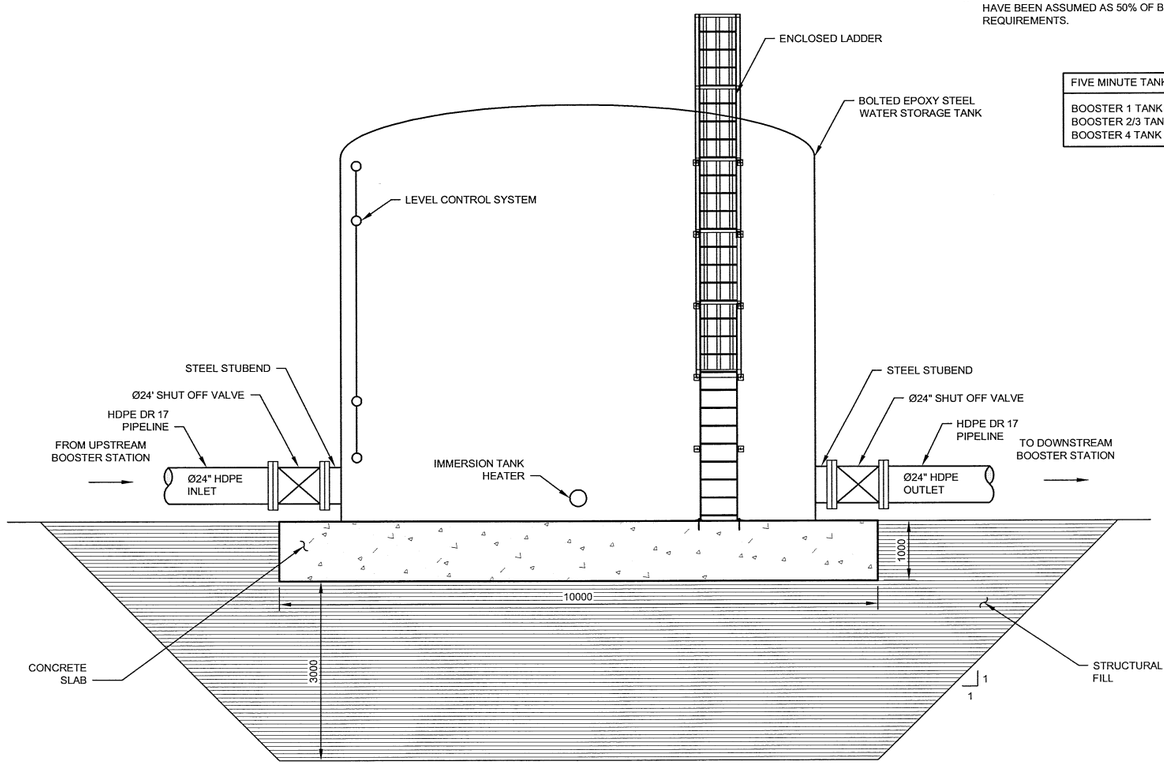
NOTES:

1. DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METERS UNLESS NOTED OTHERWISE.
2. ALL FLANGES TO MEET ASTM A516 GRADE 70 CLASS 150, UNLESS NOTED OTHERWISE.
3. INLET AND OUTLET PIPES FOR TANK AT BOOSTER STATION 4 SHALL BE Ø8".
4. AS BOOSTER STATION 4 TANK IS SMALL, MTO's FOR FOUNDATION HAVE BEEN ASSUMED AS 50% OF BOOSTER STATION 1 REQUIREMENTS.

FIVE MINUTE TANK CAPACITIES
BOOSTER 1 TANK = 200 m^3 BOOSTER 2/3 TANK = 185 m^3 BOOSTER 4 TANK = 10 m^3



PLAN
TYPICAL TANK FOR BOOSTER STATIONS 1 & 2/3
SCALE A



ELEVATION
TYPICAL TANK FOR BOOSTER STATIONS 1 & 2/3
SCALE A

NOT FOR CONSTRUCTION

SCALE A 1 0.5 0 1 2 3 4 5 m

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP	REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP	REF	NUMBER	TITLE

REFERENCES

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36208
Dec 4, 2013

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CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE
FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	DBR	20NOV13
		DRN	AN	20NOV13
SCALE	PACKAGE CODE	CHK	DDF	04DEC13
1:50		APP	SRM	04DEC13

newgold

SUBJECT
FRESH WATER SUPPLY SYSTEM
BOOSTER STATION TANK SYSTEM

Knight Piésold CONSULTING

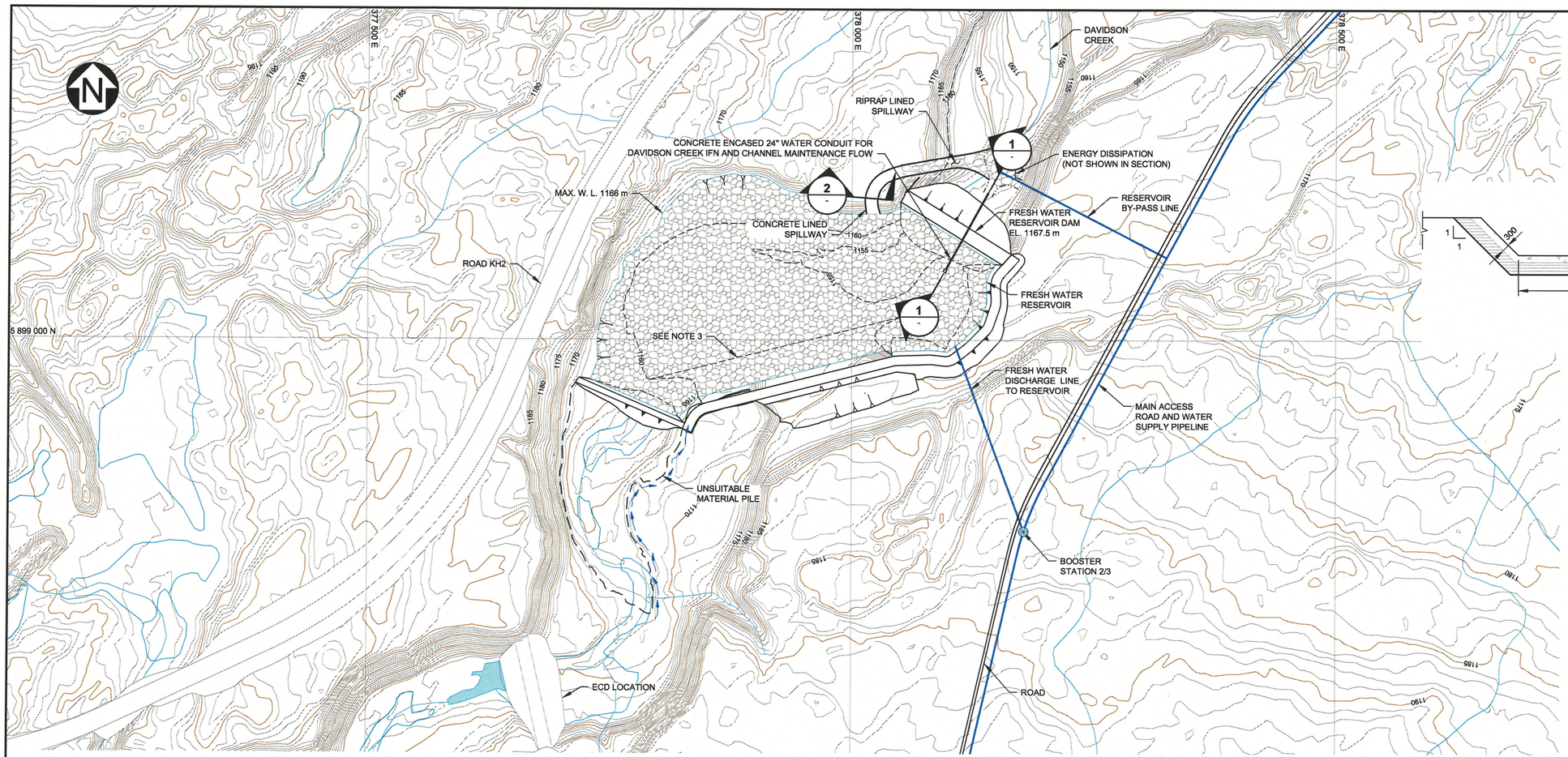
AREA

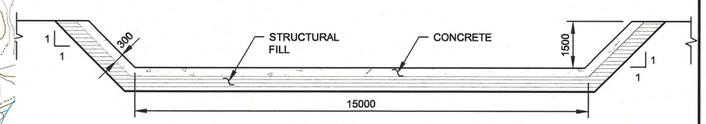
CLIENT DWG. NO.

DRAWING NO. D0207 REV. 0

SAVED: 03-Dec-13 1:22 PLOTTED: 03-Dec-13 1:34 PM USER: ABBAS NASIF PM

CAD FILE: M:\1\01\00457\05\A\ACAD\DWGS\D0207\D0207_RO.DWG





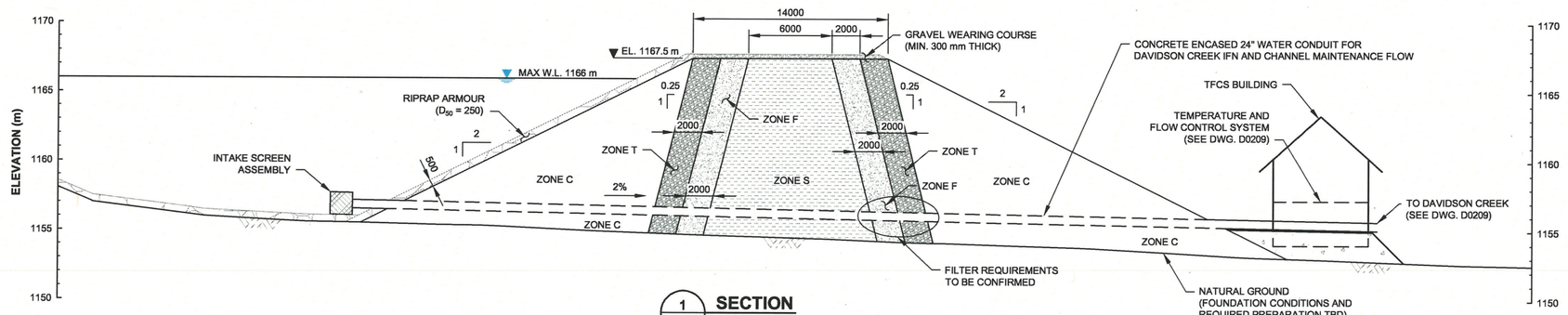
2 SECTION
SPILLWAY
SCALE C

LEGEND:

- RIPRAP
- PUMPSTATION
- FRESH WATER SUPPLY PIPELINE
- DIVERSION CHANNEL

NOTES:

1. CONTOUR INTERVAL IS 1 METRES.
2. DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
3. EXCAVATE RESERVOIR TO CREATE STORAGE CAPACITY. EXCAVATED MATERIAL WILL BE USED AS DAM FILL OR SPOILED IN THE UNSUITABLE MATERIAL PILE.



1 SECTION
FRESH WATER RESERVOIR DAM
SCALE B

NOT FOR CONSTRUCTION

SCALE C: 2 1 0 2 4 6 8 10 m
SCALE B: 4 2 0 4 8 12 16 20 m
SCALE A: 50 25 0 50 100 150 200 250 m

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP	REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP	REF	NUMBER	TITLE

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CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE: FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	DDF	20NOV13
		DRN	AN	20NOV13
SCALE	PACKAGE CODE	CHK	BR	04DEC13
VARIES		APP	SRM	04DEC13

newgold

SUBJECT: FRESH WATER SUPPLY SYSTEM
FRESH WATER RESERVOIR
PLAN AND SECTION

Knight Piésold CONSULTING

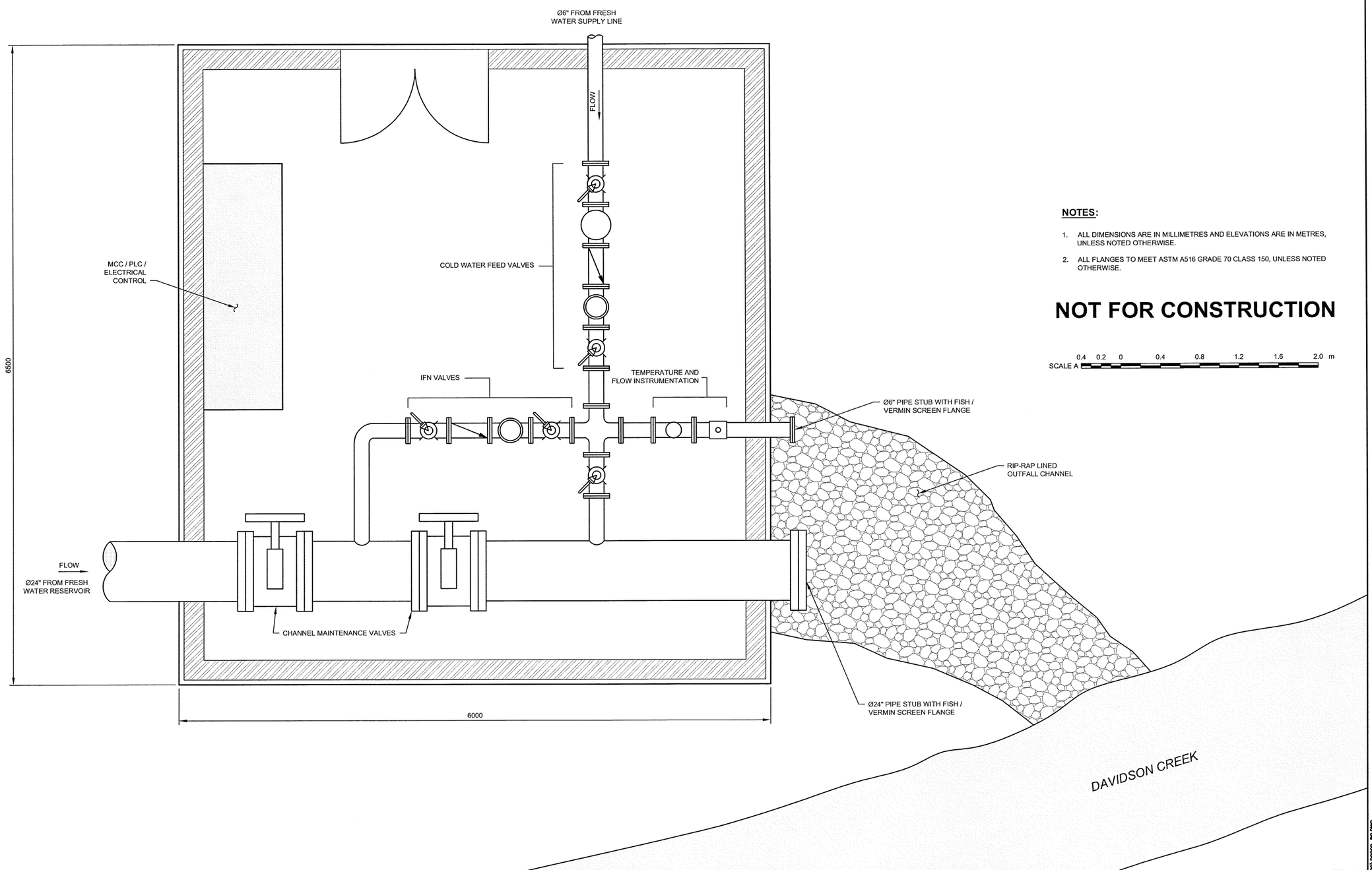
AREA

CLIENT DWG. NO.

DRAWING NO. D0208 REV. 0

CAD FILE: M:\1\01\00457\06\A\ACAD\DWGS\D0208\D0208 R0.DWG

SAVED: 03-Dec-13 4:09 PM PLOTTED: 03-Dec-13 4:09 PM USER: ABBAS NAS



NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
2. ALL FLANGES TO MEET ASTM A516 GRADE 70 CLASS 150, UNLESS NOTED OTHERWISE.

NOT FOR CONSTRUCTION

SCALE A 0.4 0.2 0 0.4 0.8 1.2 1.6 2.0 m

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP

REF	NUMBER	TITLE
		REFERENCES

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PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — D. D. FONTAINE # 36208 — Dec 4, 2013

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CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE
FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	MGP	20NOV13
SCALE	PACKAGE CODE	DRN	AN	20NOV13
1:20		CHK	DPF	04DEC13
		APP	SRM	04DEC13

newgold

SUBJECT
FRESH WATER SUPPLY SYSTEM
TEMPERATURE & FLOW CONTROL SYSTEM
PLAN

Knight Piésold CONSULTING

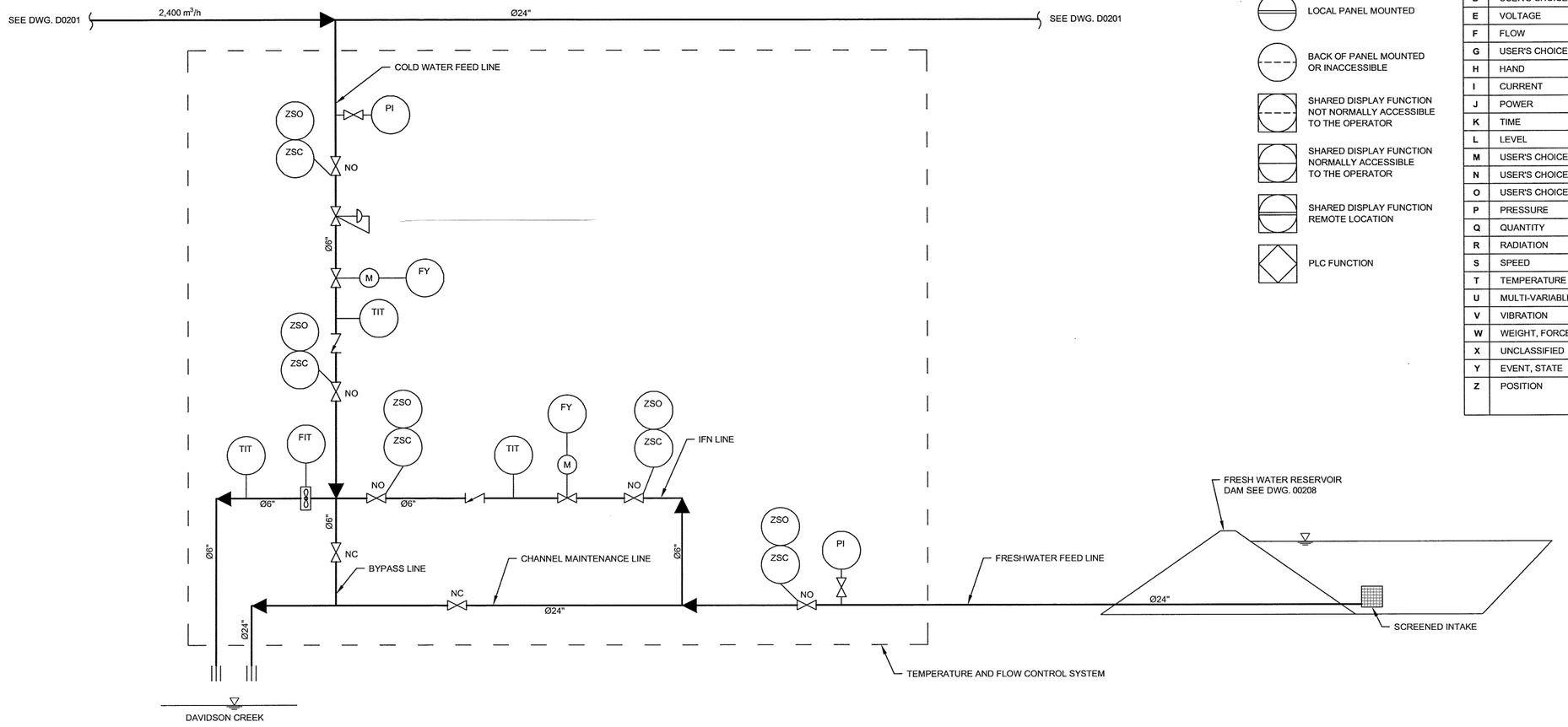
AREA

CLIENT DWG. NO.

DRAWING NO. D0209 REV. 0

SAVED: 03-Dec-13 1:30 PM PLOTTED: 03-Dec-13 1:34 PM USER: ABBAS NASR

CAD FILE: M:\1\01\00457\08\A\CAD\DWGS\D0209_RLD.DWG



INSTRUMENT SYMBOLS:

- LOCALLY MOUNTED (FIELD)
- FRONT OF PANEL MOUNTED
- LOCAL PANEL MOUNTED
- BACK OF PANEL MOUNTED OR INACCESSIBLE
- SHARED DISPLAY FUNCTION NOT NORMALLY ACCESSIBLE TO THE OPERATOR
- SHARED DISPLAY FUNCTION NORMALLY ACCESSIBLE TO THE OPERATOR
- SHARED DISPLAY FUNCTION REMOTE LOCATION
- PLC FUNCTION

INSTRUMENT LETTER IDENTIFICATION

	FIRST LETTER		SUCCEEDING LETTERS		
	MEASURED OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION FUNCTION	MODIFIER
A	ANALYZER		ALARM		
B	BURNER		USER'S CHOICE	USER'S CHOICE	USER'S CHOICE
C	USER'S CHOICE	CONTROL		CONTROL	CLOSE
D	USER'S CHOICE	DIFFERENTIAL			
E	VOLTAGE		PRIMARY ELEMENT		
F	FLOW	RATIO			
G	USER'S CHOICE		GLASS		
H	HAND				HIGH
I	CURRENT		INDICATE		
J	POWER	SCAN			
K	TIME			CONTROL STATION	
L	LEVEL		LIGHT		LOW
M	USER'S CHOICE	MOMENTARY			MEDIUM
N	USER'S CHOICE		USER'S CHOICE	USER'S CHOICE	USER'S CHOICE
O	USER'S CHOICE		ORIFICE		OPEN
P	PRESSURE		POINT TEST CONN.		
Q	QUANTITY	INTEGRATE / TOTALIZE			
R	RADIATION	RELIEF	RECORD		
S	SPEED	SAFETY		SWITCH	
T	TEMPERATURE			TRANSMIT	
U	MULTI-VARIABLE		MULTI-FUNCTION	MULTI-FUNCTION	MULTI-FUNCTION
V	VIBRATION			VALVE / DAMPER	
W	WEIGHT, FORCE		WELL		
X	UNCLASSIFIED	X-AXIS	UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED
Y	EVENT, STATE	Y-AXIS		RELAY, COMPUTE	
Z	POSITION	Z-AXIS		DRIVER, ACTUATOR, UNCLASSIFIED FINAL CONTROL ELEMENT	

LEGEND:

- PIPE FLOW
- CONTROL LOGIC
- SHUT OFF VALVE
- CHECK VALVE
- TURBINE FLOW METER
- PRESSURE REGULATING VALVE
- MOTORIZED CONTROL VALVE
- FREE DISCHARGE
- SCREENED INTAKE

NOTES:

1. THIS P&ID IS PRELIMINARY AND DOES NOT YET SHOW DISPLAY FUNCTIONS, PLC FUNCTIONS, INPUTS / OUTPUTS OR INSTRUMENTATION WIRING.

NOT FOR CONSTRUCTION

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP
REF	NUMBER	TITLE						
REFERENCES								

STAMP/SEAL: PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — D. D. FONTAINE — # 36208 — DEC 4, 2013

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APPROVED FOR _____
CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE: FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	MGP	20NOV13
		DRN	AN	20NOV13
SCALE	PACKAGE CODE	CHK	DDF	04DEC13
NTS		APP		04DEC13

newgold

Knight Piésold CONSULTING

SUBJECT: FRESH WATER SUPPLY SYSTEM TEMPERATURE AND FLOW CONTROL SYSETM PROCESS & INSTRUMENTATION DIAGRAM

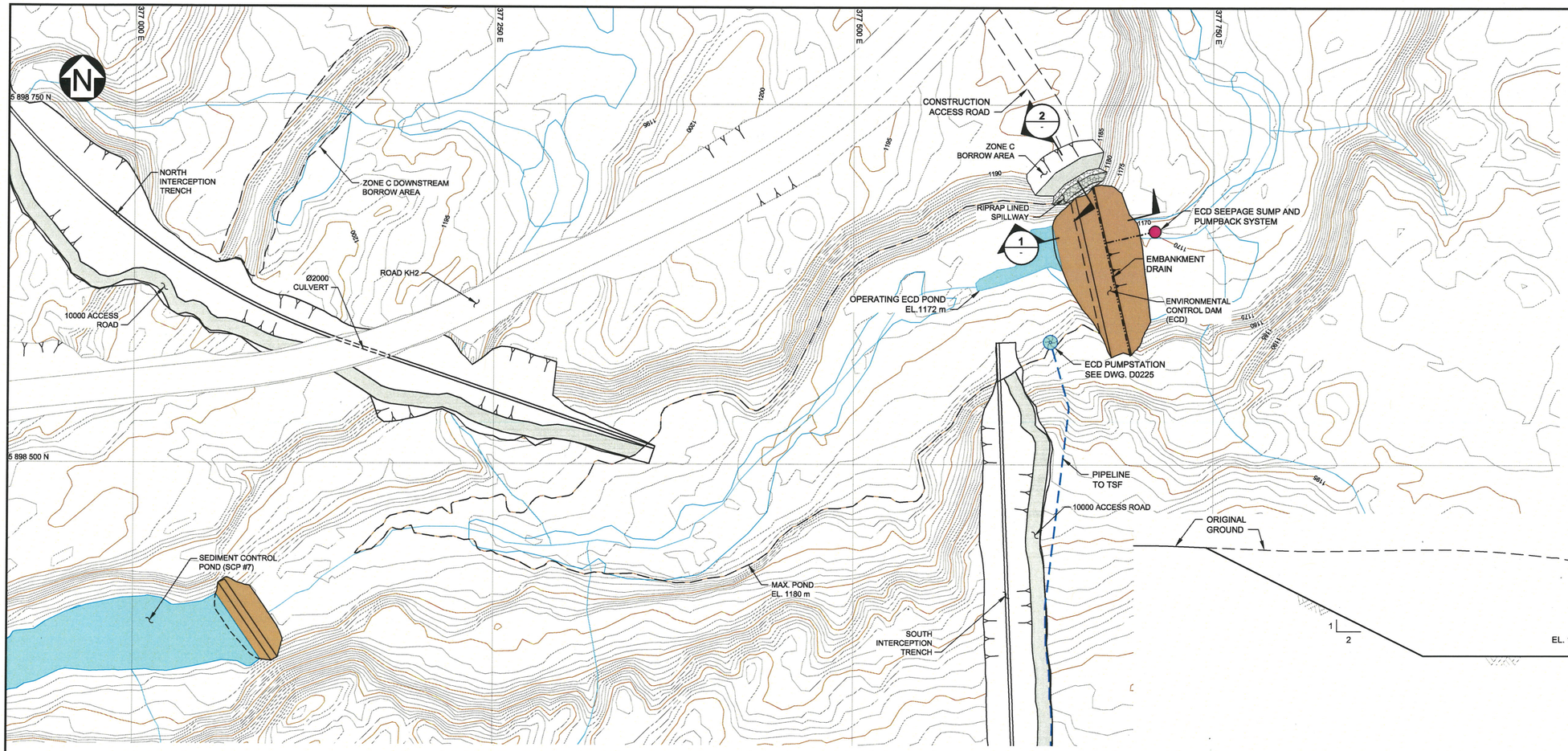
AREA

CLIENT DWG. NO.

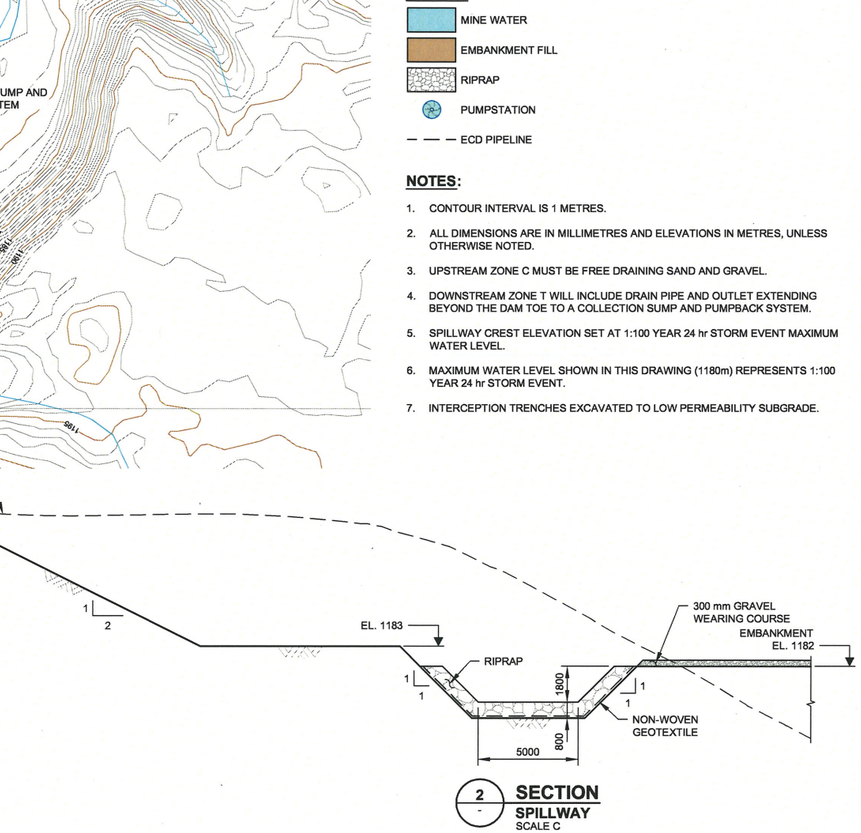
DRAWING NO. D0210 — REV. 0

SAVED: 03-Dec-13 1:33 PM PLOTTED: 03-Dec-13 1:34 PM USER: ABBAS NASIRI

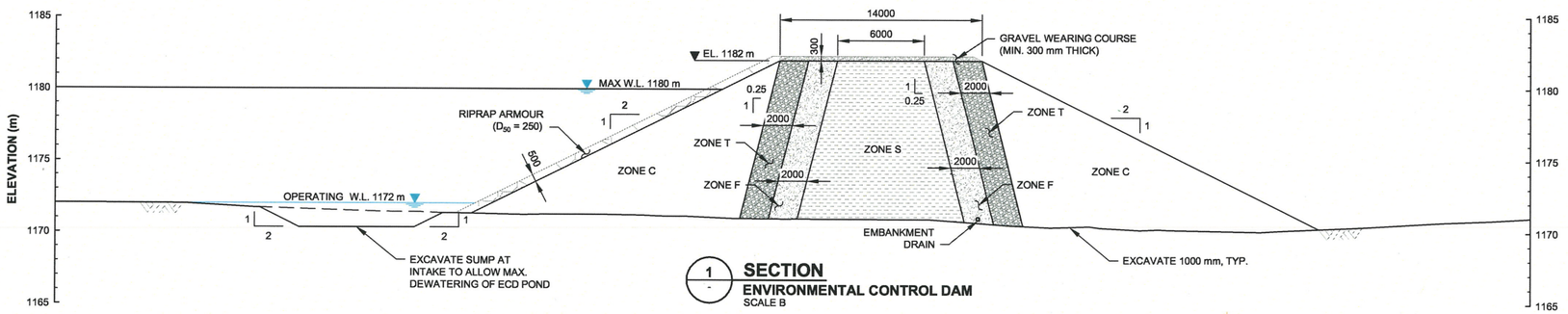
CAD FILE: M:\101\00457\VA\CAD\DWGS\D0210D0210_RLD.DWG



PLAN
ENVIRONMENTAL CONTROL DAM
SCALE A



2 SECTION
SPILLWAY
SCALE C



1 SECTION
ENVIRONMENTAL CONTROL DAM
SCALE B

LEGEND:

- MINE WATER
- EMBANKMENT FILL
- RIPRAP
- PUMPSTATION
- ECD PIPELINE

NOTES:

1. CONTOUR INTERVAL IS 1 METRES.
2. ALL DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS IN METRES, UNLESS OTHERWISE NOTED.
3. UPSTREAM ZONE C MUST BE FREE DRAINING SAND AND GRAVEL.
4. DOWNSTREAM ZONE T WILL INCLUDE DRAIN PIPE AND OUTLET EXTENDING BEYOND THE DAM TOE TO A COLLECTION SUMP AND PUMPBACK SYSTEM.
5. SPILLWAY CREST ELEVATION SET AT 1:100 YEAR 24 hr STORM EVENT MAXIMUM WATER LEVEL.
6. MAXIMUM WATER LEVEL SHOWN IN THIS DRAWING (1180m) REPRESENTS 1:100 YEAR 24 hr STORM EVENT.
7. INTERCEPTION TRENCHES EXCAVATED TO LOW PERMEABILITY SUBGRADE.

NOT FOR CONSTRUCTION

SCALE C: 3 1.5 0 5 10 15 m
SCALE B: 4 2 0 4 8 12 16 20 m
SCALE A: 50 25 0 50 100 150 200 250 m

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP
REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP

REF	NUMBER	TITLE
REFERENCES		

STAMP/SEAL: PROFESSIONAL ENGINEER, PROVINCE OF BRITISH COLUMBIA, D. D. FONTAINE # 36208, Dec 4, 2013

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APPROVED FOR _____
CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE: FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6	,	DES	DDF	08NOV13
SCALE	PACKAGE CODE	DRN	AN	08NOV13
VARIES		CHK	BR	04DEC13
		APP		04DEC13

newgold

Knight Piésold CONSULTING

SUBJECT: ENVIRONMENTAL CONTROL DAM PLAN AND SECTION

AREA
CLIENT DWG. NO.
DRAWING NO. D0221 REV. 0

DWG FILE: VA101-01\1\D0457\08\A\ACAD\DWGS\D0221\D0221 REL.DWG

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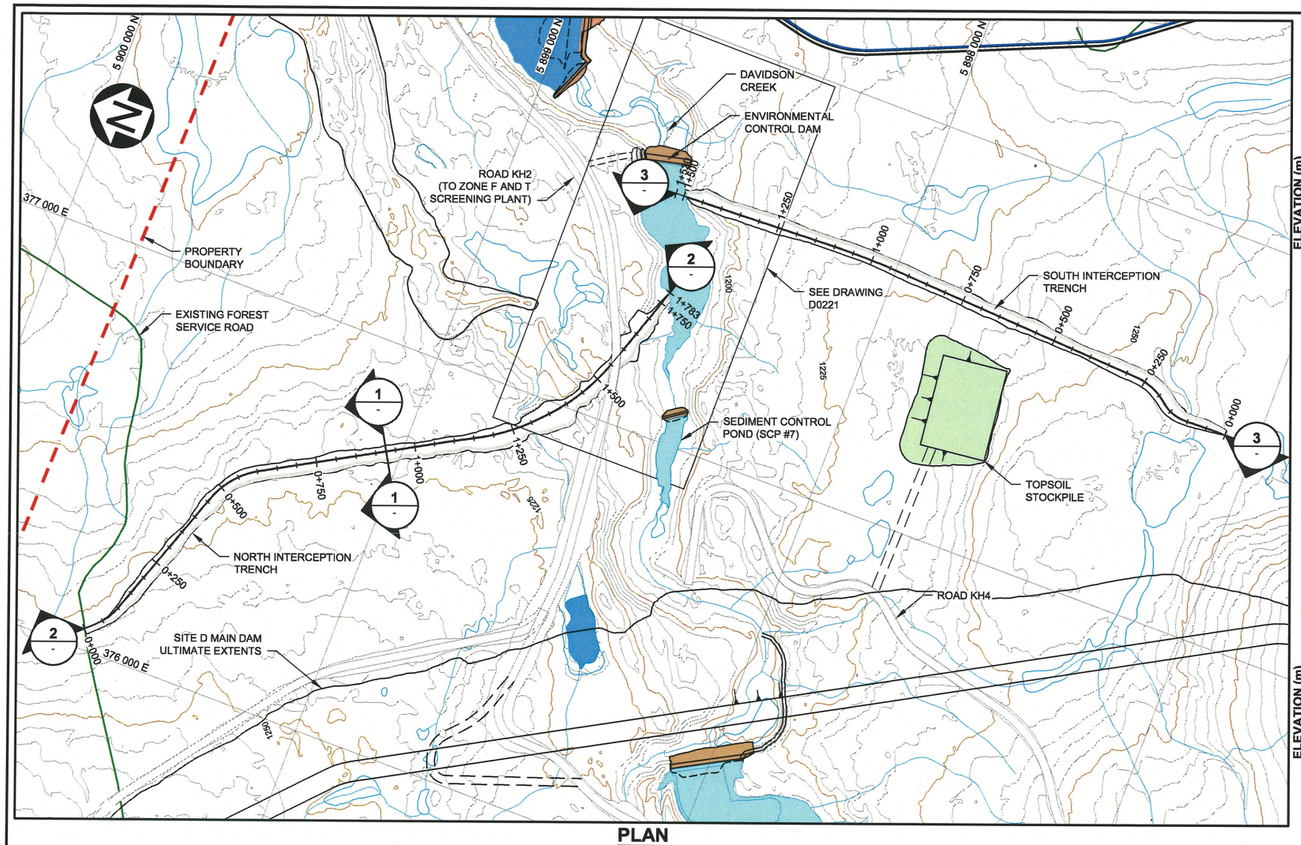
5 900 000 N
5 899 000 N
5 898 000 N
377 000 E
376 000 E
DAVIDSON CREEK
ENVIRONMENTAL CONTROL DAM
ROAD KH2 (TO ZONE F AND T SCREENING PLANT)
PROPERTY BOUNDARY
EXISTING FOREST SERVICE ROAD
SEE DRAWING D0221
SOUTH INTERCEPTION TRENCH
SEDIMENT CONTROL POND (SCP #7)
TOPSOIL STOCKPILE
NORTH INTERCEPTION TRENCH
ROAD KH4
SITE D MAIN DAM ULTIMATE EXTENTS
0+000
0+250
0+500
0+750
1+000
1+250
1+300
1+500
1+750
1+783
1200
1225
1250
1275
1300
1325
1350
1375
1400
1425
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1500
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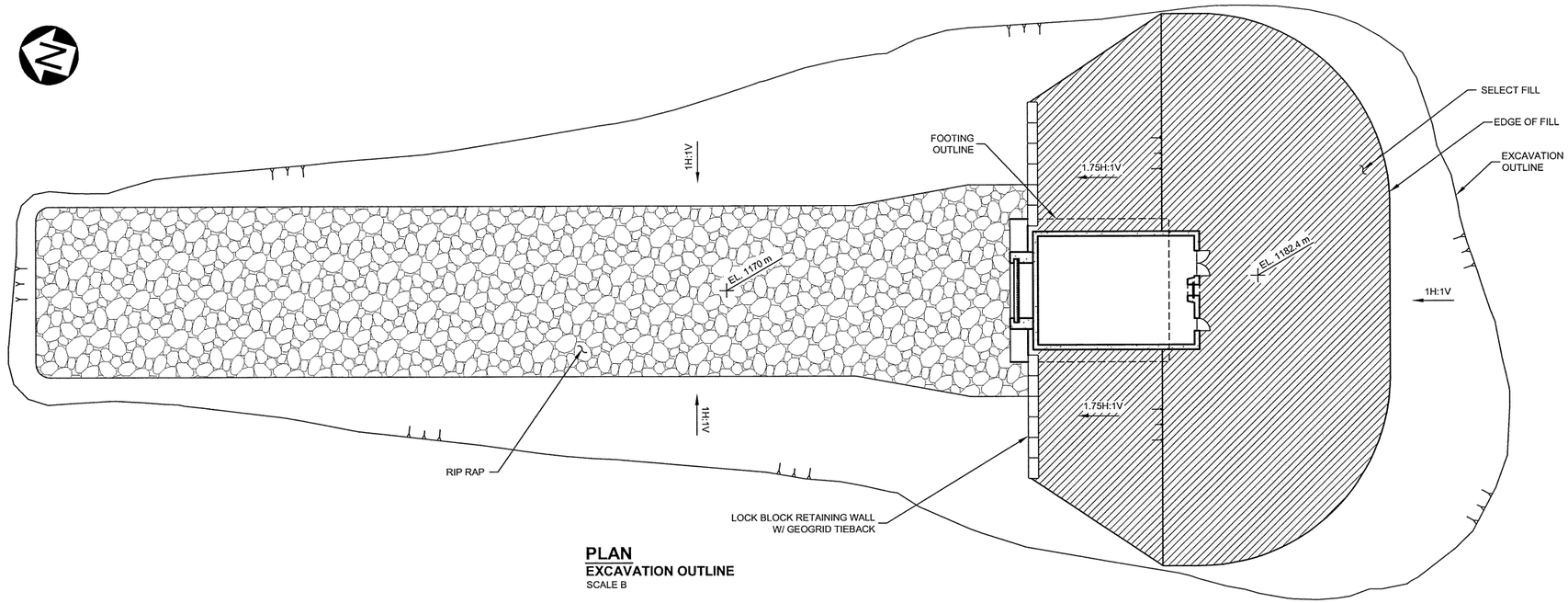
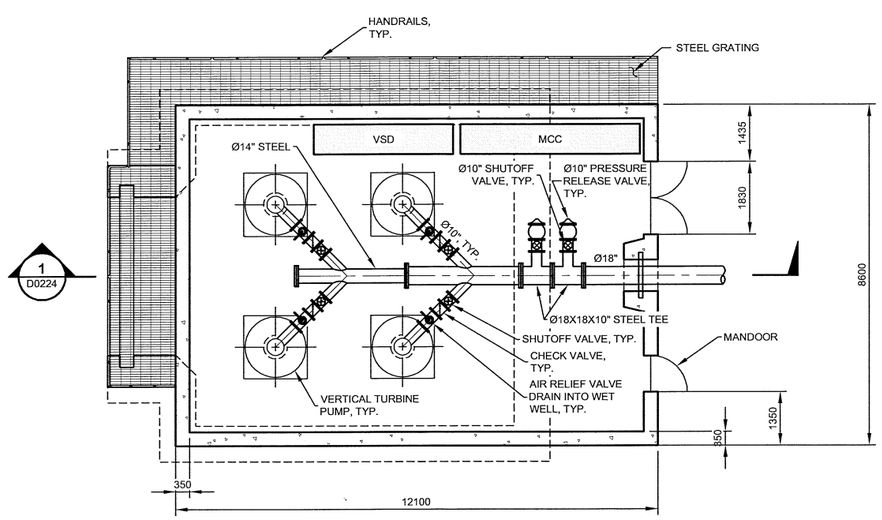
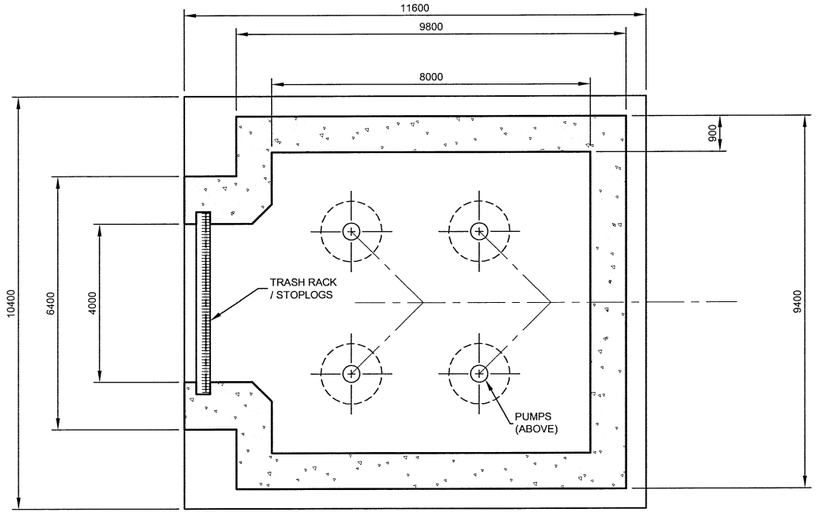


PLAN
EXCAVATION OUTLINE
SCALE B



PLAN
ELEVATION 1183 m
SCALE A



PLAN
ELEVATION 1170 m
SCALE A

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES UNLESS NOTED OTHERWISE.
2. ALL FLANGES TO MEET ASTM A516 GRADE 70 CLASS 150, UNLESS NOTED OTHERWISE.
3. PIPE SUPPORTS NOT SHOWN FOR CLARITY.

NOT FOR CONSTRUCTION

SCALE A 1.5 0.75 0 2.5 5.0 7.5 m
SCALE B 4 2 0 4 8 12 16 20 m

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP	REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP	REF	NUMBER	TITLE

REFERENCES

STAMP/SEAL
PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
D. D. FONTAINE
36208
Dec 4, 2013

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APPROVED FOR _____
CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE: FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	EJS	20NOV13
		DRN	AN	20NOV13
SCALE	PACKAGE CODE	CHK	DDF	04DEC13
AS SHOWN		APP	SRM	04DEC13

newgold

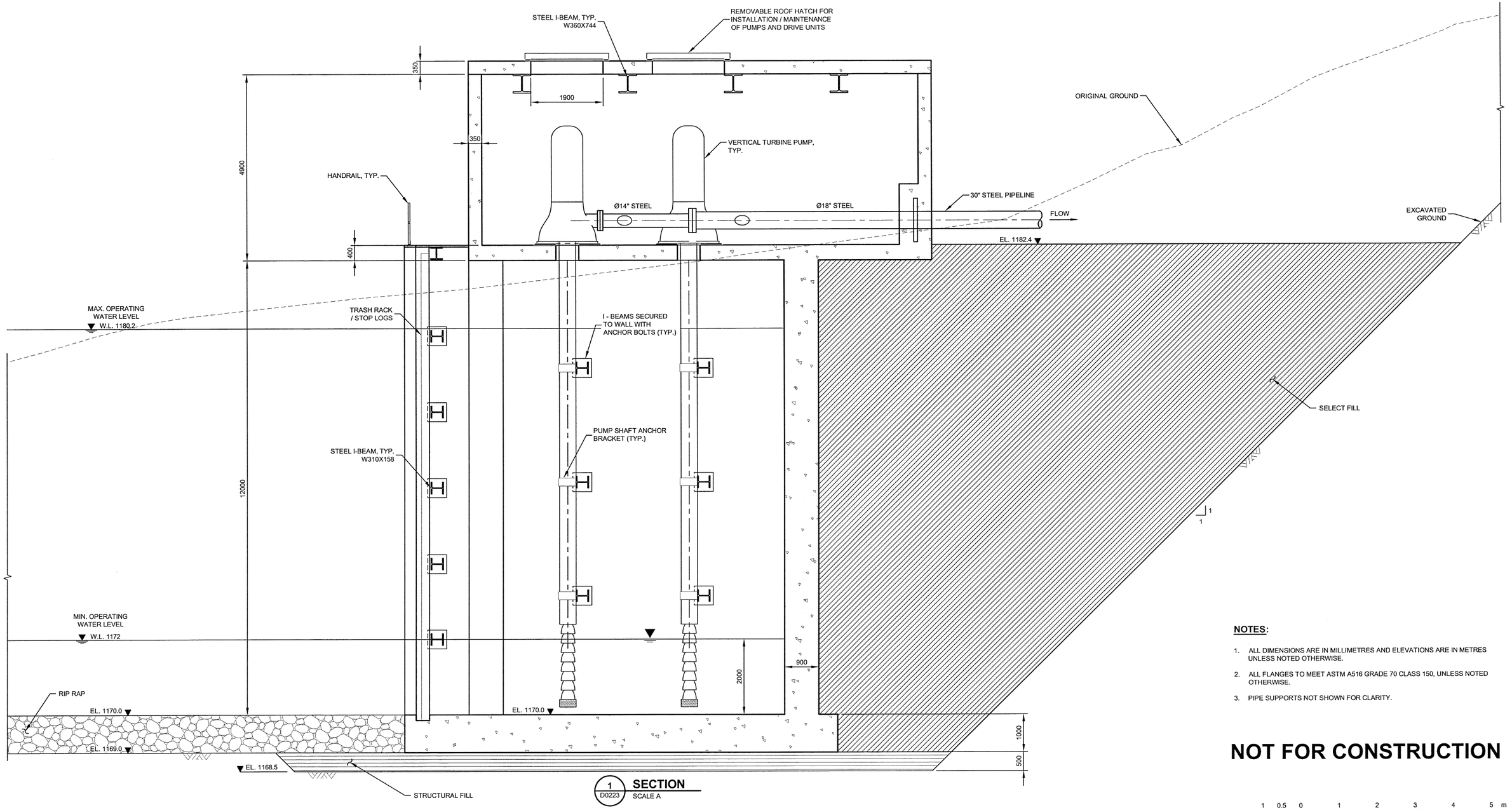
SUBJECT: ENVIRONMENTAL CONTROL DAM PUMP STATION PLANS

Knight Piésold CONSULTING

AREA
CLIENT DWG. NO.
DRAWING NO. D0223
REV. 0

CAD FILE: M:\1\01\00457\06\A\ACAD\DWGS\D0223\D0223_R0.DWG

SAVED: 03-Dec-13 1:52 PLOTTED: 03-Dec-13 2:03 PM USER: ABBAS NASIR PM



1 D0223 **SECTION**
SCALE A

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES UNLESS NOTED OTHERWISE.
2. ALL FLANGES TO MEET ASTM A516 GRADE 70 CLASS 150, UNLESS NOTED OTHERWISE.
3. PIPE SUPPORTS NOT SHOWN FOR CLARITY.

NOT FOR CONSTRUCTION

SCALE A 1 0.5 0 1 2 3 4 5 m

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP

REF	NUMBER	TITLE

REFERENCES

STAMP/SEAL: PROFESSIONAL ENGINEER — D.D. FONTAINE # 36208 — BRITISH COLUMBIA — Dec 4 2013

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APPROVED FOR _____
CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE: FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	EJS	20NOV13
SCALE	PACKAGE CODE	DRN	AN	20NOV13
AS SHOWN		CHK	DDF	04DEC13
		APP		04DEC13

newgold

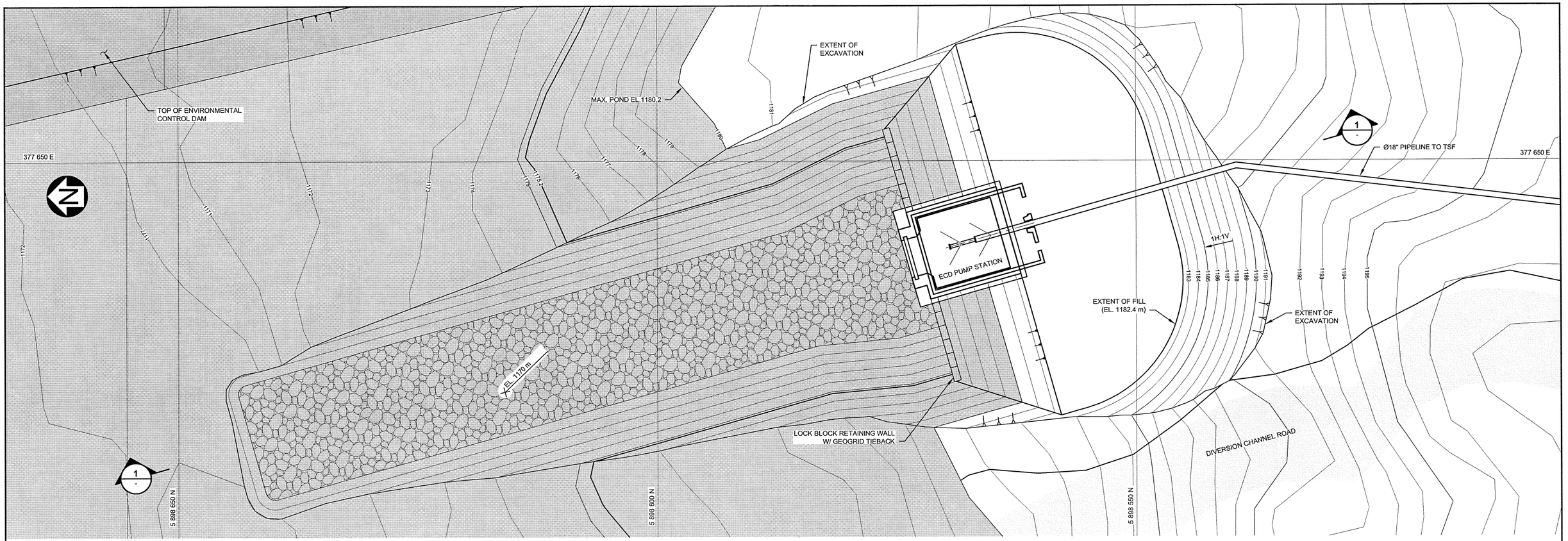
SUBJECT: ENVIRONMENTAL CONTROL DAM PUMP STATION – SECTION GENERAL ARRANGEMENT

Knight Piésold CONSULTING

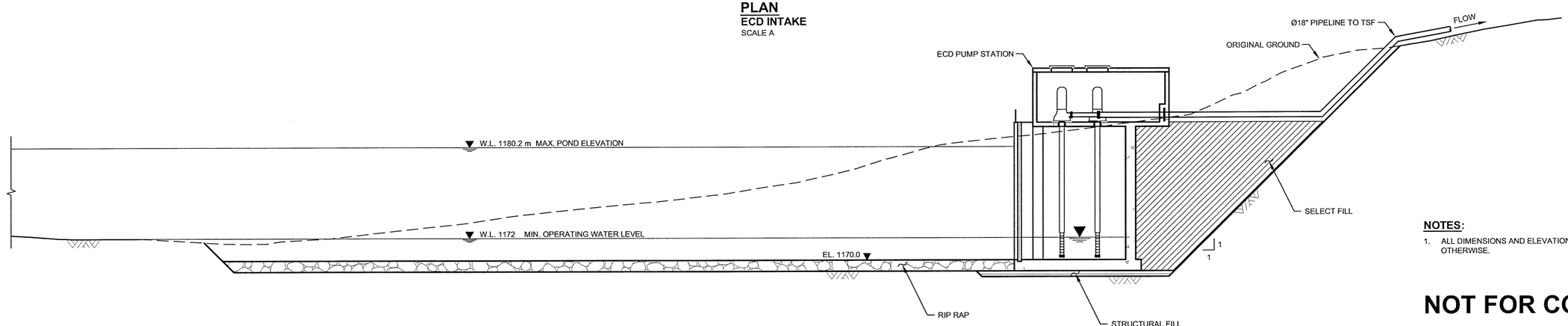
AREA
CLIENT DWG. NO.
DRAWING NO. D0224 REV. 0

C4D FILE: M:\1\01\00457\06\VA\CAD\DWGS\D0224_REV0.DWG

SAVED: 03-Dec-13 1:55 PM PLOTTED: 03-Dec-13 2:03 PM USER: ABBAS NASH



PLAN
ECD INTAKE
SCALE A



SECTION
ECD PUMP STATION INTAKE
SCALE A

NOTES:

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS UNLESS NOTED OTHERWISE.

NOT FOR CONSTRUCTION

SCALE A 4 2 0 4 8 12 16 20 m

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP
0	03DEC13	ISSUED FOR USE	AN	DDF	SRM			

REF	NUMBER	TITLE

STAMP/SEAL: PROFESSIONAL ENGINEER — D. D. FONTAINE # 36208 — BRITISH COLUMBIA — Dec 4, 2013

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APPROVED FOR _____
CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE: FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	EJS	20NOV13
SCALE	PACKAGE CODE	DRN	AN	20NOV13
AS SHOWN		CHK	DDF	04DEC13
		APP	SRM	04DEC13

newgold

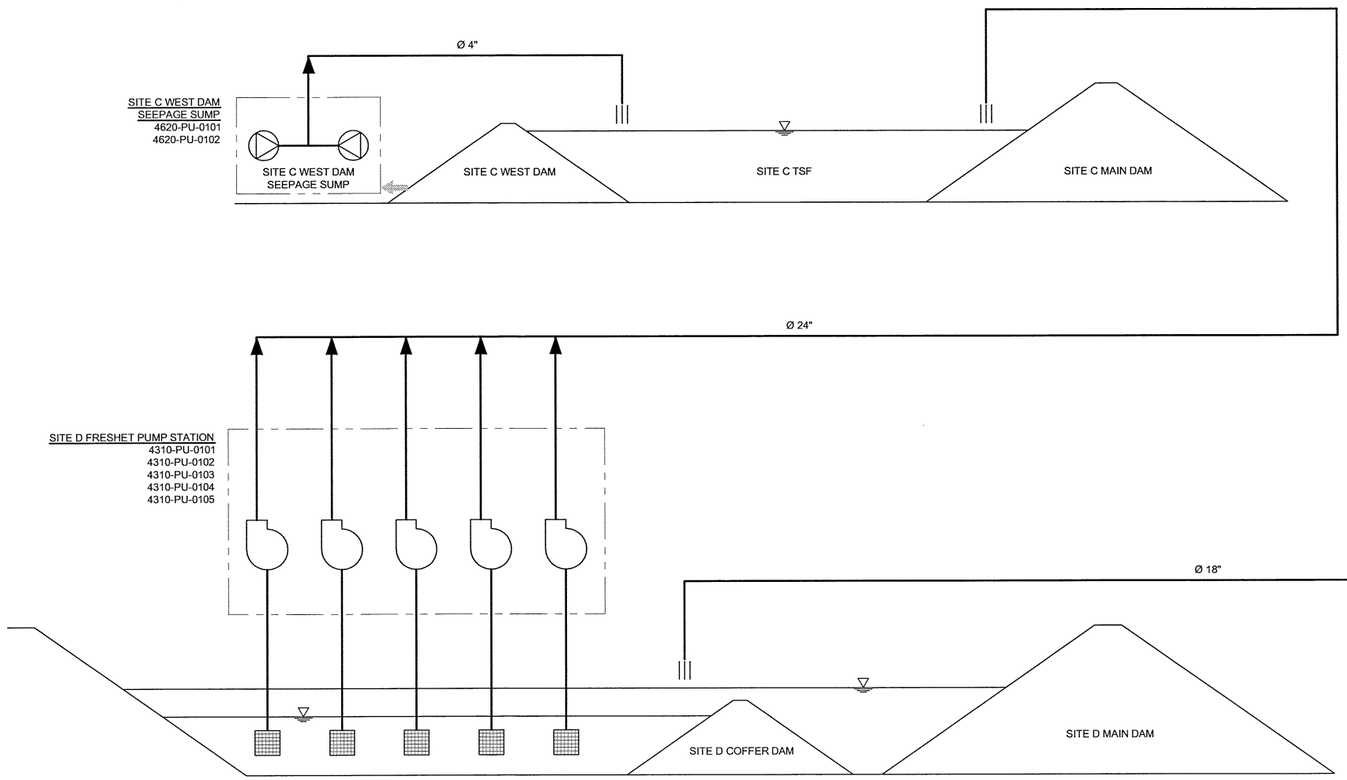
SUBJECT: ENVIRONMENTAL CONTROL DAM PUMP STATION INTAKE PLAN AND SECTION

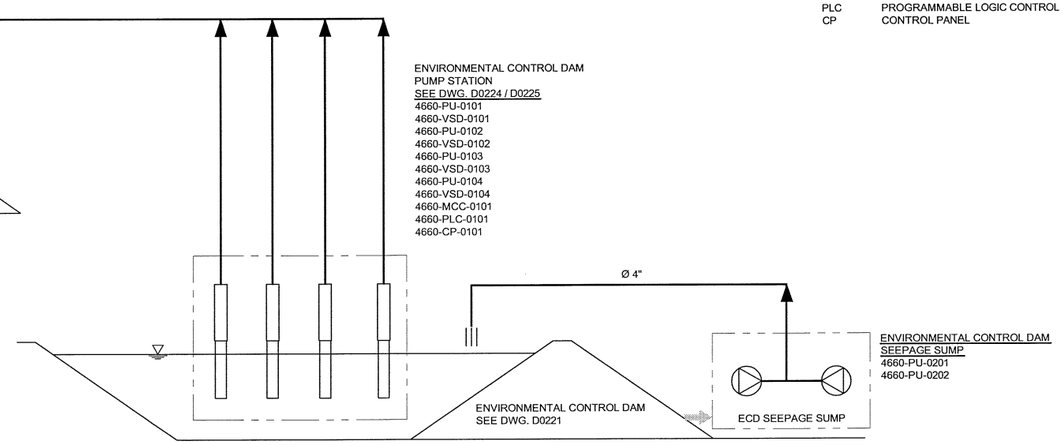
Knight Piésold CONSULTING

AREA
CLIENT DWG. NO.
DRAWING NO. D0225 — REV. 0

SAVED: 03-Dec-13 2:00 PM PLOTTED: 03-Dec-13 2:03 PM USER: ABBAS NASR

CAD FILE: M:\1\101\00457\VA\ADVANCED\DWG\D0225_INC.DWG





LEGEND:

- PIPE FLOW
- FREE DISCHARGE
- FLOW DIRECTION
- SCREENED INTAKE
- SEEPAGE
- SUBMERSIBLE PUMP
- CENTRIFUGAL TURBINE PUMP
- VERTICAL TURBINE PUMP

EQUIPMENT NUMBER LEGEND

PU	PUMP
VSD	VARIABLE SPEED DRIVE
MCC	MOTOR CONTROL CENTRE
PLC	PROGRAMMABLE LOGIC CONTROL
CP	CONTROL PANEL

NOTES:

1. CONCEPTUAL DESIGN DOES NOT INCLUDE ALL REQUIRED INSTRUMENTATION AND CONTROLS.

NOT FOR CONSTRUCTION

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP

REF	NUMBER	TITLE
REFERENCES		

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CLIENT PROJECT MGR.	DEPARTMENT MGR.	PROJECT MGR.

PROJECT PHASE: FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	DBR	08NOV13
		DRN	AN	08NOV13
SCALE: NTS	PACKAGE CODE	CHK	DDF	04DEC13
		APP		04DEC13

newgold

SUBJECT: TSF WATER MANAGEMENT PROCESS FLOW SCHEMATIC

Knight Piésold CONSULTING

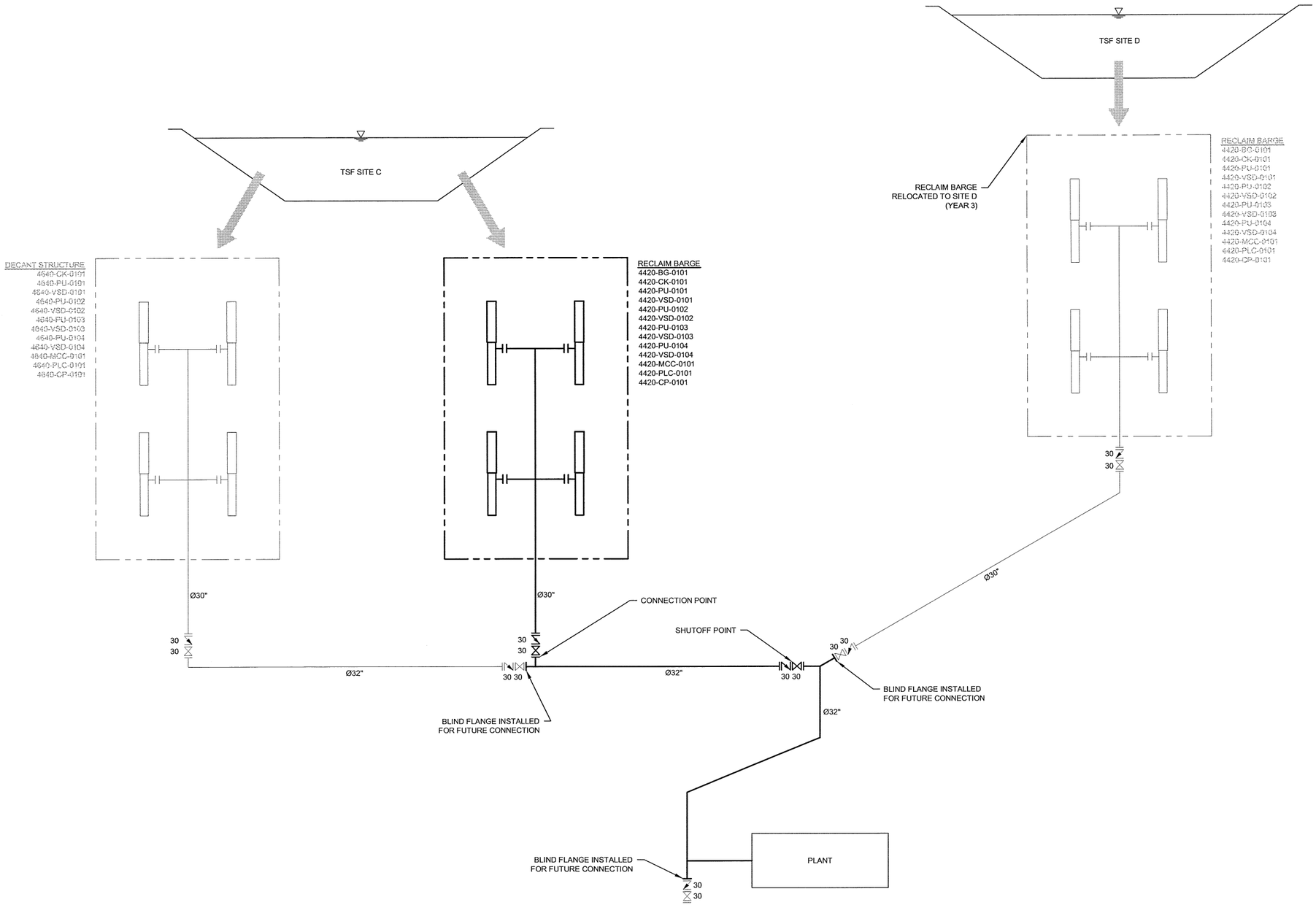
AREA

CLIENT DWG. NO.

DRAWING NO. D0227 — REV. 0

SAVED: 03-Dec-13 2:02 PM PLOTTED: 03-Dec-13 2:03 PM USER: ABBAS NASH

CAD FILE M:\1\01\00457\08\VA\CAD\DWGS\D0227\D0227_R0.DWG



LEGEND:

- 30 — ISOLATION VALVE (EG. 30" BUTTERFLY VALVE)
- 30 — CHECK VALVE (30")
- PIPE FLOW
- FUTURE PIPE FLOW
- PUMPED FLOW
- VERTICAL TURBINE PUMP

EQUIPMENT NUMBER LEGEND

BG	BARGE
PU	PUMP
VSD	VARIABLE SPEED DRIVE
MR	MOTOR
MCC	MOTOR CONTROL CENTRE
PLC	PROGRAMMABLE LOGIC CONTROL
CP	CONTROL PANEL
CK	CRANE
TK	TANK
HE	TANK HEATER
MO	MOTOR ELECTRIC
RS	RESERVOIR

NOTES:

1. CONCEPTUAL DESIGN DOES NOT INCLUDE ALL REQUIRED INSTRUMENTATION AND CONTROLS.
2. SHUTOFF POINTS AT ALL MAJOR PIPELINE INTERCHANGES.
3. CONNECTION POINTS AT ALL EQUIPMENT CONNECTIONS.

NOT FOR CONSTRUCTION

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP	REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP	REF	NUMBER	TITLE

REFERENCES

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PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — D. D. FONTAINE # 36208 — Dec 4, 2013

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CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE: FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	DBR	08NOV13
SCALE	PACKAGE CODE	DRN	AN	08NOV13
NTS		CHK	DDF	04DEC13
		APP	SRM	04DEC13

newgold

SUBJECT: RECLAIM WATER SYSTEM YEAR 1 TO 2 PROCESS FLOW SCHEMATIC

Knight Piésold CONSULTING

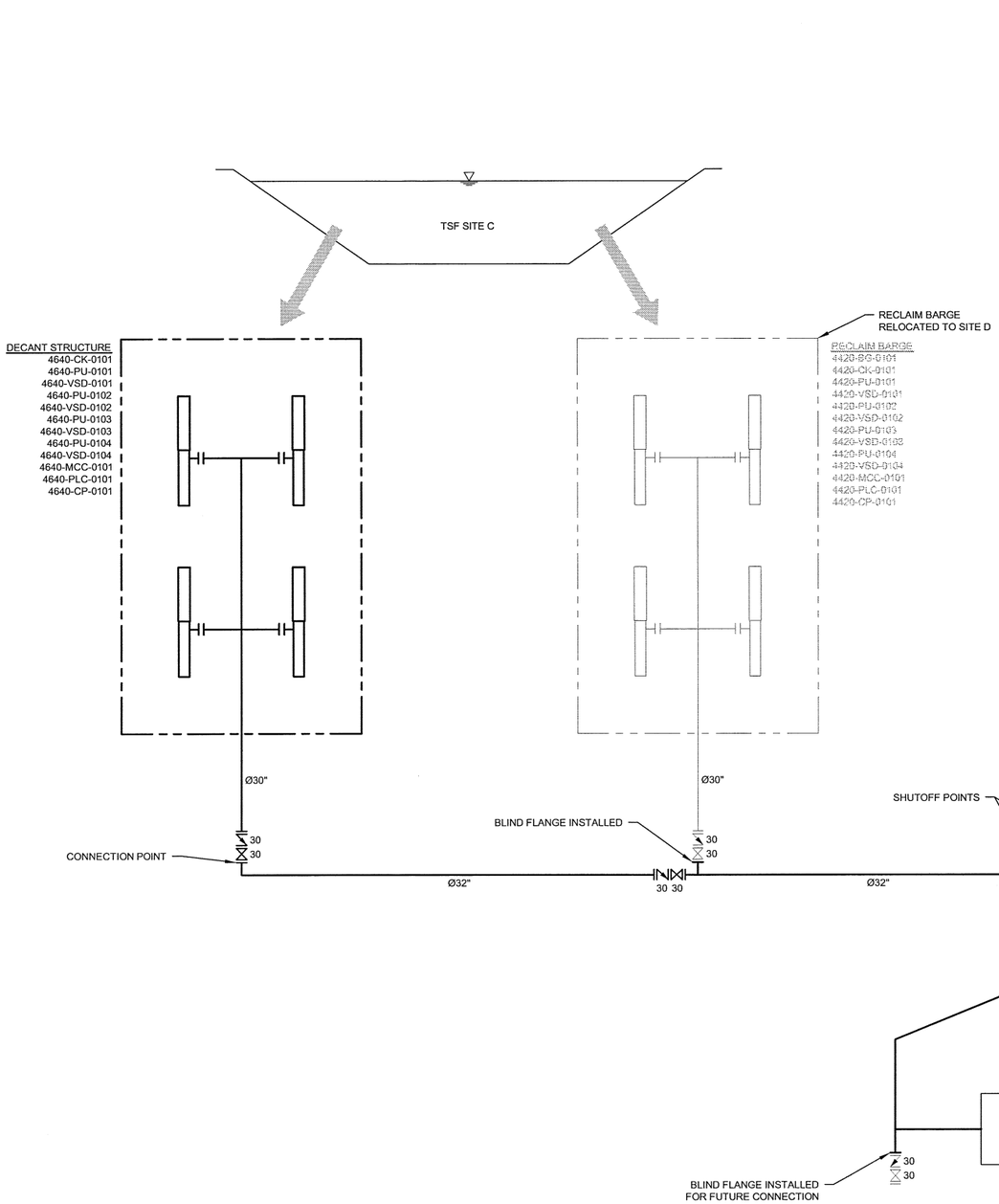
AREA

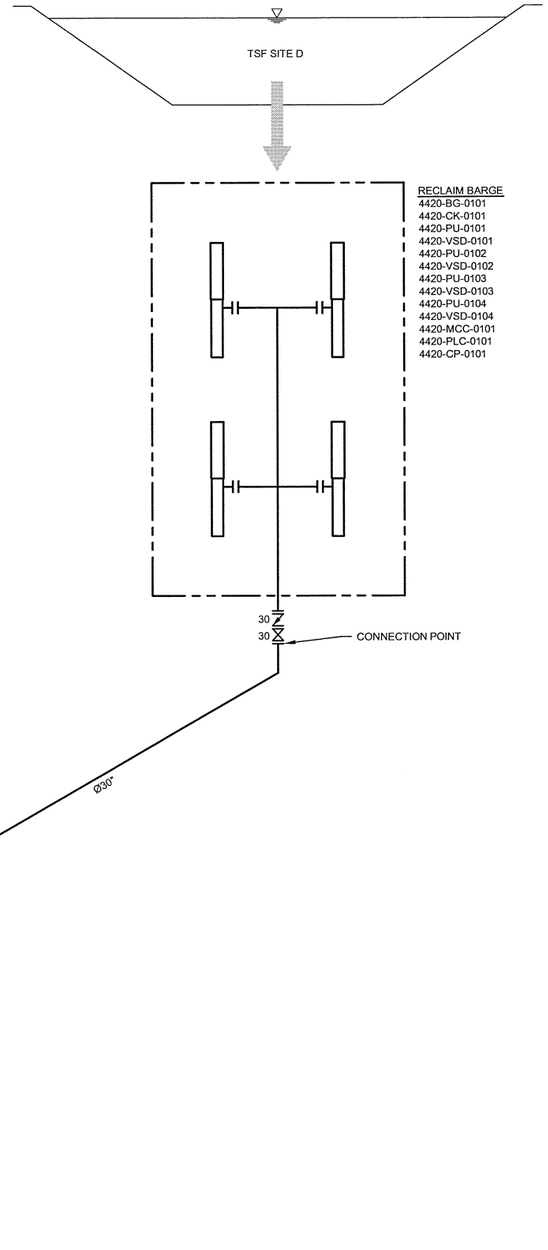
CLIENT DWG. NO.

DRAWING NO. D0241 — REV. 0

CAD FILE: M:\1\01\00457\06\A\ACAD\DWGS\D0241\D0241_RO.DWG

SAVED: 03-Dec-13 2:09 PLOTTED: 03-Dec-13 2:25 PM USER: ABBAS NASIR PM





LEGEND:

- 30 — ISOLATION VALVE (EG. 30" BUTTERFLY VALVE)
- 30 — CHECK VALVE (30")
- PIPE FLOW
- PUMPED FLOW
- VERTICAL TURBINE PUMP

EQUIPMENT NUMBER LEGEND

BG	BARGE
PU	PUMP
VSD	VARIABLE SPEED DRIVE
MR	MOTOR
MCC	MOTOR CONTROL CENTRE
PLC	PROGRAMMABLE LOGIC CONTROL
CP	CONTROL PANEL
CK	CRANE
TK	TANK
HE	TANK HEATER
MO	MOTOR ELECTRIC
RS	RESERVOIR

NOTES:

1. CONCEPTUAL DESIGN DOES NOT INCLUDE ALL REQUIRED INSTRUMENTATION AND CONTROLS.
2. SHUTOFF POINTS AT ALL MAJOR PIPELINE INTERCHANGES.
3. CONNECTION POINTS AT ALL EQUIPMENT CONNECTIONS.

NOT FOR CONSTRUCTION

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP

REF	NUMBER	TITLE
		REFERENCES

STAMP / SEAL

PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — B. D. FONTAINE — # 36208 — Dec 4, 2013

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APPROVED FOR _____

CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE: FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	DBR	08NOV13
SCALE	PACKAGE CODE	DRN	AN	08NOV13
NTS		CHK	DDF	04DEC13
		APP	RM	04DEC13

newgold

SUBJECT: RECLAIM WATER SYSTEM YEAR 3 TO 17 PROCESS FLOW SCHEMATIC

Knight Piésold CONSULTING

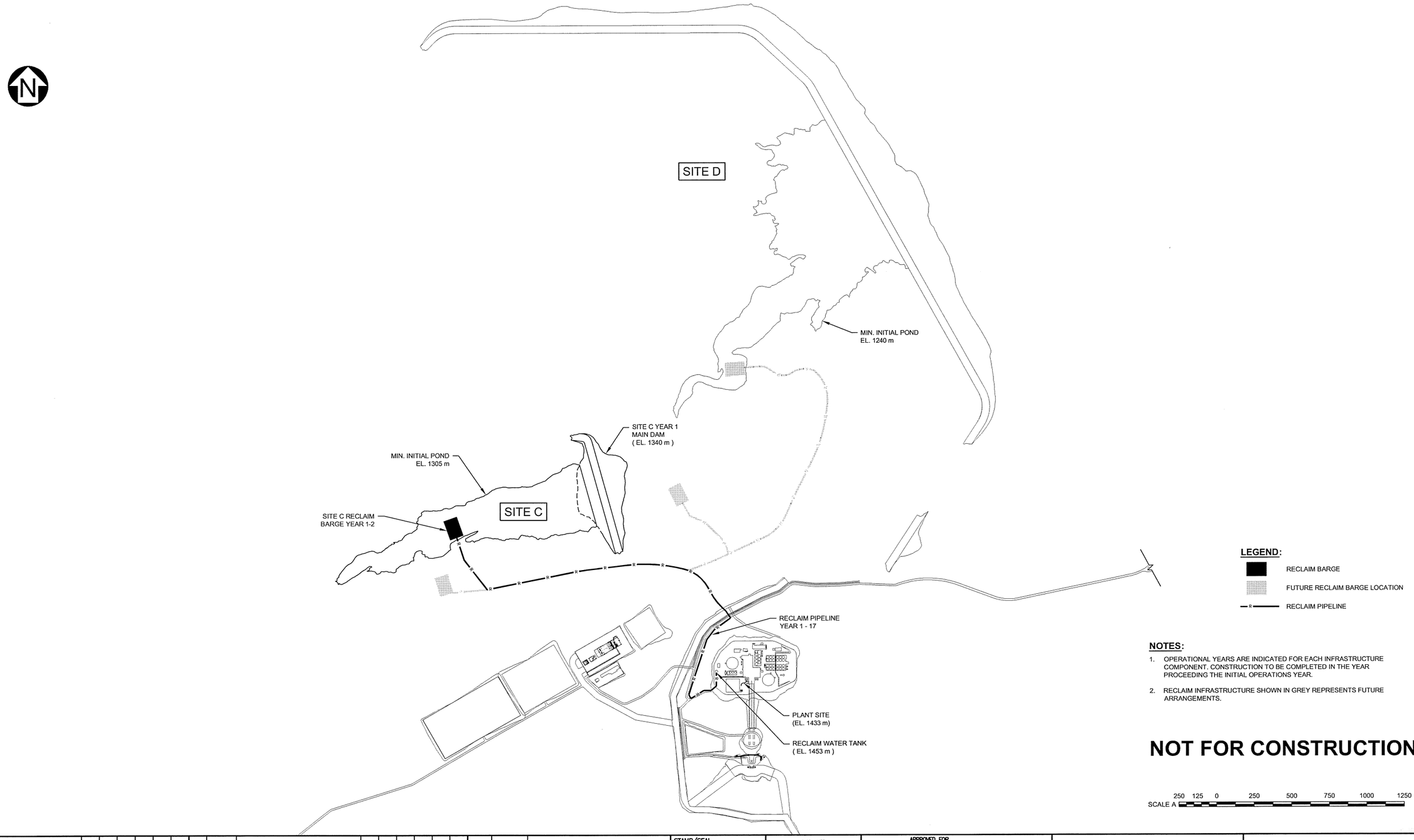
AREA

CLIENT DWG. NO.

DRAWING NO. D0242 | REV. 0

SAVED: 03-Dec-13 2:12 PLOTTED: 03-Dec-13 2:24 PM USER: ABBAS NASR PM

CAD FILE: M:\1\01\00457\08\VA\CAD\WGS\D0242_RO.DWG



NOTES:

1. OPERATIONAL YEARS ARE INDICATED FOR EACH INFRASTRUCTURE COMPONENT. CONSTRUCTION TO BE COMPLETED IN THE YEAR PROCEEDING THE INITIAL OPERATIONS YEAR.
2. RECLAIM INFRASTRUCTURE SHOWN IN GREY REPRESENTS FUTURE ARRANGEMENTS.

NOT FOR CONSTRUCTION

SCALE A 250 125 0 250 500 750 1000 1250 m

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP
0	04DEC13	ISSUED FOR USE	AN	DBR	DDF	SRM		

REF	NUMBER	TITLE
		REFERENCES

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APPROVED FOR _____

CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE: FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	DBR	12NOV13
SCALE	PACKAGE CODE	DRN	AN	12NOV13
AS SHOWN		CHK	DDF	04DEC13
		APP	SRM	04DEC13

newgold

Knight Piésold CONSULTING

SUBJECT: RECLAIM PIPELINES GENERAL ARRANGEMENT INITIAL

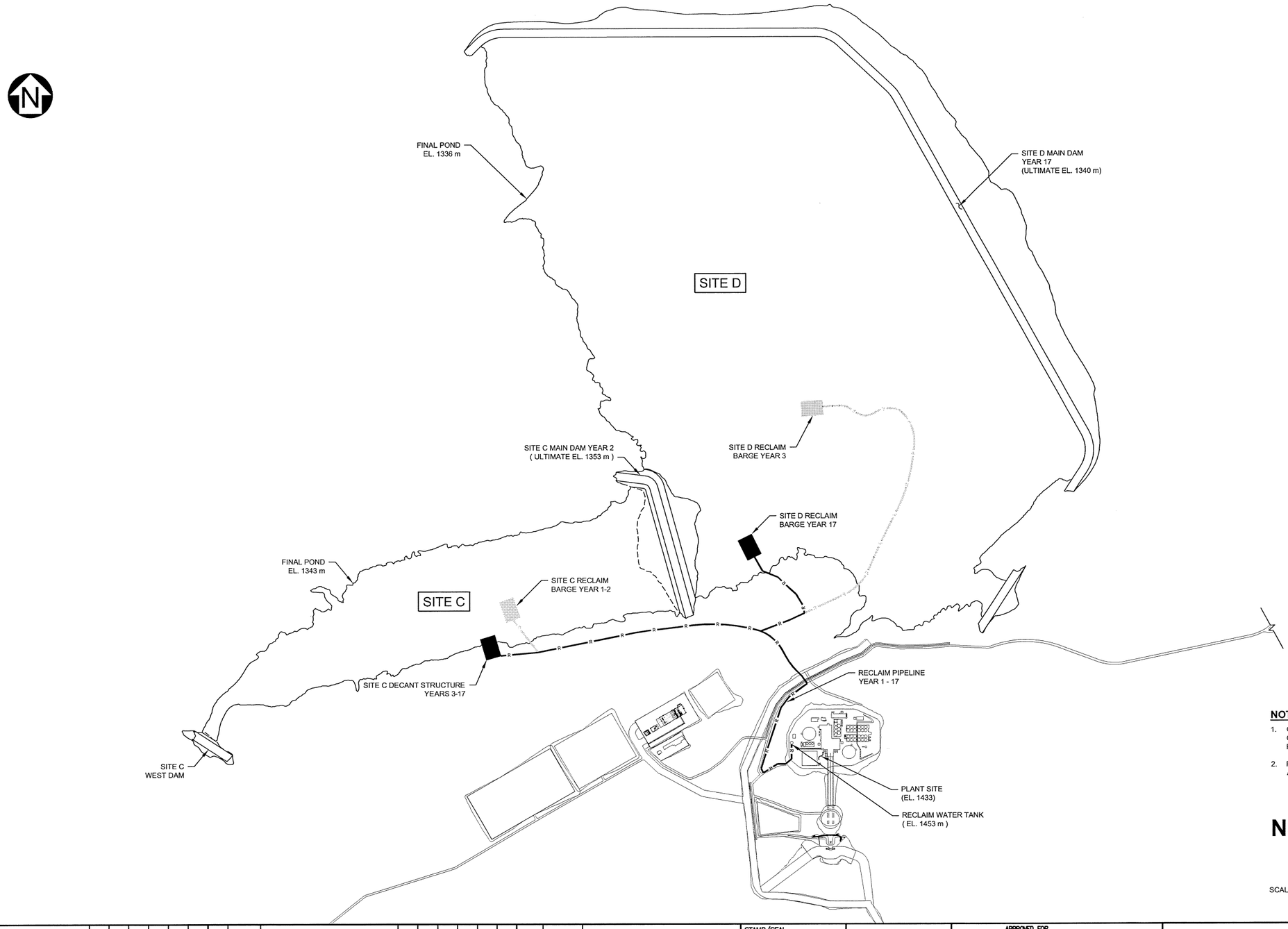
AREA

CLIENT DWG. NO.

DRAWING NO. D0243 REV. 0

CAD FILE: M:\1\01\00457\CAD\VA\DWGS\D0243_RL.DWG

SAVED: 03-Dec-13 2:15 PM PLOTTED: 03-Dec-13 2:24 PM USER: ABBAS NASIR



NOTES:

1. OPERATIONAL YEARS ARE INDICATED FOR EACH INFRASTRUCTURE COMPONENT. CONSTRUCTION TO BE COMPLETED IN THE YEAR PROCEEDING THE INITIAL OPERATIONS YEAR.
2. RECLAIM INFRASTRUCTURE SHOWN IN GREY REPRESENTS PAST ARRANGEMENTS.

NOT FOR CONSTRUCTION

SCALE A 250 125 0 250 500 750 1000 1250 m

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP
0	04DEC13	ISSUED FOR USE	DBR	AN	CDF	SRM		

REF	NUMBER	TITLE
REFERENCES		

STAMP/SEAL: PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA D.D. FONTAINE # 36208 Dec 4, 2013

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APPROVED FOR _____
CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE: FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	DBR	20NOV13
SCALE: AS SHOWN	PACKAGE CODE	DRN	AN	20NOV13
		CHK	CDF	04DEC13
		APP	SRM	04DEC13

newgold

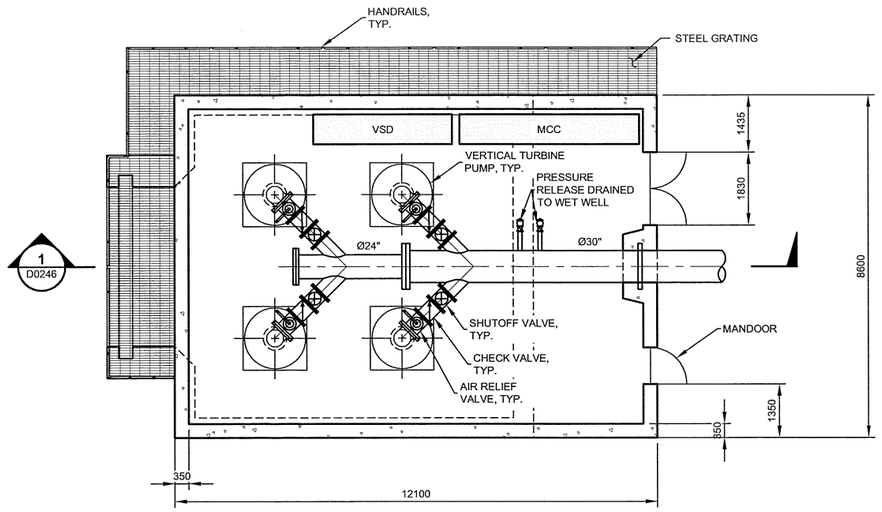
Knight Piésold CONSULTING

SUBJECT: RECLAIM PIPELINES GENERAL ARRANGEMENT FINAL

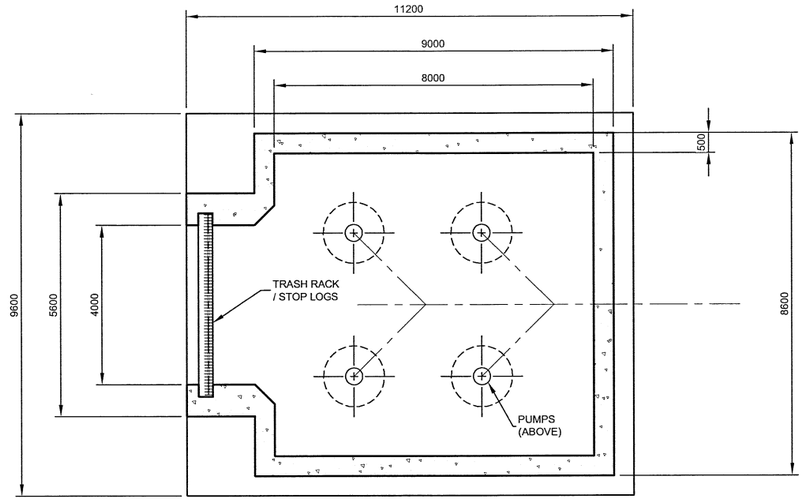
AREA
CLIENT DWG. NO.
DRAWING NO. D0244 REV. 0

CAD FILE: M:\101\00457\CAD\VA_ACAD\DWGS\D0244\D0244_RG.DWG

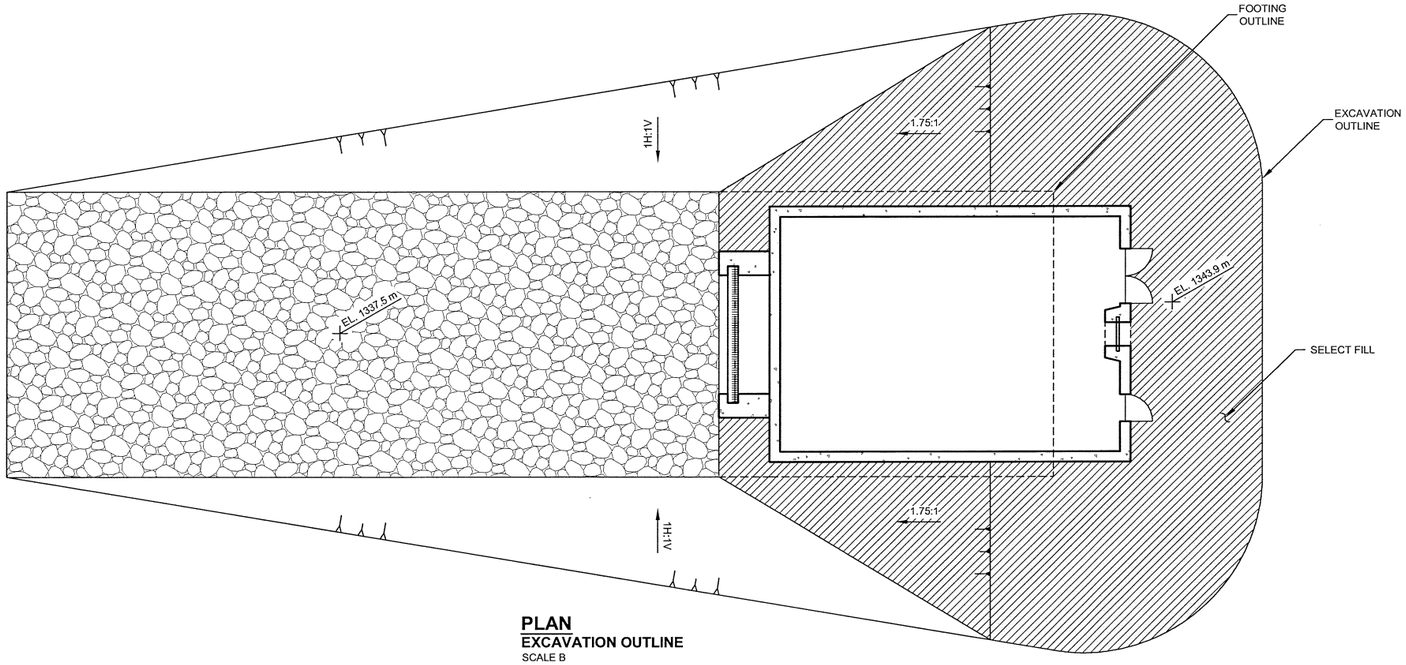
SAVED: 03-Dec-13 2:18 PM PLOTTED: 03-Dec-13 2:24 PM USER: ABBAS NASIRI



PLAN
ELEVATION 1343.9 m
SCALE A



PLAN
ELEVATION 1337.5 m
SCALE A



PLAN
EXCAVATION OUTLINE
SCALE B

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES UNLESS NOTED OTHERWISE.
2. ALL FLANGES TO MEET ASTM A516 GRADE 70 CLASS 150, UNLESS NOTED OTHERWISE.
3. PIPE SUPPORTS NOT SHOWN FOR CLARITY.

NOT FOR CONSTRUCTION

SCALE A 1.5 0.75 0 2.5 5.0 7.5 m
SCALE B 2 1 0 2 4 6 8 10 m

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP	REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP

REF	NUMBER	TITLE
REFERENCES		

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APPROVED FOR _____

CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE: FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	EJS	20NOV13
		DRN	AN	20NOV13
SCALE	PACKAGE CODE	CHK	DDF	04DEC13
AS SHOWN		APP	SRM	04DEC13

newgold

SUBJECT: RECLAIM WATER SYSTEM SITE C DECANT STRUCTURE PLANS

Knight Piésold CONSULTING

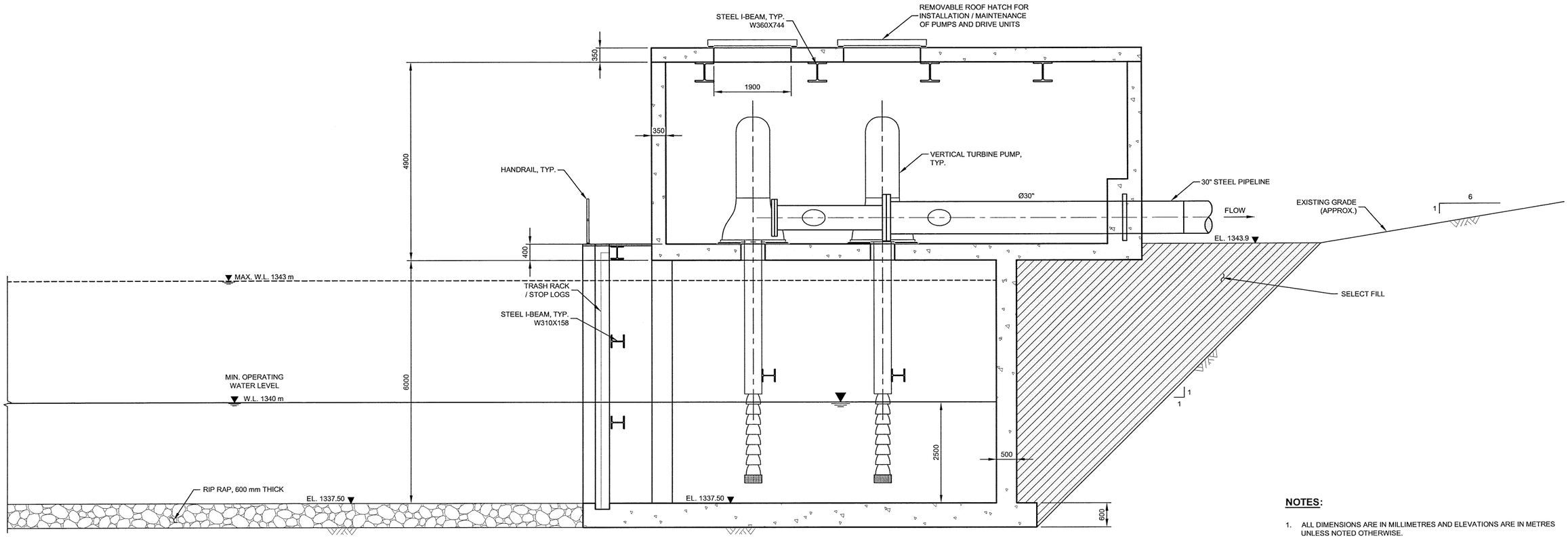
AREA

CLIENT DWG. NO.

DRAWING NO. D0245 REV. 0

CAD FILE: M:\1\01\00457\06\A\ACAD\DWGS\D0245\D0245_R0.DWG

SAVED: 03-Dec-13 2:21 PLOTTED: 03-Dec-13 2:24 PM USER: ABBAS NASIRI PM



1 / D0245 **SECTION**
SCALE A

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES UNLESS NOTED OTHERWISE.
2. ALL FLANGES TO MEET ASTM A516 GRADE 70 CLASS 150, UNLESS NOTED OTHERWISE.
3. PIPE SUPPORTS NOT SHOWN FOR CLARITY.
4. FINAL LOCATION AND BASE ELEVATION OF THE DECANT STRUCTURE TO BE DETERMINED DURING OPERATIONS DEPENDING ON THE FILL PROGRESS OF SITE C.

NOT FOR CONSTRUCTION

SCALE A 1 0.5 0 1 2 3 4 5 m

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP
0	04DEC13	ISSUED FOR USE	AN	DDF	SRM			

REF	NUMBER	TITLE
		REFERENCES

STAMP/SEAL
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PROVINCE OF BRITISH COLUMBIA
D.D. FONTAINE
36208
Dec 4, 2013

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APPROVED FOR _____
CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE
FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	EJS	20NOV13
SCALE	PACKAGE CODE	DRN	AN	20NOV13
AS SHOWN		CHK	DDF	04DEC13
		APP	SRM	04DEC13

newgold

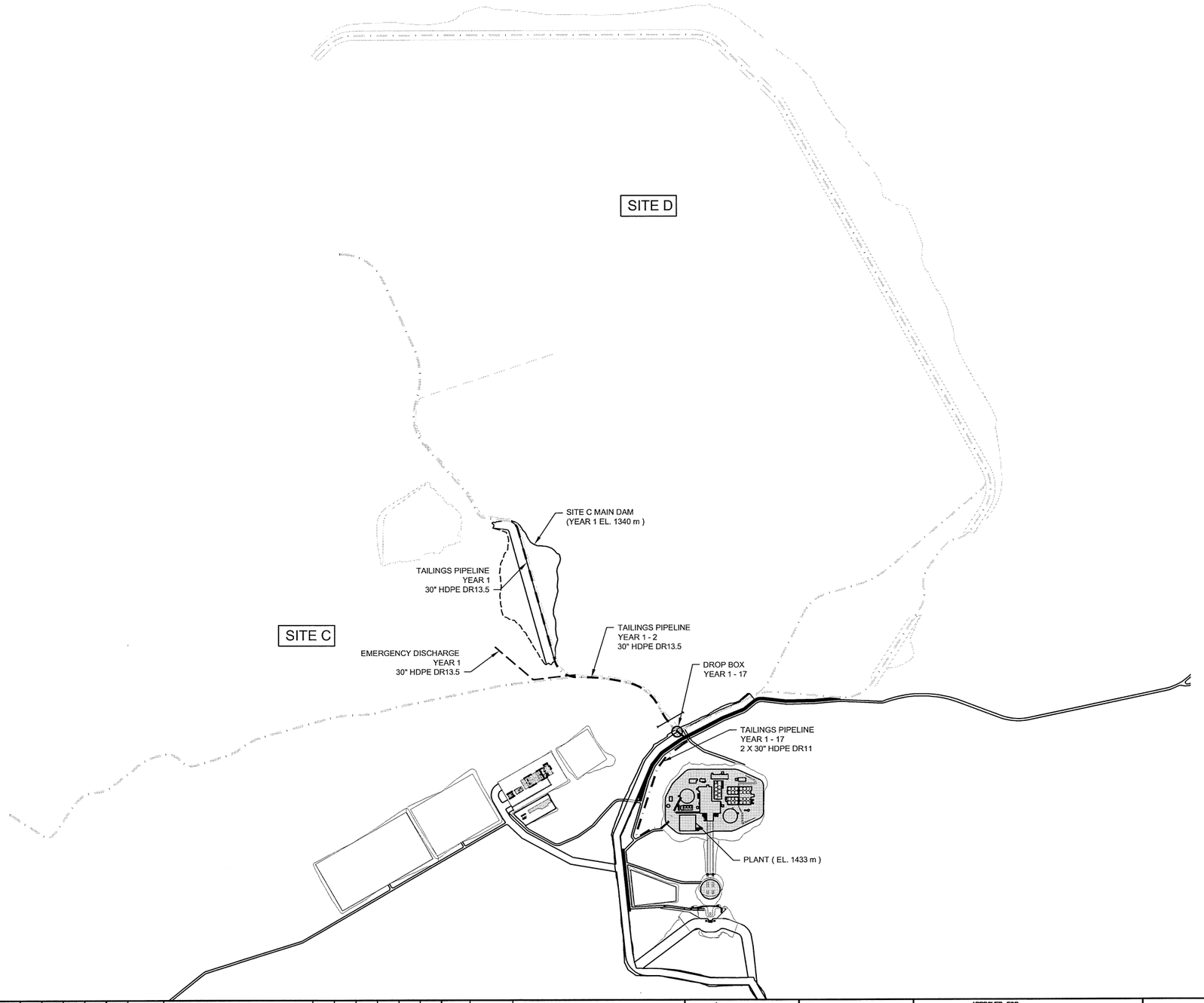
SUBJECT
RECLAIM WATER SYSTEM
SITE C DECANT STRUCTURE
SECTION

Knight Piésold CONSULTING

AREA
CLIENT DWG. NO.
DRAWING NO. D0246
REV. 0

CAD FILE: M:\101\004\07\DGN\VA04457DGN01_D0246_RLDWG

SAVED: 03-Dec-13 2:23 PM PLOTTED: 03-Dec-13 2:24 PM USER: ABBAS NASIRI



NOTES:

1. OPERATIONAL YEARS ARE INDICATED FOR EACH INFRASTRUCTURE COMPONENT. CONSTRUCTION TO BE COMPLETED IN THE YEAR PROCEEDING THE INITIAL OPERATIONS YEAR.
2. SITE C INFRASTRUCTURE WILL BE DECOMMISSIONED IN YEAR 3 AS TAILINGS DEPOSITION COMMENCES AT SITE D.

NOT FOR CONSTRUCTION

SCALE A 250 125 0 250 500 750 1000 1250 m

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP	REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP

REF	NUMBER	TITLE
REFERENCES		

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PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
D. D. FONTAINE
36208
Dec 4, 2013

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APPROVED FOR _____

CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE
FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	VM	08NOV13
		DRN	AN	08NOV13
SCALE	PACKAGE CODE	CHK	DDF	04DEC13
AS SHOWN		APP	JRM	04DEC13

newgold

SUBJECT
TAILINGS PIPELINES SITE C
GENERAL ARRANGEMENT
INITIAL

Knight Piésold
CONSULTING

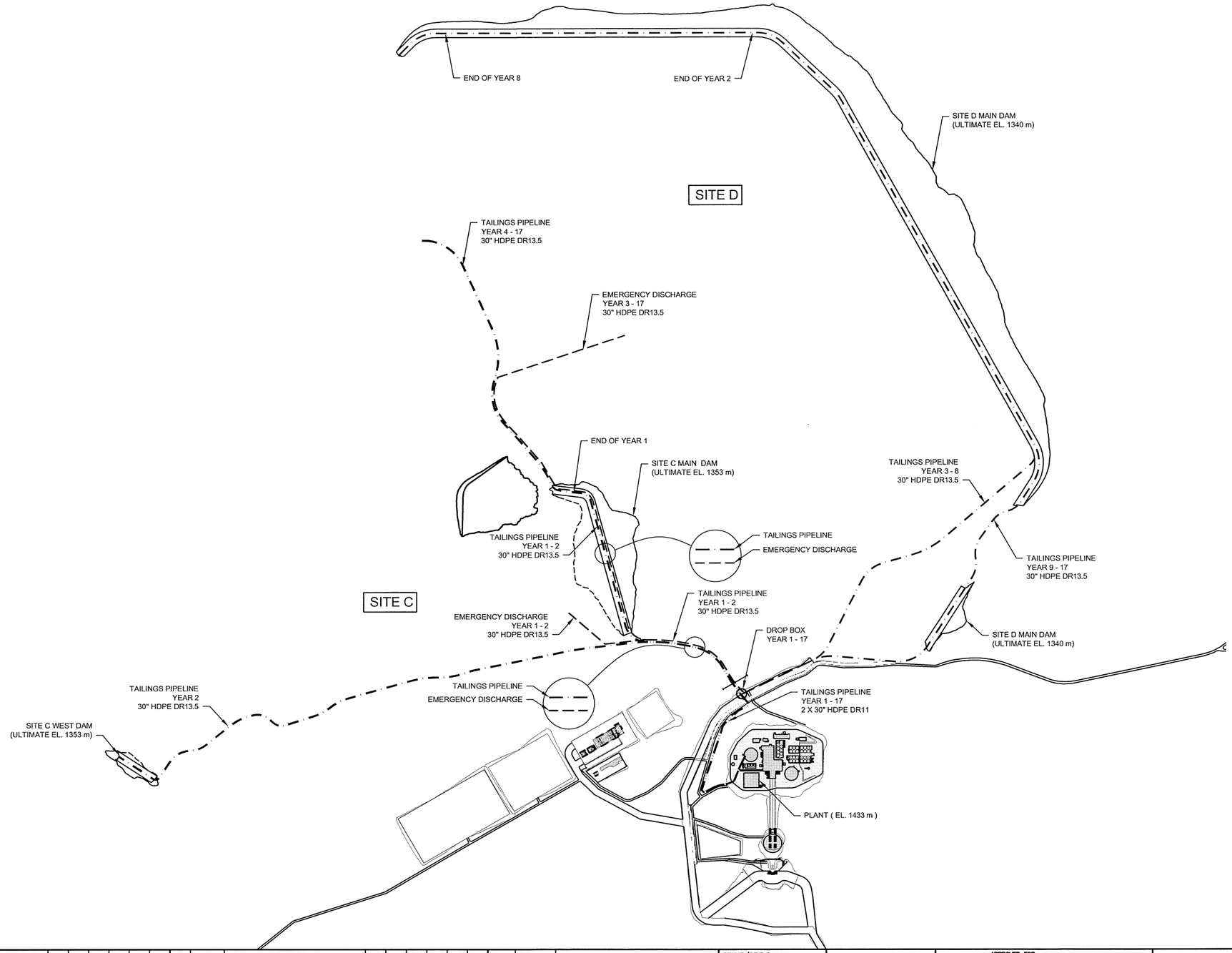
AREA

CLIENT DWG. NO.

DRAWING NO. D0260 REV. 0

CAD FILE: M:\1\01\00457\06\A\ACAD\DWGS\D0260\D0260_R0.DWG

SAVED: 03-Dec-13 2:48 PM PLOTTED: 03-Dec-13 3:13 PM USER: ABBAS NASIRI



NOTES:

1. OPERATIONAL YEARS ARE INDICATED FOR EACH INFRASTRUCTURE COMPONENT. CONSTRUCTION TO BE COMPLETED IN THE YEAR PROCEEDING THE INITIAL OPERATIONS YEAR.
2. SITE C INFRASTRUCTURE WILL BE DECOMMISSIONED IN YEAR 3 AS TAILINGS DEPOSITION COMMENCES AT SITE D.

NOT FOR CONSTRUCTION

SCALE A: 250 125 0 250 500 750 1000 1250 m

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP

REF	NUMBER	TITLE
		REFERENCES

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APPROVED FOR _____

CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE: FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	VM	08NOV13
		DRN	AN	08NOV13
SCALE	PACKAGE CODE	CHK	DDF	04DEC13
AS SHOWN		APP		04DEC13

newgold

SUBJECT: TAILINGS PIPELINES SITE C AND SITE D GENERAL ARRANGEMENT FINAL

Knight Piésold CONSULTING

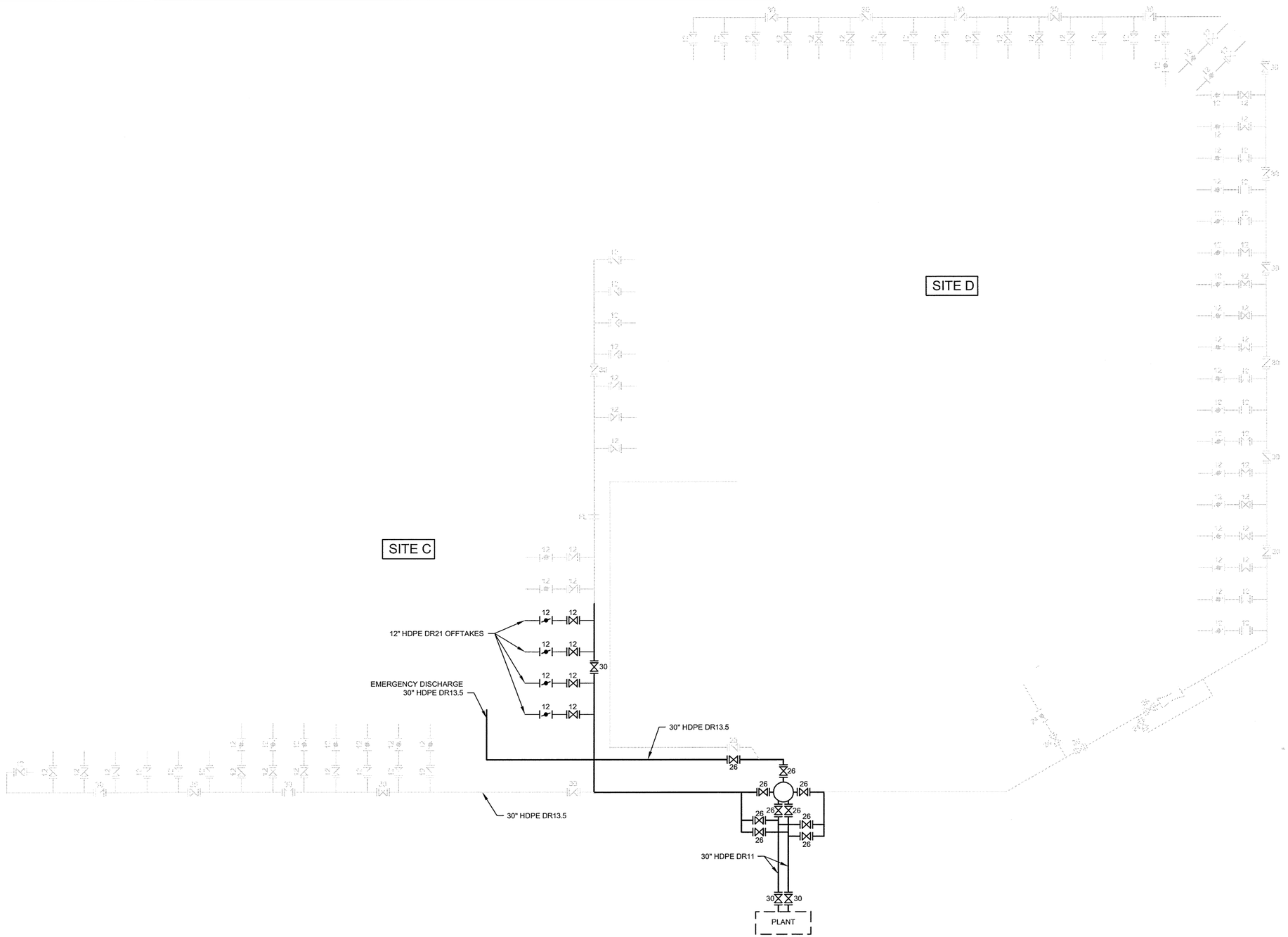
AREA

CLIENT DWG. NO.

DRAWING NO. D0261 — REV. 0

CAD FILE: \\V1\01\03457\VA\VA\CAD\DWGS\D0261\D0261_R0.DWG

SAVED: 03-Dec-13 2:51 PM PLOTTED: 03-Dec-13 3:13 PM USER: ABBAS NASIR



LEGEND:

- ISOLATION VALVE (E.G. 30" KNIFE GATE VALVE)
- FLOW REGULATING VALVE (E.G. 12" BUTTERFLY VALVE)
- DROP BOX (DETAIL ON DWG D0268)
- CHOKE STATION (DETAIL ON DWG D0268)

NOTES:

1. OFFTAKES (SPIGOTS) ARE 12" HDPE DR21 SPACED 150m APART OR FIELD FIT DURING OPERATIONS.
2. THE LOCATION OF ALL AIR RELEASE AND AIR VACUUM VALVES WILL BE DETERMINED DURING DETAILED DESIGN.

NOT FOR CONSTRUCTION

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP	REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP	REF	NUMBER	TITLE

REFERENCES

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PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
D. D. FONTAINE
36208
Dec 4, 2013

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APPROVED FOR _____

CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE: FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	VM	08NOV13
		DRN	SB	08NOV13
SCALE	PACKAGE CODE	CHK	DDF	04DEC13
NTS		APP	SRM	04DEC13

newgold

SUBJECT: TAILINGS PIPELINES SITE C PROCESS FLOW SCHEMATIC INITIAL

Knight Piésold CONSULTING

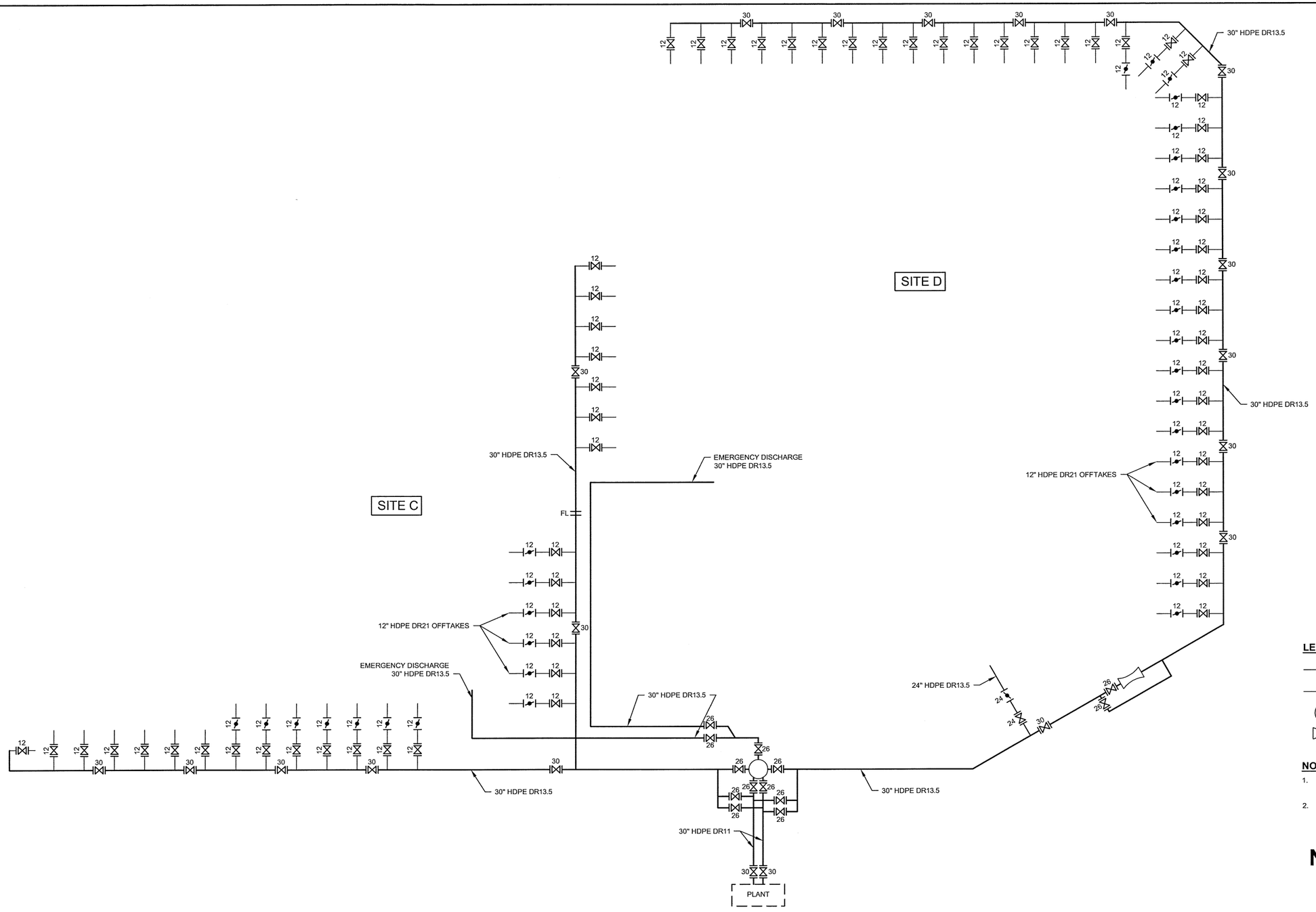
AREA

CLIENT DWG. NO.

DRAWING NO. D0262 REV. 0

CAD FILE: M:\1\01\00457\06\A\ACAD\DWGS\D0262\D0262_R0.DWG

SAVED: 03-Dec-13 2:53 PM PLOTTED: 03-Dec-13 3:13 PM USER: ABBAS NASIRI



LEGEND:

- ISOLATION VALVE (E.G. 30" KNIFE GATE VALVE)
- FLOW REGULATING VALVE (E.G. 12" BUTTERFLY VALVE)
- DROP BOX (DETAIL ON DWG D0268)
- CHOKE STATION (DETAIL ON DWG D0268)

NOTES:

1. OFFTAKES (SPIGOTS) ARE 12" HDPE DR21 SPACED 150m APART OR FIELD FIT DURING OPERATIONS.
2. THE LOCATION OF ALL AIR RELEASE AND AIR VACUUM VALVES WILL BE DETERMINED DURING DETAILED DESIGN.

NOT FOR CONSTRUCTION

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP
REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP

REF	NUMBER	TITLE
		REFERENCES

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APPROVED FOR _____

CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE: FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	VM	08NOV13
		DRN	AN	08NOV13
SCALE: NTS	PACKAGE CODE	CHK	CDF	04DEC13
		APP	SRM	04DEC13

newgold

SUBJECT: TAILINGS PIPELINES SITE C AND SITE D PROCESS FLOW SCHEMATIC FINAL

Knight Piésold CONSULTING

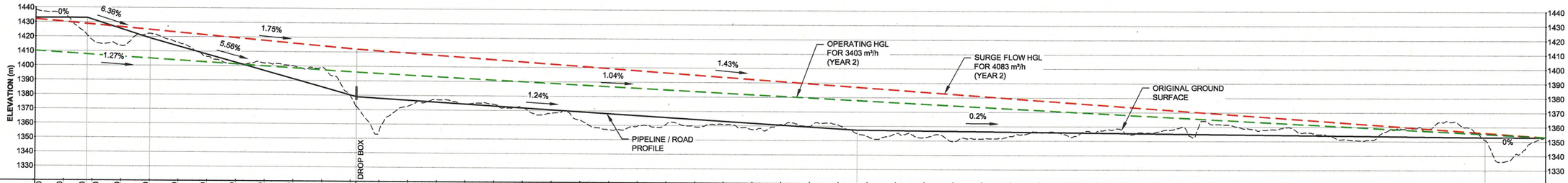
AREA

CLIENT DWG. NO.

DRAWING NO. D0263 — REV. 0

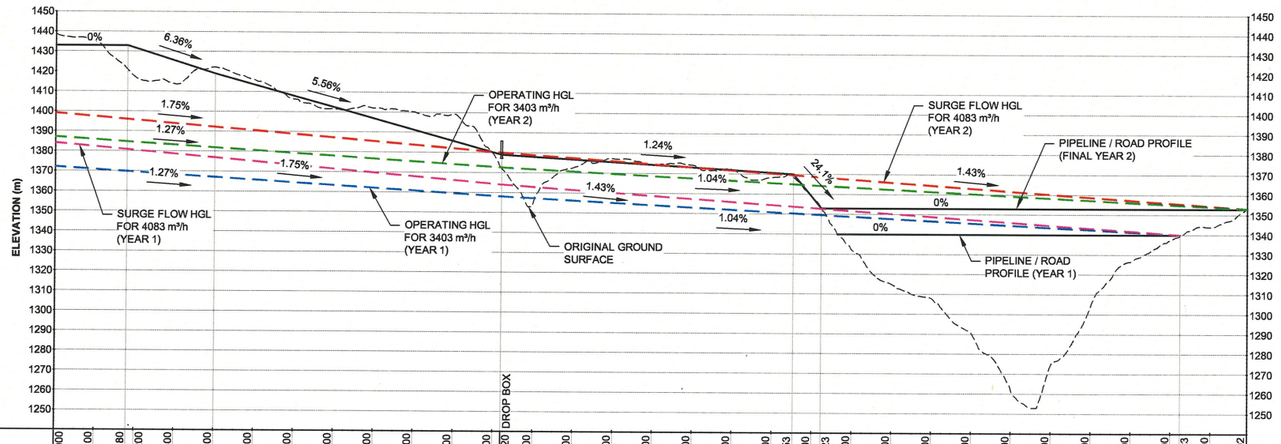
SAVED: 03-Dec-13 2:56 PM PLOTTED: 03-Dec-13 3:13 PM USER: ABBAS NASIR

CAD FILE: M:\01\00457\VA\CAD\DWGS\D0263\D0263_REV.DWG



STATION (m)	0+000	0+100	0+180	0+200	0+300	0+400	0+500	0+600	0+700	0+800	0+900	1+000	1+100	1+120	1+200	1+300	1+400	1+500	1+600	1+700	1+800	1+900	2+000	2+100	2+200	2+300	2+400	2+500	2+600	2+700	2+800	2+865	2+900	3+000	3+100	3+200	3+300	3+400	3+500	3+600	3+700	3+800	3+900	4+000	4+100	4+200	4+300	4+400	4+500	4+600	4+700	4+800	4+900	5+000	5+047	5+100	5+200	5+258
BOTTOM OF PIPE ELEVATION (m)	1433		1433			1419								1379																	1357.4																														1353			1353	
PIPELINE DESCRIPTION	30" HDPE DR11 (INTERNAL DIAMETER 615 mm)													30" HDPE DR13.5 (INTERNAL DIAMETER 642 mm)																																																								
YEAR 2 HGL ELEVATION (m) / GRADE (AVERAGE FLOW)	1410 \ 1.27%													1396 \ 1.04%																																																						
YEAR 2 HGL ELEVATION (m) / GRADE (SURGE FLOW)	1432 \ 1.75%													1412 \ 1.43%																																																						

HGL SITE C
TAILINGS PIPELINE TO EL. 1353
WEST DAM
HORIZONTAL SCALE A
VERTICAL SCALE B



STATION (m)	0+000	0+100	0+180	0+200	0+300	0+400	0+500	0+600	0+700	0+800	0+900	1+000	1+100	1+120	1+200	1+300	1+400	1+500	1+600	1+700	1+800	1+853	1+900	1+923	2+000	2+100	2+200	2+300	2+400	2+500	2+600	2+700	2+800	2+823	2+900	2+992
BOTTOM OF PIPE ELEVATION (m)	1433		1433			1419								1379								1370		1353										1340		1353
PIPELINE DESCRIPTION	30" HDPE DR11 (INTERNAL DIAMETER 615 mm)													30" HDPE DR13.5 (INTERNAL DIAMETER 642 mm)																							
YEAR 1 HGL ELEVATION (m) / GRADE (AVERAGE FLOW)	1372 \ 1.27%													1358 \ 1.04%																							
YEAR 1 HGL ELEVATION (m) / GRADE (SURGE FLOW)	1384 \ 1.75%													1364 \ 1.43%																							
YEAR 2 HGL ELEVATION (m) / GRADE (AVERAGE FLOW)	1387 \ 1.27%													1373 \ 1.04%																							
YEAR 2 HGL ELEVATION (m) / GRADE (SURGE FLOW)	1399 \ 1.75%													1380 \ 1.43%																							

HGL SITE C
TAILINGS PIPELINE TO EL. 1353
MAIN DAM
HORIZONTAL SCALE A
VERTICAL SCALE B

TAILINGS DISTRIBUTION PIPELINE		
SLURRY DESIGN SUMMARY PER LINE	AVERAGE	SURGE
SOLIDS THROUGHPUT (DRY TONNES/HOUR)	2,500	3,000
SLURRY PERCENT SOLIDS (BY WEIGHT)	50%	50%
SLURRY FLOW RATE (m^3/h)	3,400	4,080
SLURRY DENSITY (t/m^3)	1.47	1.47

LEGEND:

- HGL FOR YEAR 1 (2017) AVERAGE FLOW
- HGL FOR YEAR 1 (2017) SURGE FLOW
- HGL FOR YEAR 2 (2018) AVERAGE FLOW
- HGL FOR YEAR 2 (2018) SURGE FLOW

NOTES:

1. STATION 0+000 IS AT THE TAILINGS THICKENER TANK.
2. DIMENSIONS AND ELEVATIONS IN METRES UNLESS NOTED OTHERWISE.
3. HYDRAULIC GRADE LINES REPRESENT EXPECTED CONDITIONS FOR A RANGE OF FLOWS AND FOR CARRIER FLUID VISCOSITY AT 10°C .
4. HYDRAULIC GRADE LINES ARE SHOWN FOR FULL PIPE FLOW CONDITIONS WITH DROP BOX BYPASSED.

NOT FOR CONSTRUCTION

SCALE B: 30 15 0 50 100 150 m

SCALE A: 150 75 0 250 500 750 m

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP

REF	NUMBER	TITLE
		REFERENCES

STAMP/SEAL: PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — D. D. FONTAINE # 36208 — 4/2013

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CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE: FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	VM	08NOV13
SCALE: AS SHOWN	PACKAGE CODE	DRN	SB	08NOV13
		CHK	DDF	04DEC13
		APP		04DEC13

newgold

SUBJECT: TAILINGS PIPELINES SITE C HYDRAULIC GRADE LINES YEAR 1 AND 2 MAIN AND WEST DISTRIBUTION LINES

Knight Piésold CONSULTING

AREA

CLIENT DWG. NO.

DRAWING NO. D0264 | REV. 0

CAD FILE: M:\1\01\00457\08\A\CAD\DWGS\D0264\D0264-R0.DWG

SAVED: 03-Dec-13 2:59 PM PLOTTED: 03-Dec-13 3:13 PM USER: ABBAS NASIRI

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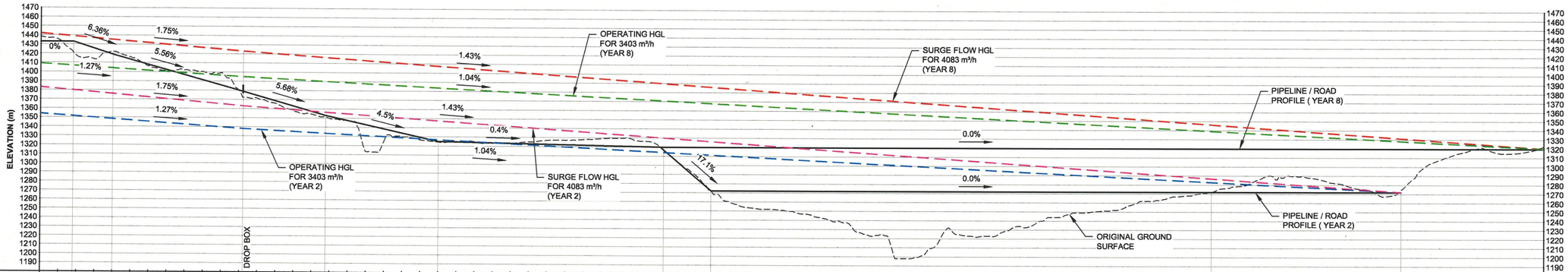

| STATION (m) | 0+000 | 0+100 | 0+180 | 0+200 | 0+300 | 0+400 | 0+500 | 0+600 | 0+700 | 0+800 | 0+900 | 1+000 | 1+100 | 1+120 | 1+200 | 1+300 | 1+400 | 1+500 | 1+578 | 1+600 | 1+700 | 1+800 | 1+900 | 2+000 | 2+100 | 2+200 | 2+300 | 2+400 | 2+500 | 2+600 | 2+700 | 2+800 | 2+900 | 3+000 | 3+100 | 3+200 | 3+300 | 3+400 | 3+444 | 3+500 | 3+600 | 3+700 | 3+706 | 3+800 | 3+900 | 4+000 | 4+100 | 4+200 | 4+300 | 4+400 | 4+500 | 4+600 | 4+700 | 4+800 | 4+900 | 5+000 | 5+100 | 5+200 | 5+300 | 5+400 | 5+500 | 5+600 | 5+700 | 5+800 | 5+900 | 6+000 | 6+100 | 6+200 | 6+300 | 6+400 | 7+168 | 6+500 | 6+600 | 6+700 | 6+800 | 6+900 | 7+000 | 7+100 | 7+200 | 7+300 | 7+400 | 7+500 | 7+510 | 7+600 | 7+700 | 7+800 | 7+900 | 8+000 | 8+100 | 8+200 | 8+286 |
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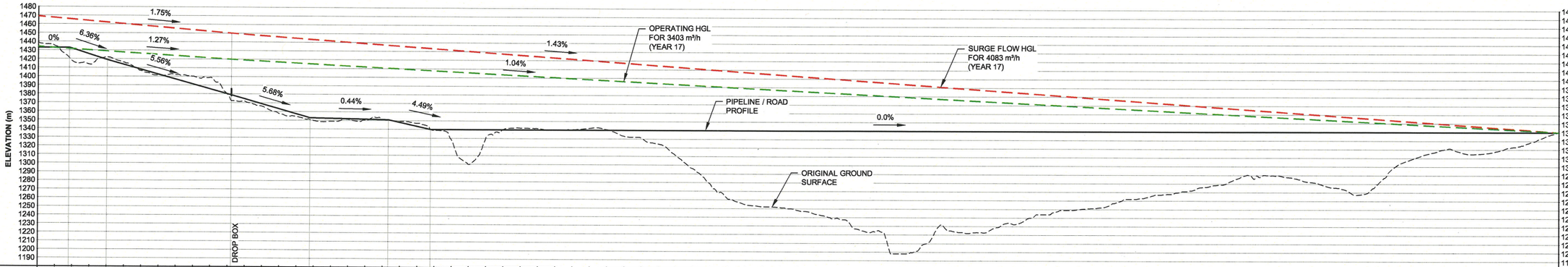
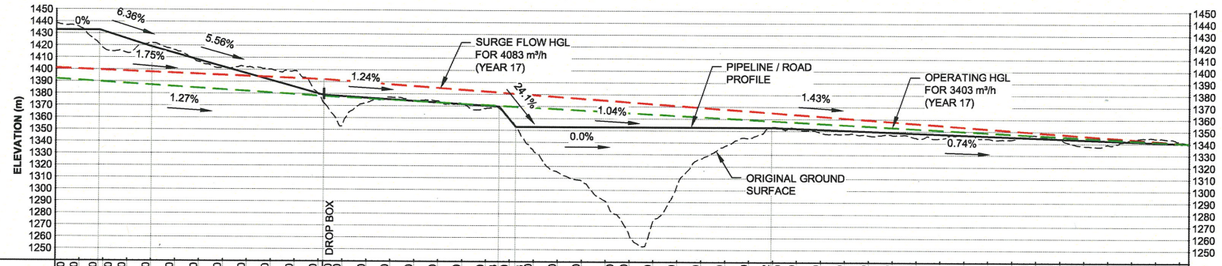


STATION (m)	0+000	0+100	0+180	0+200	0+300	0+400	0+500	0+600	0+700	0+800	0+900	1+000	1+100	1+120	1+200	1+300	1+400	1+500	1+578	1+600	1+700	1+800	1+900	2+000	2+032	2+100	2+200	2+277	2+300	2+400	2+500	2+600	2+700	2+800	2+900	3+000	3+100	3+200	3+300	3+400	3+500	3+600	3+700	3+800	3+900	4+000	4+100	4+200	4+300	4+400	4+500	4+600	4+700	4+800	4+805
BOTTOM OF PIPE ELEVATION (m)	1433		1433			1419								1379					1353						1351			1340																												1340
PIPELINE DESCRIPTION	30" HYDE DR11 (INTERNAL DIAMETER 615 mm)													30" HYDE DR13.5 (INTERNAL DIAMETER 642 mm)																																																	
YR. 17HGL ELEVATION (m) / GRADE (AVERAGE FLOW)	1434 \ 1.27%													1420 \ 1.04%																																															
YR. 17 HGL ELEVATION (m) / GRADE (SURGE FLOW)	1469 \ 1.75%													1450 \ 1.43%																																															

HGL SITE D
TAILINGS PIPELINE TO EL. 1340
MAIN DAM
HORIZONTAL SCALE A
VERTICAL SCALE B



STATION (m)	0+000	0+100	0+180	0+200	0+300	0+400	0+500	0+600	0+700	0+800	0+900	1+000	1+100	1+120	1+200	1+300	1+400	1+500	1+600	1+700	1+800	1+853	1+900	1+923	2+000	2+100	2+200	2+300	2+400	2+500	2+600	2+700	2+800	2+900	2+962	3+000	3+100	3+200	3+300	3+400	3+500	3+600	3+700	3+800	3+900	4+000	4+100	4+200	4+300	4+400	4+500	4+600	4+700	4+739
BOTTOM OF PIPE ELEVATION (m)	1433		1433			1419								1379							1370		1353												1353																				1340
PIPELINE DESCRIPTION	30" HYDE DR11 (INTERNAL DIAMETER 615 mm)													30" HYDE DR13.5 (INTERNAL DIAMETER 642 mm)																																																	
YR. 17HGL ELEVATION (m) / GRADE (AVERAGE FLOW)	1392 \ 1.27%													1378 \ 1.04%																																															
YR. 17 HGL ELEVATION (m) / GRADE (SURGE FLOW)	1411 \ 1.75%													1392 \ 1.43%																																															

HGL SITE D
TAILINGS PIPELINE TO EL. 1340
WEST PERIMETER ROAD KS4
HORIZONTAL SCALE A
VERTICAL SCALE B

TAILINGS DISTRIBUTION PIPELINE		
SLURRY DESIGN SUMMARY PER LINE	**AVERAGE**	**SURGE**
SOLIDS THROUGHPUT (DRY TONNES/HOUR)	2,500	3,000
SLURRY PERCENT SOLIDS (BY WEIGHT)	50%	50%
SLURRY FLOW RATE (m^3/h)	3,400	4,080
SLURRY DENSITY (t/m^3)	1.47	1.47

LEGEND:

— — — HGL FOR YEAR 17 (2033) AVERAGE FLOW
— — — HGL FOR YEAR 17 (2033) SURGE FLOW

NOTES:

1. STATION 0+000 IS AT THE TAILINGS THICKENER TANK.
2. DIMENSIONS AND ELEVATIONS IN METRES UNLESS NOTED OTHERWISE.
3. HYDRAULIC GRADE LINES REPRESENT EXPECTED CONDITIONS FOR A RANGE OF FLOWS AND FOR CARRIER FLUID VISCOSITY AT 10°C .
4. HYDRAULIC GRADE LINES ARE SHOWN FOR FULL PIPE FLOW CONDITIONS WITH DROP BOX BYPASSED.

NOT FOR CONSTRUCTION

SCALE B: 50 25 0 50 100 150 200 250 m
SCALE A: 250 125 0 250 500 750 1000 1250 m

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP
0	04DEC13	ISSUED FOR USE	SB	DDF				

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP
0	04DEC13	ISSUED FOR USE	SB	DDF				

REF	NUMBER	TITLE
		REFERENCES

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CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE: FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	VM	08NOV13
		DRN	SB	08NOV13
SCALE: AS SHOWN	PACKAGE CODE	CHK	DDF	04DEC13
		APP		04DEC13

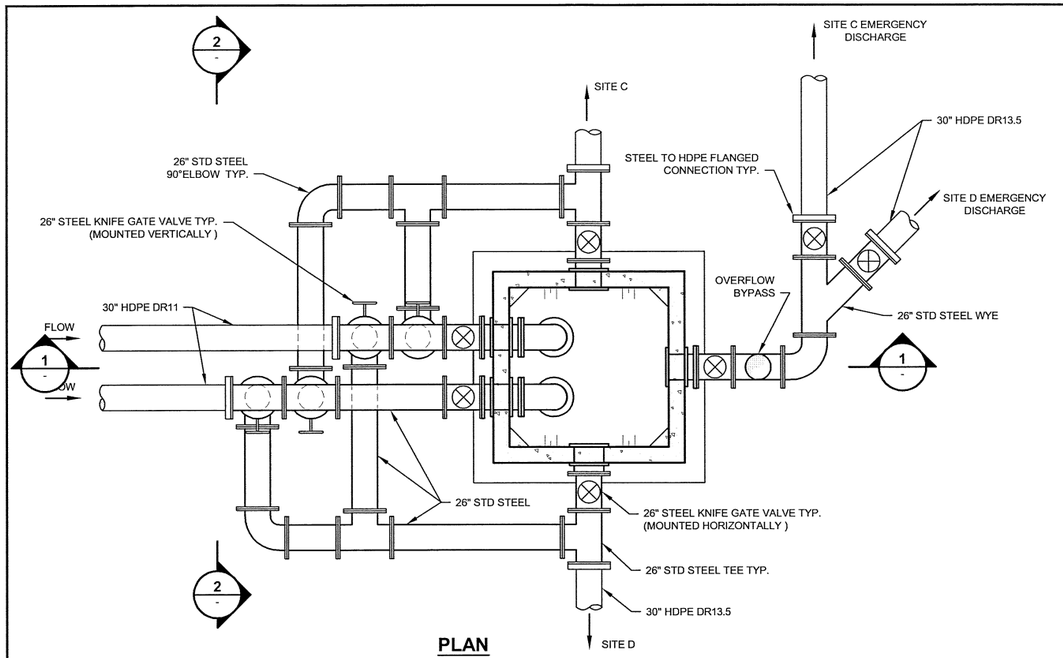
newgold

Knight Piésold CONSULTING

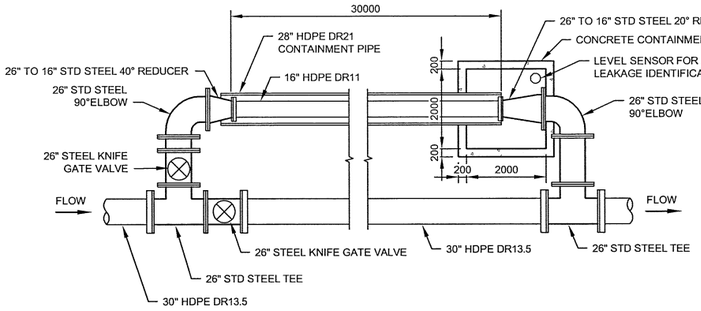
SUBJECT: TAILINGS PIPELINES SITE D HYDRAULIC GRADE LINES YEAR 17 MAIN AND WEST DISTRIBUTION LINES

AREA: -
CLIENT DWG. NO.:
DRAWING NO.: D0267
REV.: 0

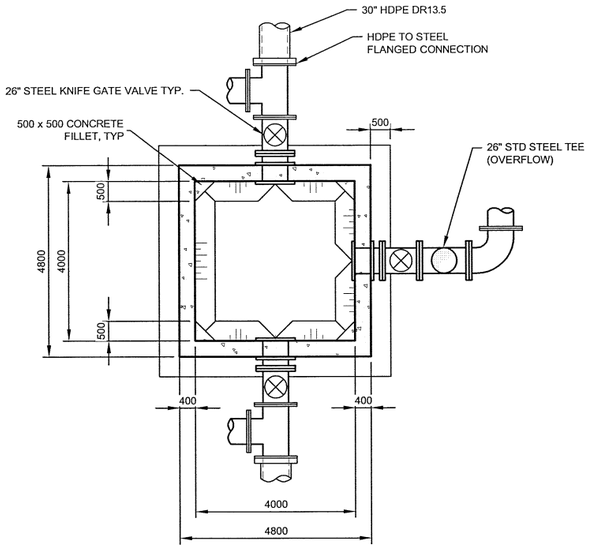
CAD FILE: M:\1\01\VGM\57\00\A\ACAD\DWGS\D0267\D0267-R0.DWG
SAVED: 03-Dec-13 3:07 PM PLOTTED: 03-Dec-13 3:13 PM USER: ABBAS NASIRI



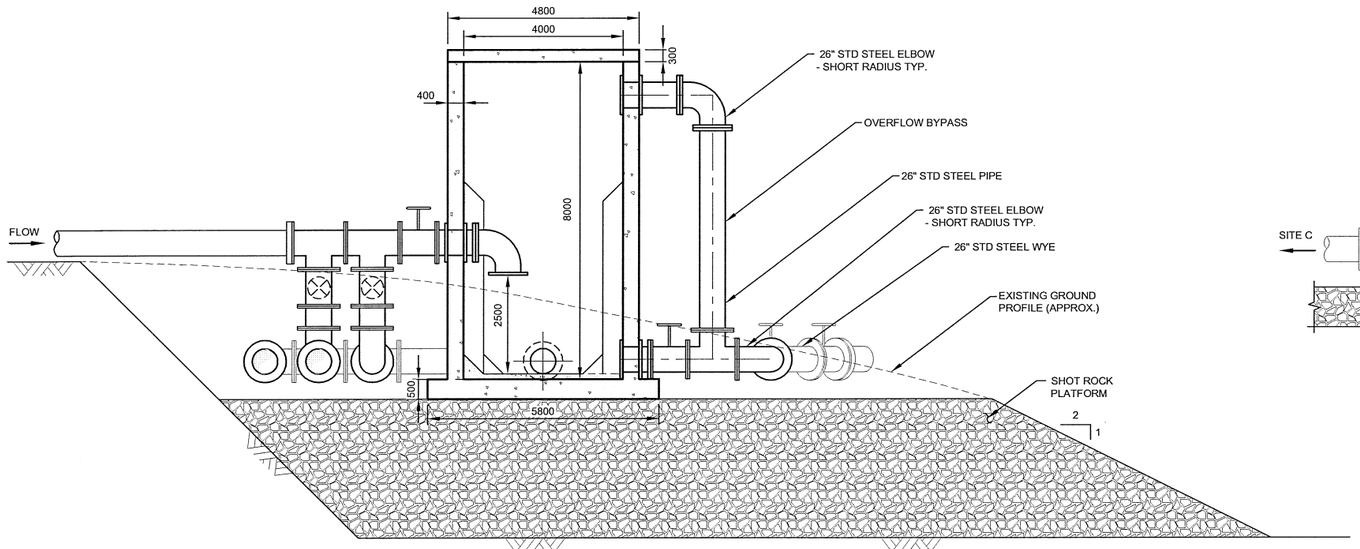
PLAN
DROP BOX
SCALE A



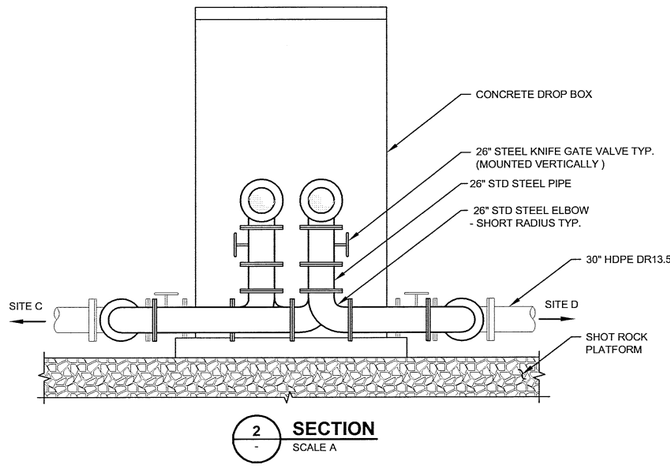
PLAN
CHOKE STATION
SCALE A



DETAIL
DROP BOX STRUCTURE AT BASE
SCALE A



1 SECTION
SCALE A



2 SECTION
SCALE A

NOTES:

1. ALL TEES, REDUCERS AND ELBOWS ARE 1/2" RUBBER LINED STEEL.
2. DIMENSIONS ARE IN MILLIMETRES, UNLESS NOTED OTHERWISE.
3. PIPE SUPPORTS AS REQUIRED.

NOT FOR CONSTRUCTION

SCALE A 1.5 0.75 0 2.5 5.0 7.5 m

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP
0	04DEC13	ISSUED FOR USE	VM	DDF	SRM			

REF	NUMBER	TITLE
		REFERENCES

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CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE: FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.
VA101-457/6	
SCALE: AS SHOWN	PACKAGE CODE

	BY	DDMMMYY
DES	VM	20NOV13
DRN	KJM	20NOV13
CHK	DDF	04DEC13
APP	SRM	04DEC13

newgold

Knight Piésold CONSULTING

SUBJECT: TAILINGS PIPELINES DROP BOX AND CHOKE STATION PLANS, SECTION AND DETAIL

AREA
CLIENT DWG. NO.
DRAWING NO. D0268
REV. 0

SAVED: 03-Dec-13 3:10 PM PLOTTED: 03-Dec-13 3:13 PM USER: ABBAS NASIRI

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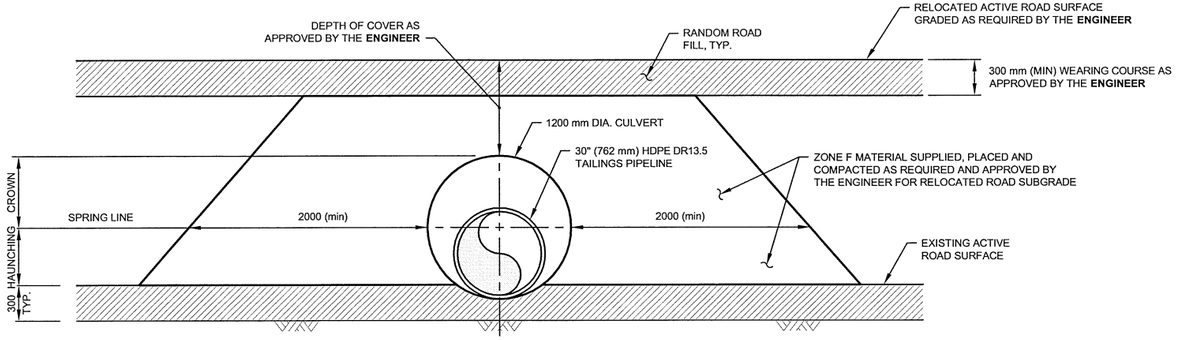
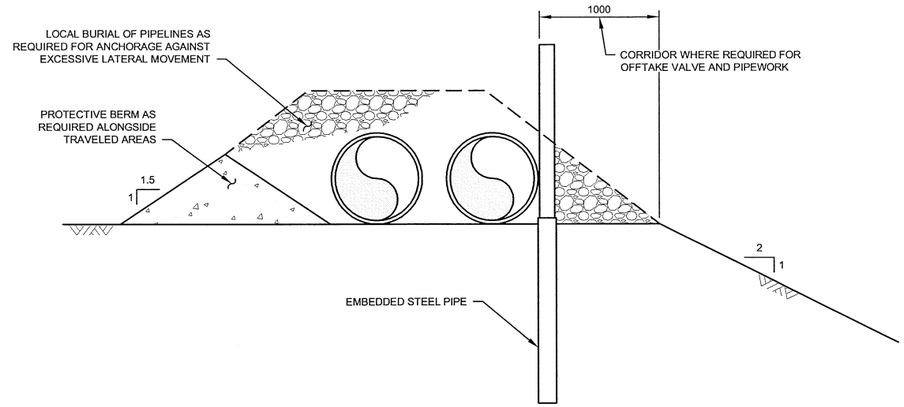
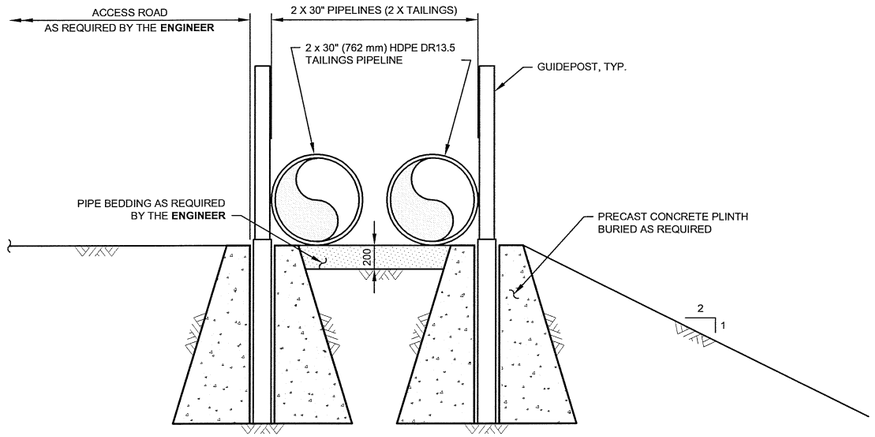


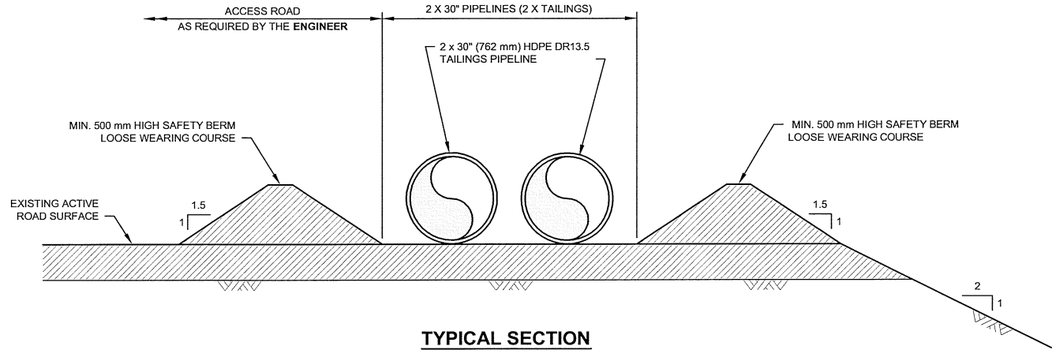
TYPICAL SECTION
CULVERT
SCALE A



TYPICAL SECTION
PIPELINE ANCHORAGE BY BURIAL
SCALE A



TYPICAL SECTION
PIPELINE CORRIDOR
SCALE A



TYPICAL SECTION
PIPELINE CORRIDOR
SCALE A

NOTES:

1. ADDITIONAL ANCHORING REQUIREMENTS MUST BE ASSESSED IN DETAILED DESIGN OR FIELD FIT DURING CONSTRUCTION.
2. DIMENSIONS ARE IN MILLIMETRES, UNLESS NOTED OTHERWISE.

NOT FOR CONSTRUCTION

SCALE A 0.5 0.25 0 0.5 1.0 1.5 2.0 2.5 m

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP
REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP

REF	NUMBER	TITLE
		REFERENCES

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PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
D. D. FONTAINE
36208
Dec 4 2013

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CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE
FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	VM	20NOV13
		DRN	AN	20NOV13
SCALE	PACKAGE CODE	CHK	DDF	04DEC13
1:25		APP	SRM	04DEC13

newgold

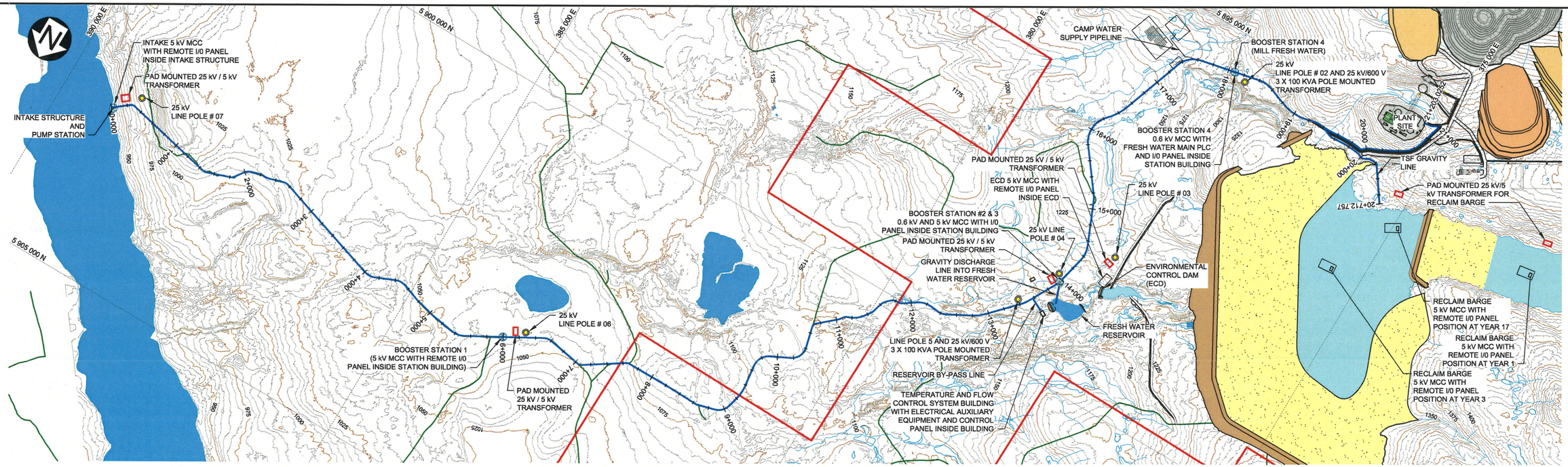
SUBJECT
TAILINGS PIPELINES
SECTIONS AND DETAILS
TYPICAL RESTRAINT OPTIONS

Knight Piésold CONSULTING

AREA
CLIENT DWG. NO.
DRAWING NO. D0269
REV. 0

CAD FILE: M:\101\00457\GA\A\CAD\DWGS\D0269\D0269_R0.DWG

SAVED: 03-Dec-13 4:13 PM PLOTTED: 03-Dec-13 4:13 PM USER: ABBAS NASIR



PLAN
PIPELINE
SCALE A

STRUCTURE LOCATIONS

DESCRIPTION	EASTING (m)	NORTHING (m)
INTAKE STRUCTURE AND PUMP STATION	5,902,922	389,324
BOOSTER STATION 1	5,902,891	383,741
BOOSTER STATION 2 & 3	5,899,019	378,294
ENVIRONMENTAL CONTROL DAM STRUCTURE	5,898,635	377,680
BOOSTER STATION 4	5,895,474	377,649

LEGEND:

- MINE WATER
- FRESH WATER
- PUMPSTATION
- 25 kV POWERLINE POLE
- TRANSFORMER
- FRESH WATER SUPPLY SYSTEM PIPELINE

NOTES:

1. DIMENSIONS AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
2. CONTOUR INTERVAL IS 5 m.

NOT FOR CONSTRUCTION

500 250 0 500 1000 1500 2000 2500 m
SCALE A

REV	DDMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP

REF	NUMBER	TITLE
		REFERENCES

STAMP/SEAL
PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
D. D. FONTAINE
36208
Dec 4 2013

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CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE
FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMYY
VA101-457/6		DES	DL	12NOV13
		DRN	AN	12NOV13
SCALE	PACKAGE CODE	CHK	DDF	04DEC13
AS SHOWN		APP	SRM	04DEC13

newgold

Knight Piésold CONSULTING

SUBJECT
WATER MANAGEMENT SYSTEMS
ELECTRICAL EQUIPMENT LAYOUT

AREA
CLIENT DWG. NO.
DRAWING NO. E0279
REV. 0

CAD FILE: M:\1\01\00457\VA\ACAD\DWGS\E0279\E0279_R0.DWG

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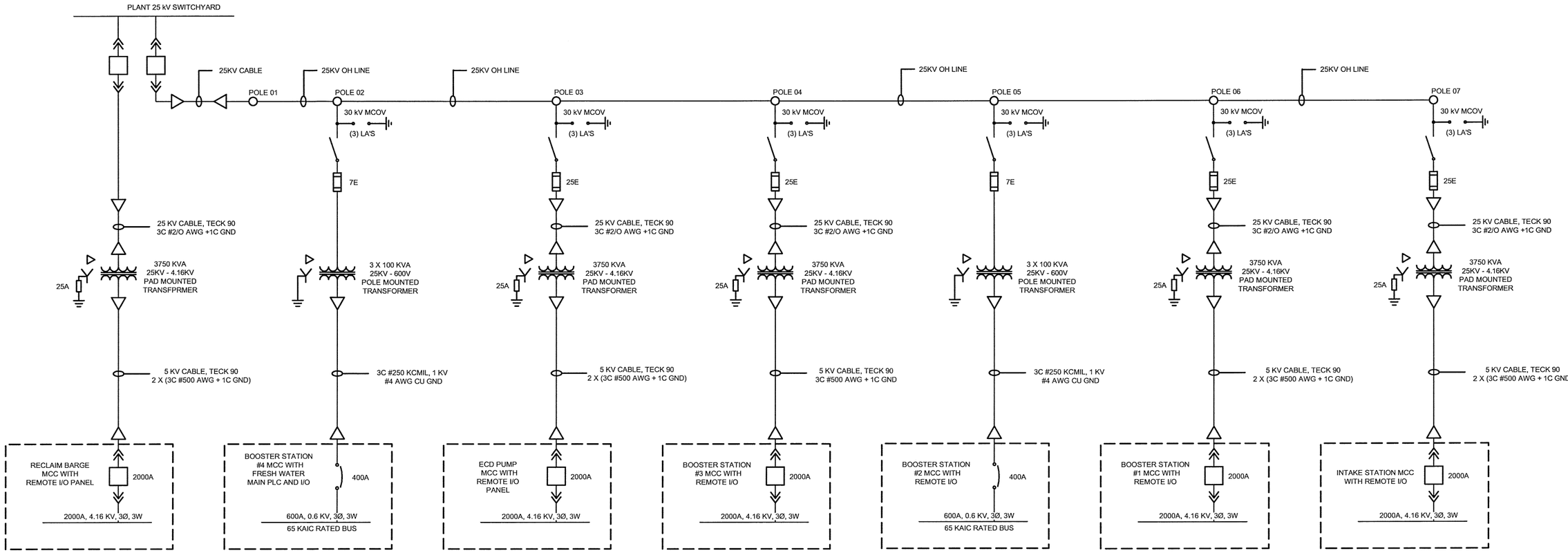

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REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP

REF	NUMBER	TITLE

REFERENCES

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APPROVED FOR _____

CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE
FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	DL	15OCT13
SCALE	PACKAGE CODE	DRN	SB	15OCT13
NTS		CHK	PDF	04DEC13
		APP	SRM	04DEC13

newgold

SUBJECT
WATER MANAGEMENT SYSTEMS
SINGLE LINE DIAGRAM

Knight Piésold CONSULTING

AREA

CLIENT DWG. NO.

DRAWING NO. E0280 REV. 0

SAVED: 03-Dec-13 3:43 PM PLOTTED: 03-Dec-13 4:05 PM USER: ABBAS NASH

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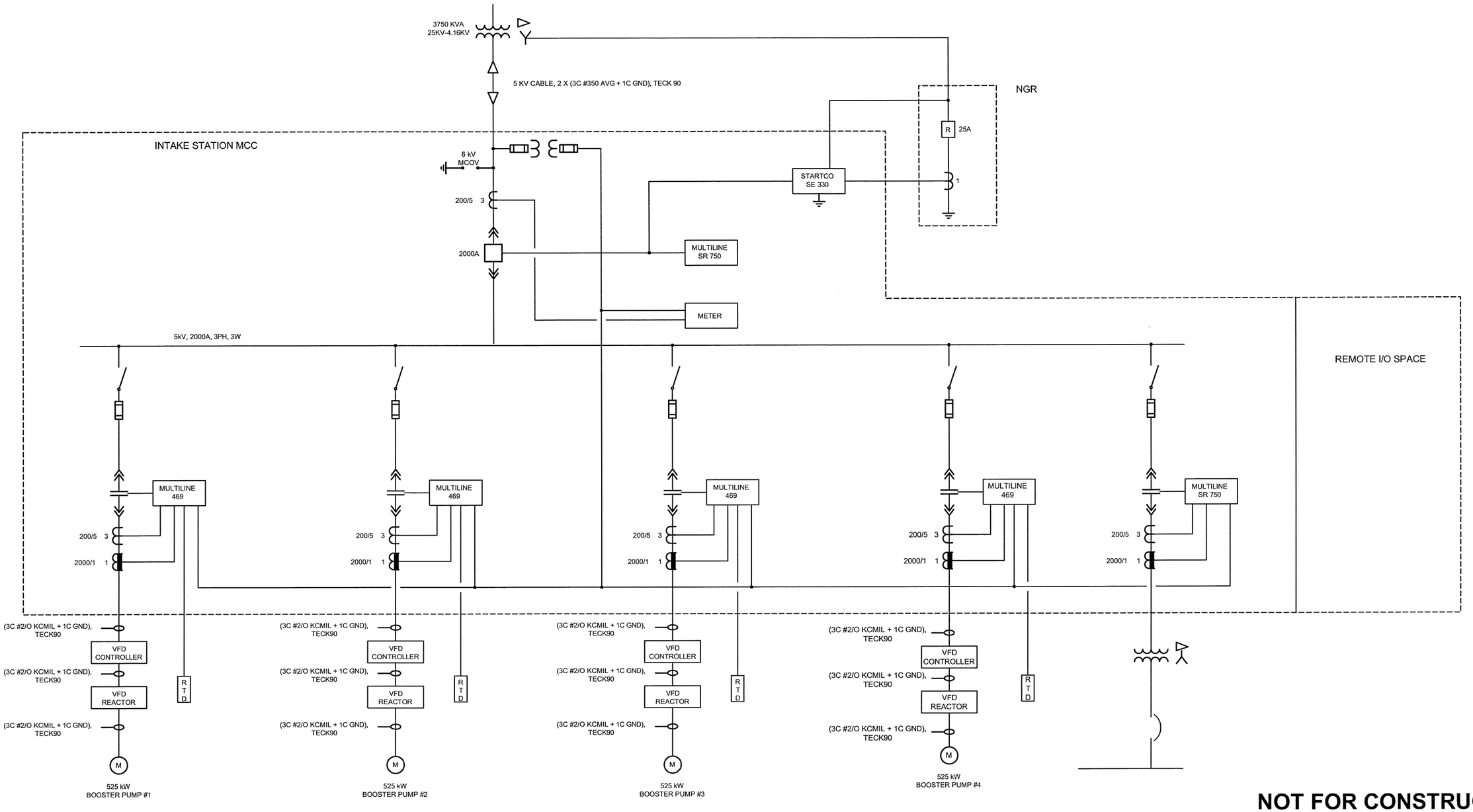

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REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP

REF	NUMBER	TITLE
		REFERENCES

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PROVINCE OF BRITISH COLUMBIA
D. D. FONTAINE
36208
Dec 4, 2013

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CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE
FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	DL	15OCT13
		DRN	SB	15OCT13
SCALE	PACKAGE CODE	CHK	DDF	04DEC13
NTS		APP	RM	04DEC13

newgold

Knight Piésold CONSULTING

SUBJECT
WATER MANAGEMENT SYSTEMS
INTAKE STATION – MCC
SINGLE LINE DIAGRAM

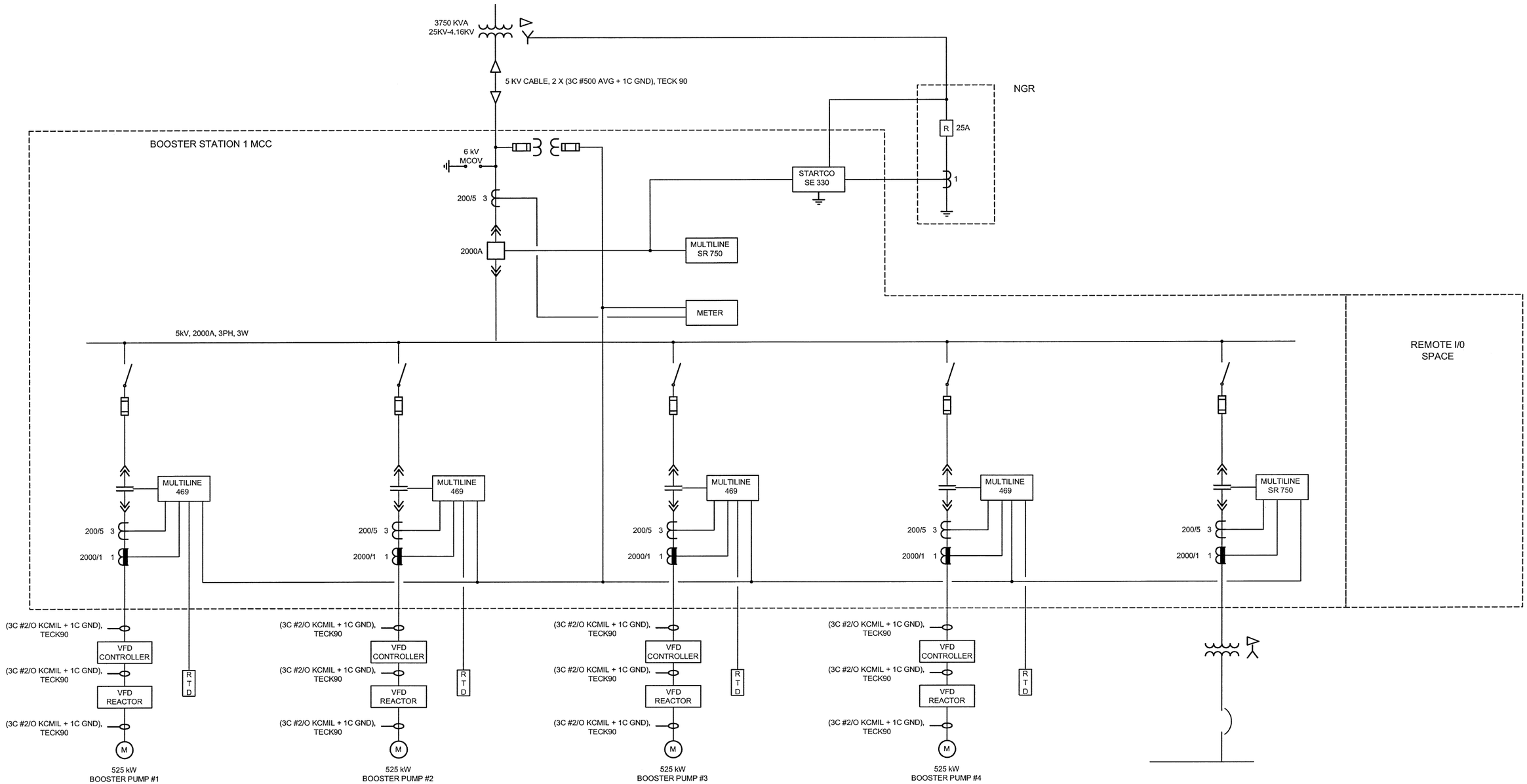
AREA

CLIENT DWG. NO.

DRAWING NO. E0281

REV. 0

SAVED: 03-Dec-13 4:33 PM PLOTTED: 03-Dec-13 4:34 PM USER: ABBAS Ni



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REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP

REF	NUMBER	TITLE
		REFERENCES

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Dec 4/2013

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CLIENT PROJECT MGR.	DEPARTMENT MGR.	PROJECT MGR.

PROJECT PHASE
FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.
VA101-457/6	
SCALE	PACKAGE CODE
NTS	

	BY	DDMMMYY
DES	DL	150CT13
DRN	SB	150CT13
CHK	DDF	04DEC13
APP	SRM	04DEC13

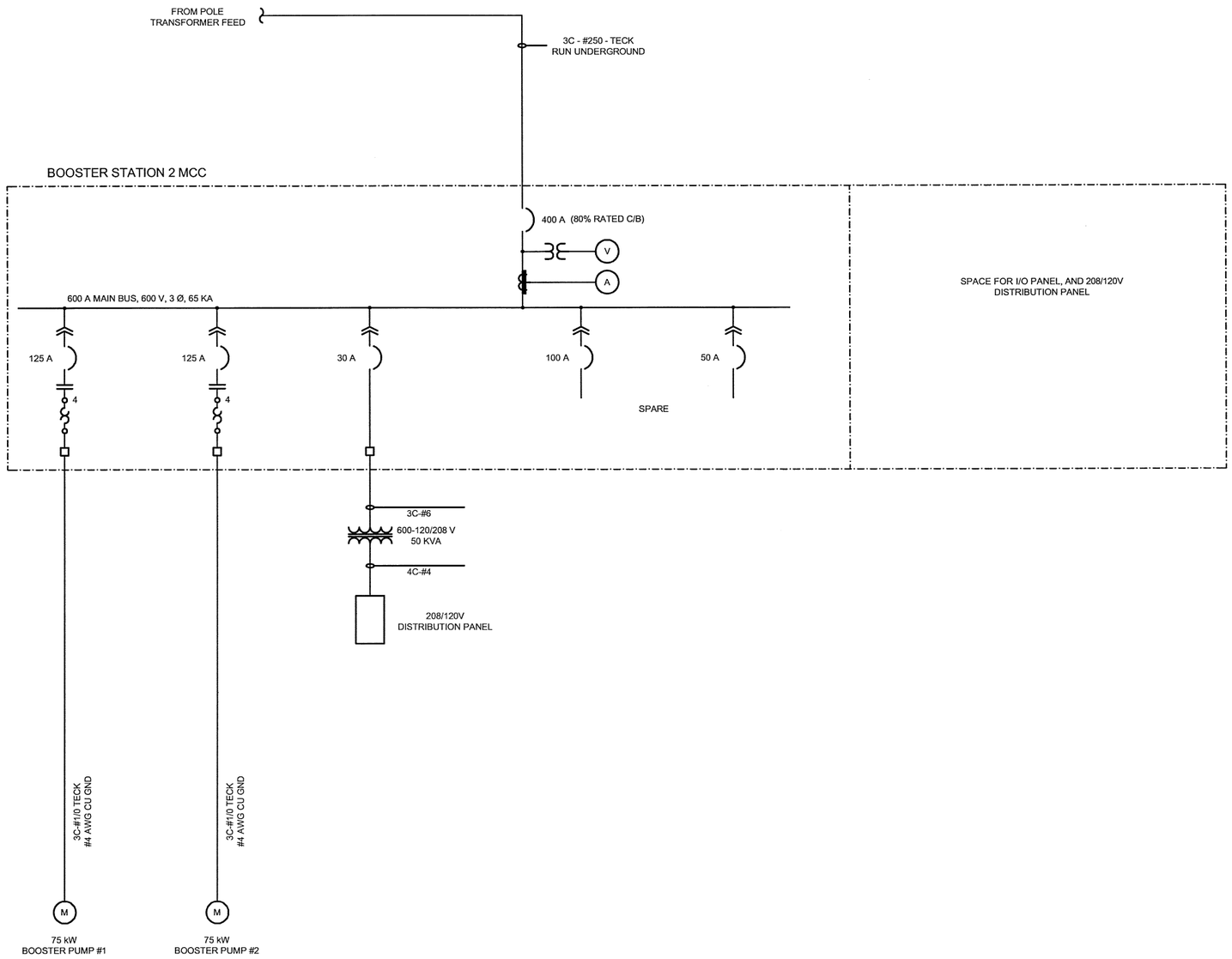
newgold

SUBJECT
WATER MANAGEMENT SYSTEMS
BOOSTER PUMP STATION #1 – MCC
SINGLE LINE DIAGRAM

Knight Piésold CONSULTING

AREA
CLIENT DWG. NO.
DRAWING NO. E0282
REV. 0

SAVED: 03-Dec-13 4:37 PLOTTED: 03-Dec-13 4:37 PM USER: ABBAS Ni PM



NOTES:

1. 20% SPARE STARTERS, BREAKER AND SPACE REQUIRED.
2. MCC SHALL BE PROJECT STANDARD.

NOT FOR CONSTRUCTION

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP	REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP	REF	NUMBER	TITLE

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CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE
FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	DL	15OCT13
		DRN	SB	15OCT13
SCALE	PACKAGE CODE	CHK	DDF	04DEC13
NTS		APP	SRM	04DEC13

newgold

Knight Piésold CONSULTING

SUBJECT
WATER MANAGEMENT SYSTEMS
BOOSTER PUMP STATION #2 – MCC
SINGLE LINE DIAGRAM

AREA

CLIENT DWG. NO.

DRAWING NO. E0283

REV. 0

CAD FILE: M:\1\01\00457\08\A\ACAD\DWGS\E0283\E0283_R0.DWG

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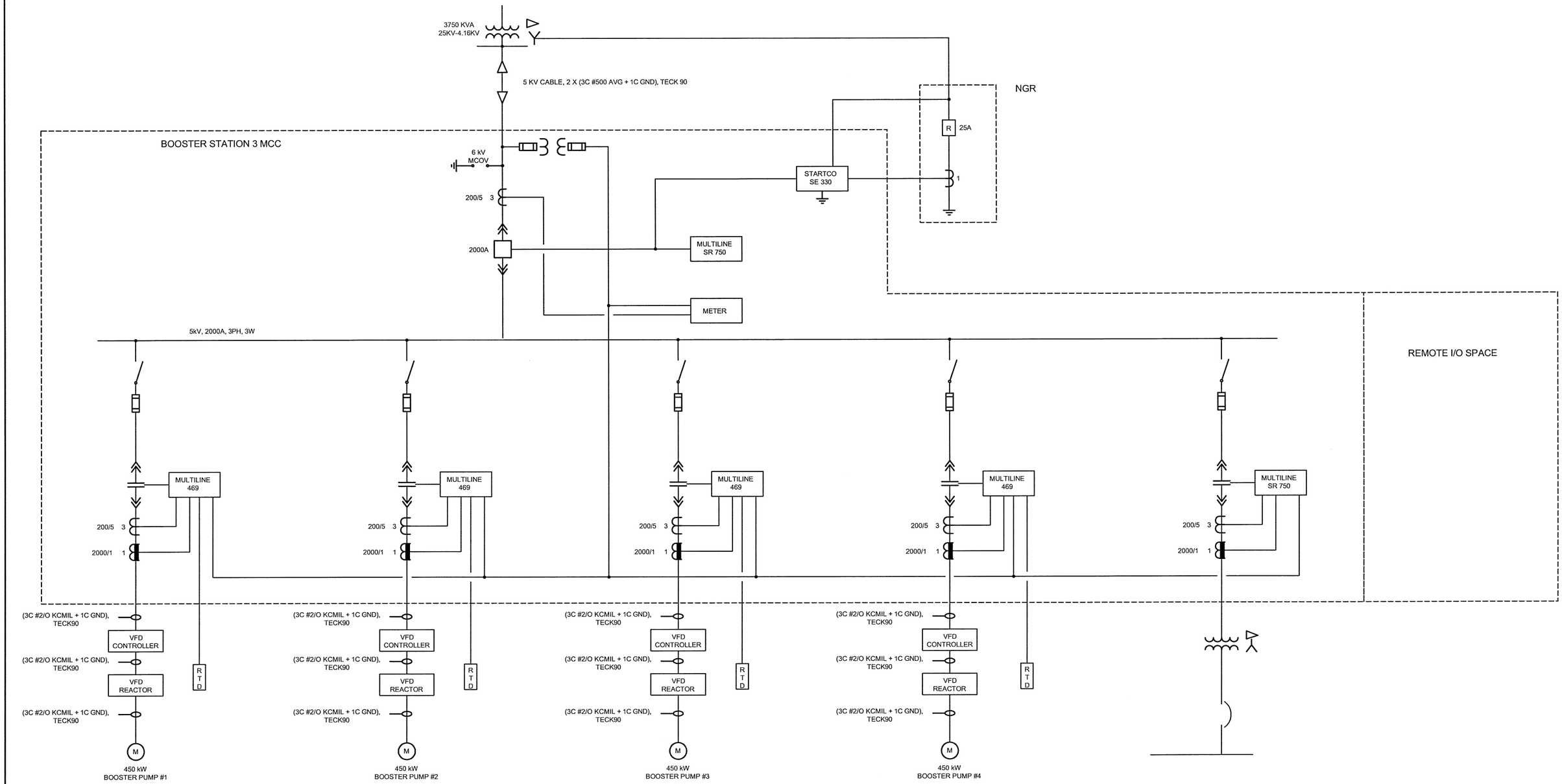

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REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP
REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP

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CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE
FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.
VA101-457/6	
SCALE	PACKAGE CODE
NTS	

	BY	DDMMMYY
DES	DL	15OCT13
DRN	SB	15OCT13
CHK	DDF	04DEC13
APP	SRM	04DEC13

newgold

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SUBJECT
WATER MANAGEMENT SYSTEMS
BOOSTER PUMP STATION #3 – MCC
SINGLE LINE DIAGRAM

AREA
CLIENT DWG. NO.
DRAWING NO. E0284
REV. 0

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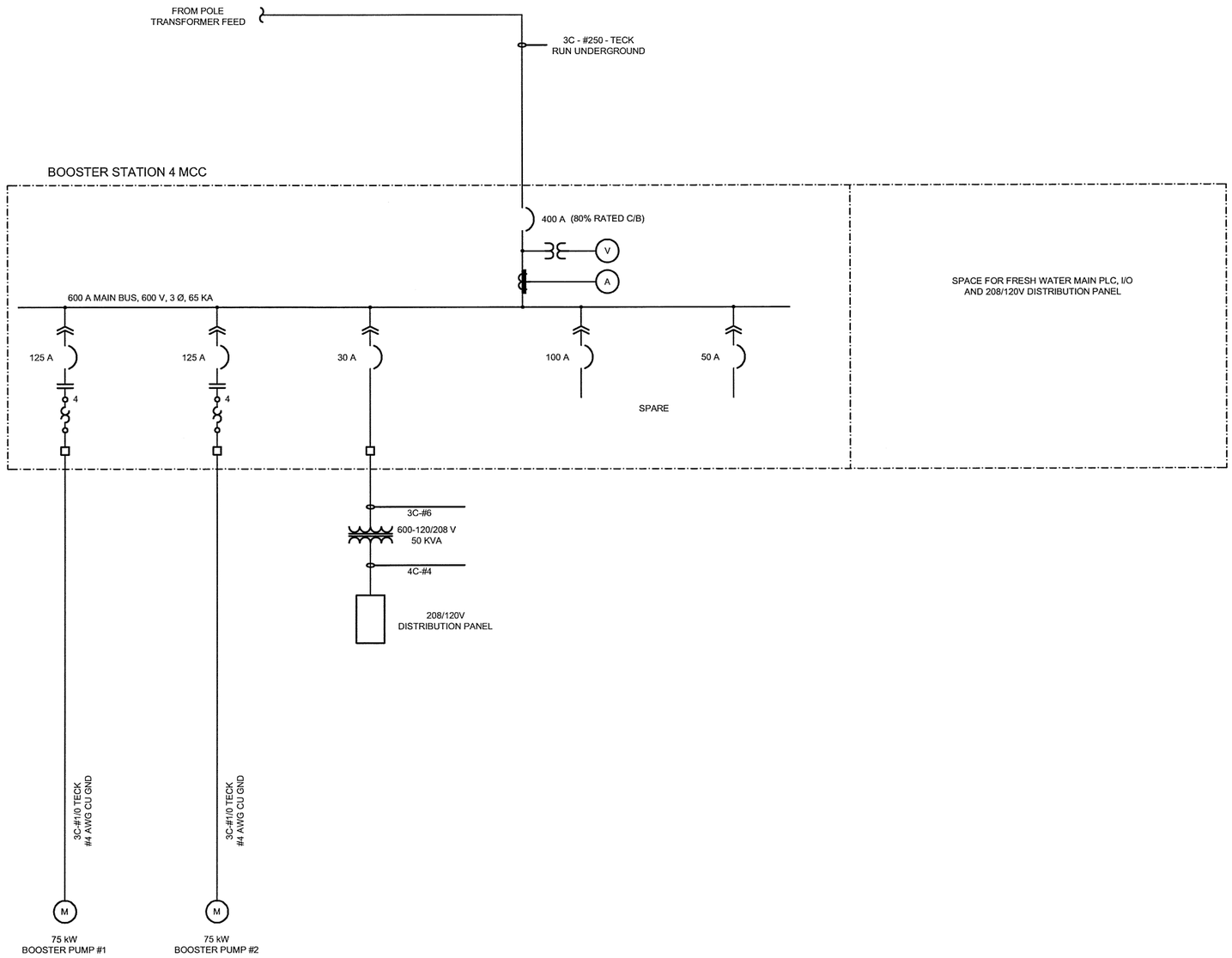

NOTES:

1. 20% SPARE STARTERS, BREAKER AND SPACE REQUIRED.
2. MCC SHALL BE PROJECT STANDARD.

NOT FOR CONSTRUCTION

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP

REF	NUMBER	TITLE
		REFERENCES

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APPROVED FOR _____

CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE
FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	DL	15OCT13
SCALE	PACKAGE CODE	DRN	SB	15OCT13
NTS		CHK	DDF	04DEC13
		APP	RJM	04DEC13

newgold

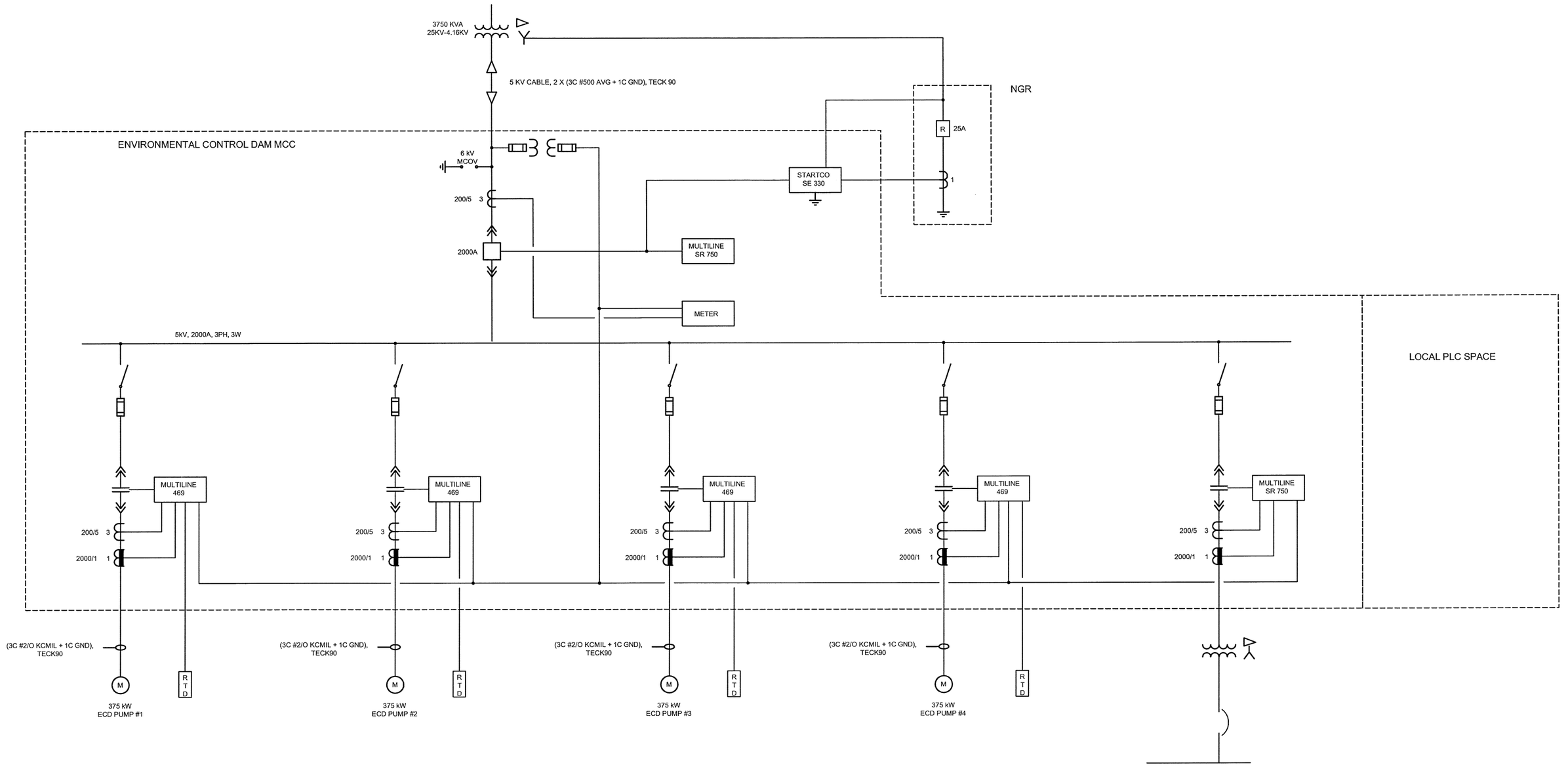
SUBJECT
WATER MANAGEMENT SYSTEMS
BOOSTER PUMP STATION #4 – MCC
SINGLE LINE DIAGRAM

Knight Piésold CONSULTING

AREA
CLIENT DWG. NO.
DRAWING NO. E0285
REV. 0

CAD FILE: M:\1\01\00457\GA\VA\CAD\DWGS\E0285\E0285_RD.DWG

SAVED: 03-Dec-13 4:45 PM PLOTTED: 03-Dec-13 4:45 PM USER: ABBAS NASR



NOT FOR CONSTRUCTION

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP	REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP	REF	NUMBER	TITLE

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CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE
FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	DL	15OCT13
SCALE	PACKAGE CODE	DRN	SB	15OCT13
NTS		CHK	DDF	04DEC13
		APP	SRM	04DEC13

newgold

SUBJECT
WATER MANAGEMENT SYSTEMS
ENVIRONMENTAL CONTROL DAM – MCC
SINGLE LINE DIAGRAM

Knight Piésold
CONSULTING

AREA

CLIENT DWG. NO.

DRAWING NO. E0286

REV. 0

SAVED: 03-Dec-13 4:48 PM PLOTTED: 03-Dec-13 4:48 PM USER: ABBAS NASIF

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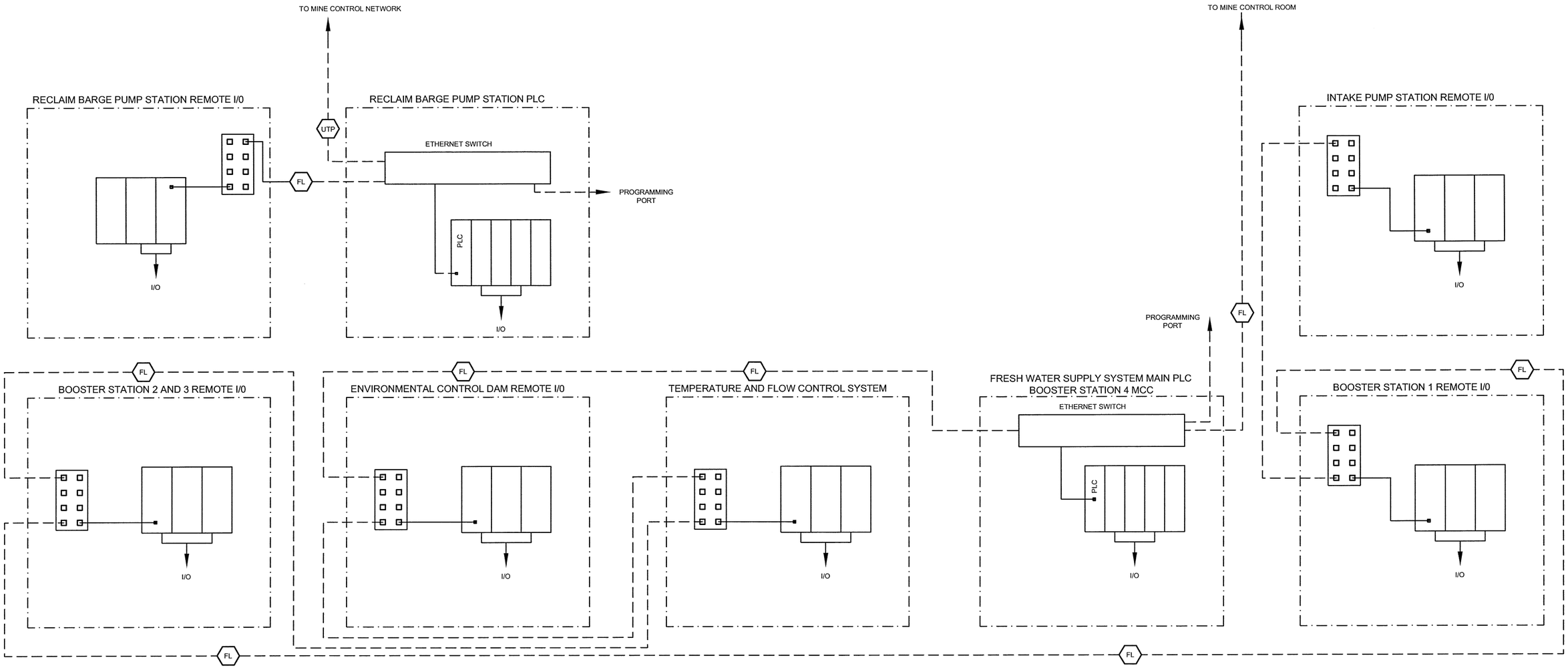

LEGEND:

FL — FIBRE OPTIC CABLE

UTP — ETHERNET COMMUNICATIONS CABLE 4-PAIR CAT. 5 UNSHIELDED TWISTED PAIR (UTP) AT BOTH ENDS WITH RJ-45 CONNECTORS

NOT FOR CONSTRUCTION

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP

REF	NUMBER	TITLE
		REFERENCES

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CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE: SINGLE LINE DIAGRAM

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	DL	15OCT13
SCALE	PACKAGE CODE	DRN	SB	15OCT13
NTS		CHK	DDF	04DEC13
		APP	JRM	04DEC13

newgold

SUBJECT: WATER MANAGEMENT SYSTEMS CONTROL BLOCK DIAGRAM

Knight Piésold CONSULTING

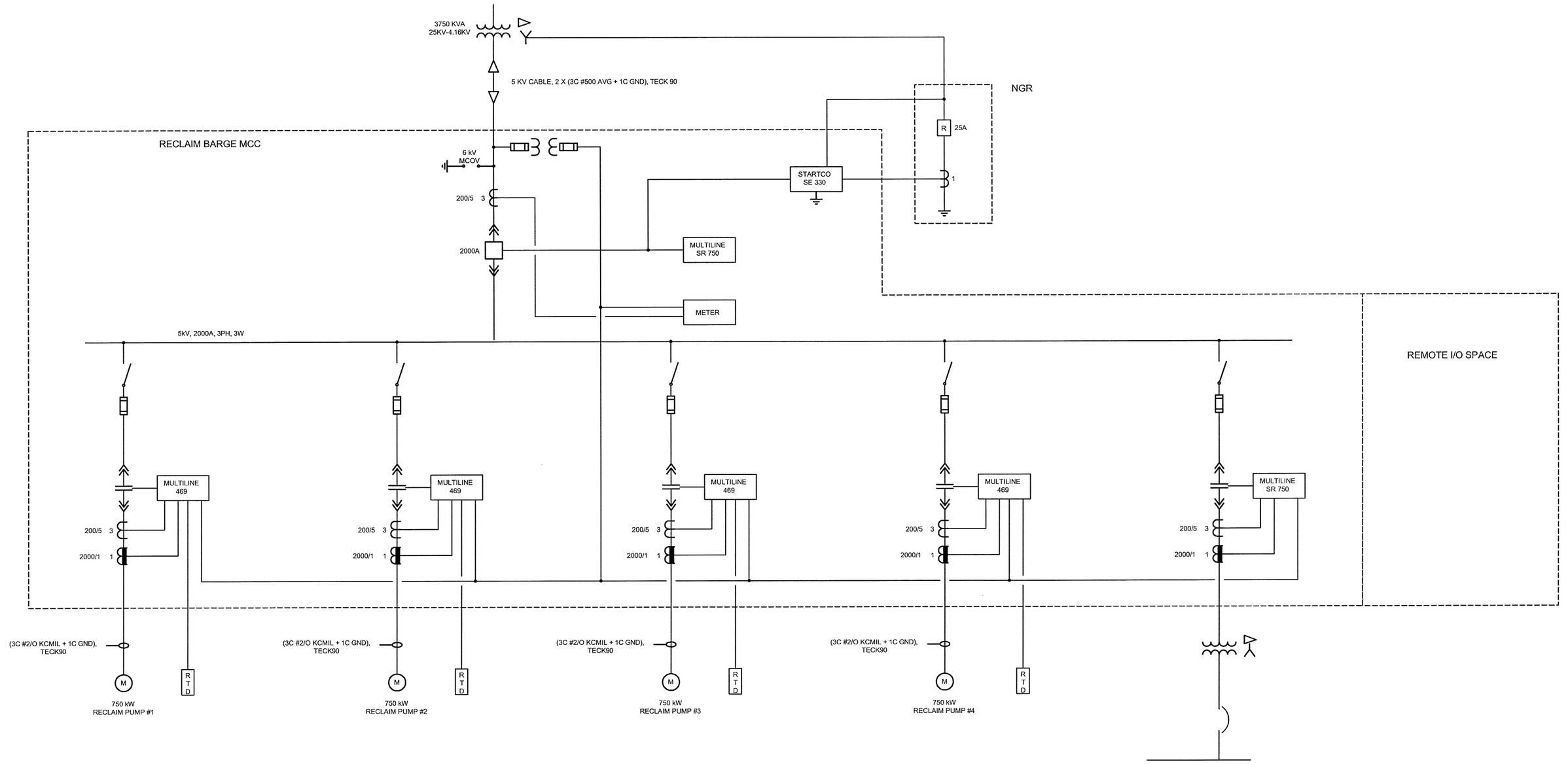
AREA

CLIENT DWG. NO.

DRAWING NO. E0287 — REV. 0

CAD FILE: M:\1\01\00457\VA\CAD\DWGS\E0287\E0287_RD.DWG

SAVED: 03-Dec-13 3:50 PM PLOTTED: 03-Dec-13 4:04 PM USER: ABBAS NASR



NOT FOR CONSTRUCTION

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP

REF	NUMBER	TITLE
		REFERENCES

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DEC 4 2013

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APPROVED FOR _____

CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE
FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	DL	15OCT13
SCALE	PACKAGE CODE	DRN	SB	15OCT13
NTS		CHK	DDF	04DEC13
		APP	SRM	04DEC13

newgold

SUBJECT
WATER MANAGEMENT SYSTEMS
RECLAIM BARGE – MCC
SINGLE LINE DIAGRAM

Knight Piésold CONSULTING

AREA
CLIENT DWG. NO.
DRAWING NO. E0288
REV. 0

SAVED: 03-Dec-13 4:51 PM PLOTTED: 03-Dec-13 4:51 PM USER: ABBAS NASR

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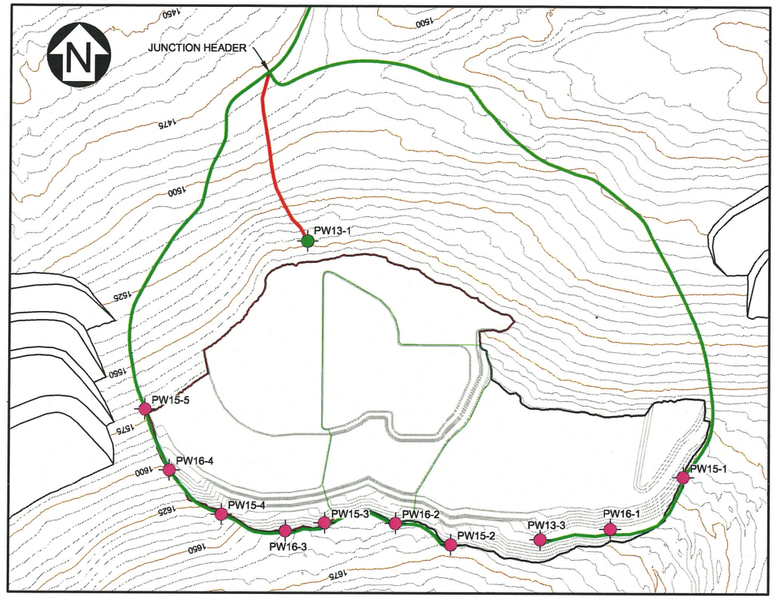
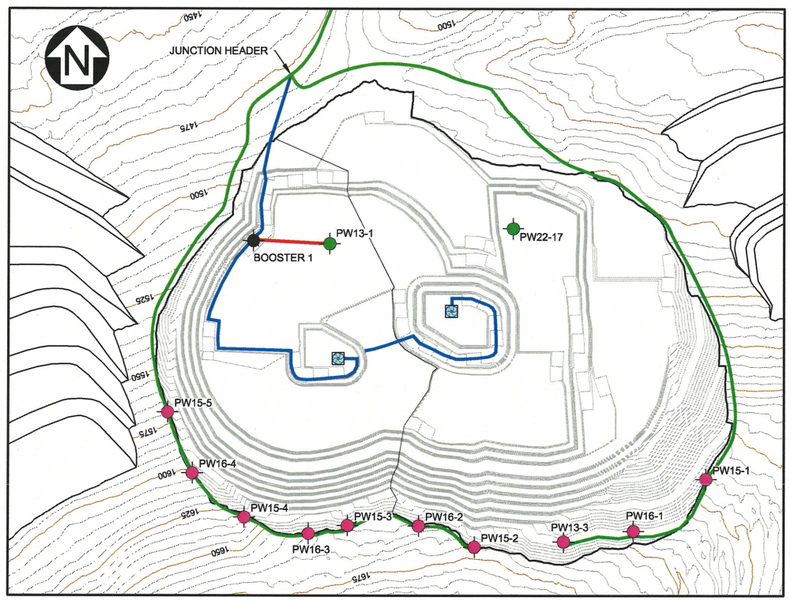
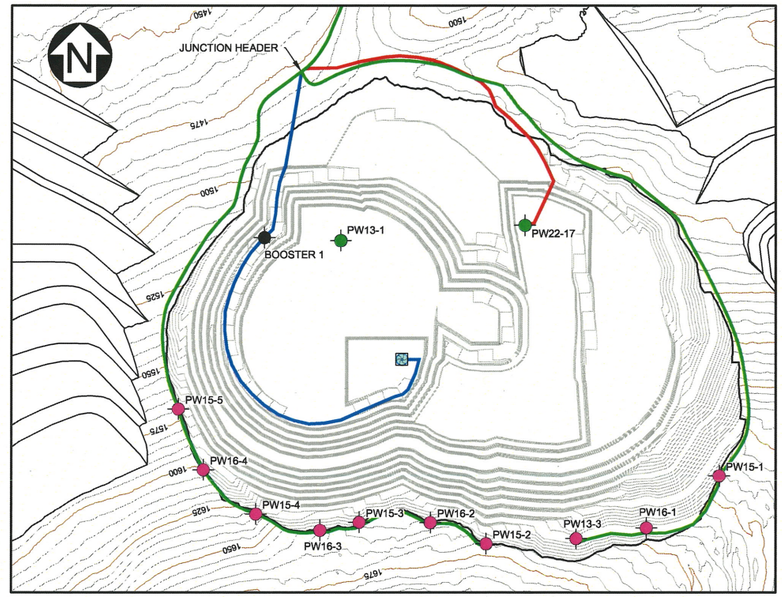


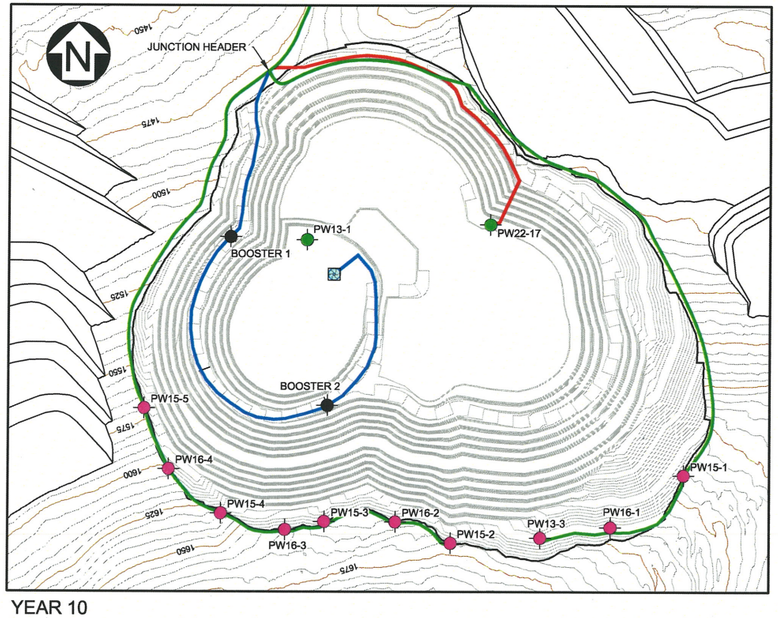
YEAR 1



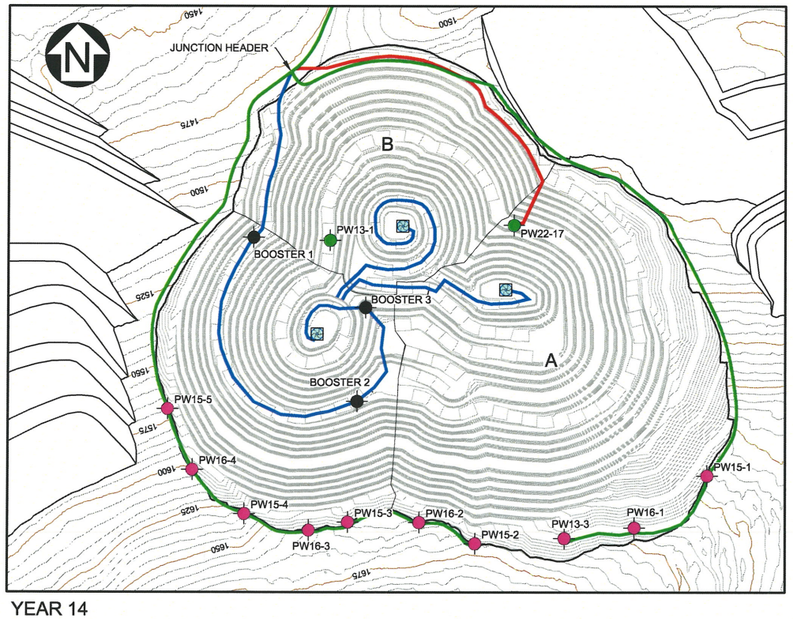
YEAR 6



YEAR 7



YEAR 10



YEAR 14

LEGEND:

- PERIMETER WELL PIPELINE
- IN-PIT DEPRESSURIZATION WELL PIPELINE
- SURFACE WATER MANAGEMENT PIPELINE
- BOOSTER PUMP
- PERIMETER DEPRESSURIZATION PUMPING WELL
- IN-PIT DEPRESSURIZATION PUMPING WELL
- SUMP PIT PUMPSTATION

NOTES:

1. CONTOUR INTERVAL IS 5 METRES.
2. OPEN PIT DESIGN PROVIDED BY NORWEST CORPORATION (AUG 2013)

NOT FOR CONSTRUCTION

SCALE A 200 100 0 200 400 600 800 1000 m

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP

REF	NUMBER	TITLE
		REFERENCES

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CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE: FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.
VA101-457/6	
SCALE: AS SHOWN	PACKAGE CODE

	BY	DDMMMYY
DES	DBR	08NOV13
DRN	AN	08NOV13
CHK	DDF	04DEC13
APP	SRM	04DEC13

newgold

SUBJECT: OPEN PIT DEWATERING PLAN IN-PIT WATER MANAGEMENT STAGED DEVELOPEMENT

Knight Piésold CONSULTING

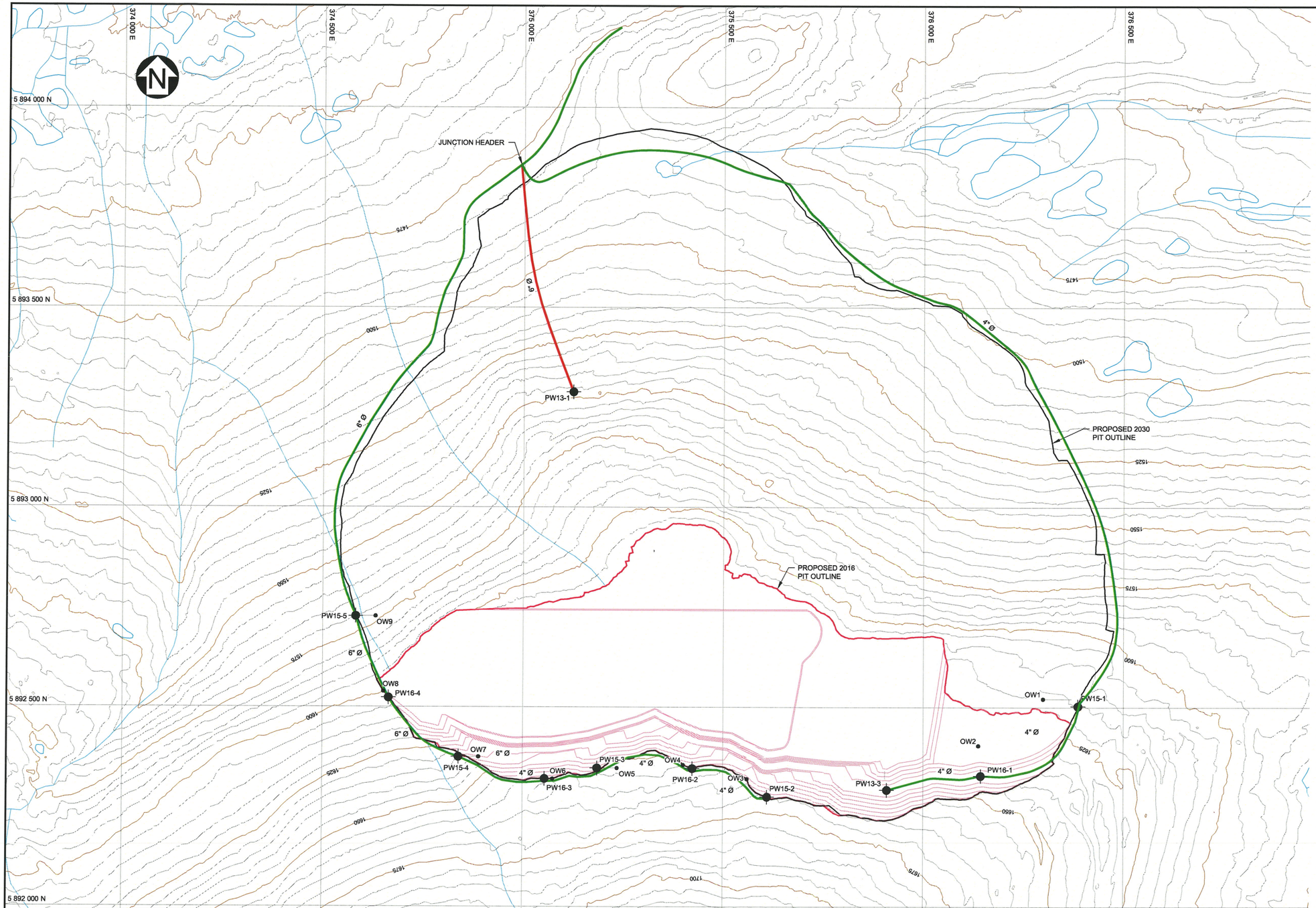
AREA

CLIENT DWG. NO.

DRAWING NO. D0300 REV. 0

CAD FILE: M:\1\101\00457\05\A\ACAD\DWGS\D0300\D0300-R0.DWG

SAVED: 03-Dec-13 3:23 PLOTTED: 03-Dec-13 3:29 PM USER: ABBAS NAS



NAME	EASTING (m)	NORTHING (m)	ELEV (m)
PW15-1	376,350	5,892,521	1616
PW15-2	375,610	5,892,320	1666
PW15-3	375,186	5,892,347	1655
PW15-4	374,840	5,892,375	1635
PW15-5	374,582	5,892,727	1570
PW13-3	375,905	5,892,341	1646
PW16-1	376,139	5,892,373	1615
PW16-2	375,424	5,892,346	1658
PW16-3	375,055	5,892,320	1656
PW16-4	374,665	5,892,523	1602

LEGEND :

- PW — PUMP WELLS WITH OBSERVATION WELLS
- PERIMETER WELL PIPELINE
- IN-PIT DEPRESSURIZATION WELL PIPELINE
- 2016 Q4 CONTOURS

NOT FOR CONSTRUCTION

NOTES:

1. CONTOUR INTERVAL IS 5 METRES.
2. OPEN PIT DESIGN PROVIDED BY NORWEST CORPORATION (AUG. 2013).
3. BENCHES TO BE CONSTRUCTED FOR ACCESS TO PIPELINES LOCATED WITHIN OPEN PIT.

SCALE A 100 50 0 100 200 300 400 500 m

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP

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CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE: FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.
VA101-457/6	
SCALE: AS SHOWN	PACKAGE CODE

	BY	DDMMMYY
DES	DBR	22NOV13
DRN	AN	22NOV13
CHK	DDF	04DEC13
APP	SKM	04DEC13

newgold

Knight Piésold CONSULTING

SUBJECT: OPEN PIT DEWATERING PLAN INITIAL

AREA

CLIENT DWG. NO.

DRAWING NO. D0301 REV. 0

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CAD FILE: M:\1\01\D0457\06\A\ACAD\DWGS\D0301D0301 R0.DWG

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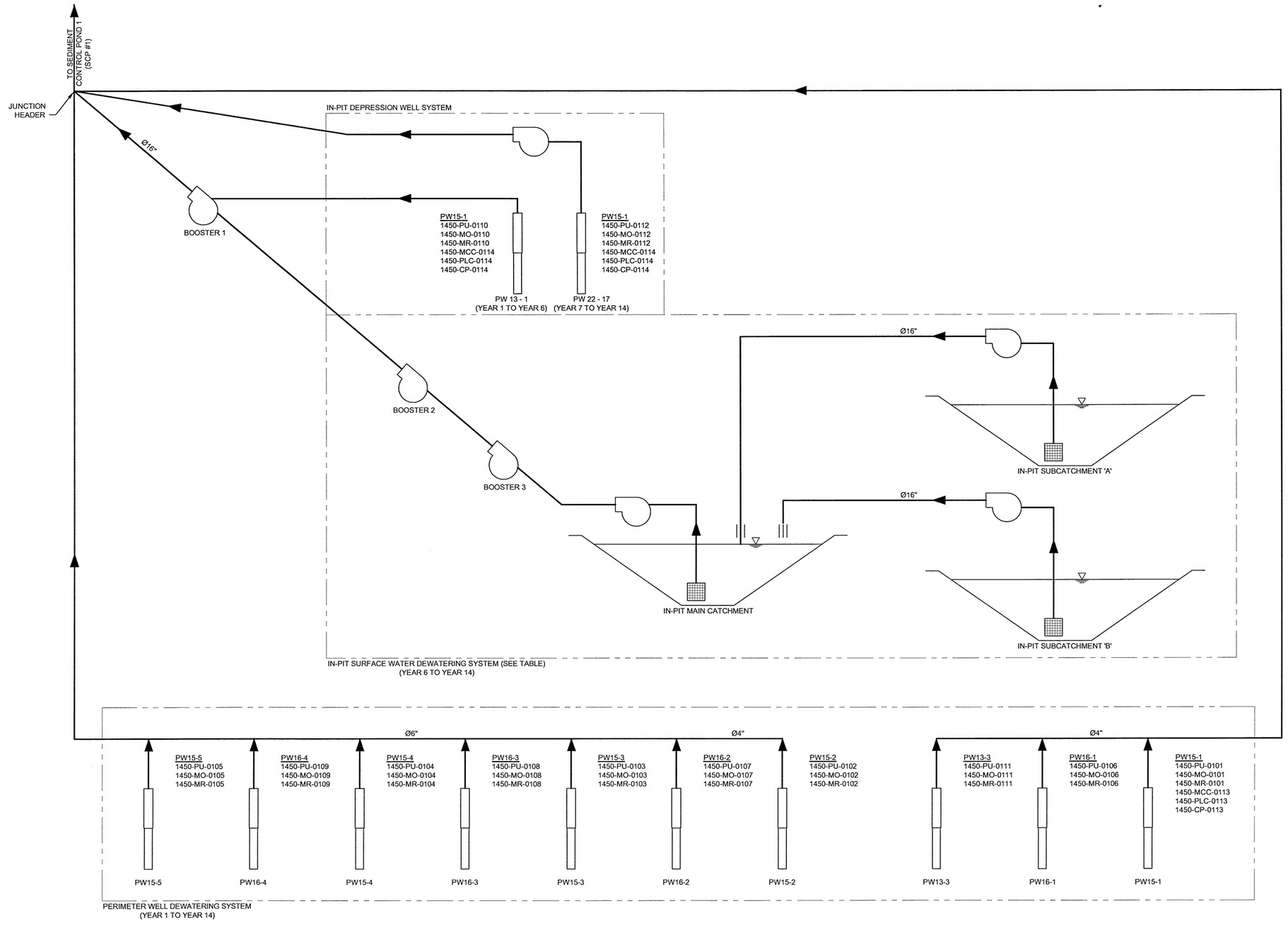

LEGEND:

- PIPE FLOW
- FLOW DIRECTION
- FREE DISCHARGE
- SCREENED INTAKE
- CENTRIFUGAL TURBINE PUMP
- VERTICAL TURBINE PUMP

IN - PIT SURFACE WATER DEWATERING SYSTEM	
YEAR	PUMPS
1	0
6	3
7	2
9	3
13	6

EQUIPMENT NUMBER LEGEND

PU	PUMP
MR	MOTOR STARTER
MCC	MOTOR CONTROL CENTRE
PLC	PROGRAMMABLE LOGIC CENTRE
CP	CONTROL PANEL
MO	MOTOR ELECTRIC

NOTES:

1. DESIGN DOES NOT INCLUDE ALL REQUIRED INSTRUMENTATION AND CONTROLS.
2. PUMP / BOOSTER CONFIGURATION AS PER DRAWING D0300.

NOT FOR CONSTRUCTION

REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP
REV	DDMMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP

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CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE: FEASIBILITY STUDY

PROJECT NO.	ACTIVITY NO.		BY	DDMMMYY
VA101-457/6		DES	DBR	22NOV13
SCALE: NTS	PACKAGE CODE	DRN	KJM	22NOV13
		CHK	DDF	04DEC13
		APP	SRM	04DEC13

newgold

SUBJECT: OPEN PIT DEWATERING PROCESS FLOW SCHEMATIC YEAR 1 – 14

Knight Piésold CONSULTING

AREA

CLIENT DWG. NO.

DRAWING NO. D0303 REV. 0

SAVED: 03-Dec-13 3:29 PM PLOTTED: 03-Dec-13 3:29 PM USER: ABBAS MASHINCHI
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APPENDIX B

SEISMIC HAZARD ASSESSMENT

(Pages B-1 to B-9)

APPENDIX B

NEW GOLD INC.
BLACKWATER GOLD PROJECT

MINE WASTE AND WATER MANAGEMENT DESIGN REPORT
SEISMIC HAZARD ASSESSMENT

B.1 INTRODUCTION

A seismicity assessment has been carried out for the Blackwater Gold Project, including a review of the regional seismicity and a seismic hazard analysis. The results of the seismic hazard analysis are required to provide seismic design parameters for the design of the Tailings Storage Facility (TSF) and for other facilities at the project site, including mine waste stockpiles. Design ground motion parameters provided by the seismic hazard analysis include peak ground acceleration, spectral acceleration (defining the uniform hazard spectrum) and earthquake magnitude.

The findings of the seismicity review and the methodology and results of the seismic hazard analysis are presented in the following sections.

B.2 REGIONAL TECTONICS AND SEISMICITY

The Blackwater Gold project is situated within central B.C., where the level of recorded historical seismic activity has been low. The maximum earthquake magnitude for this region of central B.C. is estimated to be about Magnitude 7.0, based on historical earthquake data and the regional tectonics (Adams and Halchuk, 2003). There is potential for larger earthquakes of up to about Magnitude 7.5 along the coastal region of mainland western B.C., including the Coast Mountains. Figure B.1 shows the regional tectonics and historical seismicity of central and southern B.C. and the location of the Blackwater Gold project.

The high seismicity offshore and west of the project site is associated with the Queen Charlotte fault system, which runs underwater along the west coast of Haida Gwaii and defines the boundary between the Pacific and North American tectonic plates. The coastal region has experienced many large earthquakes, including events in the range of Magnitude 7.0 to 8.1. A Magnitude 8.1 earthquake occurred along this fault in 1949. This event is the largest instrumentally recorded earthquake in Canada since 1700. There is potential for earthquakes of up to about Magnitude 8.5 along this fault system (Adams and Halchuk, 2003). More recently two large earthquakes have occurred along the Queen Charlotte fault system. A Magnitude 7.7 earthquake was recorded on the Queen Charlotte fault on October 27, 2012, located on Moresby Island (of the Haida Gwaii archipelago). This was followed by a Magnitude 7.5 event on January 5, 2013, located farther to the north and offshore of southeast Alaska. The Magnitude 7.7 earthquake was the closest of these events to the project site, at a distance of approximately 475 km to the west, as shown on Figure B.1. The amplitude of peak ground accelerations experienced at the project site from large earthquakes along the Queen Charlotte fault system would be low due to attenuation over such a large distance. However, longer period motions resulting from these large magnitude earthquakes at a large distance may be more significant.

The seismic hazard along the southwest coast of B.C. is significant due to subduction zone earthquakes along offshore faults and within the subducting oceanic tectonic plate (Juan de Fuca Plate). There is potential for very large earthquakes of Magnitude 8.0 to 9.0+ along this Cascadia subduction zone. Geological evidence indicates that these great subduction earthquakes occur on average approximately

every 500 years, but this interval varies from about 300 to 800 years. The last great Cascadia earthquake (estimated Magnitude of about 9.0) occurred over 300 years ago, in 1700. However, such an event would be located over 400 km southwest of the project site, and therefore the amplitude of ground motions experienced at the site would be low due to attenuation over such a large distance. Peak ground accelerations at the project site from a great subduction earthquake would likely be less than 0.05g. However, longer period motions resulting from these large magnitude earthquakes at a large distance may be more significant.

There is also potential for intraslab (inslab) earthquakes, occurring deep within the subducted Juan de Fuca plate that extends eastwards beneath the North American plate. These events, which have potential to be as large as Magnitude 7.0 to 7.5, would likely occur over 300 km to the southwest, at a depth of over 35 km. Ground motions experienced at the project site for this type of subduction earthquake are also likely to be less than 0.05g.

The level of seismicity in the interior of B.C. and the Rocky Mountains region drops off rapidly with distance from the west coast and to the north. The largest earthquake recorded in the southern Cordillera region was an event of about Magnitude 6.0 in 1918, located in the Valemount area of the Rocky Mountain trench. More recently, a Magnitude 5.4 earthquake occurred near Prince George in 1986 causing minor damage and a Magnitude 5.3 earthquake occurred in 2001 east of Dawson Creek. The maximum earthquake magnitude for eastern B.C. and the Rocky Mountains is estimated to be about Magnitude 7.0, with an upper bound estimate of Magnitude 7.3, based on historical earthquake data and the regional tectonics (Adams and Halchuk, 2003).

B.3 SEISMIC HAZARD ANALYSIS

The seismic hazard for the Blackwater Gold project has been defined using probabilistic methods of analysis. This method requires an examination of historical earthquake data and the regional tectonics to identify potential seismic sources and to determine the maximum earthquake magnitude for each seismic source. Appropriate relationships defining the attenuation of earthquake ground motion with distance are also required.

Design ground motion parameters have been determined for the project site using information provided by the probabilistic seismic hazard database of Natural Resources Canada (NRC) (http://earthquakescanada.nrcan.gc.ca/hazard-alea/zoning/haz-eng.php). The results are summarized in Table B.1 in terms of earthquake return period, probability of exceedance (for a 17 year design operating life) and the corresponding peak ground acceleration (median and mean hazard values). However, the NRC database only provides ground motion parameters up to a return period of approximately 2500 years (corresponding to a 2% probability of exceedance in 50 years). Higher return periods need to be considered for dam design if the classification is defined as Very High or Extreme (based on the requirements of the 2007 Canadian Dam Safety Guidelines). Therefore, a probabilistic seismic hazard analysis has been conducted to provide ground motion parameters beyond 2500 years, specifically for return periods of 5,000 and 10,000 years.

The methodology used to complete the site-specific probabilistic seismic hazard analysis and the results of the analysis are described in the following sections.

B.3.1 Ground Motion Attenuation

Appropriate attenuation models defining the relationship between earthquake magnitude, source to site distance and peak ground motion (acceleration) are required to carry out a probabilistic seismic hazard

analysis. The ground motions experienced at the project site are dependent on the regional ground motion attenuation characteristics and the earthquake source mechanism.

For shallow crustal earthquakes a set of four ground motion attenuation models, known as the New Generation Attenuation (NGA) relations was used (Earthquake Spectra, 2008). These include the ground motion relationships of Abrahamson and Silva, Boore and Atkinson, Campbell and Bozorgnia and Chiou and Youngs. These ground motion attenuation relationships are applicable to shallow crustal earthquakes in western North American and similar tectonic regions of the world. The predicted peak ground accelerations for shallow crustal earthquakes are average values calculated using the four attenuation relationships (equal weighting).

The peak ground accelerations and spectral accelerations predicted using the attenuation relationships are for soft rock/very dense soil site conditions, assuming an average shear wave velocity in the upper 30 meters (defined as the Vs30 value) of 560 m/sec (range of 360 to 760 m/sec). This corresponds to Site Class C, as defined by the National Building Code of Canada (NBCC 2010).

Attenuation relationships provided by Youngs (1997) and Atkinson (2003) were used for interface subduction and intraslab subduction earthquake source zones associated with the Cascadia subduction zone. These relationships were developed specifically for oceanic subduction zone earthquakes. The peak ground accelerations calculated for interface subduction and intraslab subduction earthquakes are average values calculated using these two attenuation relationships (equal weighting).

B.3.2 Probabilistic Analysis

A probabilistic seismic hazard analysis is carried out to define a unique probability of occurrence for each possible level of ground acceleration experienced at a site. The methodology used for the probabilistic analysis is based on that presented by Cornell (1968). The likelihood of occurrence of earthquakes within defined seismic source zones is determined by examining seismicity data. Using historical earthquake records for the region, magnitude-frequency recurrence relationships are established for potential earthquake source zones. The magnitude recurrence relationships are of the form derived by Gutenberg-Richter (1944):

$$\log(N) = a - b(M)$$

where, M = Earthquake magnitude
N =Annual frequency of occurrence for earthquakes exceeding magnitude M
(1/N = Return Period)

The computer program EZ-FRISK (Risk Engineering, Inc., 2008) was used to develop a seismic hazard model for B.C. and the surrounding regions. The seismic hazard analysis module available with EZ-FRISK includes a database provided by Risk Engineering Inc. of faults and areal seismic sources for the pertinent regions of western Canada. Seismic sources defined in the hazard model include the interior regions of northern and southern B.C., the Rocky Mountain Belt, Coast Mountains, Queen Charlotte fault system and the Cascadia subduction zone. The project site is located within an areal seismic source that defines the seismicity in the central and northern interior of B.C. A maximum earthquake of Magnitude 7.0 was assigned to this source zone, which is characterized by shallow crustal earthquakes.

Magnitude-frequency recurrence relationships and the corresponding maximum earthquake magnitude for each seismic source are prepared by Risk Engineering from consideration of historical seismicity, fault characteristics and the regional tectonics, using information obtained from the Geological Survey of

Canada and proprietary studies. For calculation of peak ground accelerations a minimum magnitude of 5.0 was used in the analysis for all seismic source zones. Earthquakes of lower magnitude are not considered to be a risk to engineered facilities. Appropriate ground motion attenuation relationships were assigned to each seismic source, as discussed in Section B3.1 above.

The seismic hazard model developed using EZ-FRISK was used to determine the relationship between peak ground acceleration and annual frequency of occurrence for the project site. Median hazard values of peak ground acceleration have been determined for return periods up to 10,000 years. Predicted values for the project site are included in Table B.1 for return periods of 5,000 and 10,000 years. Predicted values for lower return periods were very similar to those provided by the NRC seismic hazard database.

The probabilistic seismic hazard analysis has also been used to calculate spectral acceleration values (5% damping). These have been used to develop site-specific uniform hazard spectra corresponding to return periods of 500, 5,000 and 10,000 years. The uniform hazard spectra are shown on Figure B.2. Tabulated values of these uniform hazard spectra are provided in Table B.2.

Deaggregation of the probabilistic seismic hazard results has been carried out to provide the relative contributions of all potential seismic sources, and to more accurately define the characteristics of potential earthquakes contributing to the seismic hazard. This includes consideration of long period ground motions (spectral acceleration values). The findings indicate that the seismic hazard at the Blackwater Gold project is predominantly from large magnitude earthquakes occurring along coastal B.C. and the Queen Charlotte fault system, particularly for shorter return periods (less than about 1000 years). However, for larger peak ground accelerations associated with longer return period events (several thousands of years) the seismic hazard is also influenced by potential shallow crustal earthquakes occurring closer to the site within central B.C.

A design earthquake magnitude of 8.5 has been selected for earthquake return periods of 500 years, 5000 years and 10,000 years, based on the review of regional tectonics and historical seismicity, and the findings of deaggregation off the probabilistic seismic hazard. This represents the potential for large magnitude earthquakes occurring along the Queen Charlotte fault system and the Cascadia subduction zone. However, design analyses should also consider the potential for shallow crustal earthquakes occurring closer to the project site for longer return period events of 5000 and 10,000 year, representing earthquakes of up to Magnitude 7.5 and Magnitude 7.0 for the regions of coastal B.C. and central B.C respectively.

B.4 REFERENCES

Adams, J. and Halchuk, S., (2003), Fourth generation seismic hazard maps of Canada: Values for over 650 Canadian localities intended for the 2005 National Building Code of Canada, Geological Survey of Canada, Open File 4459.

Atkinson, G.M. and Boore, D.M., (2003), "Empirical Ground-Motion Relations for Subduction-Zone Earthquakes and Their Application to Cascadia and Other Regions", Bulletin of the Seismological Society of America, Vol. 93, No. 4, p. 1703–1729.

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Youngs, R.R., Chiou, S.-J., Silva, W.J. and Humphrey, J.R. (1997) "Strong Ground Motion Attenuation Relationships for Subduction Zone Earthquakes", Seismological Society of America, Seismological Research Letters, Vol. 68, No.1, p.58-73.

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TABLE B.1

NEW GOLD INC.
BLACKWATER GOLD PROJECT

MINE WASTE AND WATER MANAGEMENT DESIGN REPORT
SUMMARY OF PROBABILISTIC SEISMIC HAZARD ANALYSIS

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Return Period (Years)	Probability of Exceedance[1] (%)	Peak Ground Acceleration (PGA)[2]	
		Median PGA[3,4] (g)	Estimated Mean PGA[5] (g)
100	16	0.015	0.02
500	3	0.033	0.04
1,000	2	0.045	0.05
2,500	0.7	0.062	0.07
5,000	0.3	0.070	0.08
10,000	0.2	0.090	0.11

M:\1\01\00457\06\A\Report\11 - Waste and Water Management Design Report\Appendix B - Seismic Hazard Assessment\[Blackwater Gold - Seismic Hazard - Rev A.xlsx]UHS Table B.2

NOTES:

1. PROBABILITY OF EXCEEDANCE CALCULATED FOR A DESIGN OPERATING LIFE OF 17 YEARS.

   $q = 1-EXP(-L/T)$

   WHERE: q = PROBABILITY OF EXCEEDANCE
   L = DESIGN LIFE IN YEARS
   T = RETURN PERIOD IN YEARS

2. PEAK GROUND ACCELERATIONS ARE FOR SOFT ROCK/VERY DENSE SOIL (Vs_{30} = 360 - 760 M/SEC)
3. MEDIAN PEAK GROUND ACCELERATIONS FOR RETURN PERIOD UP TO 2,500 YEARS OBTAINED FROM THE SEISMIC HAZARD DATABASE OF I
4. MEDIAN PEAK GROUND ACCELERATIONS FOR RETURN PERIODS OF 5,000 AND 10,000 YEARS OBTAINED FROM SITE-SPECIFIC ANALYSIS US
5. MEAN PGA VALUES ESTIMATED AS 1.2 X MEDIAN VALUES.

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0	21NOV13	ISSUED WITH REPORT VA101-457/6-11	GRG	DDF	KJB

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TABLE B.2

NEW GOLD INC.
BLACKWATER GOLD PROJECT

MINE WASTE AND WATER MANAGEMENT DESIGN REPORT
UNIFORM HAZARD SPECTRA FOR 1/500, 1/5,000 AND 1/10,000 YEAR EARTHQUAKES

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Spectral Period (seconds)	Spectral Accelerations for 1/500 Year Earthquake		Spectral Accelerations for 1/5,000 Year Earthquake		Spectral Accelerations for 1/10,000 Year Earthquake	
	Median (g)	Estimated Mean (g)	Median (g)	Estimated Mean (g)	Median (g)	Estimated Mean (g)
PGA	0.03	0.04	0.07	0.08	0.09	0.11
0.02	0.03	0.04	0.07	0.08	0.09	0.11
0.03	0.03	0.04	0.07	0.09	0.10	0.11
0.05	0.03	0.04	0.08	0.10	0.11	0.13
0.1	0.04	0.05	0.11	0.14	0.15	0.18
0.2	0.07	0.08	0.16	0.20	0.21	0.26
0.3	0.08	0.09	0.19	0.22	0.24	0.29
0.4	0.08	0.10	0.20	0.24	0.25	0.30
0.5	0.08	0.10	0.21	0.25	0.26	0.31
0.75	0.09	0.11	0.23	0.28	0.30	0.36
1.0	0.07	0.09	0.19	0.23	0.24	0.29
2.0	0.04	0.04	0.11	0.13	0.15	0.17
3.0	0.02	0.03	0.06	0.07	0.08	0.09
4.0	0.02	0.02	0.04	0.05	0.06	0.07
5.0	0.01	0.01	0.03	0.04	0.05	0.05
10.0	0.00	0.01	0.02	0.02	0.03	0.03

M:\1\01\00457\06\A\Report\11 - Waste and Water Management Design Report\Appendix B - Seismic Hazard Assessment\[Blackwater Gold - Seismic Hazard - Rev A.xlsx]UHS Table B.2

NOTES:

1. SPECTRAL ACCELERATIONS ARE MEAN HAZARD VALUES FOR SOFT ROCK/ VERY DENSE SOIL SITE CONDITIONS (Vs_{30} = 360 to 760 m/sec).
2. ESTIMATED MEAN HAZARD VALUES ESTIMATED AS 1.2 X MEDIAN VALUES.

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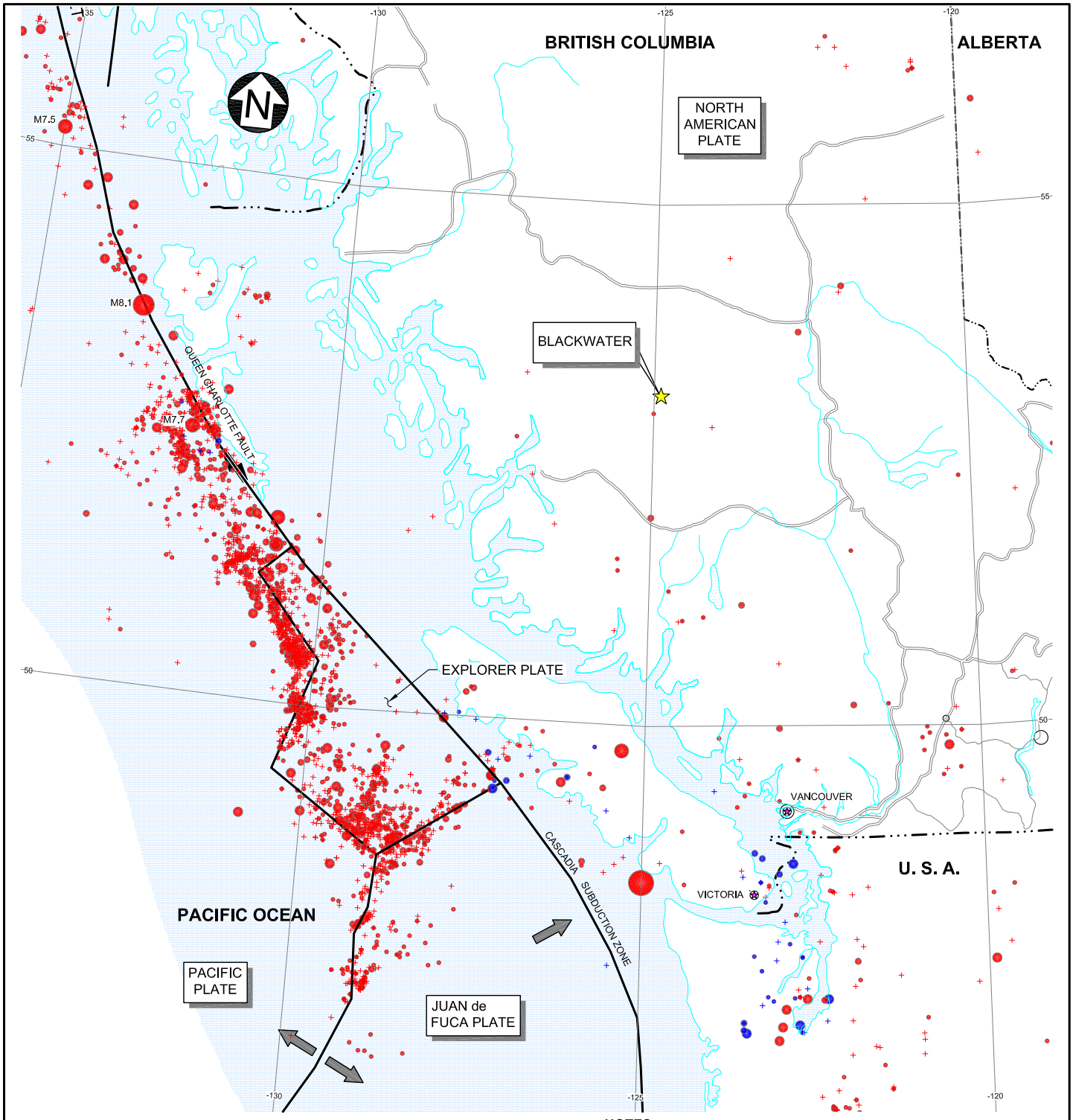

NOTES:

1. COORDINATE GRID IS UTM NAD83 ZONE 10N.
2. HISTORICAL EARTHQUAKE DATA FROM NRCAN, USGS, AND NGDC DATABASES.

INCLUDES RECORDED EARTHQUAKES FROM 1600 TO 1973 (MAGNITUDE > 6.0) AND FROM 1973 TO MAY 2013 (MAGNITUDE ≥ 3.5).

SYMBOL SIZE PROPORTIONAL TO MAGNITUDE

- 3.5 - 3.9
- 4.0 - 4.9
- 5.0 - 5.9
- 6.0 - 6.9
- 7.0 - 7.9
- 8.0 - 8.9
- 9.0 +

EARTHQUAKE FOCAL DEPTH

- 35 or LESS km
- > 35 km

DIRECTION OF TECTONIC PLATE MOVEMENT

SCALE A: 50 0 100 200 300 km

NEW GOLD INC.

BLACKWATER GOLD PROJECT

REGIONAL TECTONICS AND HISTORICAL SEISMICITY

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	CHK'D	APP'D
0	21NOV'13	ISSUED WITH REPORT	GRG	NSD	GRG	GRG

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P/A NO. VA101-457/6 | REF NO. 11

FIGURE B.1 | REV 0

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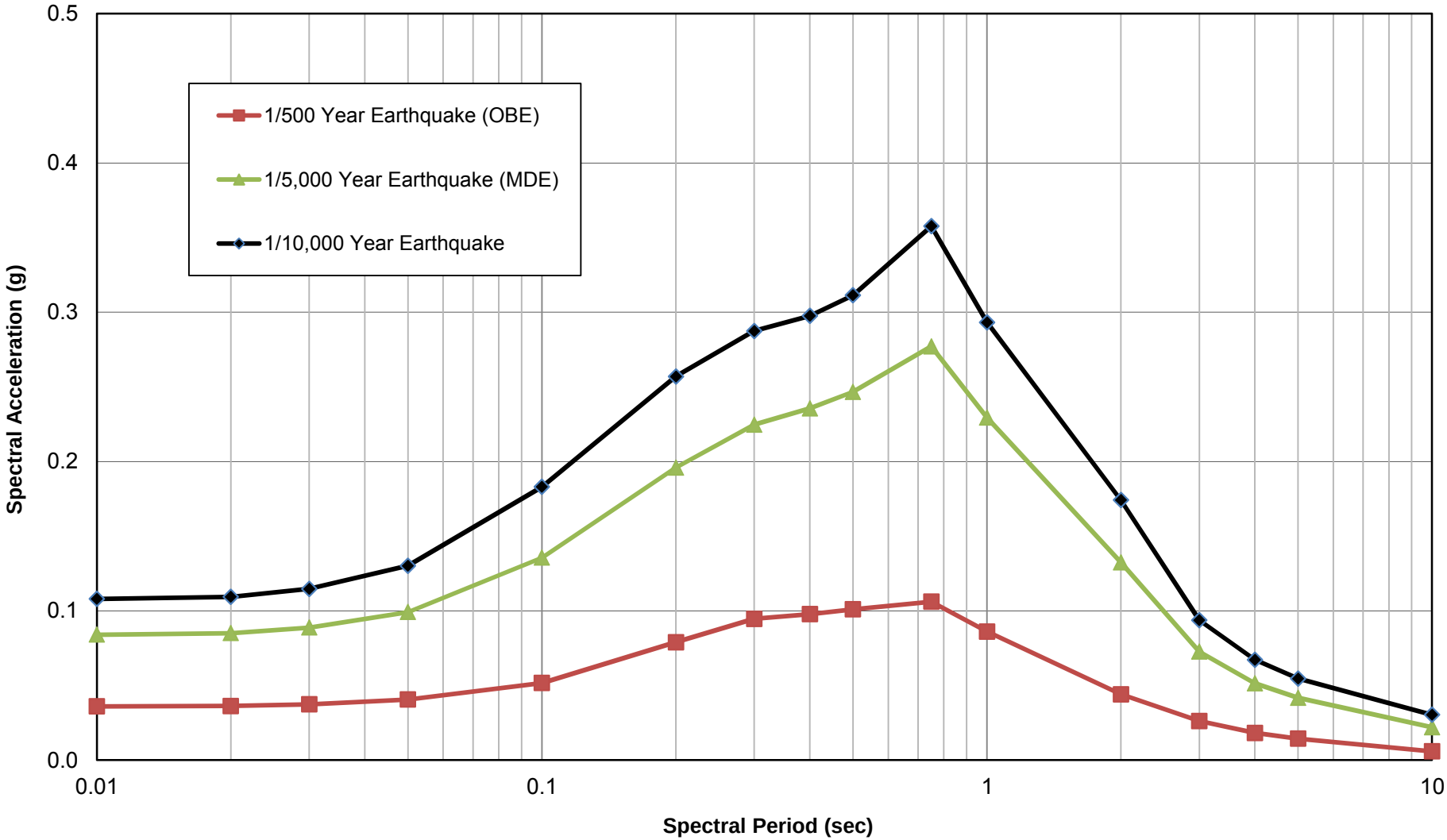


NOTES:
1. SPECTRAL ACCELERATIONS ARE MEAN HAZARD VALUES FOR SOFT ROCK/ VERY DENSE SOIL SITE CONDITIONS (Vs30 = 360 - 760 m/sec).

REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D
0	21NOV'13	ISSUED WITH REPORT	GRG	DDF	KJB

NEW GOLD INC.

BLACKWATER GOLD PROJECT

UNIFORM HAZARD SPECTRA FOR 1/500, 1/5,000 AND 1/10,000 YEAR EARTHQUAKES

Knight Piésold CONSULTING

P/A. NO. VA101-457/6

REF NO. 11

FIGURE B.2

REV 0

APPENDIX C

FEASIBILITY STUDY SEEPAGE ASSESSMENT

Appendix C1 Seepage Analyses
Appendix C1 Previous Seepage Estimates

APPENDIX C1

SEEPAGE ANALYSES

(Pages C1-1 to C1-6)

Knight Piésold
CONSULTING

APPENDIX C1

NEW GOLD INC.
BLACKWATER GOLD PROJECT

MINE WASTE AND WATER MANAGEMENT DESIGN REPORT
TSF SEEPAGE ANALYSES

C1.1 GENERAL

Seepage analyses were carried out to support the feasibility design of the TSF to investigate potential seepage pathways from TSF Site C and TSF Site D, and to determine a "best estimate" of seepage downstream of the TSF Site D Main Dam. The seepage analyses were completed using SEEP/W®, commercial seepage analysis software. Seepage modelling was completed for steady state conditions based on the maximum TSF configuration at the end of mine life. The estimated seepage rate was based on the assumed boundary conditions and material permeability parameters for the embankment and foundation materials. The foundation seepage estimate included overburden materials and heavily fractured rock.

Knight Piésold Ltd. (KP) previously provided a memo entitled "Blackwater TSF Site D Dam – Downstream Foundation Seepage Control Measures" (Knight Piésold Ltd., 2013m). This memo provided preliminary seepage rates for the embankment (50 L/s) and foundation (50 L/s) based on the proposed TSF arrangement. KPL indicated in this memo foundation seepage losses downstream of the Site D TSF dam were predicted to daylight to surface within 1 km of the downstream toe of the dam.

Subsequently, New Gold Inc. (New Gold) requested that KPL verify the estimated seepage rates and seepage flow path predictions presented in the memo (Knight Piésold Ltd., 2013m) using the seepage analysis software SEEP/W®. A second memo was prepared that presented the results of the preliminary SEEP/W® analyses along with the estimated material parameters and methodology of the analyses (Knight Piésold Ltd., 2013n). The second memo indicated that the revised estimated seepage rates at the Site D Main Dam consisted of 38 L/s of embankment seepage and 40 L/s of foundation seepage for a total seepage rate of approximately 78 L/s. The seepage model indicated a negligible amount of seepage (0.2 L/s) passed from the foundation of the Site D Main Dam beyond the Environmental Control Dam (ECD), which is located approximately 1 km downstream. Virtually all of the seepage was predicted to daylight to surface or within the surficial sand and gravel zone upstream of the ECD.

The previous two memos (Knight Piésold Ltd., 2013m and Knight Piésold Ltd., 2013n) are provided as Appendix C2 to demonstrate the development of estimated of the seepage flow pathways and flow rates.

This report presents the results of updated SEEP/W® analyses completed to support the feasibility design of the TSF.

C1.2 MATERIAL PARAMETERS

The materials used in the construction of the embankments will be excavated and/or processed from the open pit and local borrow areas. The saturated hydraulic conductivity of each of the materials was based on published values, and correlated with anticipated material types to derive a reasonable best estimate value. Hydraulic conductivity functions for partially saturated soils were estimated based on material type. The estimated material parameters were compared with existing in-situ permeability testing or

laboratory test results wherever possible. The material parameters used in the seepage analyses are summarized in Table C1.1.

Table C1.1 – Material Parameters

Material Type	Saturated or Unsaturated	Saturated Hydraulic Conductivity (K_{sat}, m/s) [4]	Anisotropy Ratio (K_V:K_H)	Remark
Sand and Gravel [1]	Saturated or Unsaturated	1.0E-04	1.0	In-situ Material
Overburden [2]	Saturated	5.0E-08	1.0	In-situ Material
Completely Weathered Bedrock [3]	Saturated	5.0E-08	1.0	In-situ Material
Fractured Bedrock	Saturated	4.0E-07	1.0	In-situ Material
Fresh Bedrock	Saturated	1.0E-07	1.0	In-situ Material
Zone S	Saturated or Unsaturated	1.0E-08	1.0	Embankment Fill Material
Zone F	Saturated or Unsaturated	1.0E-05	1.0	Embankment Fill Material
Zone T	Saturated or Unsaturated	1.0E-04	1.0	Embankment Fill Material
Zone C (Waste Rock)	Saturated or Unsaturated	1.0E-05	1.0	Embankment Fill Material
Consolidated Tailings	Saturated or Unsaturated	5.0E-08	0.1	Tailings
Unconsolidated Tailings	Saturated or Unsaturated	5.0E-08	0.1	Tailings

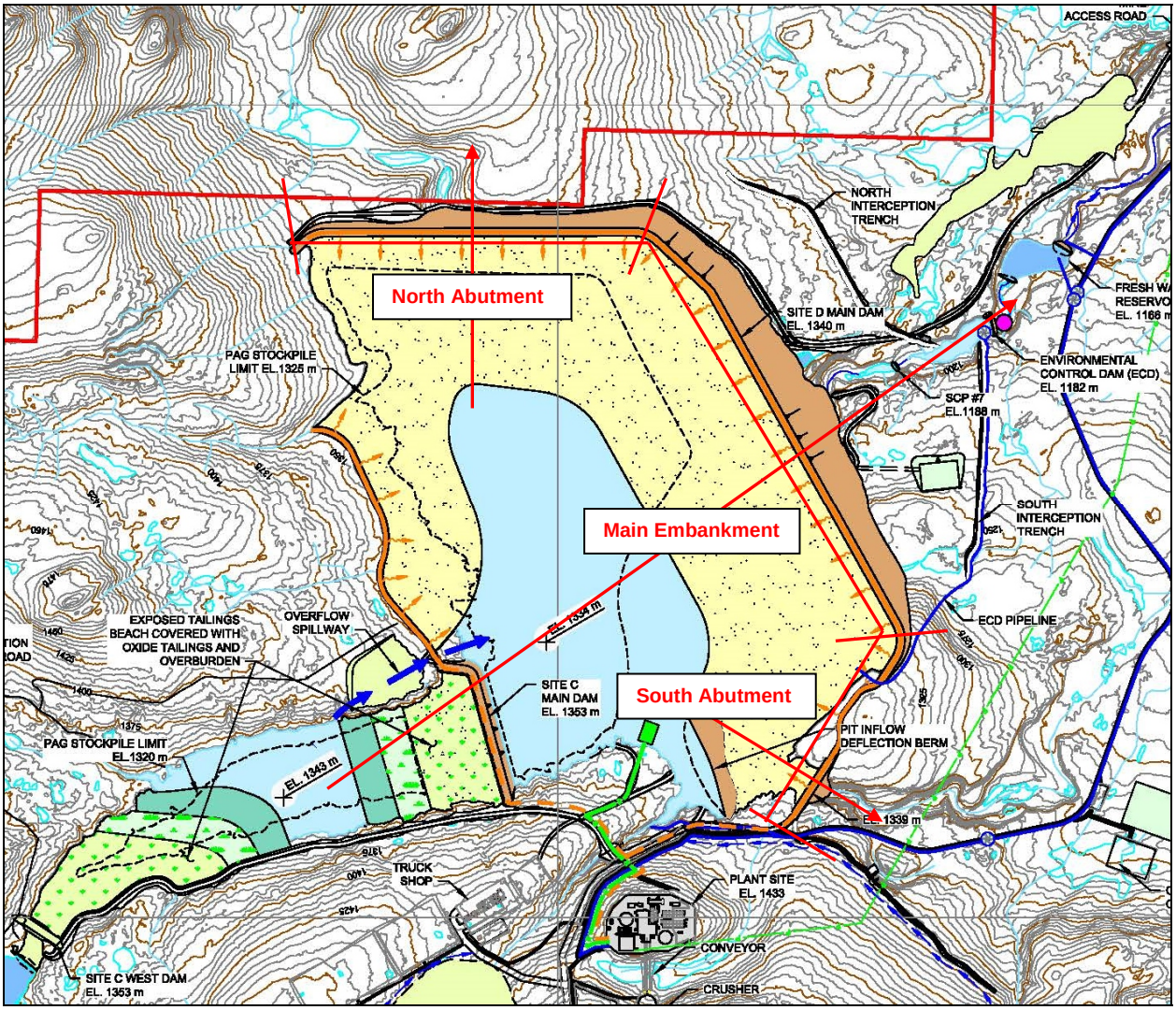
NOTES:

1. IN-SITU MATERIAL UNIFIED SOIL CLASSIFICATION SYSTEM (USCS) CLASSIFICATION – GM, GW-GP, SM-SC (Knight Piésold Ltd., 2013e).
2. IN-SITU MATERIAL USCS CLASSIFICATION – SM-SC, GM-GC (Knight Piésold Ltd., 2013e).
3. IN-SITU MATERIAL USCS CLASSIFICATION – GC, CL (Knight Piésold Ltd., 2013e).
4. USCS CLASSIFICATION PROVIDED FOR FUTURE SENSITIVITY ANALYSES ON HYDRAULIC CONDUCTIVITY.

C1.3 METHODOLOGY

The TSF was divided into three sections: the north abutment, main embankment, and south abutment as shown on Figure C1.1. The main embankment section extended from TSF Site C through TSF Site D and beyond the ECD.

Figure C1.1 – TSF Seepage Analyses Arrangement



The seepage model provided an estimate of the unit seepage rate (per linear meter of embankment) through each representative cross section of the TSF embankment at its highest point and the in-situ foundation materials. The unit seepage rates were used to calculate the total seepage through the embankment and foundation materials using the following method:

- Characteristic Length (area of the dam segment / height of the dam section in the analysis) – "Best Estimate" method

Representative cross sections through the Site D Main Dam (main embankment segment) and Site C Main Dam are shown on Figures C1.2 and C1.3, respectively.

C1.4 RESULTS OF SEEPAGE ANALYSES

Seepage analyses were completed for TSF Sites C and Site D. Results indicate that approximately 55 L/s of seepage could be expected to pass through the embankment and foundations of the Site D Main Dam at the maximum extent of the TSF in Year 17. The majority of the embankment seepage (53

L/s) would flow through the main section of the dam that faces downstream along Davidson Creek, the vast majority of this seepage is expected to be recoverable using the special design provisions discussed above and the secondary downstream collection systems associated with the Environmental Control Dam (ECD), discussed below. The seepage modeling found a negligible amount of seepage (0.2 L/s) could pass from the foundation of the Site D Main Dam beyond the ECD, located approximately 1 km downstream of the tailings dam. Virtually all of the seepage was predicted to daylight to surface or within the surficial sand and gravel zone upstream of the ECD.

The remaining 2 L/s of total seepage leaving the TSF could be expected to pass through the north and south abutments in weathered and fractured bedrock and may be unrecoverable without additional engineering measures.

Embankment seepage from TSF Site C Main Dam is predicted to be approximately 21 L/s during Years 1 and 2 and will be captured at the downstream construction sediment control pond and recycled back to the TSF Site C pond with the exception of a small portion of seepage that will be captured in TSF Site D. This capture and pumpback system will be decommissioned at Year 3 and all subsequent seepage will be captured by TSF Site D.

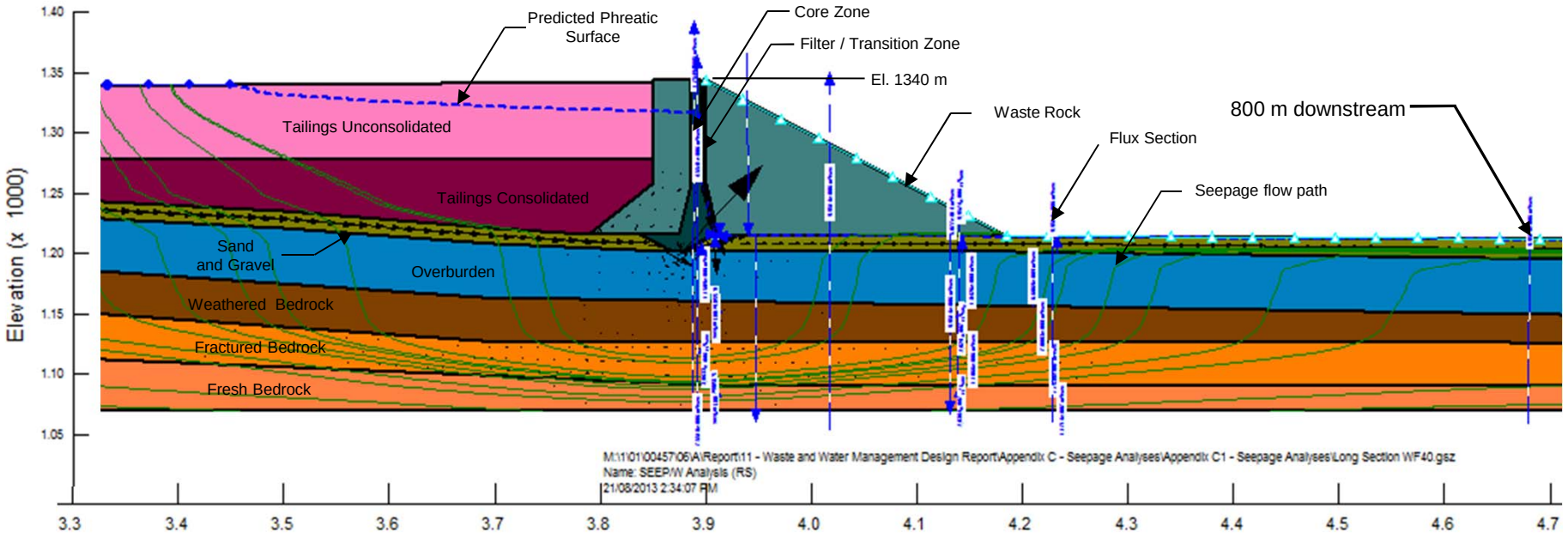
C1.5 REFERENCES

Knight Piésold Ltd., 2013e. Geotechnical Characterization Report (VA101-457/6-8).

Knight Piésold Ltd., 2013m. Blackwater Project – Memorandum on Blackwater TSF Site D Dam – Downstream Foundation Seepage Control Measures (VA101-457/6-A.01, Continuity No. VA13-00632). March 14, 2013.

Knight Piésold Ltd., 2013n. Blackwater Project – Memorandum on Blackwater TSF – Downstream Seepage Estimates (VA101-457/6-A.01, Continuity No. VA13-01001). June 25, 2013.

Material	Saturated Hydaulic Conductivity (K_{sat} = m/s)	Anisotropy Ratio (K_v:K_h)
Waste Rock (Zone C)	1.0E-04	1.0
Core Zone (Zone S)	1.0E-08	1.0
Filter (Zone F) / Transition (Zone T)	1.0E-05 / 1.0E-04	1.0
Sand and Gravel	1E-04	1.0
Overburden / Weathered Bedrock	5.0E-08	1.0
Fractured / Fresh Bedrock	4.0E-07 / 1.0E-7	1.0
Tailings Unconsolidated	5.0E-08	0.1
Tailings Consolidated	5.0E-08	0.1



NOTES:

1. LOCATION OF PHREATIC SURFACE PREDICTED FROM STEADY STATE SEEPAGE ANALYSIS.

REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D
0	04DEC'13	ISSUED WITH REPORT	LM	GRG	KJB

NEW GOLD INC.

BLACKWATER GOLD PROJECT

TAILINGS STORAGE FACILITY
TSF SITE D MAIN DAM
MAIN EMBANKMENT SECTION

Knight Piésold CONSULTING

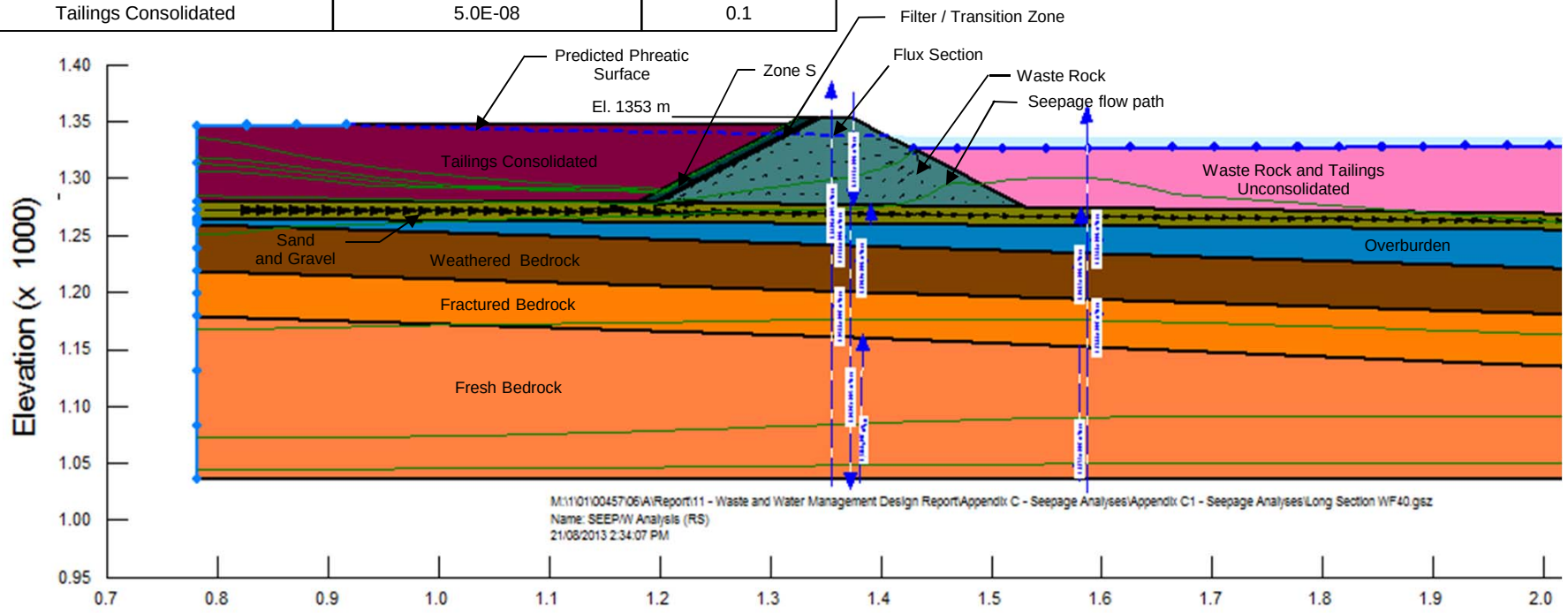
P/A. NO. VA101-457/6

REF NO. 11

FIGURE C1.2

REV 0

Material	Saturated Hydaulic Conductivity (K_{sat} = m/s)	Anisotropy Ratio (K_v:K_h)
Waste Rock (Zone C)	1.0E-04	1.0
Core Zone (Zone S)	1.0E-08	1.0
Filter (Zone F) / Transition (Zone T)	1.0E-05 / 1.0E-04	1.0
Sand and Gravel	1E-04	1.0
Overburden / Weathered Bedrock	5.0E-08	1.0
Fractured / Fresh Bedrock	4.0E-07 / 1.0E-7	1.0
Tailings Unconsolidated	5.0E-08	0.1
Tailings Consolidated	5.0E-08	0.1



NOTES:

1. LOCATION OF PHREATIC SURFACE PREDICTED FROM STEADY STATE SEEPAGE ANALYSIS.

REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D
0	04DEC'13	ISSUED WITH REPORT	LM	GRG	KJB

NEW GOLD INC.

BLACKWATER GOLD PROJECT

TAILINGS STORAGE FACILITY
TSF SITE C MAIN DAM
SEEPAGE ASSESSMENT

Knight Piésold CONSULTING

P/A. NO. VA101-457/6

REF NO. 11

FIGURE C1.3

REV 0

APPENDIX C2

PREVIOUS SEEPAGE ESTIMATES

(Pages C2-1 to C2-8)

MEMORANDUM

To:	Mr. Paul Hosford	Date:	March 14, 2013
Copy To:	Doug Moore, Ryan Todd, Keith Ferguson	File No.:	VA101-457/6-A.01
From:	Bruno Borntraeger	Cont. No.:	VA13-00632
Re:	Blackwater TSF Site D Dam - Downstream Foundation Seepage Control Measures		

DOWNSTREAM SEEPAGE CONTROL MEASURES

Preliminary seepage estimates and hydrogeological modelling for the Blackwater TSF has determined foundation seepage losses downstream of the Site D TSF dam are predicted to daylight to surface within 1 km of the downstream toe. The preliminary seepage rates consist of 50 L/s of embankment seepage and 50 L/s of foundation seepage. The embankment seepage will flow by gravity to the Environmental Control Dam (ECD) situated downstream of Dam D. Foundation seepage can be intercepted using numerous industry standard techniques. A combination of simple seepage control measures and the observational approach has been proposed for the Blackwater TSF. Seepage control measures would include the following:

- A cutoff trench beneath Dam D through the overlying sand and gravel deposits and keyed into the low permeability foundation soils and backfilled with low permeability compacted soil.
- Relocation of the Environmental Control Dam (ECD) from approximately 500 metres downstream (PEA location) to 1000 metres downstream.
- Excavation of a seepage collection trench through the surficial sand and gravels and into the low permeability soil foundation on both sides of Davidson Creek to intercept foundation seepage and convey flows to the ECD for recycle to the TSF
- The provision for installing a row of seepage relief or groundwater recovery wells approximately 100 m downstream from the ultimate Dam D toe as a contingency. These wells would only be installed if monitoring wells along this line indicated degrading water quality that has the potential to flow beyond the ECD.
- The provision for installing an additional row of monitoring wells approximately 500 metres downstream of the ECD as an additional contingency. Recovery wells would be installed, if required, to collect foundation seepage and return it during operations to the TSF and may continue into closure. Alternatively at closure, the seepage may be released to a downstream wetland for treatment.

The seepage control measures are shown schematically on Figure 1.

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA B. Borntraeger

Signed: Bruno Borntraeger March 14, 2013

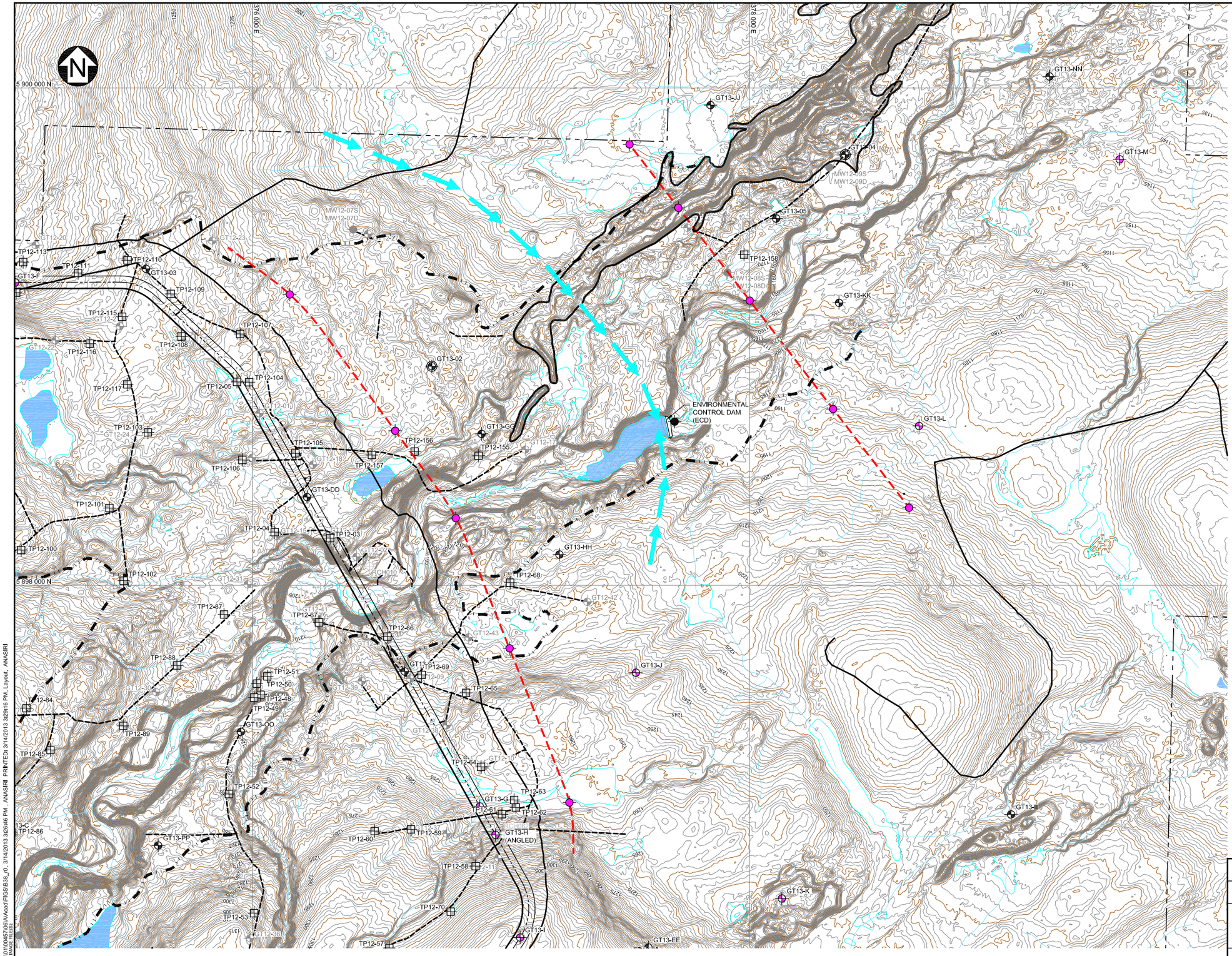
Bruno Borntraeger, P. Eng. – Specialist Engineer/Project Manager

Approved: BB for

Ken Brouwer, P. Eng. – President

Attachments:

Figure 1 Rev 0 Tailings Storage Facility Downstream Seepage Control Measures



LEGEND:

- WATER QUALITY STATION 10
  HYDROLOGY STATION H2
- MONITORING WELL
- SURFICIAL SAND AND GRAVELS LIMIT IDENTIFIED FROM TERRAIN MAPPING
- ESKERS
- PROPERTY BOUNDARY
- GROUND WATER MONITORING WELL ROWS
- SEEPAGE COLLECTION TRENCH EXCAVATED THROUGH SURFICIAL SANDS AND GRAVELS INTO LOW PERMEABILITY SOILS WITH 15% FINES

NOTES:

1. COORDINATE GRID IS UTM (WGS84/NAD83) ZONE # (LETTER).
2. CONTOUR INTERVAL IS 1 METRES.

SCALE A: 150 75 0 250 500 750 m

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NEW GOLD INC.

BLACKWATER PROJECT

TAILINGS STORAGE FACILITY DOWNSTREAM SEEPAGE CONTROL MEASURES

Knight Piésold CONSULTING

P/A NO.	REF NO.
VA101-457/6	VA13-00632

FIGURE 1 REV 0

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MEMORANDUM

To:	Mr. Paul Hosford	Date:	June 25, 2013
Copy To:	Keith Ferguson, Doug Moore, Ryan Todd	File No.:	VA101-457/6-A.01
From:	Daniel Fontaine	Cont. No.:	VA13-01001
Re:	Blackwater TSF - Downstream Seepage Estimates		

General

This memo provides a summary of the estimated seepage downstream of the Site D TSF dam and Site C TSF dam at the Blackwater Gold Project.

Knight Piésold Ltd. (KPL) previously provided a memo entitled "Blackwater TSF Site D Dam – Downstream Foundation Seepage Control Measures" (KPL Cont. No.: VA13-00632) dated March 14, 2013. This memo provided preliminary seepage rates for the embankment (50 L/s) and foundation (50 L/s) based on the proposed TSF arrangement. KPL indicated in this memo foundation seepage losses downstream of the Site D TSF dam were predicted to daylight to surface within 1 km of the downstream toe of the dam.

Subsequently, New Gold Inc. requested that KPL verify the estimated seepage rates and seepage flow path predictions presented in memo VA13-00632 using the seepage analysis software SEEP/W®. This memo presents the results of the SEEP/W® analyses along with the estimated material parameters and methodology of the analyses.

Material Parameters

The materials that will be used in the construction of the embankments will be excavated and/or processed from the open pit and local borrow areas. The saturated hydraulic conductivity of each of the materials was based on published values, and correlated with anticipated material types to derive an 'order of magnitude' level value. Hydraulic conductivity functions for partially saturated soils were estimated based on material type. The estimated material parameters were compared with existing in-situ permeability testing or laboratory test results wherever possible. The material parameters used in the seepage analyses are summarized on Table 1.

Methodology

Seepage analyses were completed using SEEP/W®, commercial seepage analysis software. Seepage modelling was completed for steady state conditions based on the maximum tailings facility configuration at the end of mine life. The estimated seepage rate was based on the assumed boundary conditions and material permeability parameters for the embankment and foundation materials. The foundation seepage estimate included overburden materials and heavily fractured rock.

The seepage model provided an estimate of the unit seepage rate (per linear meter of embankment) through a representative cross section of the TSF embankment at its highest point and the in-situ foundation materials. The unit seepage rates from the model were then applied to the corresponding crest lengths measured along the centreline of the embankment to provide a conservative estimate of potential seepage flows through the embankment and embankment foundation.

Results

The seepage analyses provided a preliminary seepage estimate for the Site C and Site D Main Dams. The estimated seepage rate for the Site C dam was less than 3 L/s. This seepage is expected to report to the Site D TSF cell. The estimated seepage rates at the Site D dam consisted of 38 L/s of embankment seepage and 40 L/s of foundation seepage for a total seepage rate of approximately 78 L/s.

A unit seepage rate was estimated passing beyond the Environmental Control Dam (ECD), which is located approximately 1 km downstream from the TSF Site D Main Dam. The seepage model indicated a negligible amount of seepage (0.2 L/s) passed from the foundation of the Site D dam beyond the ECD. Virtually all of the seepage was predicted to daylight to surface or within the surficial sand and gravel zone upstream of the ECD.

The results of the seepage analyses are summarized in Table 2. The sections analysed for Site C and Site D are shown on Figures 1 and 2, respectively.

The crest elevations used were based on the TSF arrangement for the project that was presented in the Preliminary Economic Assessment (PEA), which was completed in August 2012. The Feasibility Study arrangement currently under development envisions a similar dam arrangement and slightly lower dam crest elevations. As such, these preliminary seepage estimates provided here-in are considered to be conservative and suitable for use in the current stage of project development.

We trust this meets your needs at this time. Please contact the undersigned if you have any questions.

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
June 25, 2013
D. D. FONTAINE
36208

Signed: _____
Daniel Fontaine, P.Eng. – Project Engineer / Project Manager

Reviewed: _____
Bruno Borntraeger, P.Eng. – Specialist Engineer

Approved: _____
Ken Brouwer, P.Eng. – President

Attachments:

Table 1 Rev 0	Summary of Material Parameters
Table 2 Rev 0	Summary of Seepage Rates
Figure 1 Rev 0	Seepage Model – Site C Main Dam
Figure 2 Rev 0	Seepage Model – Site D Main Dam

/ml

Knight Piésold CONSULTING

TABLE 1

NEW GOLD INC.
BLACKWATER GOLD PROJECT

DOWNSTREAM SEEPAGE ESTIMATES
SUMMARY OF MATERIAL PARAMETERS

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Material Type	Saturated or Unsaturated	Saturated Hydraulic Conductivity (K_{sat}, m/s) [1, 2]	Anisotropy Ratio (K_V:K_H)	Saturated Volumetric Water Content (Θ_{sat})	Residual Water Content (Θ_r)	Coefficient of Volumetric Compressibility (M_v, /kPa)	Remark
Sand and Gravel	Saturated or Unsaturated	1.0E-04	1.0	0.35	0.01	1.5E-05	In-situ Material
Overburden	Saturated	5.0E-08	1.0	0.25	-	5.0E-05	In-situ Material
Completely Weathered Bedrock	Saturated	5.0E-08	1.0	0.08	-	1.0E-05	In-situ Material
Fractured Bedrock	Saturated	4.0E-07	1.0	0.08	-	1.0E-05	In-situ Material
Fresh Bedrock	Saturated	1.0E-07	1.0	0.08	-	1.0E-05	In-situ Material
Zone S	Saturated or Unsaturated	1.0E-08	1.0	0.145	0.0092	1.0E-05	Embankment Fill Material
Zone F	Saturated or Unsaturated	1.0E-05	1.0	0.35	0.01	2.5E-05	Embankment Fill Material
Zone T	Saturated or Unsaturated	1.0E-04	1.0	0.3	0.02	1.0E-05	Embankment Fill Material
Zone C (Waste Rock)	Saturated or Unsaturated	1.0E-05	1.0	0.3	0.01	2.0E-06	Embankment Fill Material
Consolidated Tailings	Saturated or Unsaturated	5.0E-08	0.1	0.38	0.05	0	Tailings
Unconsolidated Tailings	Saturated or Unsaturated	5.0E-08	0.1	0.38	0.05	0	Tailings

M:\1\01\00457\06\A\Correspondence\VA13-01001 - Seepage Analysis\Tables\[Table 1 - Summary of Material Parameters.xlsx]Table 1

NOTES:

1. MATERIAL PARAMETERS PROVIDED ARE FOR THE BASE CASE SEEPAGE ASSESSMENT AND ADDITIONAL SENSITIVITY ANALYSES WILL BE COMPLETED.
2. THE SATURATED HYDRAULIC CONDUCTIVITY OF CONSOLIDATED AND UNCONSOLIDATED TAILINGS MAY VARY BY AN ORDER OF MAGNITUDE.

REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D
0	25JUN'13	ISSUED WITH MEMO VA13-01001	ML	DDF	KJB

Knight Piésold CONSULTING

TABLE 2

NEW GOLD INC.
BLACKWATER GOLD PROJECT

DOWNSTREAM SEEPAGE ESTIMATES
SUMMARY OF SEEPAGE RATES

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TSF Cell	Section	Embankment Crest Elevation	Length	Estimated Seepage [1]		
				Embankment	Foundation	Total
		(m)	(m)	(L/s)	(L/s)	(L/s)
Site C	Main Dam	1360	1620	1.4	0.9	2.3
Site D	North Abutment	1345	2300	13.4	11.0	24.4
	Centre	1345	3140	18.2	15.0	33.2
	South Abutment	1345	1160	6.7	5.6	12.3
	Fractured Rock	1345	3140	-	8.3	8.3
	Total	**1345**	**6600**	**38.3**	**39.9**	**78.2**
ECD	Fractured Rock - Beyond ECD	1178	3140	-	0.2	0.2

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NOTES:

1. SEEPAGE RATES PROVIDED ARE FOR THE BASE CASE SEEPAGE ASSESSMENT AND ADDITIONAL SENSITIVITY ANALYSES WILL BE COMPLETED.

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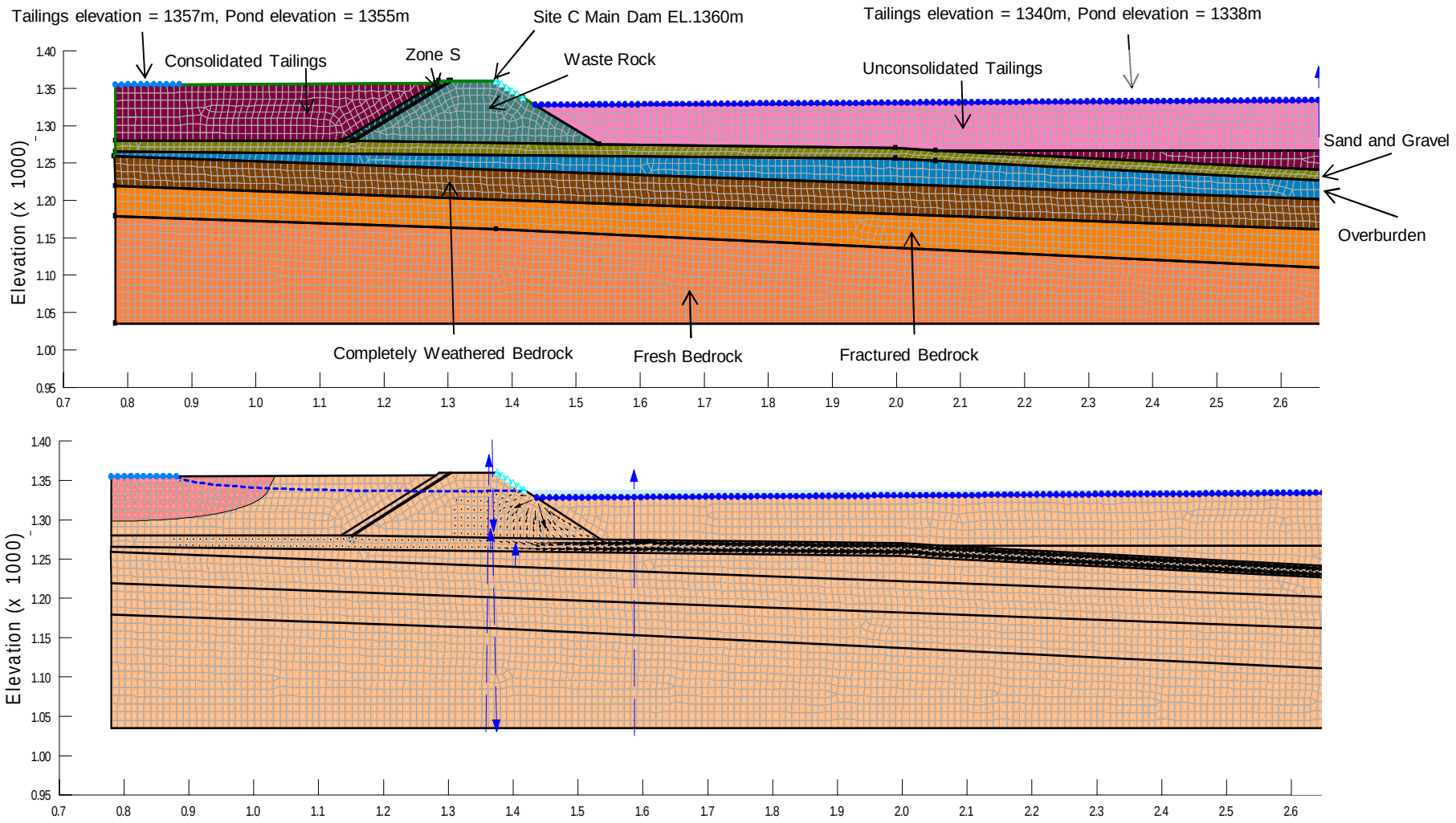

REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D
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NEW GOLD INC.

BLACKWATER GOLD PROJECT

SEEPAGE MODEL
SITE C MAIN DAM

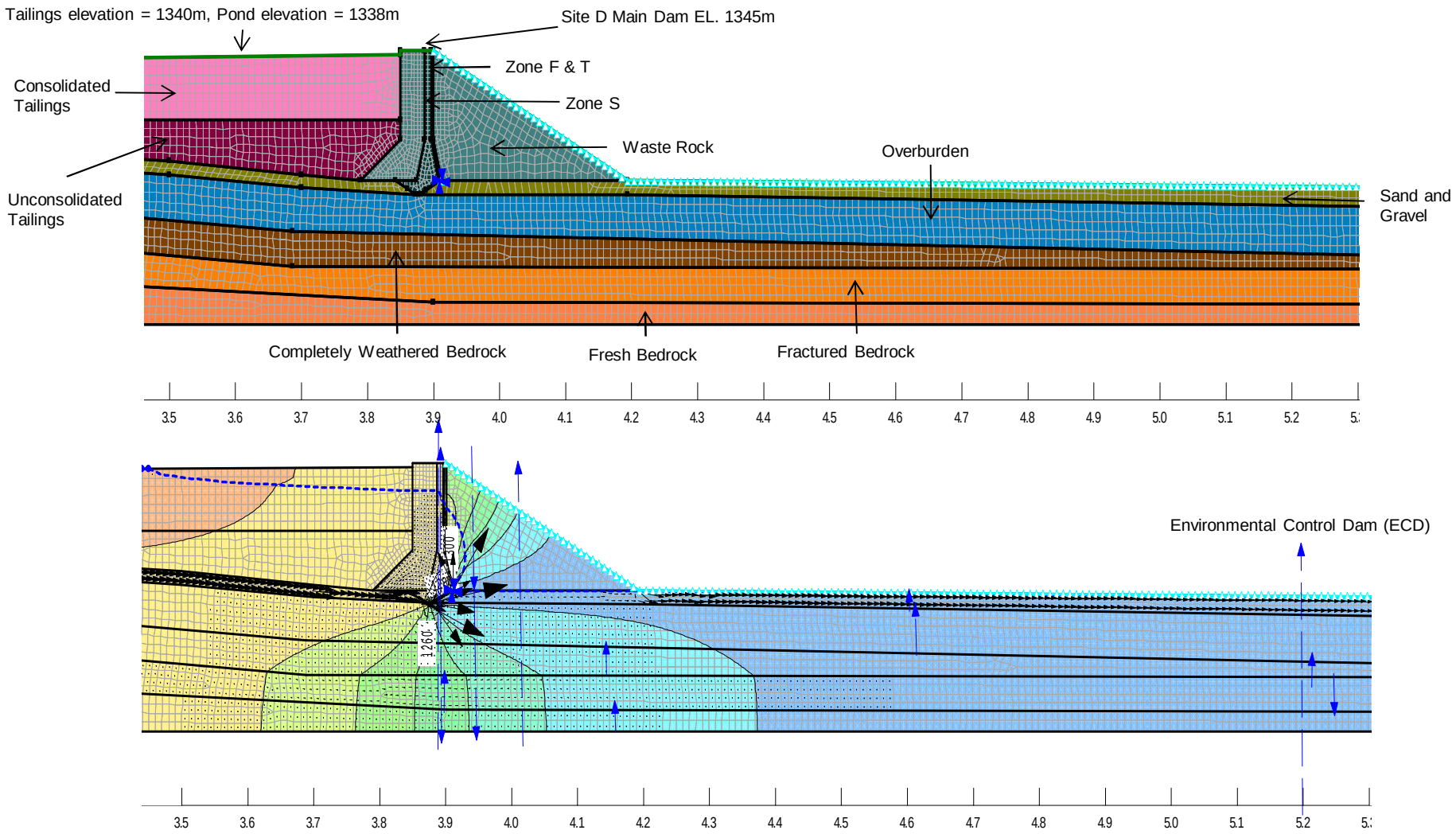
Knight Piésold CONSULTING

P/A NO. VA101-457/6

REF. NO. VA13-01001

FIGURE 1

REV 0



NEW GOLD INC.

BLACKWATER GOLD PROJECT

SEEPAGE MODEL
SITE D MAIN DAM

Knight Piésold CONSULTING

P/A NO. VA101-457/6

REF. NO. VA13-01001

FIGURE 2

REV 0

REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D
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APPENDIX D ▲R2

DAM STABILITY ANALYSES

(Pages D-1 to D-44)

APPENDIX D

NEW GOLD INC.
BLACKWATER GOLD PROJECT

MINE WASTE AND WATER MANAGEMENT
STABILITY ANALYSES

D.1 GENERAL

Stability analyses were carried out to evaluate the stability of the project facilities under both static and seismic loading conditions. The following mine waste and water management structures were evaluated in the assessment:

- TSF dams: Site D Main Dam and Site C Main Dam
- Water retaining dams: Environmental Control Dam (ECD) and Fresh Water Reservoir (FWR)
- Waste rock dumps and stockpiles: West Dump, East Dump, and Low-Grade Ore (LGO) Stockpile

The modelling approach, inputs, and results of the stability analyses are discussed in the sections that follow.

D.2 TSF DAMS

D.2.1 MODELLING APPROACH

The stability of the dam arrangement was checked for each of the following cases:

- Static conditions during operations and post-closure
- Earthquake loading from the Operating Basis Earthquake (OBE) and the Maximum Design Earthquake (MDE) during operations
- Earthquake loading from the Maximum Credible Earthquake (MCE) during post closure; and
- Post-earthquake conditions using residual (post-liquefaction) tailings strengths.

The stability analyses were carried out using the limit equilibrium computer program SLOPE/W (Geostudio, 2007). In this program a systematic search is performed to obtain the minimum factor of safety from a number of potential slip surfaces. Factors of safety have been computed using the Morgenstern-Price method. The predicted phreatic surface determined from TSF seepage modelling was used as the pore water pressure (PWP) level in the stability analysis for the dams.

In accordance with the Canadian Dam Association (CDA) “Dam Safety Guidelines” (CDA, 2007) and standard industry practice, the minimum acceptable factor of safety for the tailings dam under static conditions is 1.3 for short-term operating conditions and 1.5 for long-term (steady-state and post-closure) of the TSF. A factor of safety of less than 1.0 is acceptable under earthquake loading conditions provided that calculated embankment deformations resulting from seismic loading are not significant and that the post earthquake stability of the embankment maintains a factor of safety greater than 1.2, implying there is no flow slide potential. The TSF would be expected to function in a normal manner after the OBE. Limited deformation of the tailings embankment is acceptable under seismic loading from the MDE, provided that the overall stability and integrity of the TSF is maintained and that there is no release of stored tailings or water (ICOLD, 1995). Some remediation of the embankment may be required following the MDE.

The seismic stability assessment included estimation of seismically induced deformations of the dam from the OBE and MDE events. The OBE has been defined as the 1 in 500 year earthquake with a mean Peak Ground Acceleration (PGA) of 0.04g and design earthquake magnitude of 8.5. The MDE corresponds to the 1 in 5,000 year earthquake with a mean PGA of 0.08g and design earthquake magnitude of 8.5. The Maximum Credible Earthquake (MCE) has also been considered to demonstrate the robustness of the embankment design at closure to seismic loading in accordance with a draft bulletin release by the CDA in 2014 (CDA, 2014). The 1 in 10,000 year earthquake with a PGA of 0.11g and design earthquake magnitude of 8.5 was used for the MCE.

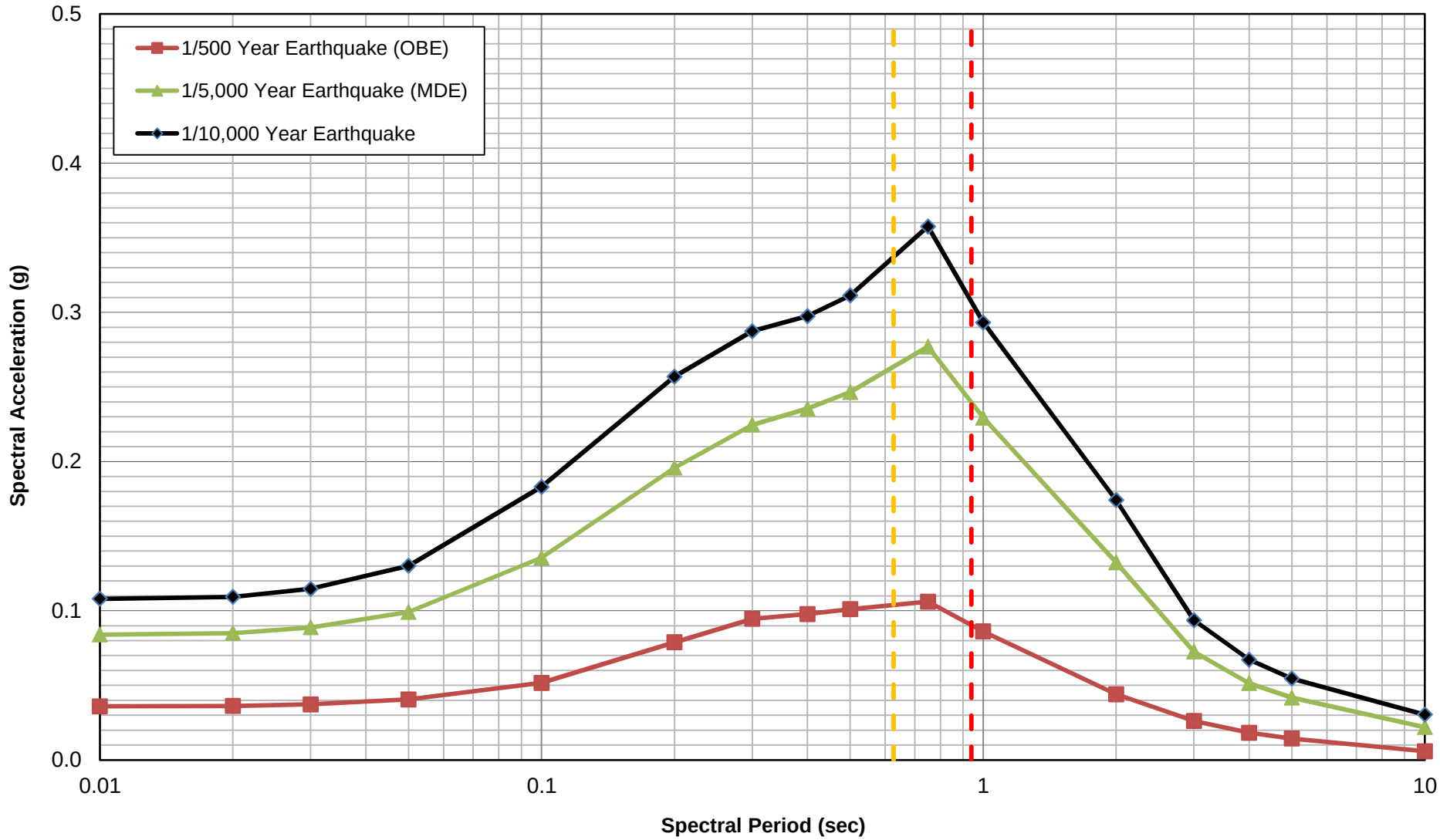
The design PGA values were for very dense soils and soft (weathered) rock ground conditions, which is consistent with foundation conditions for the TSF dams. An amplification factor of 1.5 has been assumed to estimate the average PGA along a potential slip surface through the embankment to account for the potential amplification of ground motions as seismic waves propagate through the foundation soils and embankment. This results in an estimated average PGA within the embankment of 0.06g for the OBE, 0.13g for the MDE and 0.16g for the 1 in 10,000 year earthquake.

Embankment stability during earthquake loading has been assessed by performing a pseudo-static analysis, whereby a horizontal force (seismic coefficient) is applied to the embankment to simulate earthquake loading to determine the critical acceleration (yield acceleration) required to reduce the factor of safety to 1.0. Deformation of the embankment is predicted to occur if the critical acceleration is lower than the predicted average PGA along the potential slip surface from the design earthquake.

Potential deformations under earthquake loading have been estimated using the simplified methods of Newmark (1965) and Makdisi-Seed (1977). These two methods estimate displacement of the potential sliding mass based on the average maximum ground acceleration and the yield acceleration. The yield acceleration corresponds to the seismic coefficient required to initiate movement of the sliding mass.

The more recently published method of Bray (2007) was also used to predict seismically induced slide displacement of the embankment. In addition to the yield acceleration, this method considers the predominant period of response of the embankment under seismic loading and the corresponding spectral ground acceleration. The predominant period is related to the stiffness characteristics of the embankment fill and to the height of the embankment. Spectral acceleration values were provided by the uniform hazard spectrum defined for each design earthquake event. The uniform hazard spectra for the 1 in 500 (OBE), 1 in 5,000 (MDE) and 1 in 10,000 year earthquakes were defined from the results of a site specific probabilistic seismic hazard analysis (see Appendix B) and are provided on Figure D.1.

Some deformation of the embankment is expected to result from settlement of the fill materials during earthquake shaking. Potential settlement of the embankment crest has been estimated using the empirical relationship provided by Swaisgood (2003). This relationship was developed from an extensive review of case histories of embankment dam behaviour due to earthquake loading. Required inputs to the relationship are the earthquake magnitude, the peak ground acceleration on rock at the site, the depth to rock (overburden thickness) and the embankment height.



NOTES:

1. SPECTRAL ACCELERATIONS ARE MEAN HAZARD VALUES FOR SOFT ROCK/ VERY DENSE SOIL SITE CONDITIONS (Vs30 = 360 - 760 m/sec).
2. ADOPTED FROM FIGURE B.2 OF APPENDIX B - VA101-457/6-11.

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2	12SEP'14	ISSUED WITH REPORT	GRG	LM	KJB

NEW GOLD INC.

BLACKWATER GOLD PROJECT

UNIFORM HAZARD SPECTRA FOR 1/500, 1/5,000 AND 1/10,000 YEAR EARTHQUAKES

Knight Piésold CONSULTING

P/A. NO. VA101-457/6

REF NO. 11

FIGURE D.1

REV 2

D.2.2 MATERIAL PARAMETERS AND ASSUMPTIONS

The following parameters and assumptions were incorporated into the stability analyses:

- Bulk unit weights for the embankment and foundation materials were based on typical values for similar materials and the results of laboratory testing (see Table 4.2). The unit weights are listed on Table D.1 below.
- An undrained shear strength was adopted to represent the tailings material strength for the static, seismic and post-earthquake cases, as described by the following relation:
  - Su/p' = 0.25 (static and seismic loading).
  - Su/p' = 0.10 (post liquefaction residual strength).

  where, Su = undrained shear strength.
  p' = effective vertical stress.
- An average effective friction angle of 35 degrees was adopted for the sand-gravel foundation soils based on typical values for similar materials.
- An average effective friction angle of 37 degrees was adopted for the overburden and completely weathered bedrock material based on laboratory test results conducted (see Table 4.2).
- Effective strength parameters for the embankment core zone was based on laboratory triaxial test results and conservatively assumed equal to 36 degrees with zero cohesion (see Table 2.1).
- Effective strength parameters for the embankment filter and transition zone were estimated based on typical values for similar materials. An average effective friction angle of 33 degrees was used.
- The shear strength for the embankment fill was determined using a conservative strength function that defines the variation of shear strength with normal stress. It was based on published information on the shear strength properties of soils without cohesion and rockfill (Leps, 1970).

Table D.1 Material Strength Parameters

Unit	Unit Weight (kN/m^3)	Friction Angle (deg)	Cohesion (kPa)
Embankment Materials			
Zone S (Core)	20	36	0
Zone F (Filter)	20	33	0
Zone T (Transition)	20	33	0
Zone C (Waste Rock / Shell)	21	See Note 1	
Tailings Materials			
Consolidated Tailings	17	See Note 2	
Unconsolidated Tailings	20	See Note 2	
Foundation Materials			
Sand and Gravel	21	35	0
Overburden / Weathered Bedrock	22	37	0
Fractured / Fresh Bedrock	Impenetrable		

NOTES:

1. A relationship for friction angle and effective stress was developed for the rockfill materials, based on published information on the shear strength properties of rockfill (Leps, 1970).
2. A relationship for shear stress and effective normal stress (S_u/p') was used to model the tailings strength. The (S_u/p') values used for the analyses were 0.25 for static and seismic loading and 0.1 for liquefied tailings.

D.2.3 RESULTS

Site D Main Dam

The stability analyses for the Site D Main Dam were based on the maximum cross section through the dam for the final TSF with a supernatant pond elevation of 1336 m and an embankment crest elevation of 1340 m.

Cross sections showing the stability model and failure surfaces considered are shown on Figures D.2 through D.6. The figures include the critical slip surfaces and factors of safety (FS) for static normal operating conditions, pseudo-seismic yield acceleration and post-liquefaction stability. Slip surfaces considered in the assessment include shallow downstream failure from the edge of the dam crest, failure from the mid-crest of the dam, and deep-seated failure propagating into the tailings mass. The factors of safety calculated for different slip surfaces and failure modes are included on Table D.2.

Table D.2 Site D Main Dam Results Summary

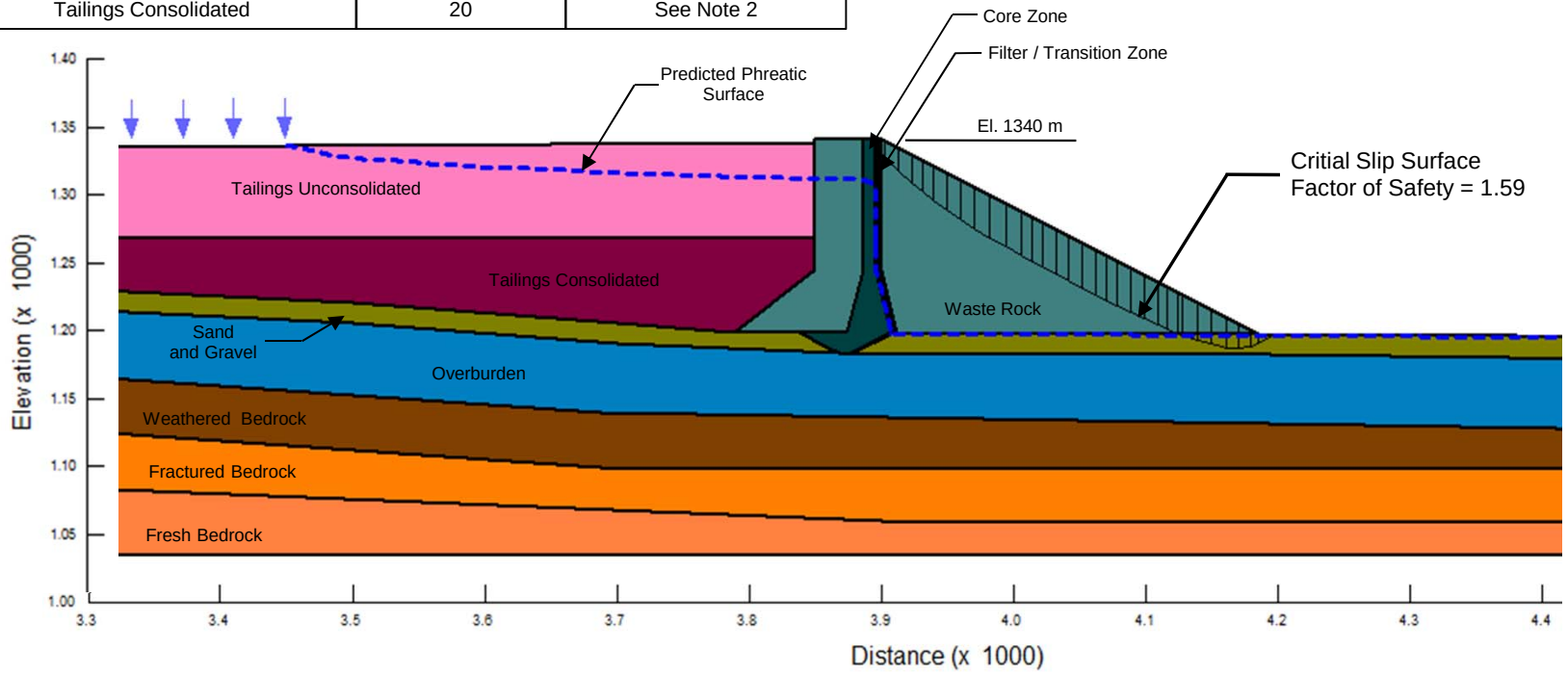
Location	PWP Level	Slip Surface	Static FS	Yield Acceleration (1)	Post-Liquefaction FS
Site D Main Dam	Parental Analysis (2)	Downstream – initiation near dam crest edge	1.59	0.18	1.59
		Mid-crest - initiation from mid-crest and back	1.64	-	-
		Deep - propagates into tailings mass	1.83	-	-
Site D Main Dam	Fully Specified Piezometric Line (3)	Water at the embankment crest	1.51	-	-

NOTES:
1. The yield acceleration (K_Y) corresponds to the horizontal seismic acceleration required to reduce the factor of safety to 1.0.
2. Parental analysis from previous analysis in SEEP/W.
3. Piezometric line was created from the phreatic level extracted from seepage analysis and engineering judgement.

The minimum factor of safety calculated for static conditions was 1.6. This exceeds the minimum factor of safety for short-term operating conditions and for long-term (post-closure) conditions. The estimated yield acceleration for the Site D Main Dam was approximately 0.18g. The post-earthquake condition that conservatively assumes complete liquefaction of the tailings deposit was also analysed, using a post-liquefaction residual tailings strength. The calculated factor of safety is the same as the static factor of safety as the critical potential slip surface does not pass through the liquefied tailings deposit. This indicates that the embankment is not dependent on tailings strength for downstream stability and is not susceptible to a flow slide or large deformations resulting from earthquake-induced liquefaction of the tailings deposit. The on-going increase in tailings strength and reduction in pore water pressures as the tailings consolidate will only improve the overall stability and integrity of the TSF and main dam after closure.

The factor of safety calculated for water reaching the embankment crest was 1.5, representing an unlikely scenario of an improperly managed tailings pond coupled with inoperative embankment drains. This exceeds the minimum factor of safety for short-term operating conditions.

Materia	Unit Weight (kN/m^3)	Effective Friction Angle (deg)
Waste Rock	21	See Note 3
Core Zone	20	36
Filter/Transition Zone	20	33
Sand and Gravel	21	35
Overburden / Weathered Bedrock	22	37
Fractured / Fresh Bedrock	N/A	Impenetrable
Tailings Unconsolidated	17	See Note 2
Tailings Consolidated	20	See Note 2



NOTES:

1. LOCATION OF PHREATIC SURFACE PREDICTED FROM STEADY STATE SEEPAGE ANALYSIS.
2. A RELATIONSHIP FOR SHEAR STRESS AND EFFECTIVE NORMAL STRESS (SU/P') WAS USED TO MODEL THE TAILINGS STRENGTH, SU/P' = 0.25 FOR STATIC CONDITIONS.
3. RELATIONSHIPS FOR FRICTION ANGLES AND EFFECTIVE STRESS WERE DEVELOPED BASED ON LEPS (1970).

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2	12SEP'14	ISSUED WITH REPORT	LM	GRG	KJB

NEW GOLD INC.

BLACKWATER GOLD PROJECT

TAILINGS STORAGE FACILITY
SITE D MAIN DAM STABILITY
DOWNSTREAM SLIP SURFACE - STATIC

Knight Piésold CONSULTING

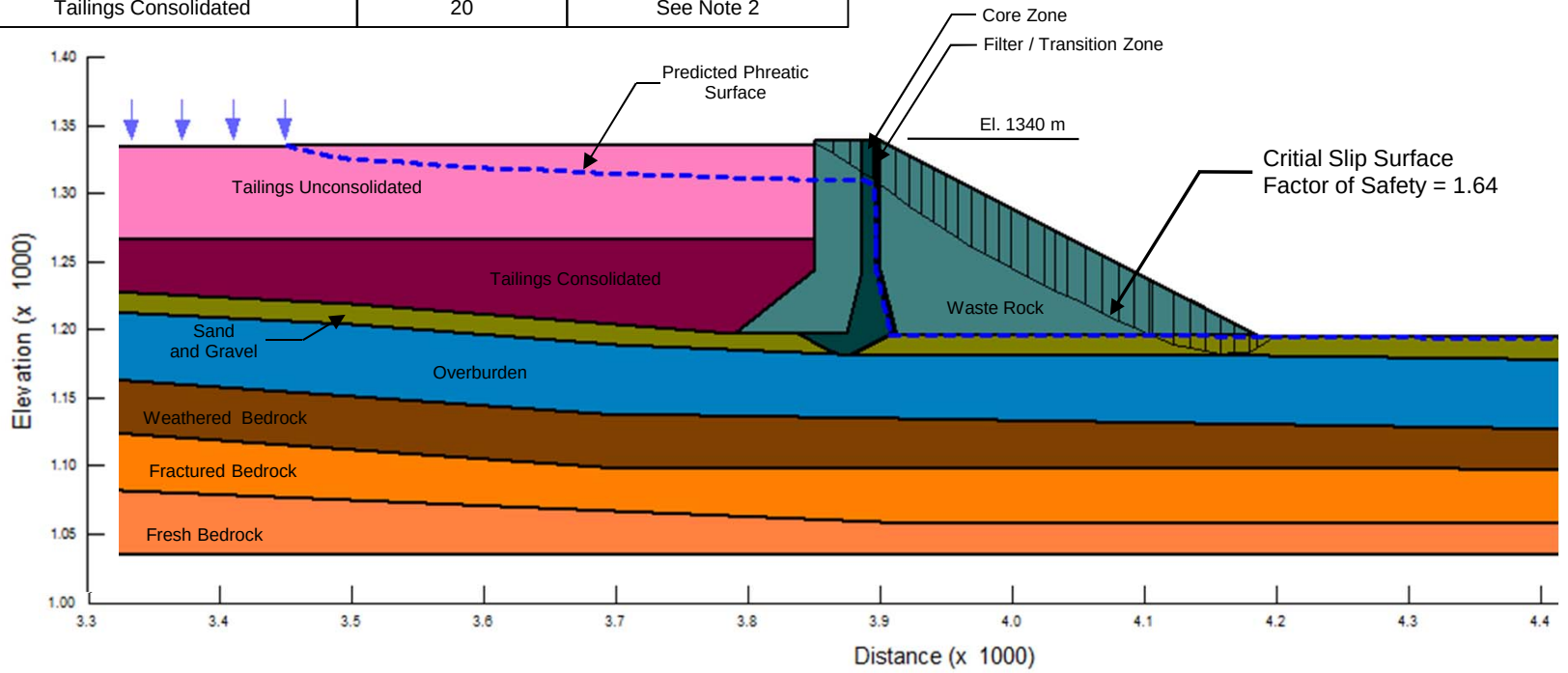
P/A. NO. VA101-457/6

REF NO. 11

FIGURE D.2

REV 2

Material	Unit Weight (kN/m^3)	Effective Friction Angle (deg)
Waste Rock	21	See Note 3
Core Zone	20	36
Filter/Transition Zone	20	33
Sand and Gravel	21	35
Overburden / Weathered Bedrock	22	37
Fractured / Fresh Bedrock	N/A	Impenetrable
Tailings Unconsolidated	17	See Note 2
Tailings Consolidated	20	See Note 2



NOTES:

1. LOCATION OF PHREATIC SURFACE PREDICTED FROM STEADY STATE SEEPAGE ANALYSIS.
2. A RELATIONSHIP FOR SHEAR STRESS AND EFFECTIVE NORMAL STRESS (SU/P') WAS USED TO MODEL THE TAILINGS STRENGTH, SU/P' = 0.25 FOR STATIC CONDITIONS.
3. RELATIONSHIPS FOR FRICTION ANGLES AND EFFECTIVE STRESS WERE DEVELOPED BASED ON LEPS (1970).

REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D
2	12SEP'14	ISSUED WITH REPORT	LM	GRG	KJB

NEW GOLD INC.

BLACKWATER GOLD PROJECT

TAILINGS STORAGE FACILITY
SITE D MAIN DAM STABILITY
MID-CREST SLIP SURFACE - STATIC

Knight Piésold CONSULTING

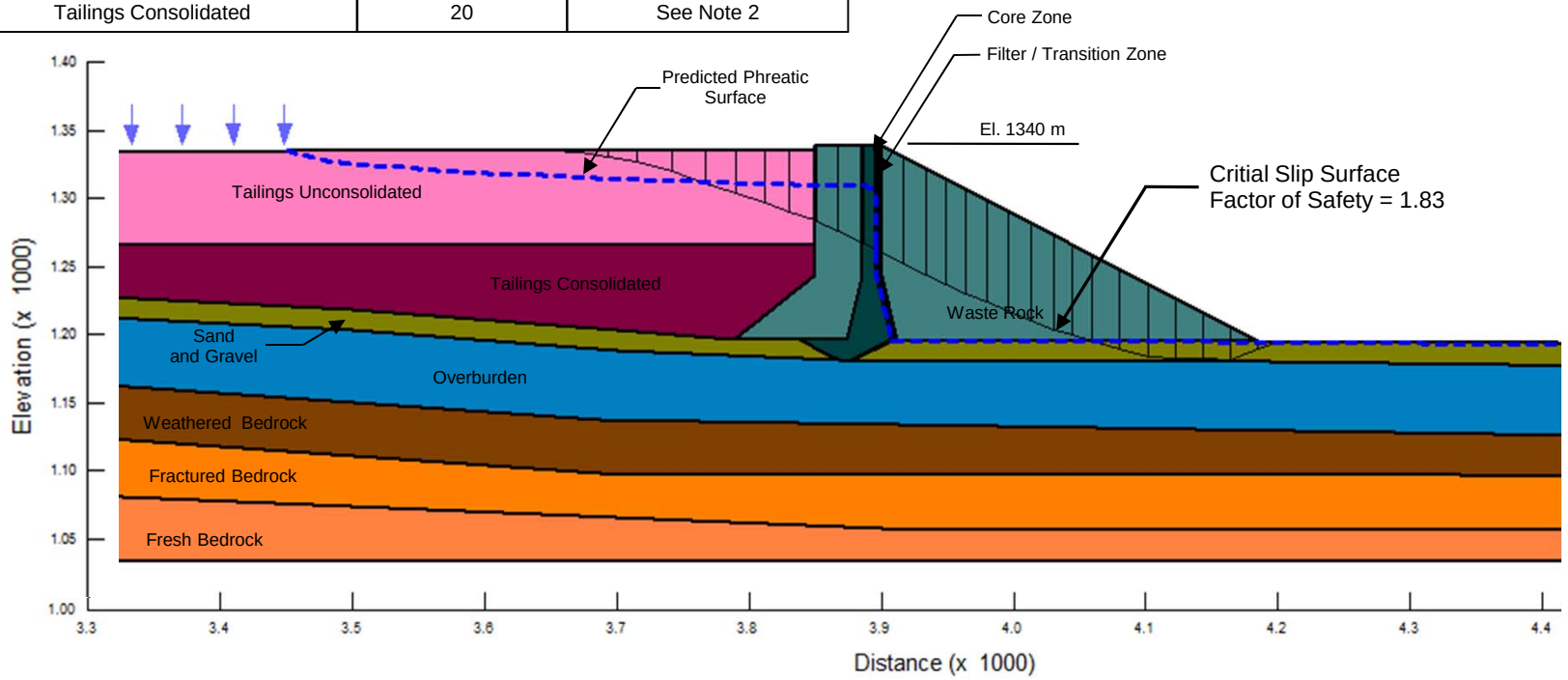
P/A. NO. VA101-457/6

REF NO. 11

FIGURE D.3

REV 2

Material	Unit Weight (kN/m^3)	Effective Friction Angle (deg)
Waste Rock	21	See Note 3
Core Zone	20	36
Filter/Transition Zone	20	33
Sand and Gravel	21	35
Overburden / Weathered Bedrock	22	37
Fractured / Fresh Bedrock	N/A	Impenetrable
Tailings Unconsolidated	17	See Note 2
Tailings Consolidated	20	See Note 2



NOTES:

1. LOCATION OF PHREATIC SURFACE PREDICTED FROM STEADY STATE SEEPAGE ANALYSIS.
2. A RELATIONSHIP FOR SHEAR STRESS AND EFFECTIVE NORMAL STRESS (SU/P') WAS USED TO MODEL THE TAILINGS STRENGTH, SU/P' = 0.25 FOR STATIC CONDITIONS.
3. RELATIONSHIPS FOR FRICTION ANGLES AND EFFECTIVE STRESS WERE DEVELOPED BASED ON LEPS (1970).

REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D
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NEW GOLD INC.

BLACKWATER GOLD PROJECT

TAILINGS STORAGE FACILITY
SITE D MAIN DAM STABILITY
DEEP SLIP SURFACE - STATIC

Knight Piésold CONSULTING

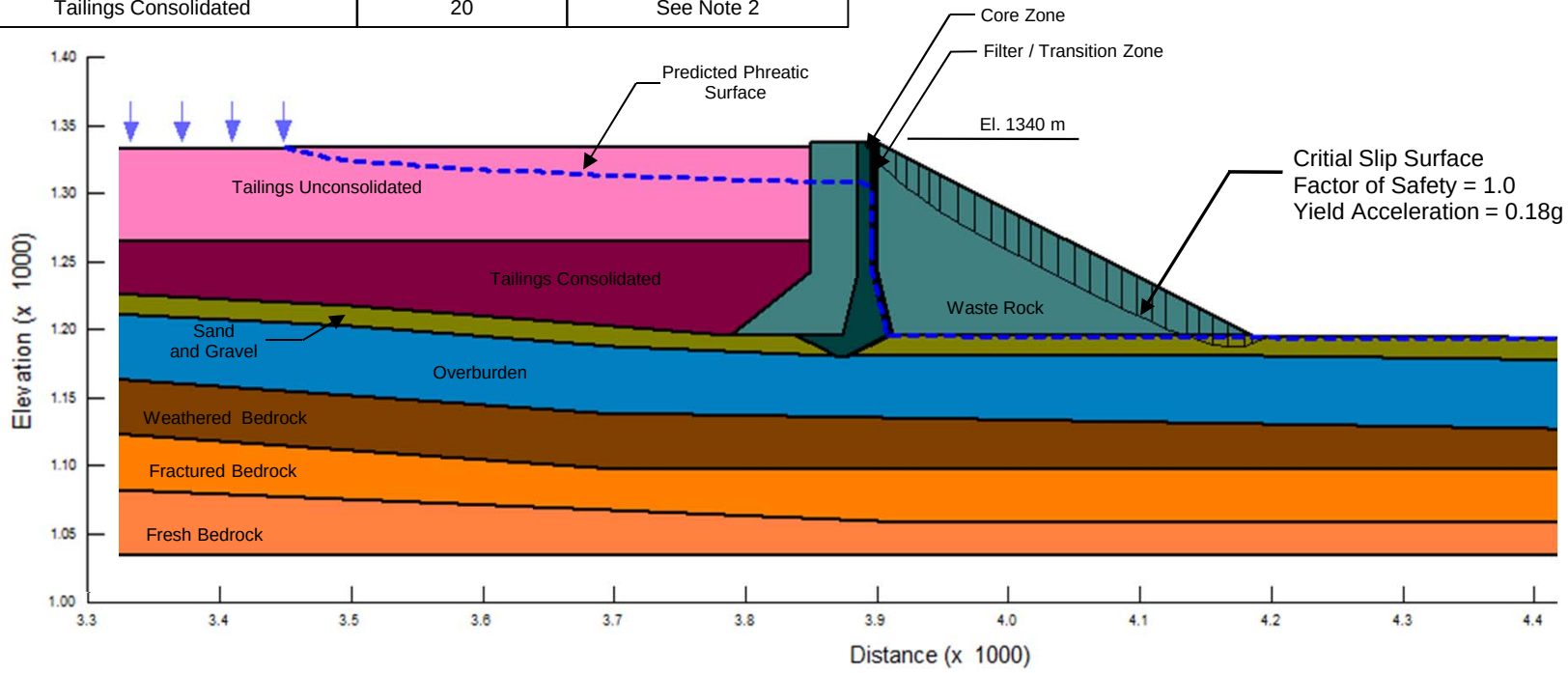
P/A. NO. VA101-457/6

REF NO. 11

FIGURE D.4

REV 2

Material	Unit Weight (kN/m^3)	Effective Friction Angle (deg)
Waste Rock	21	See Note 3
Core Zone	20	36
Filter/Transition Zone	20	33
Sand and Gravel	21	35
Overburden / Weathered Bedrock	22	37
Fractured / Fresh Bedrock	N/A	Impenetrable
Tailings Unconsolidated	17	See Note 2
Tailings Consolidated	20	See Note 2



NOTES:

1. LOCATION OF PHREATIC SURFACE PREDICTED FROM STEADY STATE SEEPAGE ANALYSIS.
2. A RELATIONSHIP FOR SHEAR STRESS AND EFFECTIVE NORMAL STRESS (SU/P') WAS USED TO MODEL THE TAILINGS STRENGTH, SU/P' = 0.25 FOR STATIC CONDITIONS.
3. RELATIONSHIPS FOR FRICTION ANGLES AND EFFECTIVE STRESS WERE DEVELOPED BASED ON LEPS (1970).

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2	12SEP'14	ISSUED WITH REPORT	LM	GRG	KJB

NEW GOLD INC.

BLACKWATER GOLD PROJECT

TAILINGS STORAGE FACILITY
SITE D MAIN DAM STABILITY
CRITICAL SLIP SURFACE - YIELD ACCEL.

Knight Piésold CONSULTING

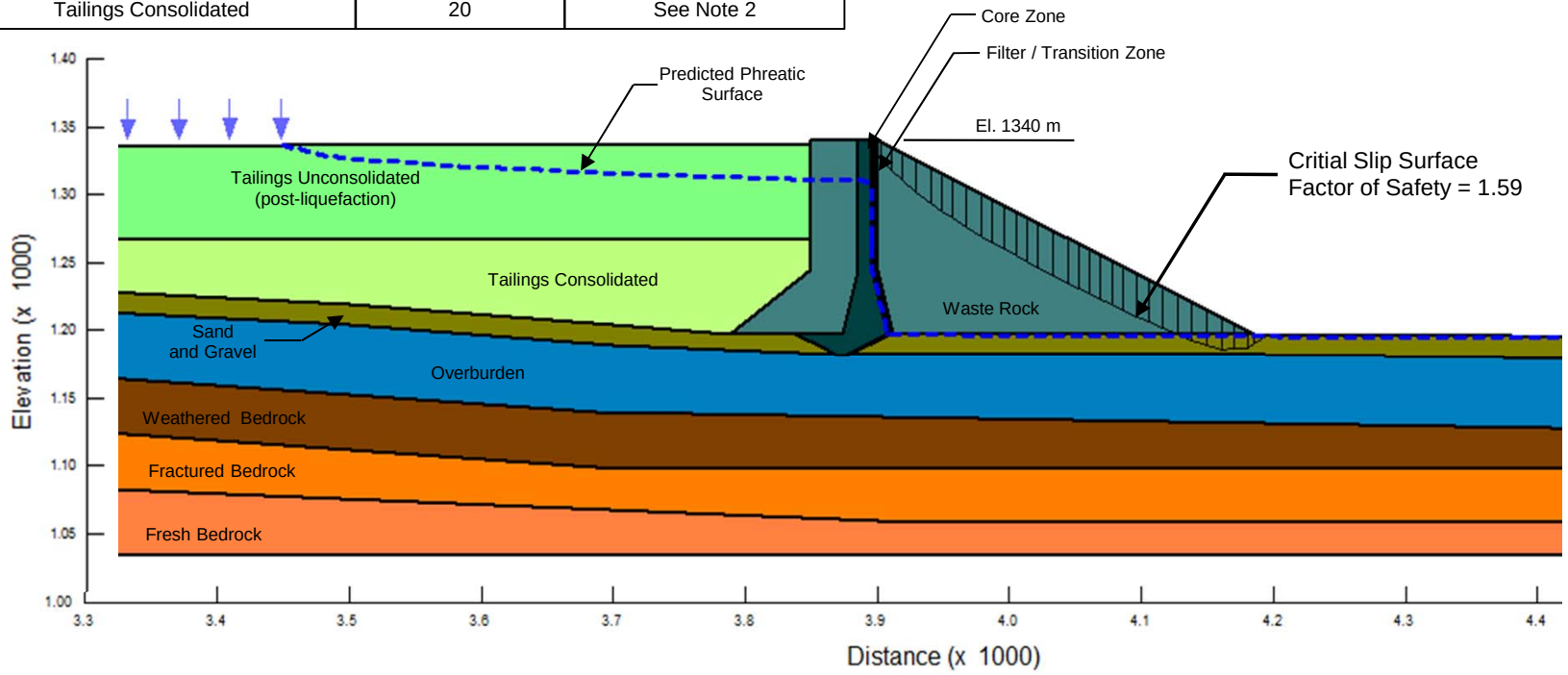
P/A. NO. VA101-457/6

REF NO. 11

FIGURE D.5

REV 2

Materia	Unit Weight (kN/m^3)	Effective Friction Angle (deg)
Waste Rock	21	See Note 3
Core Zone	20	36
Filter/Transition Zone	20	33
Sand and Gravel	21	35
Overburden / Weathered Bedrock	22	37
Fractured / Fresh Bedrock	N/A	Impenetrable
Tailings Unconsolidated	17	See Note 2
Tailings Consolidated	20	See Note 2



NOTES:

1. LOCATION OF PHREATIC SURFACE PREDICTED FROM STEADY STATE SEEPAGE ANALYSIS.
2. A RELATIONSHIP FOR SHEAR STRESS AND EFFECTIVE NORMAL STRESS (SU/P') WAS USED TO MODEL THE TAILINGS STRENGTH, SU/P' = 0.1 FOR POST-LIQUEFACTION CONDITIONS.
3. RELATIONSHIPS FOR FRICTION ANGLES AND EFFECTIVE STRESS WERE DEVELOPED BASED ON LEPS (1970).

REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D
2	12SEP'14	ISSUED WITH REPORT	LM	GRG	KJB

NEW GOLD INC.

BLACKWATER GOLD PROJECT

TAILINGS STORAGE FACILITY
SITE D MAIN DAM STABILITY
CRITICAL SLIP SURFACE - POST LIQUEFACTION

Knight Piésold CONSULTING

P/A. NO. VA101-457/6

REF NO. 11

FIGURE D.6

REV 2

Predicted embankment deformations under seismic loading are negligible, if any, as the calculated yield acceleration exceeds the estimated average PGA values for the OBE, MDE and MCE.

Maximum displacements of approximately 0.11 m and 0.06 m were predicted for the MCE and MDE respectively, based on the stiffness of the embankment fill and predominant period of the embankment under seismic loading (estimated to be in the range of about 0.6 seconds). Predicted embankment displacement for the OBE is negligible (< 0.01 m). The predicted maximum crest settlements for the Site D Main Dam section were approximately 0.13 m for the OBE, 0.17 m for the MDE and 0.2 m for the MCE. A summary of the seismic displacement results are included in Table D.3.

Table D.3 Site D Main Dam Seismic Displacement Summary

Description	Design PGA[1] (g) Mean[2]	Design Earthquake Magnitude	Calculated Yield Acceleration (K_Y)[3]	Displacement Along Slip Surface (m)			Crest Settlement (m)
				Newmark[4]	Makdisi-Seed (Average)[4]	Bray ($D_{84\%}$)[5]	Swaisgood[6]
OBE	0.04	8.5	0.18	0.00	0.00	0.00	0.13
MDE	0.08	8.5	0.18	0.00	0.00	0.06	0.17
MCE	0.11	8.5	0.18	0.00	0.00	0.11	0.20

NOTES:
1. The design maximum acceleration is for Site Class C conditions (defined as soft rock or very dense soils).
2. Mean acceleration values are conservatively estimated by multiplying the median acceleration value by 1.15. Mean acceleration values are recommended for dam design by the Canadian Dam Association "Dam Safety Guidelines" (2007).
3. The yield acceleration (ky) corresponds to the horizontal seismic coefficient (acceleration) required to reduce the factor of safety to 1.0
4. The Newmark (1965) and Makdisi-Seed (1977) methods estimate potential displacement along the critical slip surface.
5. The Bray (2007) method estimates potential displacement taking into consideration the fundamental period of the structure (Ts) and the ground motion's spectral acceleration at a degraded period equal to 1.5Ts.
6. The Swaisgood (2003) method estimates the predicted vertical settlement of the dam crest
7. Slip surfaces are a minimum of 2 m depth

Maximum embankment deformations and settlements calculated for the design earthquakes were approximately 0.2 m or less, and would not have a significant impact on the available embankment freeboard (minimum of 2.0 m) or result in any loss of embankment integrity. Predicted embankment deformations from the OBE were negligible and would not impact on-going operations at the TSF.

Site C Main Dam

The stability analyses for the Site C Main Dam were based on the maximum cross section through the dam with a crest elevation of 1353 m, a maximum tailings filling elevation of 1346 m, and supernatant pond elevation of 1344 m. The analyses did not consider the stabilizing effect of the construction of TSF Site D directly downstream of TSF Site C. Disposal of mine waste rock in the PAG disposal area and tailings discharged into the lower facility during operation will provide a buttress to the Site C Main Dam over the long-term.

Cross sections showing the stability model and failure surfaces considered are shown on Figures D.7 through D.12. The figures include the critical slip surfaces and factors of safety (FS) for static normal operating conditions, pseudo-seismic yield acceleration and post-liquefaction stability. Slip surfaces considered in the assessment include shallow downstream failure from the edge of the dam crest, failure

from the mid-crest of the dam, and deep-seated failure propagating into the tailings mass. The factors of safety calculated for different slip surfaces and failure modes are included on Table D.4.

Table D.4 Site C Main Dam Results Summary

Location	PWP Level	Slip Surface	Static FS	Yield Acceleration (1)	Post-Liquefaction FS
Site C Main Dam	Parental Analysis (2)	Downstream – initiation near dam crest edge	1.71	0.26	1.71
		Mid-crest - initiation from mid-crest and back	1.75	-	-
		Deep - propagates into tailings mass	2.08	-	2.08
Site C Main Dam	Fully Specified Piezometric Line (3)	Water at the embankment crest	1.38	-	-

NOTES:
1. The yield acceleration (K_Y) corresponds to the horizontal seismic acceleration required to reduce the factor of safety to 1.0.
2. Parental analysis from previous analysis in SEEP/W.
3. Phreatic surface was created from engineering judgement and represents a condition of an improperly managed tailings pond coupled with a poorly drained embankment.

The minimum factor of safety calculated for long-term static conditions was 1.7. This exceeds the minimum factor of safety for long-term (post-closure) conditions. The factor of safety calculated for water reaching the embankment crest was 1.38, representing an unlikely scenario of an improperly managed tailings pond coupled with inoperative embankment drains. This exceeds the minimum factor of safety for short-term operating conditions.

The estimated yield acceleration for the Site C Main Dam was approximately 0.26g. The post-earthquake condition that conservatively assumes complete liquefaction of the tailings deposit was also analysed using a post-liquefaction residual tailings strength. The calculated factor of safety is the same as the static factor of safety as the critical potential slip surface does not pass through the liquefied tailings deposit.

Predicted embankment deformations under seismic loading are negligible, if any, as the calculated yield acceleration exceeds the estimated average PGA values for the OBE, MDE and MCE. A summary of the seismic displacement results are included in Table D.5.

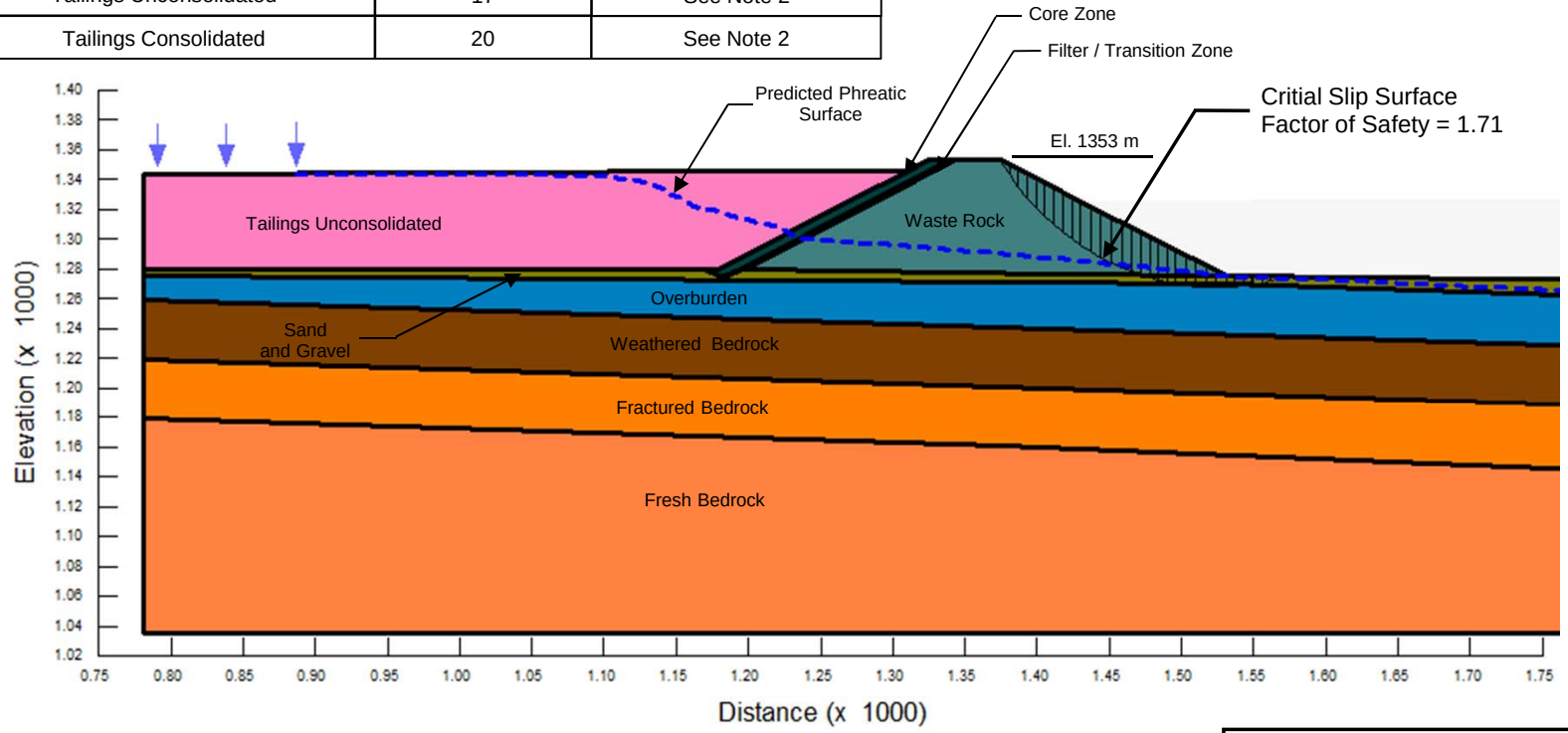
Table D.5 Site C Main Dam Seismic Displacement Summary

Description	Design PGA[1] (g) Mean[2]	Design Earthquake Magnitude	Calculated Yield Acceleration (K_Y)[3]	Displacement Along Slip Surface (m)			Crest Settlement (m)
				Newmark[4]	Makdisi-Seed (Average)[4]	Bray ($D_{84\%}$)[5]	Swaisgood[6]
OBE	0.04	8.5	0.26	0.00	0.00	0.00	0.09
MDE	0.08	8.5	0.26	0.00	0.00	0.02	0.12
MCE	0.11	8.5	0.26	0.00	0.00	0.03	0.14

Maximum displacements of approximately 0.03 m and 0.02 m were predicted for the MCE and MDE respectively, based on the stiffness of the embankment fill and predominant period of the embankment under seismic loading (estimated to be in the range of about 0.6 seconds). Predicted embankment displacement for the OBE is negligible (< 0.01 m). The predicted maximum crest settlements for the Site C Main Dam section are approximately 0.09 m for the OBE, 0.12 m for the MDE and 0.14 m for the MCE.

Maximum embankment deformations and settlements calculated for the design earthquakes are approximately 0.14 m or less, and would not have a significant impact on the available embankment freeboard or result in any loss of embankment integrity. Predicted embankment deformations from the OBE are negligible and would not impact on-going operations at the TSF.

Material	Unit Weight (kN/m^3)	Effective Friction Angle (deg)
Waste Rock	21	See Note 3
Core Zone	20	36
Filter/Transition Zone	20	33
Sand and Gravel	21	35
Overburden / Weathered Bedrock	22	37
Fractured / Fresh Bedrock	N/A	Impenetrable
Tailings Unconsolidated	17	See Note 2
Tailings Consolidated	20	See Note 2



NOTES:

1. LOCATION OF PHREATIC SURFACE PREDICTED FROM STEADY STATE SEEPAGE ANALYSIS.
2. A RELATIONSHIP FOR SHEAR STRESS AND EFFECTIVE NORMAL STRESS (SU/P') WAS USED TO MODEL THE TAILINGS STRENGTH, SU/P' = 0.25 FOR STATIC CONDITIONS.
3. RELATIONSHIPS FOR FRICTION ANGLES AND EFFECTIVE STRESS WERE DEVELOPED BASED ON LEPS (1970).

REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D
2	12SEP'14	ISSUED WITH REPORT	DDF	BB	KJB

NEW GOLD INC.

BLACKWATER GOLD PROJECT

TAILINGS STORAGE FACILITY
SITE C MAIN DAM STABILITY
DOWNSTREAM SLIP SURFACE - STATIC

Knight Piésold CONSULTING

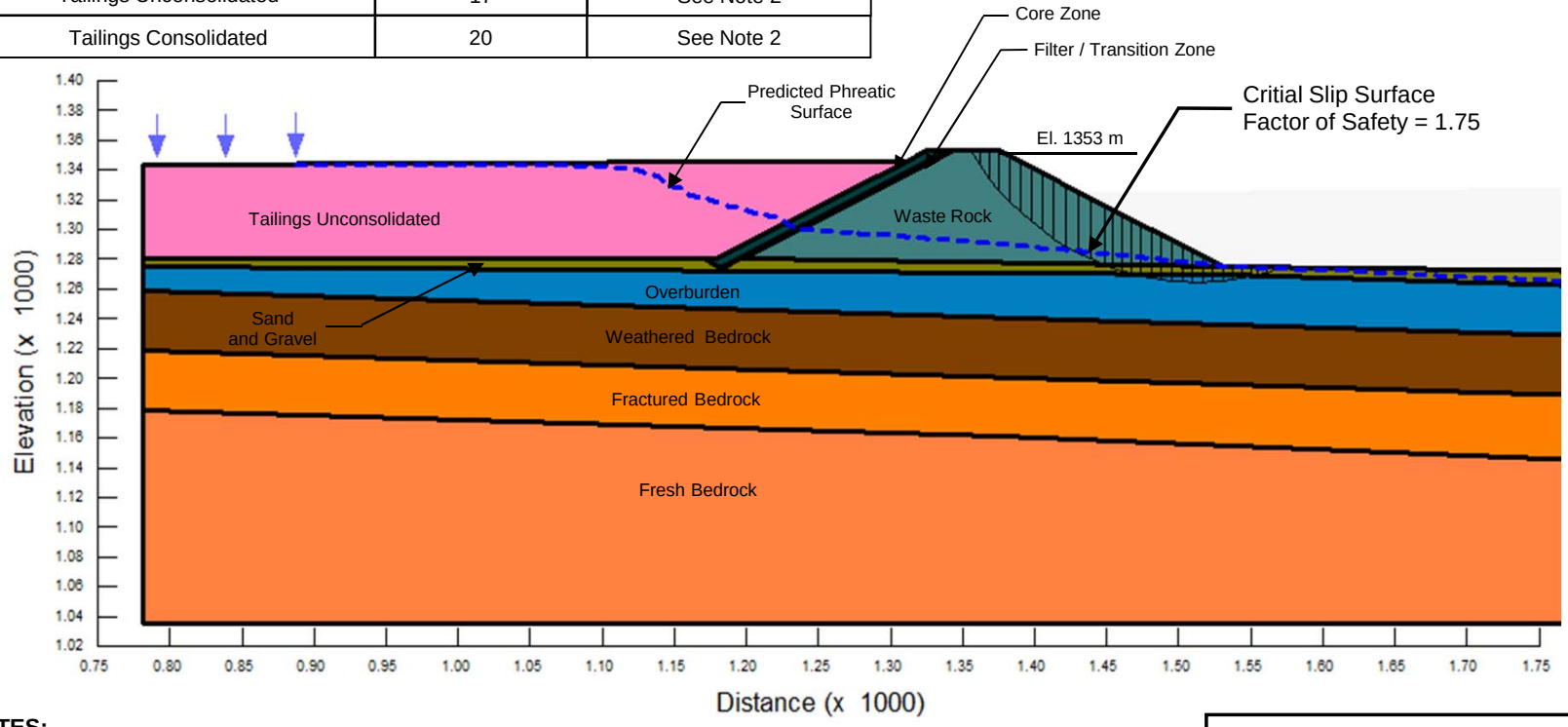
P/A. NO. VA101-457/6

REF NO. 11

FIGURE D.7

REV 2

Material	Unit Weight (kN/m^3)	Effective Friction Angle (deg)
Waste Rock	21	See Note 3
Core Zone	20	36
Filter/Transition Zone	20	33
Sand and Gravel	21	35
Overburden / Weathered Bedrock	22	37
Fractured / Fresh Bedrock	N/A	Impenetrable
Tailings Unconsolidated	17	See Note 2
Tailings Consolidated	20	See Note 2



NOTES:

1. LOCATION OF PHREATIC SURFACE PREDICTED FROM STEADY STATE SEEPAGE ANALYSIS.
2. A RELATIONSHIP FOR SHEAR STRESS AND EFFECTIVE NORMAL STRESS (SU/P') WAS USED TO MODEL THE TAILINGS STRENGTH, SU/P' = 0.25 FOR STATIC CONDITIONS.
3. RELATIONSHIPS FOR FRICTION ANGLES AND EFFECTIVE STRESS WERE DEVELOPED BASED ON LEPS (1970).

REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D
2	12SEP'14	ISSUED WITH REPORT	DDF	BB	KJB

NEW GOLD INC.

BLACKWATER GOLD PROJECT

TAILINGS STORAGE FACILITY
SITE C MAIN DAM STABILITY
MID-CREST SLIP SURFACE - STATIC

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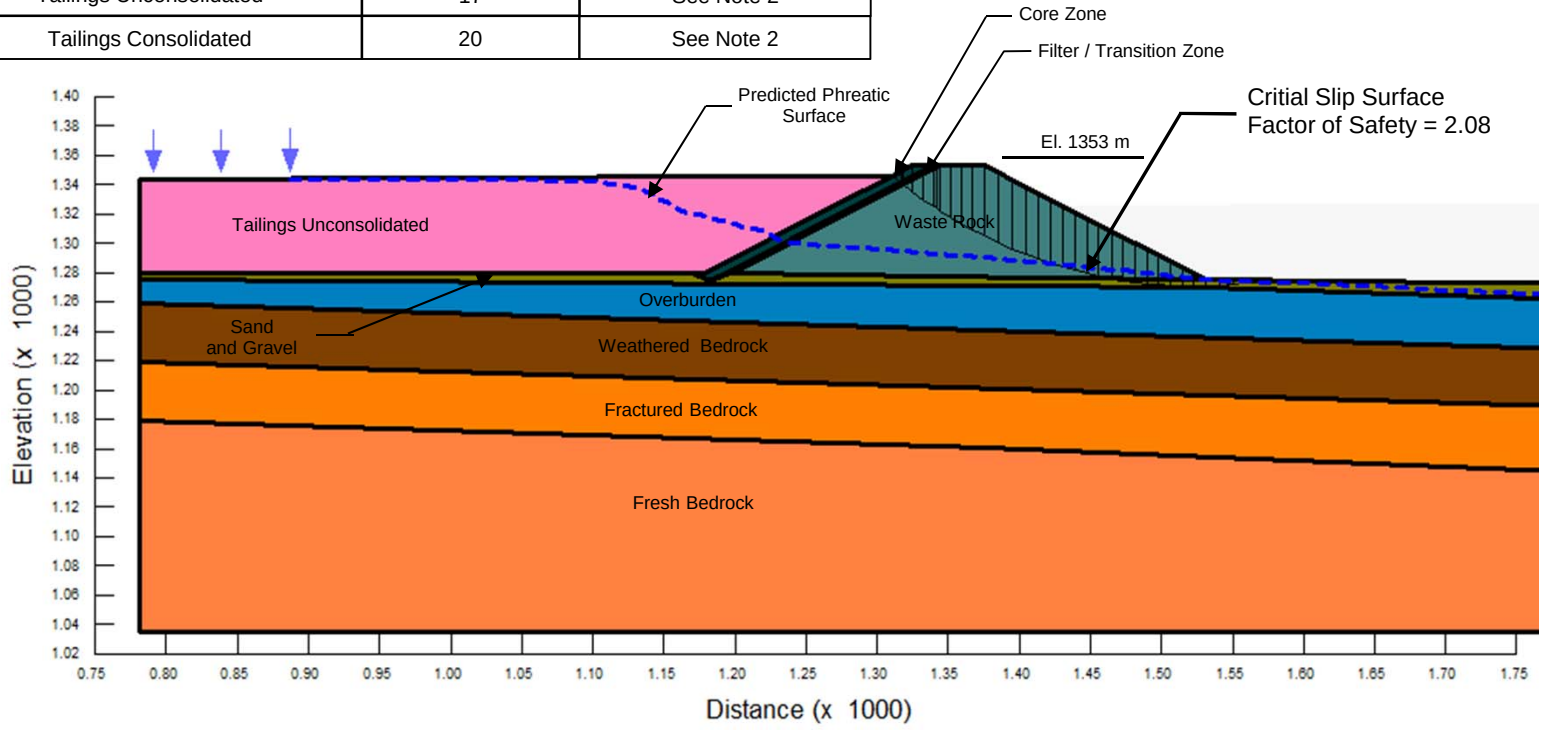
P/A. NO. VA101-457/6

REF NO. 11

FIGURE D.8

REV 2

Material	Unit Weight (kN/m^3)	Effective Friction Angle (deg)
Waste Rock	21	See Note 3
Core Zone	20	36
Filter/Transition Zone	20	33
Sand and Gravel	21	35
Overburden / Weathered Bedrock	22	37
Fractured / Fresh Bedrock	N/A	Impenetrable
Tailings Unconsolidated	17	See Note 2
Tailings Consolidated	20	See Note 2



NOTES:

1. LOCATION OF PHREATIC SURFACE PREDICTED FROM STEADY STATE SEEPAGE ANALYSIS.
2. A RELATIONSHIP FOR SHEAR STRESS AND EFFECTIVE NORMAL STRESS (SU/P') WAS USED TO MODEL THE TAILINGS STRENGTH, SU/P' = 0.25 FOR STATIC CONDITIONS.
3. RELATIONSHIPS FOR FRICTION ANGLES AND EFFECTIVE STRESS WERE DEVELOPED BASED ON LEPS (1970).

REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D
2	12SEP'14	ISSUED WITH REPORT	DDF	BB	KJB

NEW GOLD INC.

BLACKWATER GOLD PROJECT

TAILINGS STORAGE FACILITY
SITE C MAIN DAM STABILITY
DEEP SLIP SURFACE - STATIC

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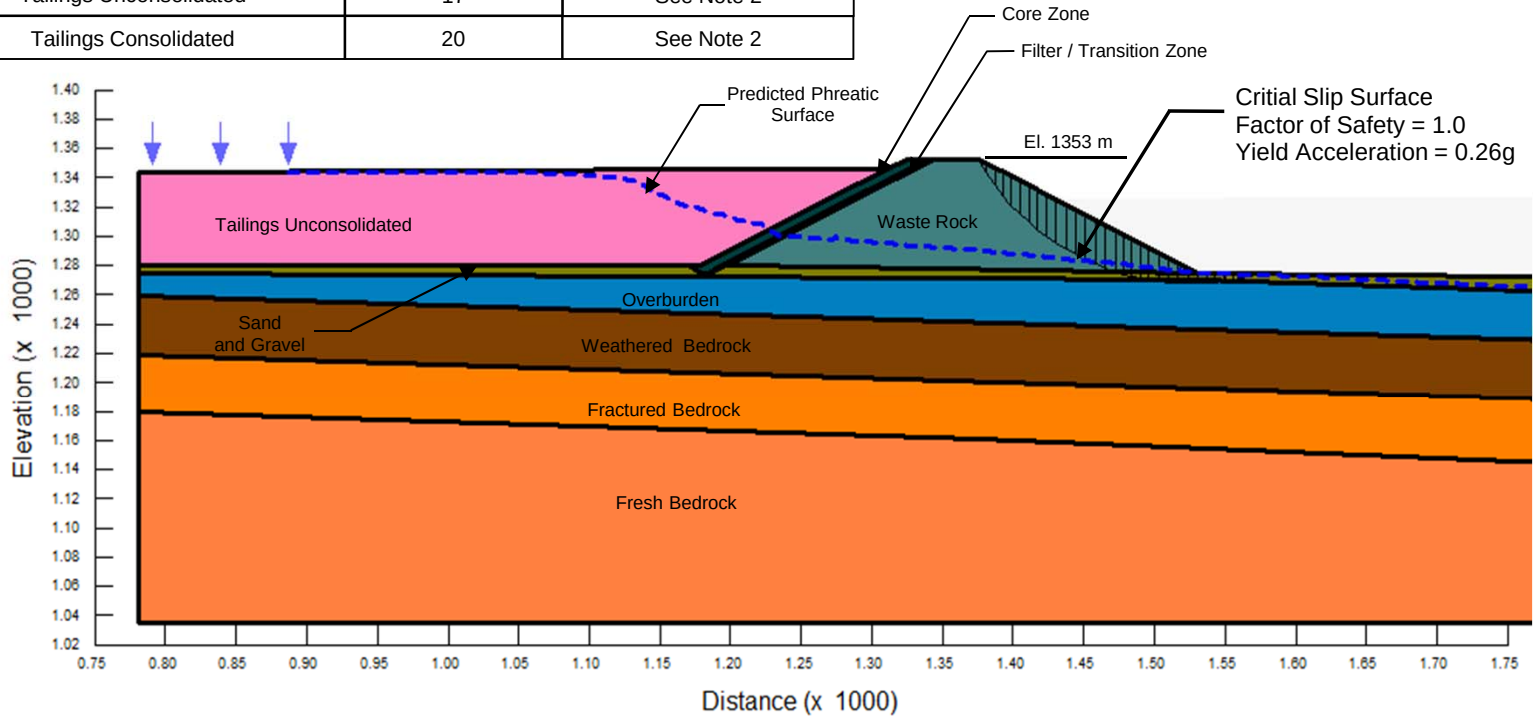
P/A. NO. VA101-457/6

REF NO. 11

FIGURE D.9

REV 2

Material	Unit Weight (kN/m^3)	Effective Friction Angle (deg)
Waste Rock	21	See Note 3
Core Zone	20	36
Filter/Transition Zone	20	33
Sand and Gravel	21	35
Overburden / Weathered Bedrock	22	37
Fractured / Fresh Bedrock	N/A	Impenetrable
Tailings Unconsolidated	17	See Note 2
Tailings Consolidated	20	See Note 2



NOTES:

1. LOCATION OF PHREATIC SURFACE PREDICTED FROM STEADY STATE SEEPAGE ANALYSIS.
2. A RELATIONSHIP FOR SHEAR STRESS AND EFFECTIVE NORMAL STRESS (SU/P') WAS USED TO MODEL THE TAILINGS STRENGTH, SU/P' = 0.25 FOR STATIC CONDITIONS.
3. RELATIONSHIPS FOR FRICTION ANGLES AND EFFECTIVE STRESS WERE DEVELOPED BASED ON LEPS (1970).

REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D
2	12SEP'14	ISSUED WITH REPORT	DDF	BB	KJB

NEW GOLD INC.

BLACKWATER GOLD PROJECT

TAILINGS STORAGE FACILITY
SITE C MAIN DAM STABILITY
DOWNSTREAM SLIP SURFACE - YIELD ACCEL.

Knight Piésold CONSULTING

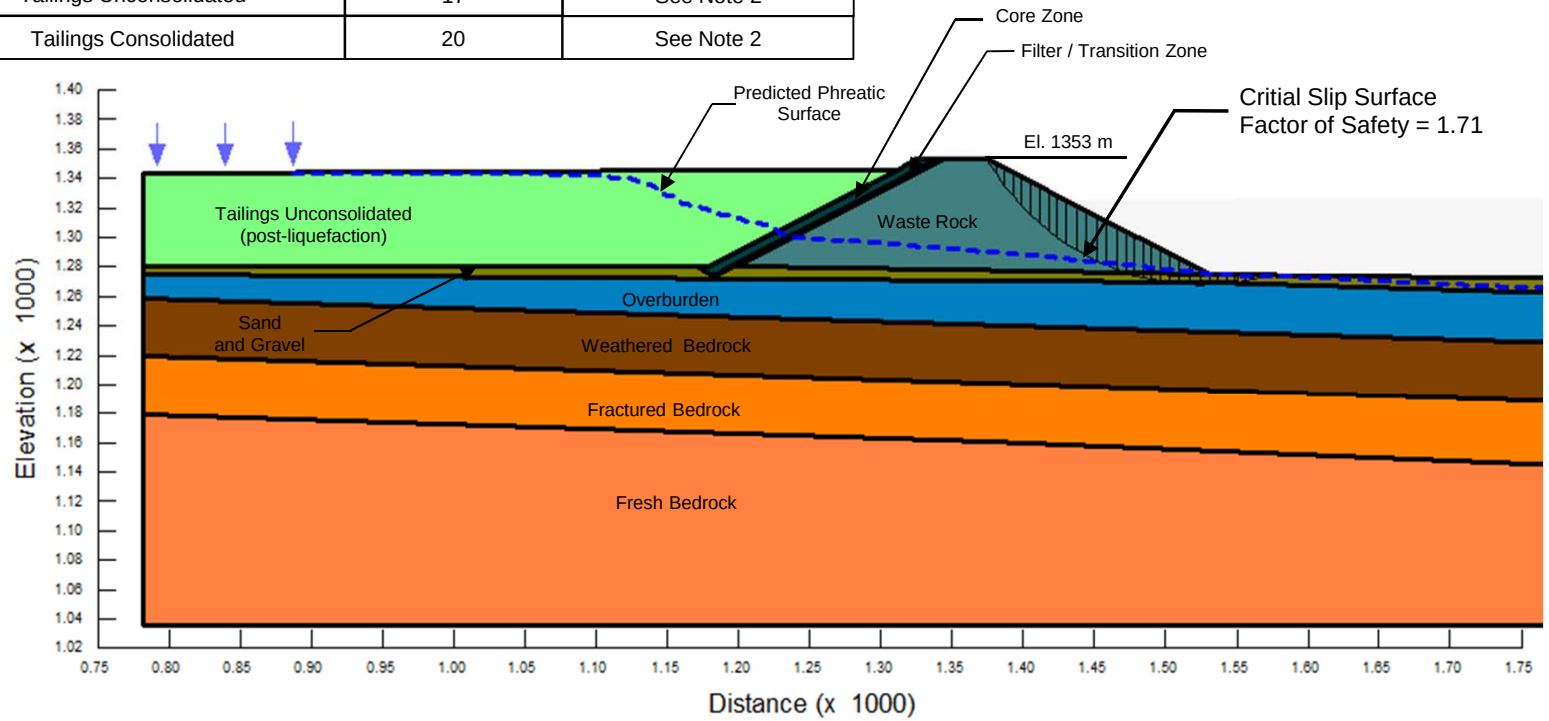
P/A. NO. VA101-457/6

REF NO. 11

FIGURE D.10

REV 2

Material	Unit Weight (kN/m^3)	Effective Friction Angle (deg)
Waste Rock	21	See Note 3
Core Zone	20	36
Filter/Transition Zone	20	33
Sand and Gravel	21	35
Overburden / Weathered Bedrock	22	37
Fractured / Fresh Bedrock	N/A	Impenetrable
Tailings Unconsolidated	17	See Note 2
Tailings Consolidated	20	See Note 2



NOTES:

1. LOCATION OF PHREATIC SURFACE PREDICTED FROM STEADY STATE SEEPAGE ANALYSIS.
2. A RELATIONSHIP FOR SHEAR STRESS AND EFFECTIVE NORMAL STRESS (SU/P') WAS USED TO MODEL THE TAILINGS STRENGTH, SU/P' = 0.1 FOR POST-LIQUEFACTION CONDITIONS.
3. RELATIONSHIPS FOR FRICTION ANGLES AND EFFECTIVE STRESS WERE DEVELOPED BASED ON LEPS (1970).

REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D
2	12SEP'14	ISSUED WITH REPORT	DDF	BB	KJB

NEW GOLD INC.

BLACKWATER GOLD PROJECT

TAILINGS STORAGE FACILITY
SITE C MAIN DAM STABILITY
CRITICAL SLIP SURFACE - POST LIQUEFACTION

Knight Piésold CONSULTING

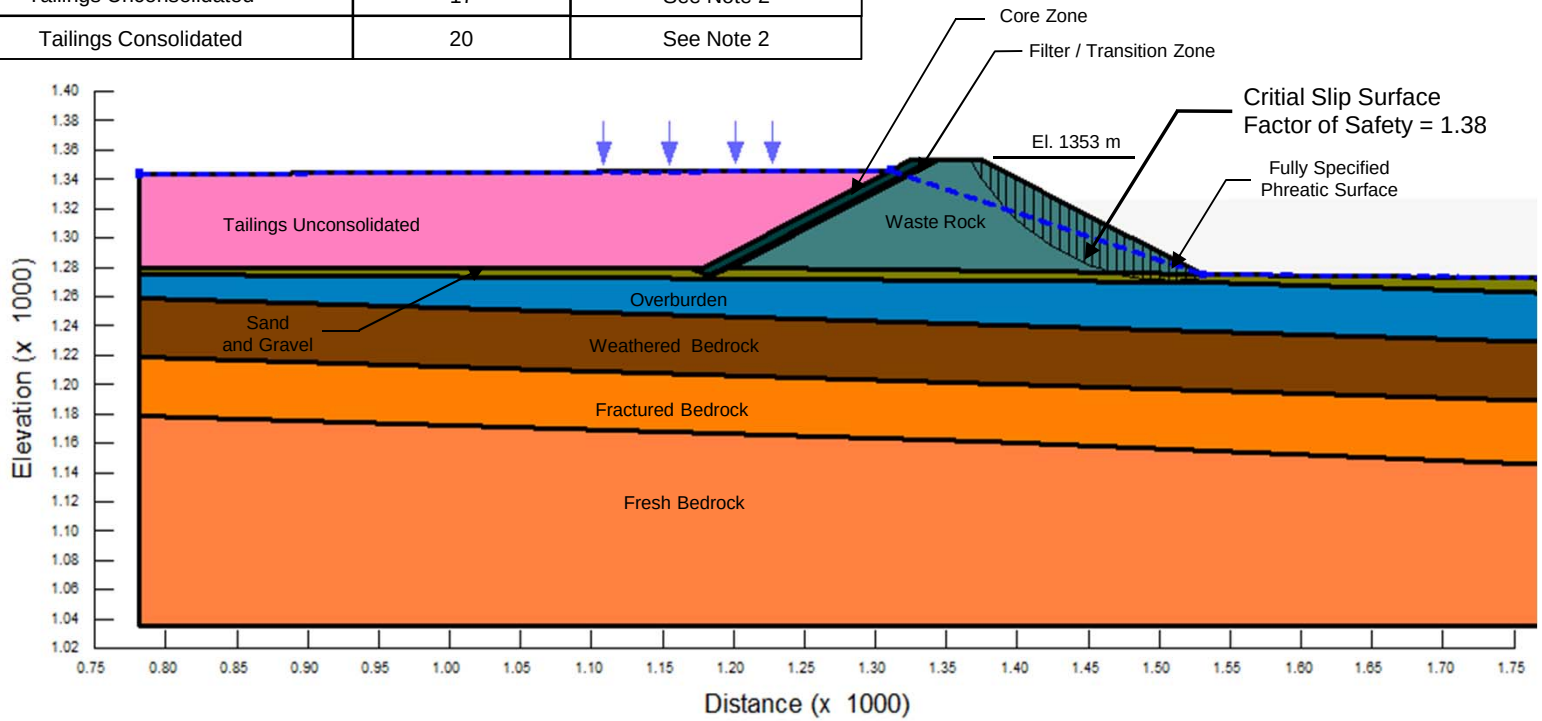
P/A. NO. VA101-457/6

REF NO. 11

FIGURE D.11

REV 2

Material	Unit Weight (kN/m^3)	Effective Friction Angle (deg)
Waste Rock	21	See Note 3
Core Zone	20	36
Filter/Transition Zone	20	33
Sand and Gravel	21	35
Overburden / Weathered Bedrock	22	37
Fractured / Fresh Bedrock	N/A	Impenetrable
Tailings Unconsolidated	17	See Note 2
Tailings Consolidated	20	See Note 2



NOTES:

1. LOCATION OF PHREATIC SURFACE PREDICTED FROM STEADY STATE SEEPAGE ANALYSIS.
2. A RELATIONSHIP FOR SHEAR STRESS AND EFFECTIVE NORMAL STRESS (SU/P') WAS USED TO MODEL THE TAILINGS STRENGTH, SU/P' = 0.25 FOR STATIC CONDITIONS.
3. RELATIONSHIPS FOR FRICTION ANGLES AND EFFECTIVE STRESS WERE DEVELOPED BASED ON LEPS (1970).
4. PHREATIC SURFACE WAS FULLY SPECIFIED TO REPRESENT SHORT TERM SCENARIO OF AN IMPROPERLY MANAGED TAILINGS POND COUPLED WITH POORLY OPERATING EMBANKMENT DRAINS.

REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D
2	12SEP'14	ISSUED WITH REPORT	DDF	BB	KJB

NEW GOLD INC.

BLACKWATER GOLD PROJECT

TAILINGS STORAGE FACILITY
SITE C MAIN DAM STABILITY
DOWNSTREAM SLIP SURFACE - ELEVATED PWP

Knight Piésold CONSULTING

P/A. NO. VA101-457/6

REF NO. 11

FIGURE D.12

REV 2

D.3 WATER RETAINING DAMS

D.3.1 MODELLING APPROACH

The project includes two additional water retaining dams classified as SIGNIFICANT consequence dams in accordance with Dam Safety Guidelines (CDA, 2007). The Earthquake Design Ground Motion (EDGM) for a SIGNFICANT consequence dam is the 1 in 1000 year return period event. The MDE corresponding to the 1 in 5,000 year earthquake was selected as the design earthquake for the water retaining dams to demonstrate robustness in the design. The OBE was also considered in the stability assessment.

The two water retaining dams are referred to as the Environmental Control Dam (ECD) and Fresh Water Reservoir (FWR). These dams are both earthfill core rockfill dams with upstream and downstream filter and drain zones, equivalent upstream and downstream slopes, and operating criteria. The FWR is 14 m high and the ECD is 11 m high. Both facilities include spillways that were designed to maintain a minimum freeboard of 1.5 m. Foundation conditions for both dams are similar. The larger of the two dams, the FWR, was adopted for the slope stability analyses in the feasibility study to represent both dams.

Dam stability analyses were carried out to investigate the stability of the water retaining dams under both static and seismic loading conditions. These comprised checking the stability of the dam arrangement for each of the following cases:

- Static conditions during operations (short term and long term), and
- Earthquake loading from the Operating Basis Earthquake (OBE) and the Maximum Design Earthquake (MDE) during operations.

The stability analyses were carried out using the limit equilibrium computer program SLOPE/W (Geostudio, 2007). Factors of safety were computed using the Morgenstern-Price method. The predicted phreatic surface determined from TSF seepage modelling was used as the pore water pressure (PWP) level in the stability analysis for the dams.

The seismic stability assessment of the dam included estimation of seismically induced deformations of the dam from the MDE and OBE. The MDE has a mean PGA of 0.08g and design earthquake magnitude of 8.5. The OBE was defined as the 1 in 500 year earthquake with a mean PGA of 0.04g and design earthquake magnitude of 8.5, was also considered in the stability assessment. The design PGA values are for very dense soils and soft (weathered) rock ground conditions, which is consistent with foundation conditions for the ECD and FWR dams. An amplification factor of 1.5 has been assumed to estimate the average PGA along a potential slip surface through the embankment to account for the potential amplification of ground motions as seismic waves propagate through the foundation soils and embankment. This results in an estimated average PGA within the embankment of 0.13g and 0.06g for the MDE and OBE, respectively.

Embankment stability during earthquake loading has been assessed by performing a pseudo-static analysis, whereby a horizontal force (seismic coefficient) is applied to the embankment to simulate earthquake loading to determine the critical acceleration (yield acceleration) required to reduce the factor of safety to 1.0. Deformation of the embankment is predicted to occur if the critical acceleration is lower than the predicted average PGA along the potential slip surface from the design earthquake.

Potential deformations under earthquake loading have been estimated using the EDGM and the simplified methods of Newmark (1965), Makdisi-Seed (1977), and Bray (2007). Potential settlement of

the embankment crest was estimated using the empirical relationship provided by Swaisgood (2003). These methods and relationships were described previously in Section D.2.1.

In accordance with the Dam Safety Guidelines (CDA, 2007) and standard industry practice, the minimum acceptable factor of safety for the dams under static conditions is 1.3 for short-term operating conditions and 1.5 for long-term (steady-state and closure). A factor of safety of less than 1.0 is acceptable under earthquake loading conditions provided that calculated embankment deformations resulting from seismic loading are not significant.

D.3.2 MATERIAL PARAMETERS AND ASSUMPTIONS

The material parameters used in the analyses were described previously in Section D.2.2. A summary of the material unit weights and effective strength parameters used in the analyses are provided in Table D.6.

Table D.6 Material Strength Parameters

Unit	Unit Weight (kN/m^3)	Friction Angle (deg)	Cohesion (kPa)
Embankment Materials			
Zone S (Core)	20	36	0
Zone F (Filter)	20	33	0
Zone T (Transition)	20	33	0
Zone C (Waste Rock / Shell)	21	See Note 1	
Foundation Materials			
Sand and Gravel	21	35	0
Overburden / Weathered Bedrock	22	37	0
Fractured / Fresh Bedrock	Impenetrable		

NOTES:
1. A relationship for friction angle and effective stress was developed for the rockfill materials, based on published information on the shear strength properties of rockfill (Leps, 1970).

D.3.3 RESULTS

The stability analyses for the ECD and FWR were based on the maximum cross section through the dam with a crest elevation of 1168 m and a maximum pond elevation of 1166 m.

Cross sections showing the stability model and failure surfaces considered are shown on Figures D.13 through D.16. The figures include the critical slip surfaces and factors of safety (FS) for static normal operating conditions and pseudo-seismic yield acceleration. Slip surfaces considered in the assessment include downstream and upstream failure mechanisms. The factors of safety calculated for different slip surfaces and failure modes are included on Table D.7.

The minimum factor of safety calculated for long-term static conditions was 2.35. This exceeds the minimum factor of safety for long-term (operating and closure) conditions. The factor of safety calculated for elevated pore water pressure (PWP) within the dam was 1.97, representing a scenario of inoperative embankment drains prior to repair. This exceeds the minimum factor of safety for short-term operating conditions.

Table D.7 ECD and FWR Results Summary

Location	PWP Level	Slip Surface	Static FS	Yield Acceleration (1)
ECD and FWR	Parental Analysis (2)	Downstream Slope	2.35	0.36
		Upstream Slope	2.70	0.26
ECD and FWR	Fully Specified Piezometric Line (3)	Downstream with elevated pore pressure	1.97	-

NOTES:
1. The yield acceleration (K_Y) corresponds to the horizontal seismic acceleration required to reduce the factor of safety to 1.0.
2. Parental analysis from previous analysis in SEEP/W.
3. Phreatic surface was created from engineering judgement and represents a condition of an improperly managed tailings pond coupled with a poorly drained embankment.

The estimated yield acceleration for the water retaining dams was approximately 0.26g for the upstream slope and 0.36g for the downstream slope. Predicted embankment deformations under seismic loading are negligible, if any, as the calculated yield acceleration exceeds the estimated average PGA values for the OBE, MDE and MCE. A summary of the seismic displacement results are included in Table D.8.

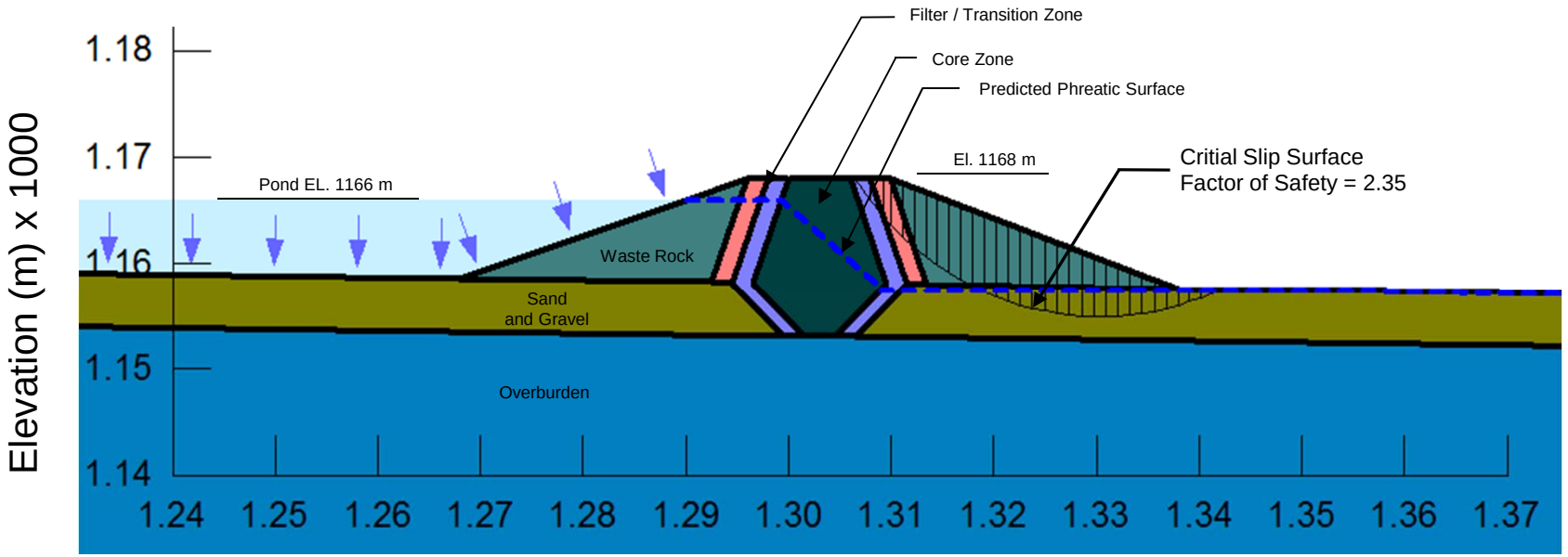
Table D.5 ECD and FWR Seismic Displacement Summary

Description	Design PGA[1] (g) Mean[2]	Design Earthquake Magnitude	Calculated Yield Acceleration (K_Y)[3]	Displacement Along Slip Surface (m)			Crest Settlement (m)
				Newmark[4]	Makdisi-Seed (Average)[4]	Bray ($D_{84\%}$)[5]	Swaisgood[6]
OBE	0.04	8.5	0.26	0.00	0.00	0.00	0.04
MDE	0.08	8.5	0.26	0.00	0.00	0.00	0.06

Maximum displacements of less than 0.01 m were predicted for the OBE and MDE, based on the stiffness of the embankment fill and predominant period of the embankment under seismic loading (estimated to be in the range of about 0.1 to 0.2 seconds). The predicted maximum crest settlements for the dams were approximately 0.04 m for the OBE and 0.06 m for the MDE.

Maximum embankment deformations and settlements calculated for the design earthquakes are approximately 0.06 m or less, and would not have a significant impact on the available dam freeboard (minimum of 2.0 m) or result in any loss of dam integrity. Predicted dam deformations from the OBE are negligible and would not impact on-going operations of the structures.

Material	Unit Weight (kN/m^3)	Effective Friction Angle (deg)
Waste Rock	21	See Note 2
Core Zone	20	36
Filter/Transition Zone	20	33
Sand and Gravel	21	35
Overburden / Weathered Bedrock	22	37
Fractured / Fresh Bedrock	N/A	Impenetrable



NOTES:

1. LOCATION OF PHREATIC SURFACE PREDICTED FROM STEADY STATE SEEPAGE ANALYSIS.
2. RELATIONSHIPS FOR FRICTION ANGLES AND EFFECTIVE STRESS WERE DEVELOPED BASED ON LEPS (1970).

REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D
2	12SEP'14	ISSUED WITH REPORT	DDF	BB	KJB

NEW GOLD INC.

BLACKWATER GOLD PROJECT

FRESH WATER RESERVOIR AND ENVIRONMENTAL CONTROL DAM DOWNSTREAM SLIP SURFACE - STATIC

Knight Piésold CONSULTING

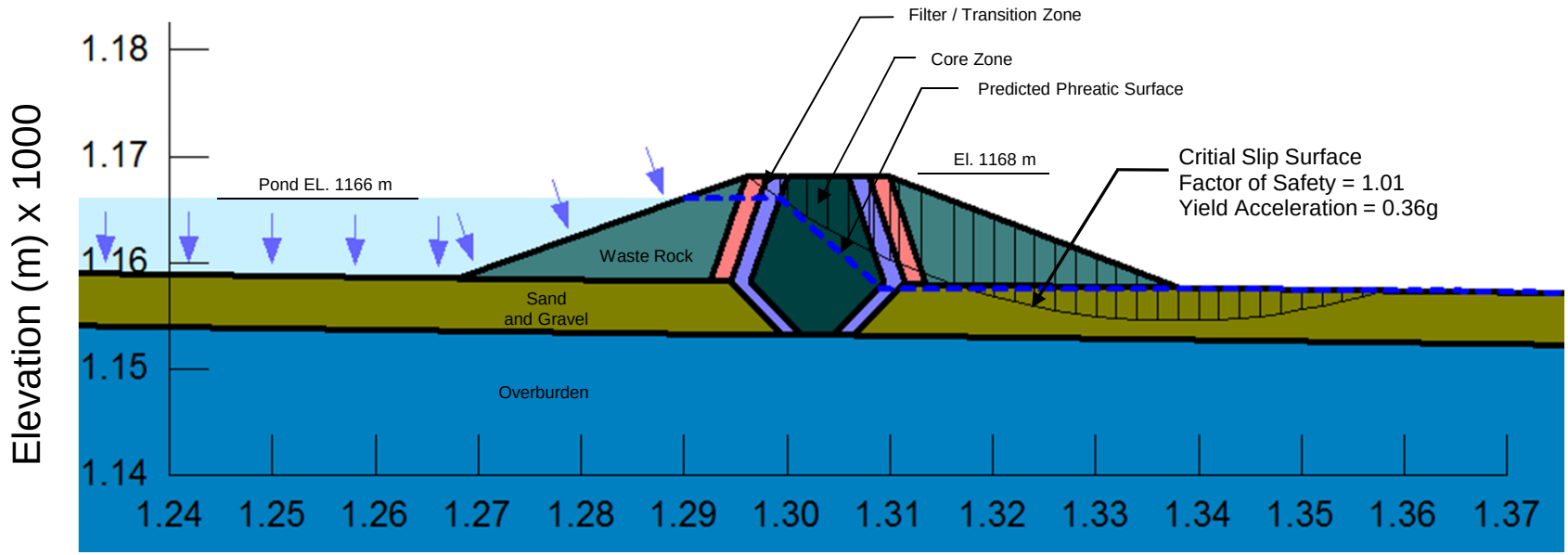
P/A. NO. VA101-457/6

REF NO. 11

FIGURE D.13

REV 2

Material	Unit Weight (kN/m^3)	Effective Friction Angle (deg)
Waste Rock	21	See Note 2
Core Zone	20	36
Filter/Transition Zone	20	33
Sand and Gravel	21	35
Overburden / Weathered Bedrock	22	37
Fractured / Fresh Bedrock	N/A	Impenetrable



NOTES:

1. LOCATION OF PHREATIC SURFACE PREDICTED FROM STEADY STATE SEEPAGE ANALYSIS.
2. RELATIONSHIPS FOR FRICTION ANGLES AND EFFECTIVE STRESS WERE DEVELOPED BASED ON LEPS (1970).

REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D
2	12SEP'14	ISSUED WITH REPORT	DDF	BB	KJB

NEW GOLD INC.

BLACKWATER GOLD PROJECT

FRESH WATER RESERVOIR AND ENVIRONMENTAL CONTROL DAM DOWNSTREAM SLIP SURFACE - YIELD ACCEL.

Knight Piésold CONSULTING

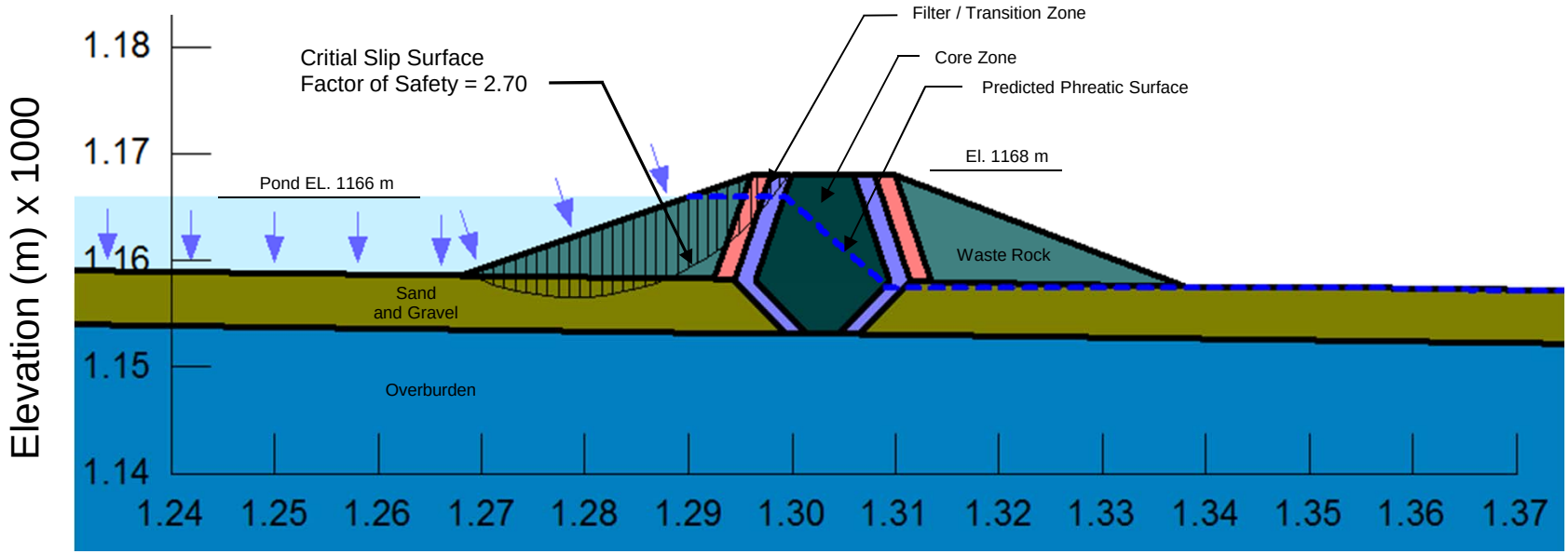
P/A. NO. VA101-457/6

REF NO. 11

FIGURE D.14

REV 2

Material	Unit Weight (kN/m^3)	Effective Friction Angle (deg)
Waste Rock	21	See Note 2
Core Zone	20	36
Filter/Transition Zone	20	33
Sand and Gravel	21	35
Overburden / Weathered Bedrock	22	37
Fractured / Fresh Bedrock	N/A	Impenetrable



NOTES:

1. LOCATION OF PHREATIC SURFACE PREDICTED FROM STEADY STATE SEEPAGE ANALYSIS.
2. RELATIONSHIPS FOR FRICTION ANGLES AND EFFECTIVE STRESS WERE DEVELOPED BASED ON LEPS (1970).

REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D
2	12SEP'14	ISSUED WITH REPORT	DDF	BB	KJB

NEW GOLD INC.

BLACKWATER GOLD PROJECT

FRESH WATER RESERVOIR AND ENVIRONMENTAL CONTROL DAM UPSTREAM SLIP SURFACE - STATIC

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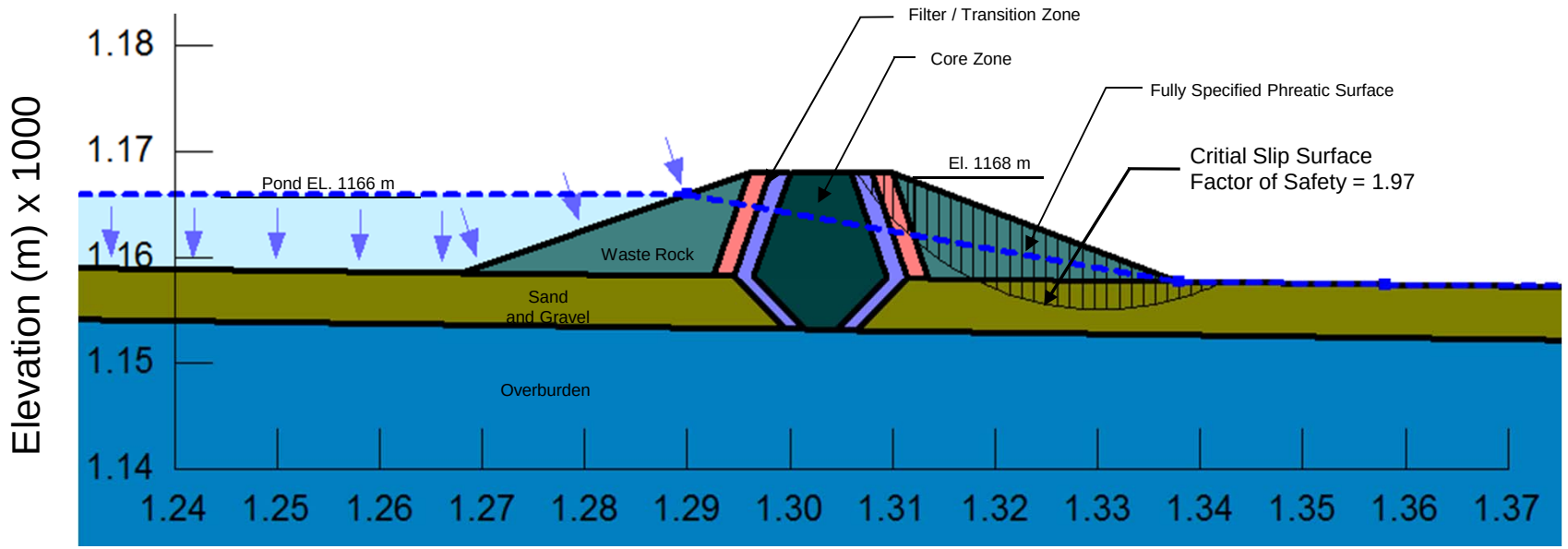
P/A. NO. VA101-457/6

REF NO. 11

FIGURE D.15

REV 2

Material	Unit Weight (kN/m^3)	Effective Friction Angle (deg)
Waste Rock	21	See Note 2
Core Zone	20	36
Filter/Transition Zone	20	33
Sand and Gravel	21	35
Overburden / Weathered Bedrock	22	37
Fractured / Fresh Bedrock	N/A	Impenetrable



NOTES:

1. LOCATION OF PHREATIC SURFACE PREDICTED FROM STEADY STATE SEEPAGE ANALYSIS.
2. RELATIONSHIPS FOR FRICTION ANGLES AND EFFECTIVE STRESS WERE DEVELOPED BASED ON LEPS (1970).

REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D
2	12SEP'14	ISSUED WITH REPORT	DDF	BB	KJB

NEW GOLD INC.

BLACKWATER GOLD PROJECT

FRESH WATER RESERVOIR AND ENVIRONMENTAL CONTROL DAM DOWNSTREAM SLIP SURFACE - ELEVATED PWP

Knight Piésold CONSULTING

P/A. NO. VA101-457/6

REF NO. 11

FIGURE D.16

REV 2

D.4 WASTE ROCK DUMPS AND LOW-GRADE ORE STOCKPILE

D.4.1 MODELLING APPROACH

An assessment of the stability rating for the East Dump, West Dump, and LGO stockpile was carried out using the waste and stockpile stability rating system as described in the interim guidelines provided by the B.C. Mine Waste Rock Pile Research Committee (BCMWRPRC, 1991). All three areas have been classified as "Class II" low failure hazard dumps (rating of 500). The development of the stability rating for each facility is shown on Table D.9 below.

Table D.9 Waste Dump and LGO Stockpile Stability Rating Summary

Key Factors Affecting Stability	Point Rating					
	West Dump		Low Grade Ore Stockpile		East Dump	
	Condition	Point Rating	Condition	Point Rating	Condition	Point Rating
Dump Height	75	50	70	50	90	50
Dump Volume	Medium	50	Medium	50	Medium	50
Dump Slope	Flat	0	Flat	0	Flat	0
Foundation Slope	Flat	0	Flat	0	Flat	0
Degree of Confinement	Moderately Confined	50	Moderately Confined	50	Moderately Confined	50
Foundation Type	Competent	0	Competent	0	Competent	0
Dump Material Quality	Moderate	100	Moderate	100	Moderate	100
Method of Construction	Mixed	100	Mixed	100	Mixed	100
Piezometric & Climatic Conditions	Intermediate	100	Intermediate	100	Intermediate	100
Dumping Rate	Slow	0	Slow	0	Slow	0
Seismicity	Moderate	50	Moderate	50	Moderate	50
DUMP STABILITY RATING		**500**		**500**		**500**
	Class	**Failure Hazard**	**Class**	**Failure Hazard**	**Class**	**Failure Hazard**
Dump Stability Class	II	Low	II	Low	II	Low

The guidelines (BCMWRPRC, 1991) recommended level of effort for design of mine rock and overburden piles with a low failure hazard rating include basic stability analyses.

Stability analyses for each of the dump facilities have been carried out in accordance with the recommended level of effort indicated the guidelines. The stability analyses were carried out using the limit equilibrium computer program SLOPE/W (Geostudio, 2007). The assessment of stability of each facility was undertaken using a critical section through each of the piles at ultimate extents. A factor of safety (FS) was estimated for the following static failure modes:

- deep seated failure surface propagating a minimum of 100 m from the crest of the waste pile
- mid-sized failure surface propagating a minimum of 50 m from the crest, and
- smaller scale failure surface allowed to form just at the crest of the pile.

A pseudo-static analysis was undertaken on the critical static slip surface identified for each of the sections. The yield acceleration was determined by iteratively bringing the FS to 1. The potential seismic displacements were estimated using the simplified methods of Newmark (1965), Makdisi-Seed (1977),

and Bray (2007) as described in previous sections. The analysis included seismically induced deformations of the dumps and stockpile from the OBE and MDE events.

D.4.2 MATERIAL PARAMETERS AND ASSUMPTIONS

The material parameters used in the analyses were described previously in Section D.2.2. A summary of the material unit weights and effective strength parameters used in the analyses are provided in Table D.10. The phreatic surface for each analysis was assumed to be 1 m below the foundation based on a review of the observations during test pit excavation and drilling in the vicinity of the piles.

Table D.10 Waste Dump and LGO Stockpile Material Parameters

Unit	Unit Weight (kN/m^3)	Friction Angle (deg)	Cohesion (kPa)
Waste Dump Materials			
Waste Rock / Overburden	21	Leps, 1970 – Lower Bound (See Note 1)	
Foundation Materials			
Sand and Gravel	21	35	0
Overburden / Weathered Bedrock	22	37	0
Fractured / Fresh Bedrock	Impenetrable		

NOTES:
1. A relationship for friction angle and effective stress was developed for the rockfill materials, based on published information on the shear strength properties of rockfill (Leps, 1970).

D.4.3 RESULTS

Stability analyses for the West Dump, East Dump, and LGO stockpile were based on the maximum cross section through each facility. The figures include the critical slip surface and factor of safety (FS) for static normal operating conditions. The factors of safety calculated for different slip surfaces and failure modes are included on Table D.11.

Table D.11 Waste Dump and LGO Stockpile Results Summary

Location	PWP Level	Slip Surface	Static Factor of Safety	Yield Acceleration (g)
West Dump	**Fully Specified Piezometric Line**	Deep Seated	2.16	-
		Middle Sized	1.80	-
		Small Scale	1.37	0.15
East Dump	**Fully Specified Piezometric Line**	Deep Seated	1.93	-
		Middle Sized	1.76	-
		Small Scale	1.57	0.19
LGO Stockpile	**Fully Specified Piezometric Line**	Deep Seated	3.02	-
		Middle Sized	2.79	-
		Small Scale	2.51	0.40

Cross sections showing the stability model for each facility are shown on the following figures:

- West Dump: Figures D.17 to D.20
- East Dump Figures D.21 to D.24
- LGO Stockpile: Figures D.25 to D.28

The guidelines (BCMWRPRC, 1991) provide suggested minimum acceptable FS for various conditions. The most conservative case (Case A) was adopted for this level of study. The guidelines suggest a minimum long-term FS of 1.2 under static conditions for the dump surface (small scale slip surface). The suggested FS for overall dump stability and deep seated failure mechanisms is 1.3 for short-term operating conditions and 1.5 for long-term conditions (steady-state and post-closure). The results of the stability analyses satisfy the requirements for factors of safety as indicated in the guidelines.

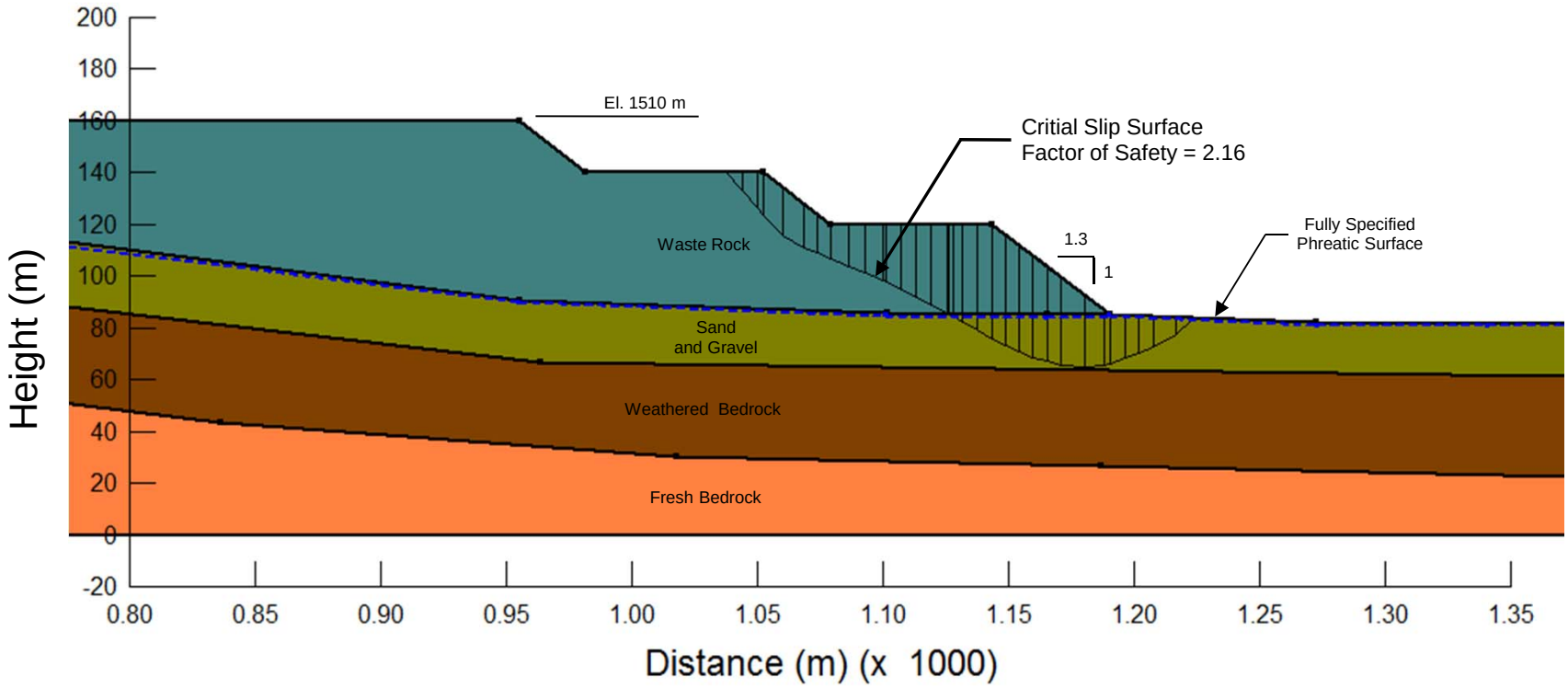
The OBE was defined as the 1 in 500 year earthquake with a mean Peak Ground Acceleration (PGA) of 0.04g and design earthquake magnitude of 8.5. The MDE corresponds to the 1 in 5,000 year earthquake with a mean PGA of 0.08g and design earthquake magnitude of 8.5. The yield acceleration determined for the West Dump, East Dump, and LGO Stockpile was 0.15g, 0.19g, and 0.40g, respectively. Predicted deformations under seismic loading are estimated to be minor, if any, as the calculated yield acceleration exceeds the estimated average PGA values.

Maximum displacements of approximately 0.06 m and 0.04 m were predicted for the West Dump and East Dump, respectively, under loading from the MDE, based on the stiffness of the dump fill and predominant period of the waste rock dump under seismic loading. Predicted seismic displacements for the OBE were negligible for all facilities. The predicted maximum crest settlements were 0.12 m for the West Dump and LGO Stockpile, and 0.13 m for the East Dump. A summary of the seismic displacement results are included in Table D.12.

Table D.12 Waste Dump and LGO Stockpile Seismic Displacement Summary

Description	Design PGA (g) Mean	Design Earthquake Magnitude	Calculated Yield Acceleration (K_Y)	Displacement Along Slip Surface (m)			Crest Settlement (m)
				Newmark	Makdisi-Seed (Average)	Bray ($D_{84\%}$)	Swaisgood
West Dump							
OBE	0.04	8.5	0.15	0.00	0.00	0.00	0.09
MDE	0.08	8.5	0.15	0.00	0.00	0.06	0.12
East Dump							
OBE	0.04	8.5	0.19	0.00	0.00	0.00	0.10
MDE	0.08	8.5	0.19	0.00	0.00	0.04	0.13
LGO Stockpile							
OBE	0.04	8.5	0.40	0.00	0.00	0.00	0.09
MDE	0.08	8.5	0.40	0.00	0.00	0.00	0.12

Material	Unit Weight (kN/m^3)	Effective Friction Angle (deg)
Waste Rock	21	See Note 1
Sand and Gravel	21	35
Overburden / Weathered Bedrock	22	37
Fractured / Fresh Bedrock	N/A	Impenetrable



NOTES:

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REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D
2	12SEP'14	ISSUED WITH REPORT	ACR	LM	KJB

NEW GOLD INC.

BLACKWATER GOLD PROJECT

WEST DUMP STABILITY
DEEP-SEATED SLIP SURFACE - STATIC

Knight Piésold CONSULTING

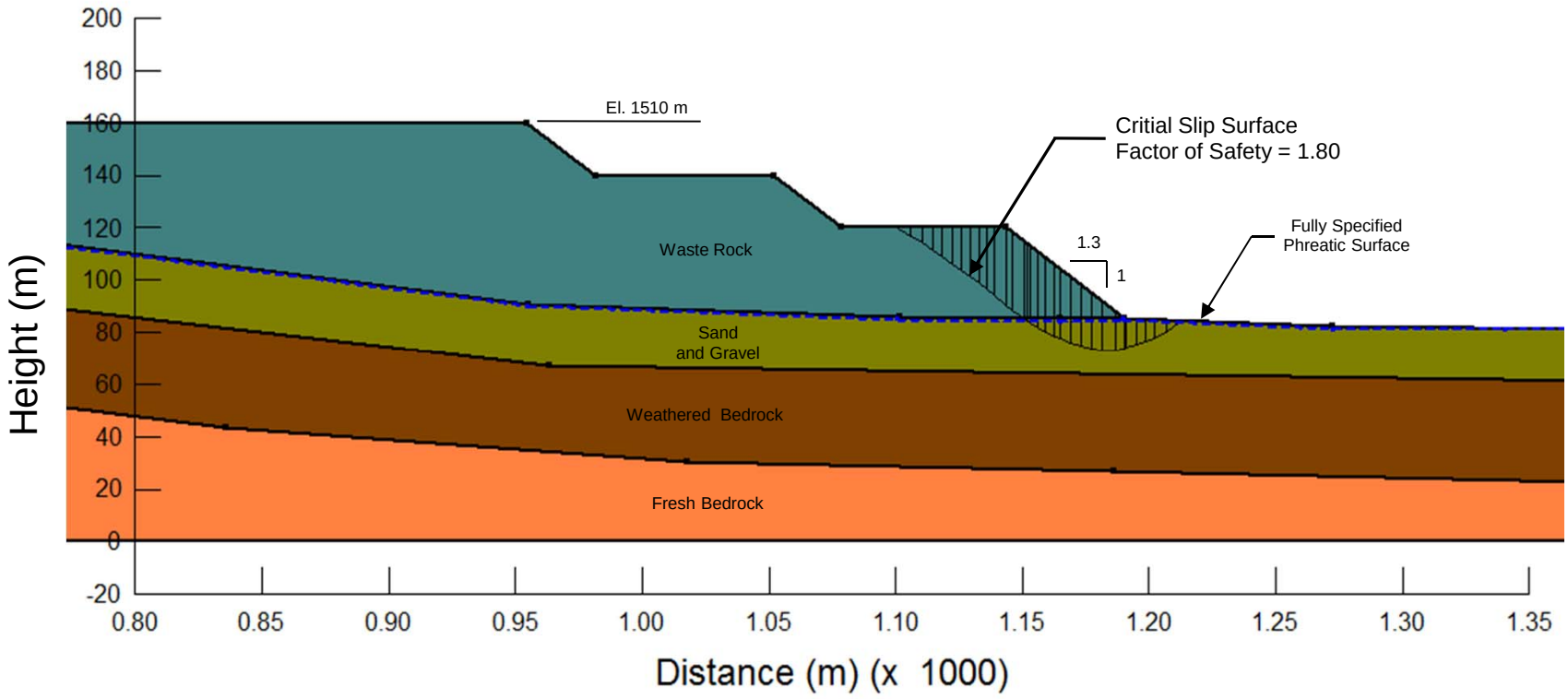
P/A. NO. VA101-457/6

REF NO. 11

FIGURE D.17

REV 2

Material	Unit Weight (kN/m^3)	Effective Friction Angle (deg)
Waste Rock	21	See Note 1
Sand and Gravel	21	35
Overburden / Weathered Bedrock	22	37
Fractured / Fresh Bedrock	N/A	Impenetrable



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NEW GOLD INC.

BLACKWATER GOLD PROJECT

WEST DUMP STABILITY
MID-SIZED SLIP SURFACE - STATIC

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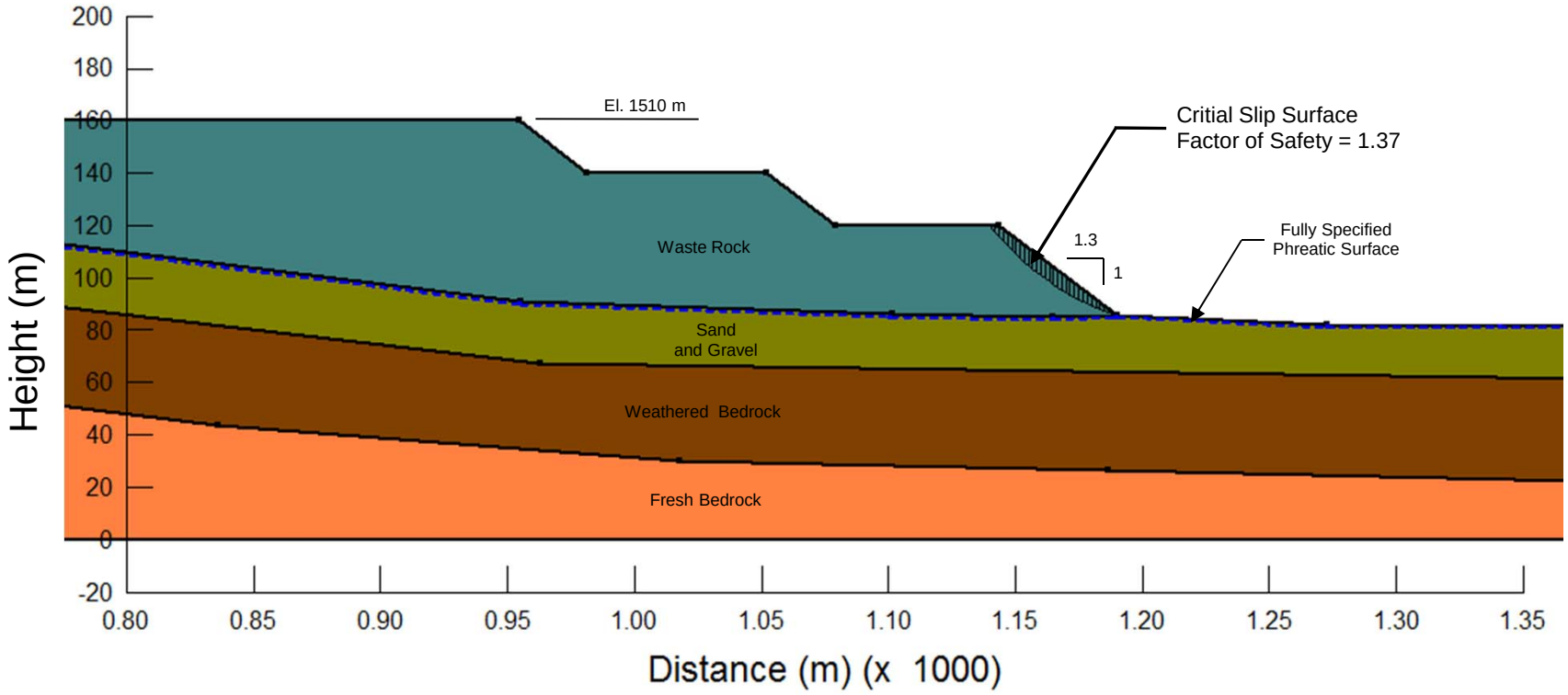
P/A. NO. VA101-457/6

REF NO. 11

FIGURE D.18

REV 2

Material	Unit Weight (kN/m^3)	Effective Friction Angle (deg)
Waste Rock	21	See Note 1
Sand and Gravel	21	35
Overburden / Weathered Bedrock	22	37
Fractured / Fresh Bedrock	N/A	Impenetrable



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NEW GOLD INC.

BLACKWATER GOLD PROJECT

WEST DUMP STABILITY
SMALL SCALE SLIP SURFACE - STATIC

Knight Piésold CONSULTING

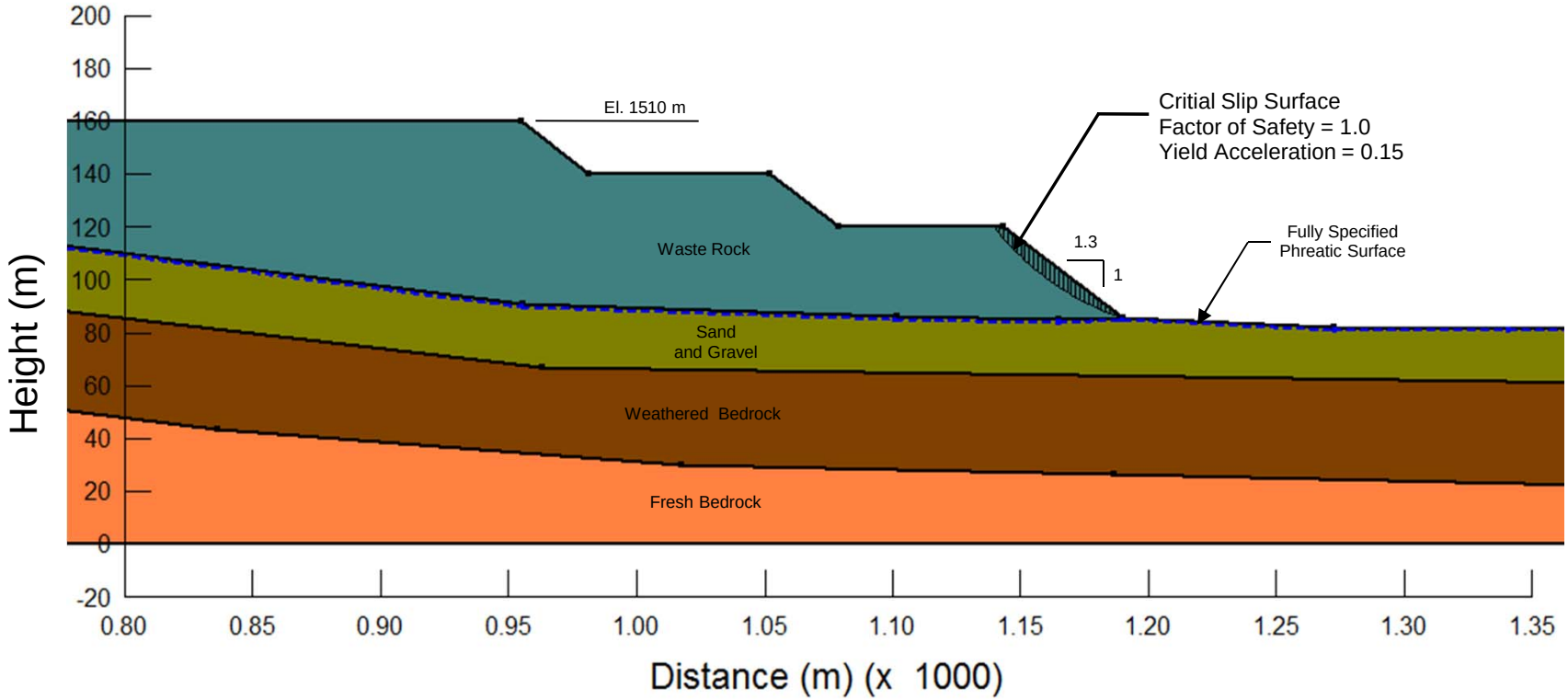
P/A. NO. VA101-457/6

REF NO. 11

FIGURE D.19

REV 2

Material	Unit Weight (kN/m^3)	Effective Friction Angle (deg)
Waste Rock	21	See Note 1
Sand and Gravel	21	35
Overburden / Weathered Bedrock	22	37
Fractured / Fresh Bedrock	N/A	Impenetrable



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NEW GOLD INC.

BLACKWATER GOLD PROJECT

WEST DUMP STABILITY
CRITICAL SLIP SURFACE - YIELD ACCELERATION

Knight Piésold CONSULTING

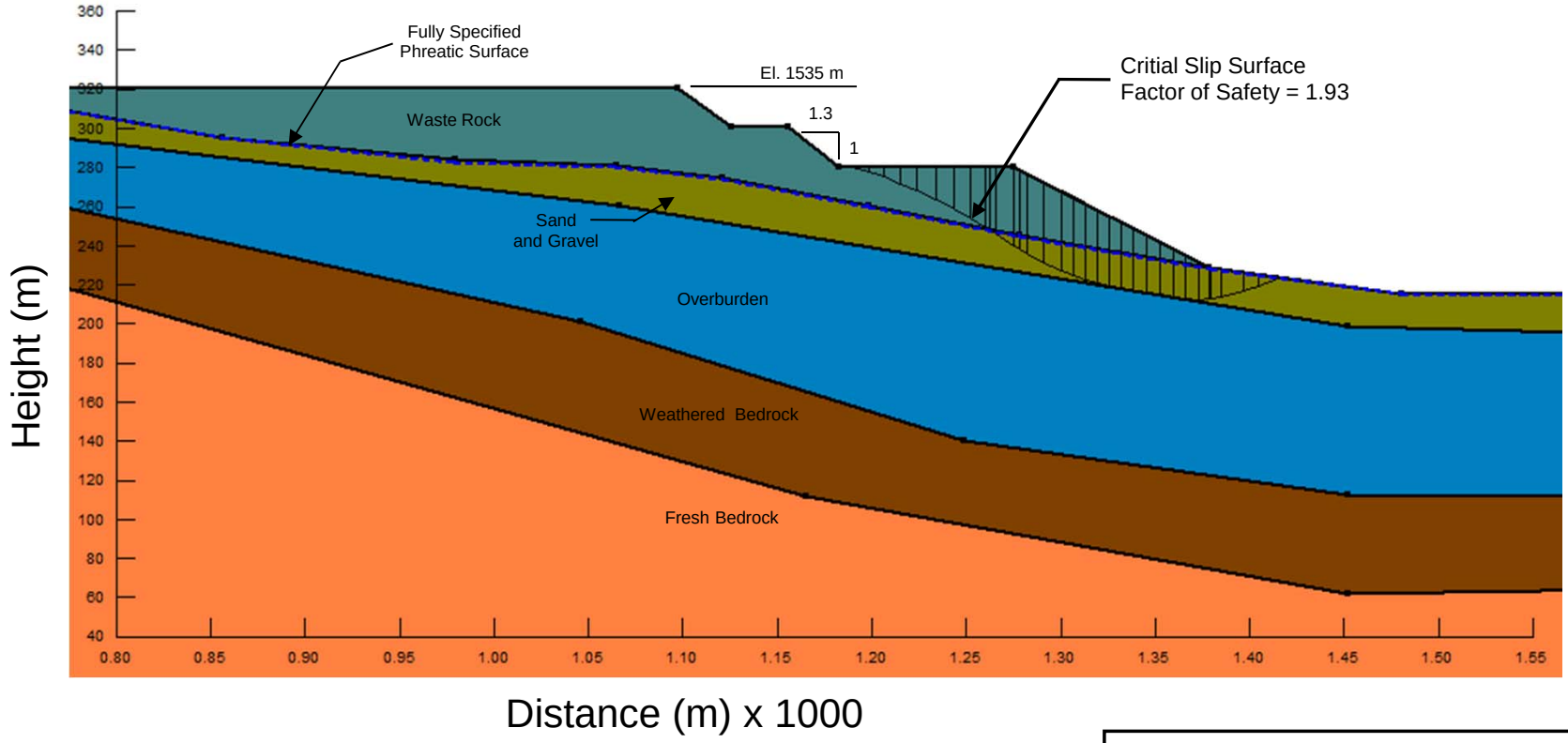
P/A. NO. VA101-457/6

REF NO. 11

FIGURE D.20

REV 2

Material	Unit Weight (kN/m^3)	Effective Friction Angle (deg)
Waste Rock	21	See Note 1
Sand and Gravel	21	35
Overburden / Weathered Bedrock	22	37
Fractured / Fresh Bedrock	N/A	Impenetrable



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NEW GOLD INC.

BLACKWATER GOLD PROJECT

EAST DUMP STABILITY
DEEP-SEATED SLIP SURFACE - STATIC

Knight Piésold CONSULTING

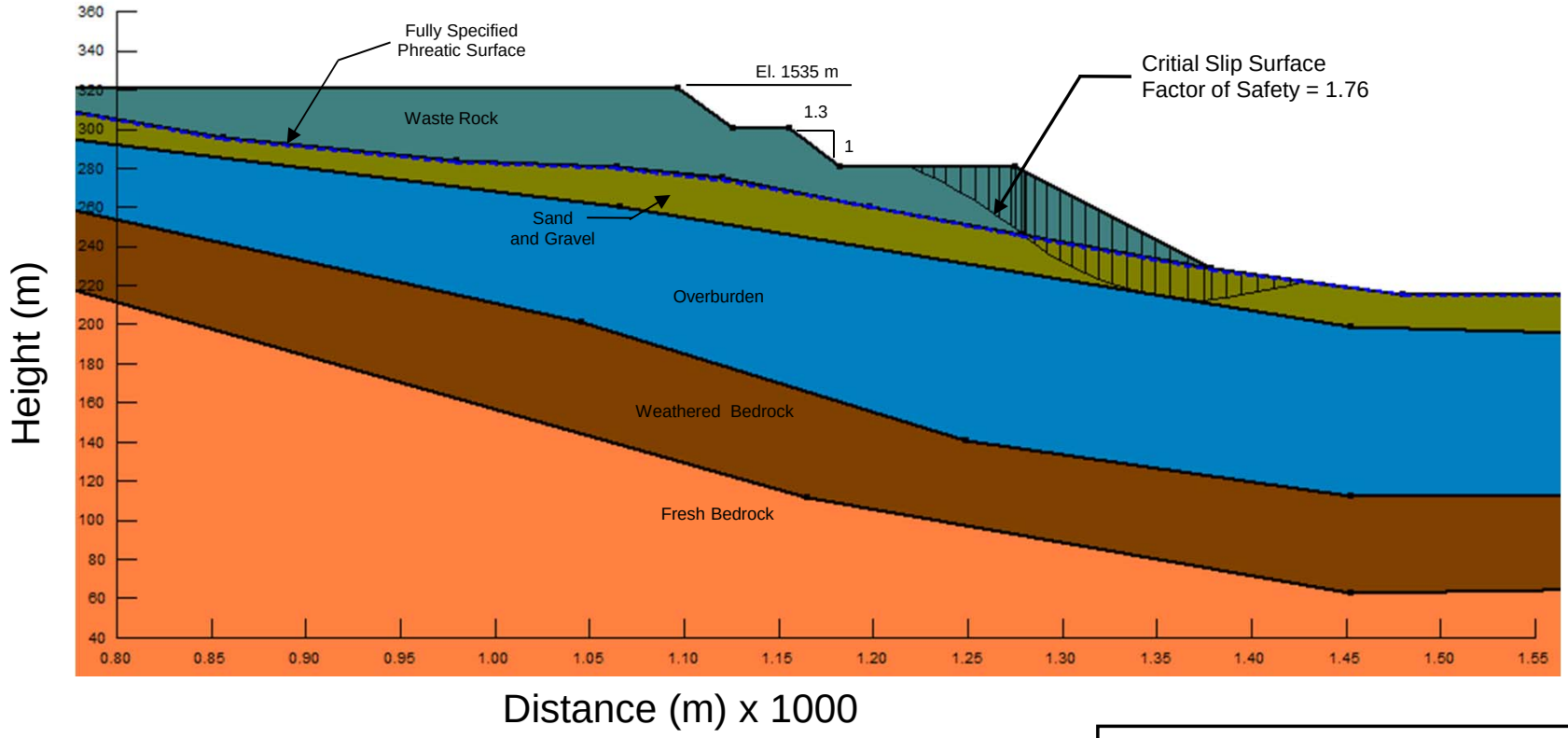
P/A. NO. VA101-457/6

REF NO. 11

FIGURE D.21

REV 2

Material	Unit Weight (kN/m^3)	Effective Friction Angle (deg)
Waste Rock	21	See Note 1
Sand and Gravel	21	35
Overburden / Weathered Bedrock	22	37
Fractured / Fresh Bedrock	N/A	Impenetrable



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NEW GOLD INC.

BLACKWATER GOLD PROJECT

EAST DUMP STABILITY
MID-SIZED SLIP SURFACE - STATIC

Knight Piésold CONSULTING

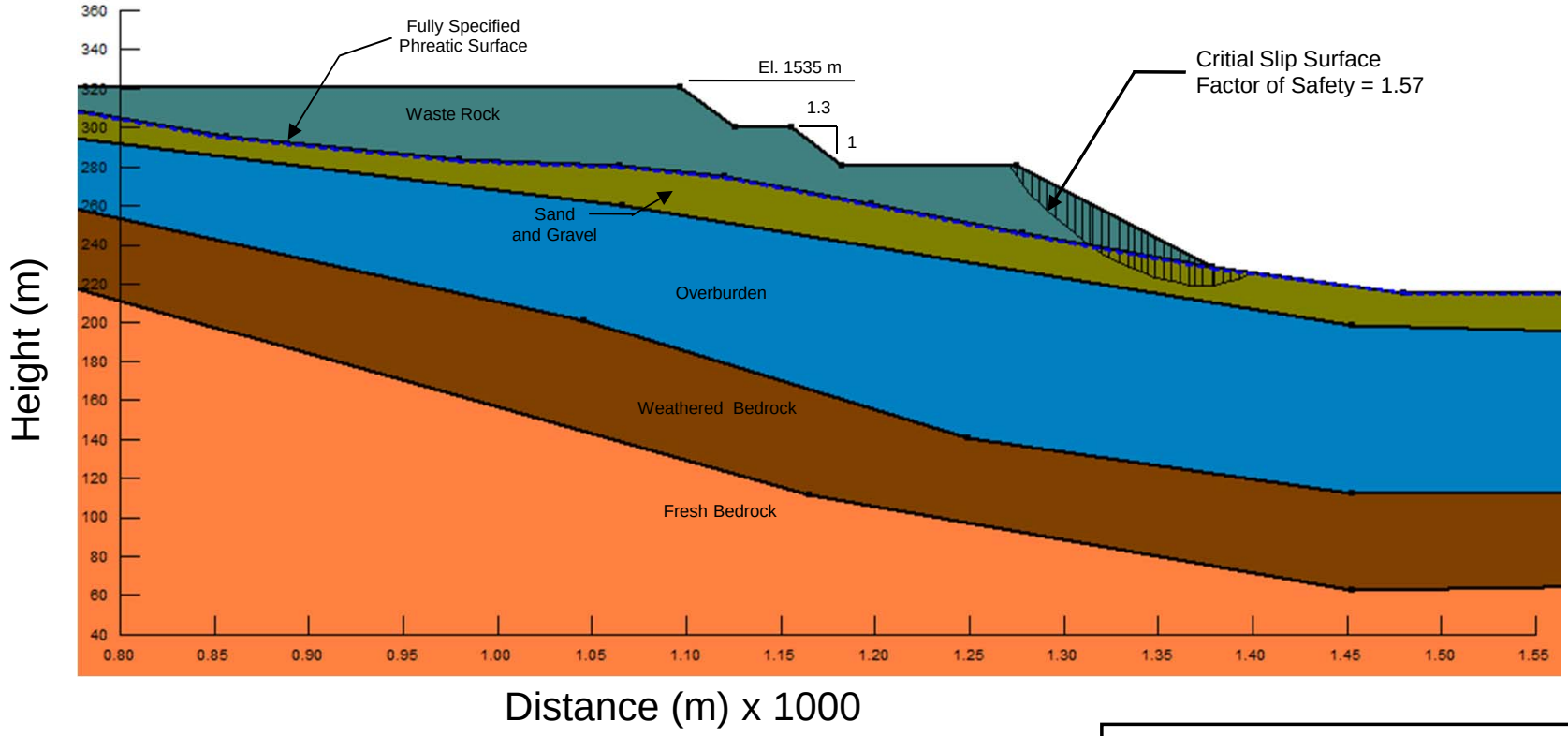
P/A. NO. VA101-457/6

REF NO. 11

FIGURE D.22

REV 2

Material	Unit Weight (kN/m^3)	Effective Friction Angle (deg)
Waste Rock	21	See Note 1
Sand and Gravel	21	35
Overburden / Weathered Bedrock	22	37
Fractured / Fresh Bedrock	N/A	Impenetrable



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NEW GOLD INC.

BLACKWATER GOLD PROJECT

EAST DUMP STABILITY
SMALL SCALE SLIP SURFACE - STATIC

Knight Piésold CONSULTING

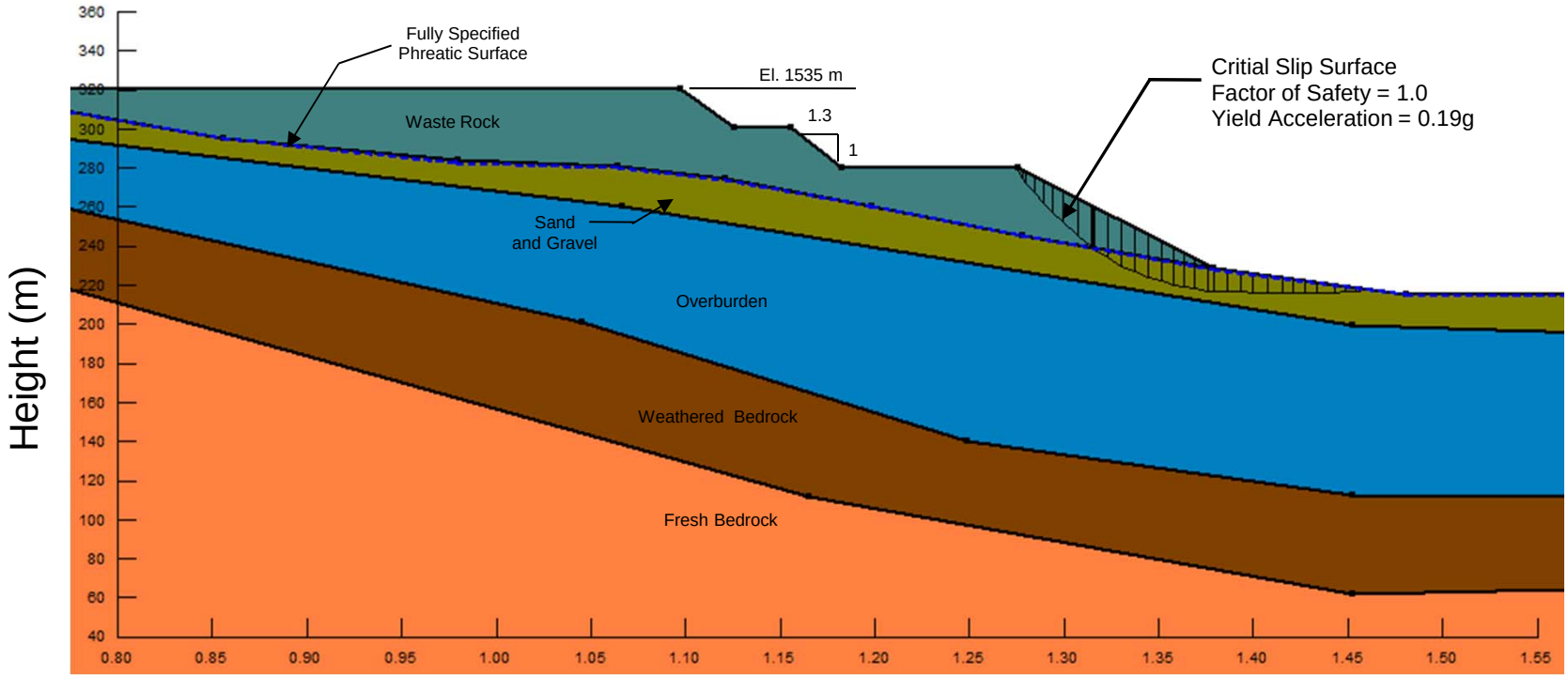
P/A. NO. VA101-457/6

REF NO. 11

FIGURE D.23

REV 2

Material	Unit Weight (kN/m^3)	Effective Friction Angle (deg)
Waste Rock	21	See Note 1
Sand and Gravel	21	35
Overburden / Weathered Bedrock	22	37
Fractured / Fresh Bedrock	N/A	Impenetrable



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NEW GOLD INC.

BLACKWATER GOLD PROJECT

EAST DUMP STABILITY
CRITICAL SLIP SURFACE - YIELD ACCELERATION

Knight Piésold CONSULTING

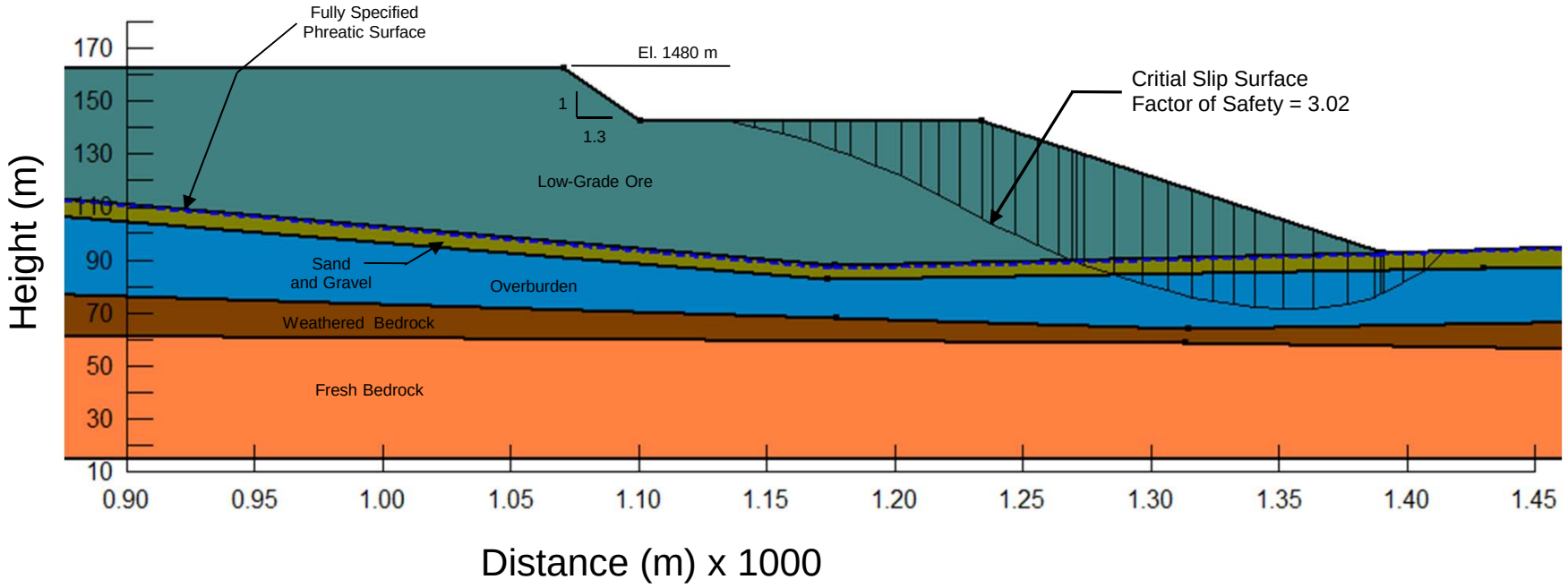
P/A. NO. VA101-457/6

REF NO. 11

FIGURE D.24

REV 2

Material	Unit Weight (kN/m^3)	Effective Friction Angle (deg)
Low-Grade Ore	21	See Note 1
Sand and Gravel	21	35
Overburden / Weathered Bedrock	22	37
Fractured / Fresh Bedrock	N/A	Impenetrable



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NEW GOLD INC.

BLACKWATER GOLD PROJECT

LOW-GRADE ORE STOCKPILE STABILITY
DEEP-SEATED SLIP SURFACE - STATIC

Knight Piésold CONSULTING

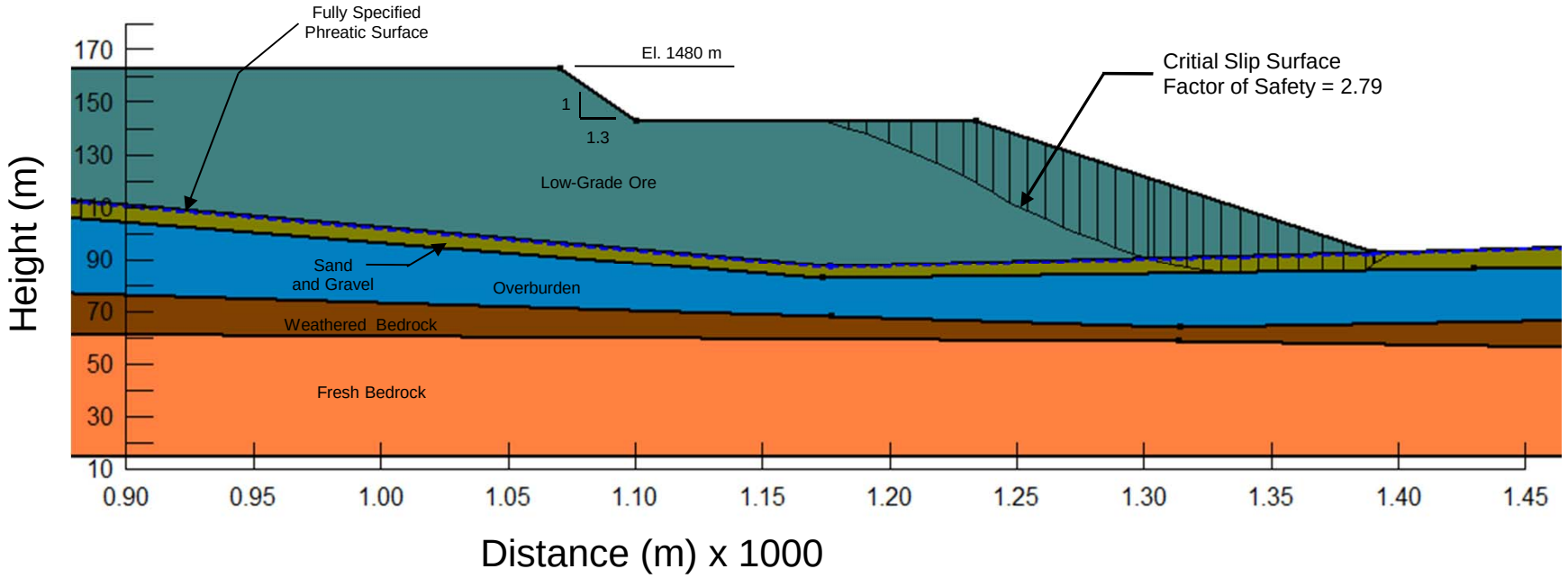
P/A. NO. VA101-457/6

REF NO. 11

FIGURE D.25

REV 2

Material	Unit Weight (kN/m^3)	Effective Friction Angle (deg)
Low-Grade Ore	21	See Note 1
Sand and Gravel	21	35
Overburden / Weathered Bedrock	22	37
Fractured / Fresh Bedrock	N/A	Impenetrable



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NEW GOLD INC.

BLACKWATER GOLD PROJECT

LOW-GRADE ORE STOCKPILE STABILITY
MID-SIZED SLIP SURFACE - STATIC

Knight Piésold CONSULTING

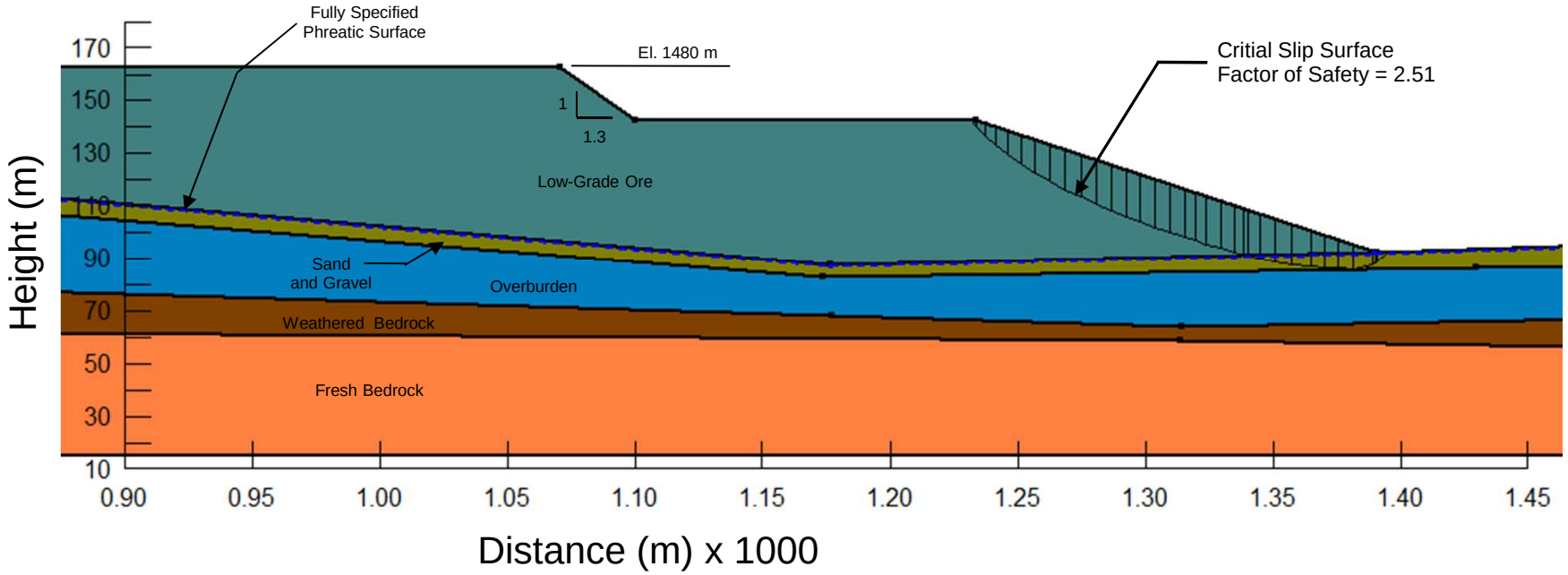
P/A. NO. VA101-457/6

REF NO. 11

FIGURE D.26

REV 2

Material	Unit Weight (kN/m^3)	Effective Friction Angle (deg)
Low-Grade Ore	21	See Note 1
Sand and Gravel	21	35
Overburden / Weathered Bedrock	22	37
Fractured / Fresh Bedrock	N/A	Impenetrable



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NEW GOLD INC.

BLACKWATER GOLD PROJECT

LOW-GRADE ORE STOCKPILE STABILITY
SMALL SCALE SLIP SURFACE - STATIC

Knight Piésold CONSULTING

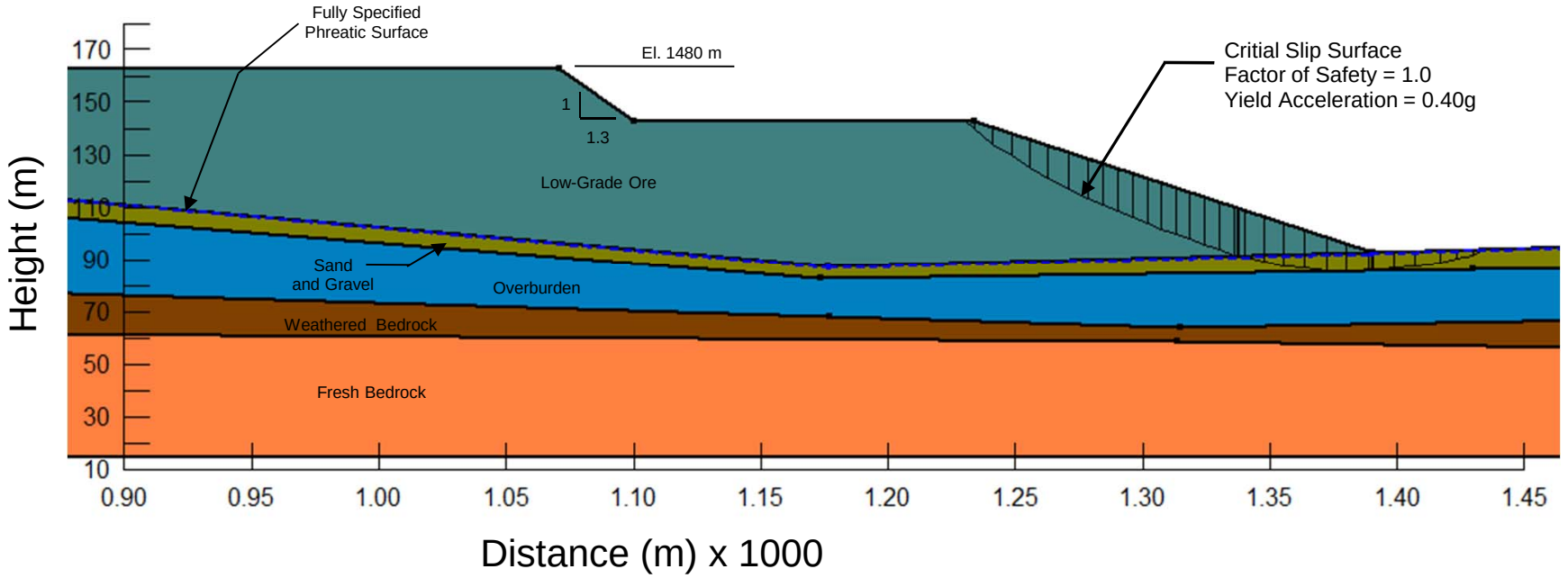
P/A. NO. VA101-457/6

REF NO. 11

FIGURE D.27

REV 2

Material	Unit Weight (kN/m^3)	Effective Friction Angle (deg)
Low-Grade Ore	21	See Note 1
Sand and Gravel	21	35
Overburden / Weathered Bedrock	22	37
Fractured / Fresh Bedrock	N/A	Impenetrable



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NEW GOLD INC.

BLACKWATER GOLD PROJECT

LOW-GRADE ORE STOCKPILE STABILITY
CRITICAL SLIP SURFACE - YIELD ACCELERATION

Knight Piésold CONSULTING

P/A. NO. VA101-457/6

REF NO. 11

FIGURE D.28

REV 2

D.5 SUMMARY AND CONCLUSIONS

Stability analyses were carried out to confirm the stability of the TSF embankments, two water retaining dams, and the waste dumps under both static and seismic loading conditions. These analyses comprised checking the stability of the embankment arrangements for each of the following cases:

- Static conditions during operations and post-closure.
- Earthquake loading from the operating basis earthquake (OBE) and the maximum design earthquake (MDE).
- Post-earthquake conditions for TSF embankments using residual (post-liquefaction) tailings strengths.

The stability analyses were carried out using the limit equilibrium computer program SLOPE/W. Factors of safety have been computed using the Morgenstern-Price method.

In accordance with international recommendations (ICOLD, 1995) and standard industry practice, the minimum acceptable factor of safety for the tailings embankment under static conditions is 1.3 for short-term operating conditions and 1.5 for long-term (steady-state and post-closure) of the TSF. A factor of safety of less than 1.0 is acceptable under earthquake loading conditions provided that calculated embankment deformations resulting from the seismic loading are not significant and that the post-earthquake stability of the embankment maintains a factor of safety greater than 1.2, implying there is no flow slide potential.

The seismic stability assessment of the TSF has included estimation of seismically induced deformations of the dam from the OBE and MDE events. The OBE has been defined as the 1 in 500 year earthquake with a mean Peak Ground Acceleration (PGA) of 0.04g and design earthquake magnitude of 8.5. The MDE corresponds to the 1 in 5,000 year earthquake with a mean PGA of 0.08g and design earthquake magnitude of 8.5. The 1 in 10,000 year earthquake was also considered to demonstrate the robustness of the TSF embankment designs to seismic loading. The PGA for the 1 in 10,000 year event is 0.11g.

The stability analyses results satisfy the factor of safety design criteria and shows the proposed design is adequate to maintain both short term (operational) and long term (post-closure) stability. The seismic analyses indicate any embankment deformations during earthquake loading from the OBE, MDE, and 1 in 10,000 year event would be minor and would not have a significant impact of the available embankment freeboard or result in any loss of embankment integrity. The results indicate the TSF embankments are not dependent on tailings strength to maintain overall stability and integrity.

The stability analyses for the ECD and FWR were based on a typical maximum cross section through both dams. The minimum factor of safety calculated for long-term static conditions was 2.35. This exceeds the minimum factor of safety for long-term (post-closure) conditions. The factor of safety calculated for elevated pore water pressure (PWP) within the dam was 1.97, representing a scenario of inoperative embankment drains prior to repair. This exceeds the minimum factor of safety for short-term operating conditions. The seismic analyses indicate any dam deformations during earthquake loading from the OBE and MDE would be minor, and would not have a significant impact of the available dam freeboard or result in any loss of the dam integrity.

Stability analyses for each of the dump facilities have been carried out in accordance with the recommended level of effort indicated the guidelines. The stability analyses were carried out using a similar methodology to the stability analyses for the TSF embankments. The stability of each dump was assessed for a deep seated failure surface propagating a minimum of 100 m from the crest of the pile, a mid-sized failure surface propagating a minimum of 50 m from the crest, and a smaller scale failure surface allowed to form just at the crest of the pile. The results of the stability analyses satisfy the requirements for factors of safety as indicated in the guidelines. The seismic analyses indicate that any dump and stockpile deformations during earthquake loading from the OBE and MDE would be minor and would not result in significant displacement in the piles.

D.6 REFERENCES

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APPENDIX E

FEASIBILITY STUDY WATER BALANCE MODEL

(Pages E-1 to E-14)

December 23, 2013

File No.:VA101-457/6-A.01
Cont. No.:VA13-02400

Mr. Paul Hosford
Feasibility Study Director
New Gold Inc.
Suite 1800, Two Bentall Centre
555 Burrard Street
Vancouver, BC V7X 1M9

Dear Paul,

Re: Blackwater Project – Updated Feasibility Study Water Balance Model

1. GENERAL

A monthly operational and closure water balance was developed by Knight Piesold Ltd. (KP) for the Blackwater Project using the GoldSim© software package. This letter provides updated results for the feasibility study monthly operational and closure water balance that was originally issued in September 2013 (KP, 2013a). The updated model reflects corrections to the closure embankment seepage routing and changes to the closure pit filling assumptions. Details of the model updates are further described in the KP memo VA13-02367 (2013b).

The intent of the modelling was to estimate the magnitude and extent of any water surplus and/or deficit conditions in the Tailings Storage Facility (TSF) based on a range of possible climatic conditions. The modelling timeline included one year of pre-production (Year -1) and 16.2 years of operations (Year 1 to 17.2) at a nominal milling rate of 60,000 dry metric tonnes per day, and 18 years of closure until the TSF discharges to Davidson Creek. The project layout and catchment areas assumed for the model are shown on Figure 1 and the water balance model is illustrated schematically on Figure 2. The model incorporates the following major project components:

- Open Pit
- Mill
- Low Grade Ore (LGO) stockpile
- Tailings Storage Facility (TSF) Site D
- Tailings Storage Facility (TSF) Site C, and
- Non-Acid Generating (NAG) waste rock and overburden dumps.

The model assumptions and parameters are discussed in the following sections and summarized in Table 1.

2. MODEL ASSUMPTIONS

Average Hydrometeorological Conditions

The base case monthly operational water balance model was developed using average estimated values for runoff and precipitation. The mean annual unit runoff (MAUR) for undisturbed basins in the project area is estimated to be approximately 199 mm based on the long-term MAUR for the project site station H2 on Davidson Creek. The mean annual precipitation (MAP) is estimated to be approximately 636 mm, with 49% of the annual precipitation falling as rain and the remainder as snow. The annual average potential evapotranspiration (PET) for the project site is about 443 mm. PET was assumed to equal lake evaporation and was applied to the TSF pond surface to estimate evaporation losses. The mean monthly values for precipitation, runoff, and lake evaporation are summarized in Table 2. Complete details of the derivation of the

hydrometeorological parameters are included in the Engineering Hydrometeorology Report (Knight Piésold, 2013c).

Table 1 Water Balance Input Parameters

Component	Assumption
Freshwater requirement for mill (m^3/hr)	120
Total Tailings Production (million tonnes)	345
Waste Rock (million tonnes of PAG / NAG3 stored in TSF C/D Years -1 to 17)	413
Mine Life (years)	16.2
Tailings slurry solids content (% by weight)	50%
Tailings dry density (tonnes/m^3)	1.3
Bulk tailings specific gravity	2.79
Waste Rock dry density (t/m^3)	2.2
Waste Rock specific gravity	2.7

Table 2 Average Hydrometeorological Inputs

Parameter	Monthly Value (mm)												Annual
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(mm)
Precipitation	73	45	39	20	50	66	52	51	47	47	74	72	**636**
Rainfall	0	0	0	13	50	66	52	51	47	31	0	0	**310**
Snowfall	73	45	39	7	0	0	0	0	0	16	74	72	**326**
Sublimation	20	20	20	0	0	0	0	0	0	0	20	20	**100**
Snowmelt	0	0	0	104	51	71	0	0	0	0	0	0	**226**
Available Precipitation	**0**	**0**	**0**	**117**	**101**	**137**	**52**	**51**	**47**	**31**	**0**	**0**	**536**
Lake Evaporation	0	0	5	18	65	93	104	93	54	12	0	0	**443**
Available Runoff	**7**	**7**	**9**	**17**	**50**	**45**	**17**	**11**	**9**	**10**	**11**	**8**	**199**

NOTES:

1. THE PRECIPITATION VALUES WERE ESTIMATED FOR THE BLACKWATER CLIMATE STATION, WHICH IS AT AN APPROXIMATE ELEVATION OF 1470 m.
2. SURFACE RUNOFF WAS ESTIMATED BY MULTIPLYING THE AVAILABLE PRECIPITATION VALUES BY THE CORRESPONDING RUNOFF COEFFICIENT FOR EACH PROJECT AREA.
3. THE LAKE EVAPORATION VALUES WERE APPLIED TO THE TSF POND AREA TO ESTIMATE EVAPORATIVE LOSSES.
4. AVAILABLE RUNOFF VALUES WERE APPLIED TO UNDISTURBED AREAS WITHIN THE MINE FOOTPRINT TO ESTIMATE RUNOFF.

Disturbed Footprint Area Runoff

Natural runoff values are not directly applicable for mine site disturbed areas because of the substantial changes in runoff caused by altering the ground cover. Therefore, the quantities of water (runoff/infiltration) generated from the mine affected areas (open pit, TSF embankments, waste rock dumps, and TSF beaches) and open water (TSF supernatant pond) were estimated by multiplying rainfall and snowmelt by a runoff coefficient. The monthly available precipitation values are summarized in Table 2. The assumed runoff coefficients for the mine site areas are summarized below.

- TSF beach: 0.5
- TSF embankments, and waste rock/overburden stockpiles: 0.5
- Reclaimed TSF beaches and embankments: 0.37
- TSF pond: 1.0
- Open pit walls: 0.8

The portion of net precipitation that is assumed to infiltrate through the stockpiles was assumed to be 100% during operations and reduced to 50% in closure based on progressive reclamation with a soil cover being effective in closure. The TSF beach and embankments were also assumed to be reclaimed at closure and the reclaimed runoff coefficient of 0.37 was based on the ratio of the available runoff to available precipitation assumed for the natural catchment (199 mm/536 mm) areas, as shown in Table 2.

Stochastic Inputs

The potential variability of climatic conditions was addressed by using a stochastic version of the water balance model that incorporates Monte Carlo type simulation techniques. The monthly climatic parameters were modelled as probability distributions rather than simply as mean values. The year-to-year variability of monthly runoff was quantified using coefficient of variation (C_v) values that were derived using a long-term synthetic streamflow record developed for the open water months of April to October for the project site station H2 on Davidson Creek. The C_v values for the months of November to March were based on the WSC station at Van Tine Creek, due to lack of measured winter flow data at the project site stations. The monthly C_v values for runoff, along with the monthly mean and corresponding standard deviation values, are presented in Table 3. The monthly mean and standard deviation values were used to develop the monthly probability distributions that are required for a Monte Carlo simulation. The distributions of monthly precipitation were modelled assuming an underlying Gamma distribution.

Table 3 Stochastic Monthly Inputs

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean Runoff (mm)	7	7	9	17	50	45	17	11	9	10	11	8
Standard Deviation (mm)	6.7	5.9	7.7	10	39	37	14	7.9	5.8	4.0	11	6.3
Coefficient of Variation (C_v)	0.9	0.9	0.9	0.6	0.8	0.8	0.8	0.7	0.7	0.4	1.1	0.8

NOTES:
1. COEFFICIENT OF VARIATION = STANDARD DEVIATION / MEAN.

TSF and Open Pit Water Management Plan

The water balance provides key inputs to the site wide water management plan, particularly with respect to anticipated start-up pond size, surface water diversions/collection systems, additional make-up water needs, and TSF operating criteria (supernatant pond volumes). Figure 1 illustrates the project catchment areas and the main mine facilities.

The TSF Site C Main Dam will be constructed in the upper Davidson Creek catchment and capture runoff from the upstream catchment A2, as shown on Figure 1. Catchment A3, upstream of the TSF Site C West Dam, will be redirected to the southwest away from TSF Site C by a cofferdam built in Year -2, permanently changing the natural catchment divide in this area. Catchment A3 does not contribute to the water balance for the mine site.

A cofferdam will be constructed on Davidson Creek within the TSF Site D Main Dam footprint as of Year -1 to capture runoff from catchments A1 and A14, as shown on Figure 1. The accumulated water behind the TSF Site D cofferdam will then be pumped to the TSF Site C start-up pond beginning in the second quarter of Year -1.

The starter dam for the TSF Site D Main Dam will be completed as of the start of operations in Year 1, and will begin to capture catchment runoff from the contributing areas of the West Dump (A4), East Dump (A6), and Low Grade Ore (LGO) Stockpile (A10), as well as the corresponding upstream catchment areas (A5, A9 and A11) and area downstream of the East Dump (A12). The Environmental Control Dam (ECD) will also be constructed in Year 1 to capture seepage and surface runoff (A13) from the TSF Site D Main Dam. The recoverable seepage and surface runoff will be collected at the ECD and pumped back to TSF Site D during mine operations and into closure until the open pit is full and TSF Site D spills to Davidson Creek via the closure spillway.

The water stored in the TSF Site C start-up pond will serve as the primary process water source at the start of mill operations until the end of Year 2, with additional water being drawn from the TSF Site D pond (via the pump system at the cofferdam), as necessary. Once tailings deposition in TSF Site D commences in Year 3, and until the end of mining operations in Year 17, the TSF Site D pond will be the primary source of process water. Additional make-up water, if required during this time, can be provided by the TSF Site C pond. The pond in TSF Site C, as of Year 3, will be allowed to accumulate naturally to the closure spillway elevation at or below 1343 m, and then overflow into the pond of TSF Site D in approximately Year 27. The fresh water required for the mill throughout mine operations and any additional process water that is required above what can be supplied by the TSF ponds and open pit dewatering will be sourced from the fresh water supply pipeline from Tatelkuz Lake.

Groundwater inflow and surface runoff to the open pit, including water from the vertical depressurization wells, will be collected and recycled for use in the milling process as of Year 1 to end of open pit mining in Year 15. It is noted that pit dewatering flows during operations may be directed to the TSF depending on water quality, and this detail should be addressed in subsequent design phases. The dewatering system will be decommissioned in Year 15 once open pit mining has ceased and the pit will begin to fill as low grade ore is being processed through the mill from Year 15 to 17. Once mill operations cease in Year 17, the surplus inflow to TSF Site D (inflow minus losses) will be pumped to the open pit to aid in pit filling. To aid in pit filling, once mill operations have ceased, the freshwater pipeline from Tatelkuz Lake will also be used to pump additional water to the open pit at a rate of 33 L/s (equal to the fresh water requirement of the mill at 120 m^3/hr) until the pit is full. Once the open pit is full (predicted in Year 35), then it will overflow via a spillway to the TSF Site D pond. Subsequently, the TSF Site D pond will overflow via the closure spillway to a plunge pool in Davidson Creek downstream of the ECD.

Mill Requirements

Water requirements at the mill were calculated based on the specified mill production rate and the expected solids content (% by weight) of the tailings. All of the process water was assumed to be supplied by the TSF reclaim system. A fresh water requirement for the mill was assumed to be 120 m^3/hr based on information provided by the mill process designers. This fresh water requirement was assumed to be in addition to any process water make-up extracted from the TSF reclaim system.

Pit Dewatering System

The water pumped from the open pit by the dewatering system includes pit wall runoff, undisturbed pit catchment runoff entering the pit, and groundwater inflows. Groundwater inflows to the open pit were estimated to be approximately 80 L/s at the maximum extent of the pit in Year 15. The inflow rate was assumed to increase linearly during the 14 years of open pit mining, from 0 L/s in Year 1 up to 80 L/s in Year 15. For modelling purposes, it was assumed that pit dewatering flows will be pumped to the mill for use in the process until Year 15.

Tailings Embankment Seepage

The total embankment seepage leaving TSF Site D was assumed to linearly increase from 0 L/s in Year -1 to 55 L/s in Year 17. The majority of the TSF D embankment seepage is assumed to be lost through the Main Embankment (53.5 L/s), with the remaining 1.5 L/s leaves TSF Site D through the north (1.3 L/s) and south (0.2 L/s) abutments and is unredcoverable. Approximately 53.3 L/s of the TSF D embankment seepage is captured by the ECD and recycled back to the TSF Site D pond until the open pit is full and TSF Site D is discharging downstream via the closure spillway (Year 35). The unrecoverable seepage from the TSF D embankment (0.2 L/s) is assumed to bypass the seepage collection system and be lost to Davidson Creek downstream. Therefore, the total unrecoverable seepage from TSF D is 1.7 L/s at the end of operations.

Embankment seepage (21 L/s as of Year 3) from TSF Site C for Years 1 and 2 will be captured and recycled back to the TSF Site C pond with the exception of 0.4 L/s of unrecoverable seepage that will be captured in TSF Site D. The TSF Site C embankment seepage recycle system will be decommissioned at Year 3 and all subsequent seepage is assumed to be captured by TSF Site D.

Water Retained in Voids in TSF

The amount of water retained in the tailings and waste rock stored in the TSF is a function of the production schedule and the dry density and specific gravity of the solids. The dry density values for the tailings and waste rock are summarized in Table 1.

Potentially acid generating (PAG) and Non-acid generating (NAG3) waste rock will be stored in the TSF Site C and Site D. The co-disposed PAG and NAG3 waste rock will be stored and submerged in the TSF Site C

beginning during pit pre-stripping in Year -1 and continuing until the end of Year 1. Subsequently, all of the PAG and NAG3 waste rock will be stored in TSF Site D beginning in Year 2 and continuing until the end of the mine life, with some additional material being backfilled in the open pit at the end of the mine life. Initially all tailings will be deposited in TSF Site C. Starting in Year 3 and continuing to the end of operations, the tailings will be deposited in TSF Site D.

Reclaim Water

The volume of water available for reclaim to the mill was estimated using the TSF water balance.

The primary TSF inflows are:
- Water pumped to the TSF from the mill as part of the tailings slurry
- Direct precipitation on and runoff to the TSF, which includes runoff from the upslope catchments and embankments, and
- Runoff collected from the East and West Dumps and the LGO Stockpile.

The primary TSF water balance losses were:
- Unrecoverable TSF embankment/foundation seepage
- Water retained in the tailings and waste rock voids, and
- Evaporation.

The water available for process use was assumed to be the difference between these inflows and losses. Any shortfall in the water available for milling was assumed to be made up from an external source.

3. RESULTS

Operations

The water balance model was used to determine the likelihood of having a surplus or deficit of water in TSF Sites C and D, as illustrated on Figure 3. The water balance model assumed that a start-up pond of at least 6 Mm^3 (under average conditions) will accumulate in TSF Site C in the one year prior to mill start up, of which 1.0 Mm^3 is assumed to accumulate behind the TSF Site C Main Dam based on runoff from its contributing upslope catchment of A2 (7.1 km^2), with the additional 5.0 Mm^3 generated from the TSF Site D undisturbed contributing catchments of A1 and A14 (25 km^2), as shown on Figure 1. This runoff will be collected behind a cofferdam located at the TSF Site D Main Dam location and be pumped to the TSF Site C pond until the end of Year -1. The minimum operating pond volume for TSF Sites C and D were assumed to be 3.0 Mm^3 and 7.5 Mm^3, respectively. Figure 3 presents the predicted pond volumes available throughout operations for both facilities, based on average precipitation conditions.

The facilities are in a balance or surplus condition throughout operations, as the water accumulated within the supernatant ponds in TSF Sites C and D as well as open pit dewatering will satisfy the process requirements under average precipitation conditions. However, there is a constant freshwater requirement for the mill, as summarized in Table 4, which is assumed to be supplied by the freshwater pipeline from Tatelkuz Lake. In Years 5 until Year 10 when tailings are being deposited in TSF Site D, reclaim water is withdrawn from both the supernatant pond of TSF Site D and TSF Site C to meet the process water requirement. The additional process water requirement from TSF Site C is largely needed during the winter months in each year when precipitation falls as snow, but with snowmelt occurring during the spring freshet period, excess water becomes available and the system then operates in a surplus condition. The amount of surplus increases over time due to increasing runoff from the expanding surface area of the mine facilities, and also from decreases in waste rock production and corresponding decreases of water storage in waste rock voids for the mine rock stored annually within TSF Site D.

Table 4 Annual Average Volume of Makeup Water Requirement

Mine Life	Annual volume of makeup water required to supplement TSF reclaim (m^3/yr)	Annual volume of makeup water required from freshwater source (m^3/yr)
-1	0	0
1	0	1,051,200
2	0	1,051,200
3	0	1,051,200
4	0	1,054,080
5	0	1,051,200
6	0	1,051,200
7	0	1,051,200
8	0	1,054,080
9	0	1,051,200
10	0	1,051,200
11	0	1,051,200
12	0	1,054,080
13	0	1,051,200
14	0	1,051,200
15	0	1,051,200
16	0	1,054,080
17	0	259,200
TOTAL	**0**	**17,089,920**
	TOTAL MAKEUP WATER REQUIRED (m^3) =	**17,089,920**

The maximum operating pond volume for TSF Site C was assumed to be 14.3 Mm^3 (corresponding to a spillway elevation of 1343 m), with any excess water being discharged to TSF D via the closure spillway. The maximum operating pond volume for TSF Site D was assumed to be based on a spillway elevation of 1336 m. However, as shown on Figure 3, TSF Site D is predicted to exceed its maximum operating pond volume in the last year of operations, which indicates that it may be beneficial to divert a portion of the upstream contributing catchment around the facility to Davidson Creek in the later years of mine life.

Closure

The results of the closure pit filling model are shown on Figure 4. The open pit is assumed to begin filling in Year 15 when the dewatering system is decommissioned after open pit mining has ceased. At the end of mining operations in Year 17, the surplus inflow to TSF Site D (inflow minus losses) is assumed to be pumped to the open pit to aid in pit filling. The water balance shows this pit filling as a steady annual volume with peak monthly pumping rates in the summer. However, the TSF ponds will provide enough storage to minimize peak pumping needs during this closure phase to average monthly rates. TSF Site C is assumed to continue to naturally overflow into TSF Site D via a closure spillway in Year 27. The open pit takes approximately 18 years from the end of mining to fill based on average precipitation conditions, and was predicted to begin spilling in Year 35. TSF Site D was predicted to begin discharging via the closure spillway in that same year. Therefore it's

predicted that it will take a total of 18 years after the end of operations before the system will discharge to Davidson Creek.

Stochastic results

Figure 5 presents the range of possible cumulative pond volumes available in TSF Site C and TSF Site D over the mine life, as defined by the 95th percentile wet and dry values (5% and 95% chance of being equalled or exceeded in any month, respectively). This range of volumes also indicates possible active or live storage capacity in the TSF ponds for a reasonably large range of anticipated climatic conditions. The stochastic water balance highlights the sensitivity of the TSF pond volumes to the assumed climatic inputs and pond minimum/maximum operating capacities. The stochastic results indicate that for extreme conditions (5th percentile), the accumulated TSF ponds, open pit and associated contributing catchments are not able to supply enough water to meet the process water requirements until Year 11, and the system will operate in a deficit condition until that time, as indicated in Table 5.

Table 5 Annual Stochastic Volume of Makeup Water Requirement

Mine Life	Annual volume of makeup water required to supplement TSF reclaim (m^3/yr)			Annual volume of makeup water required from freshwater source (m^3/yr)
	5th Percentile	50th Percentile (Median)	95th Percentile	
-1	0	0	0	0
1	0	0	0	1,051,200
2	2,000,400	0	0	1,051,200
3	2,389,900	0	0	1,051,200
4	2,865,800	0	0	1,054,080
5	2,655,700	0	0	1,051,200
6	2,918,600	0	0	1,051,200
7	2,903,800	0	0	1,051,200
8	2,741,400	0	0	1,054,080
9	2,708,800	0	0	1,051,200
10	1,801,800	0	0	1,051,200
11	979,120	0	0	1,051,200
12	0	0	0	1,054,080
13	0	0	0	1,051,200
14	0	0	0	1,051,200
15	0	0	0	1,051,200
16	0	0	0	1,054,080
17	0	0	0	259,200

4. REFERENCES

Knight Piésold (2013a). *Blackwater Project – Feasibility Study Water Balance Model*, Ref. No. VA13-00972, September 19, 2013

Knight Piésold (2013b). *Blackwater – Site Water Balance Model update in GoldSim (WBM_013)*. Ref. No. VA13-02367, December 13, 2013

Knight Piésold (2013c). *Engineering Hydrometeorology Report*, Ref. No. VA101-457/6-12 Rev 0, November 2013

We trust that this letter meets the current needs of the project team. Please contact the undersigned with any questions or comments.

Yours truly,

KNIGHT PIESOLD LTD.

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
ERIN RAINEY
34952

Signed:
Erin Rainey, P.Eng.
Project Engineer

Reviewed:
Daniel Fontaine, P.Eng.
Project Engineer

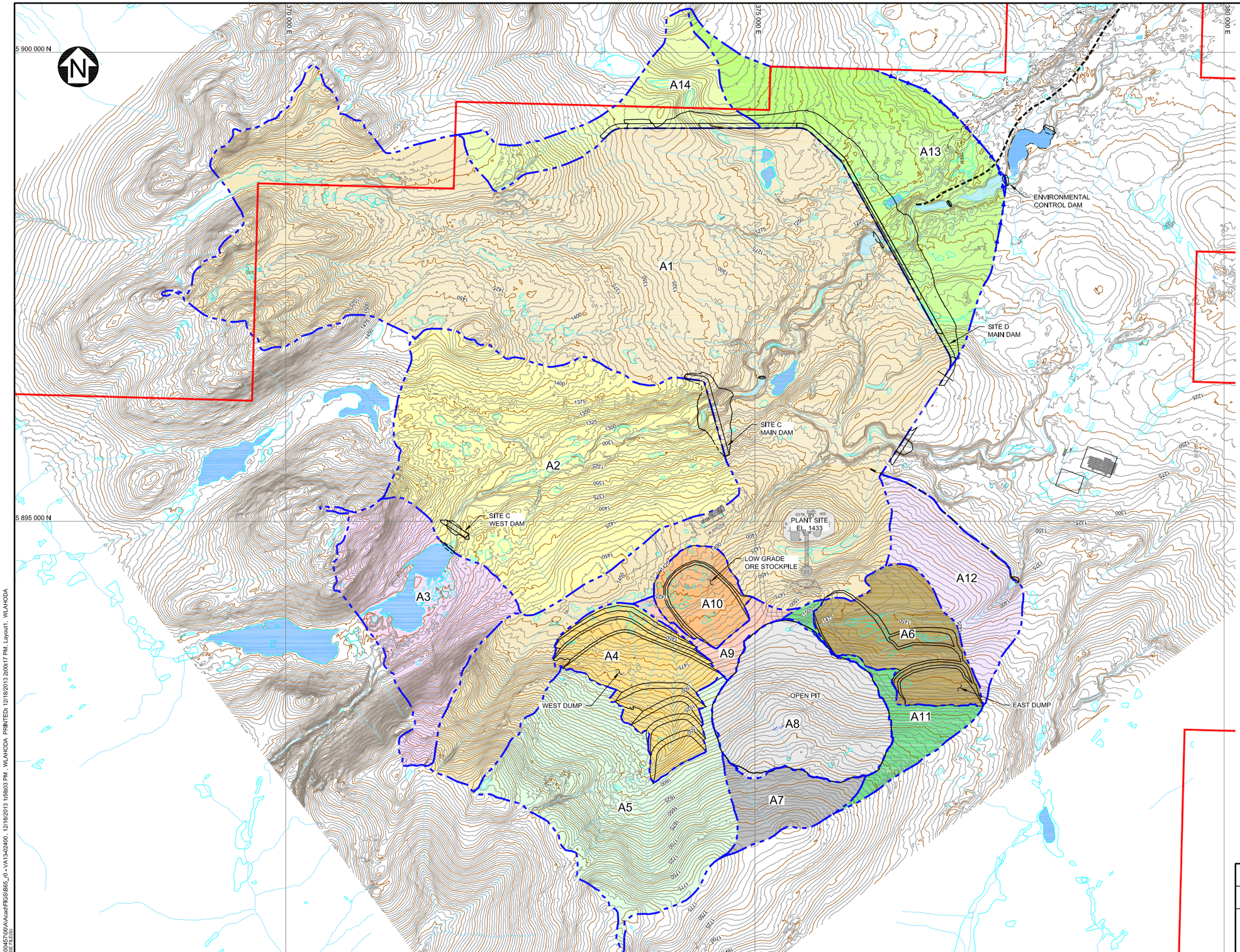
Approved:
Ken Brouwer, P.Eng.
President

Attachments:

Figure 1 Rev 0	Catchment Area – Plan
Figure 2 Rev 0	Water Balance Schematic – During Operations Year 13
Figure 3 Rev 0	Monthly TSF Pond Volume Average
Figure 4 Rev 0	Closure Pit Filling Average
Figure 5 Rev 0	Monthly Pond Volume - Stochastic

Copy To: Nigel Fisher, Doug Moore, Keith Ferguson, Dave Hall

/er



ID	CATCHMENT AREA (m²)
A1	23,493,258
A2	7,203,864
A3	2,745,670
A4	1,716,662
A5	4,041,717
A6	1,584,807
A7	778,163
A8	2,380,000
A9	308,576
A10	759,710
A11	701,996
A12	1,507,979
A13	4,143,515
A14	1,567,691

LEGEND:

- CATCHMENT AREA A1
- CATCHMENT AREA A2
- CATCHMENT AREA A3
- CATCHMENT AREA A4
- CATCHMENT AREA A5
- CATCHMENT AREA A6
- CATCHMENT AREA A7
- CATCHMENT AREA A8
- CATCHMENT AREA A9
- CATCHMENT AREA A10
- CATCHMENT AREA A11
- CATCHMENT AREA A12
- CATCHMENT AREA A13
- CATCHMENT AREA A14
- CATCHMENT BOUNDARY
- NEW GOLD PROPERTY BOUNDARY

NOTES:

1. CONTOUR INTERVAL IS 5 METRES.
2. DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.

SCALE A 400 200 0 400 800 1200 1600 2000 m

NEW GOLD INC

BLACKWATER GOLD PROJECT

CATCHMENT AREA PLAN

Knight Piésold CONSULTING

P/A NO.	REF NO.
VA101-457/6	VA13-02400

FIGURE 1 REV 0

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	CHK'D	APP'D
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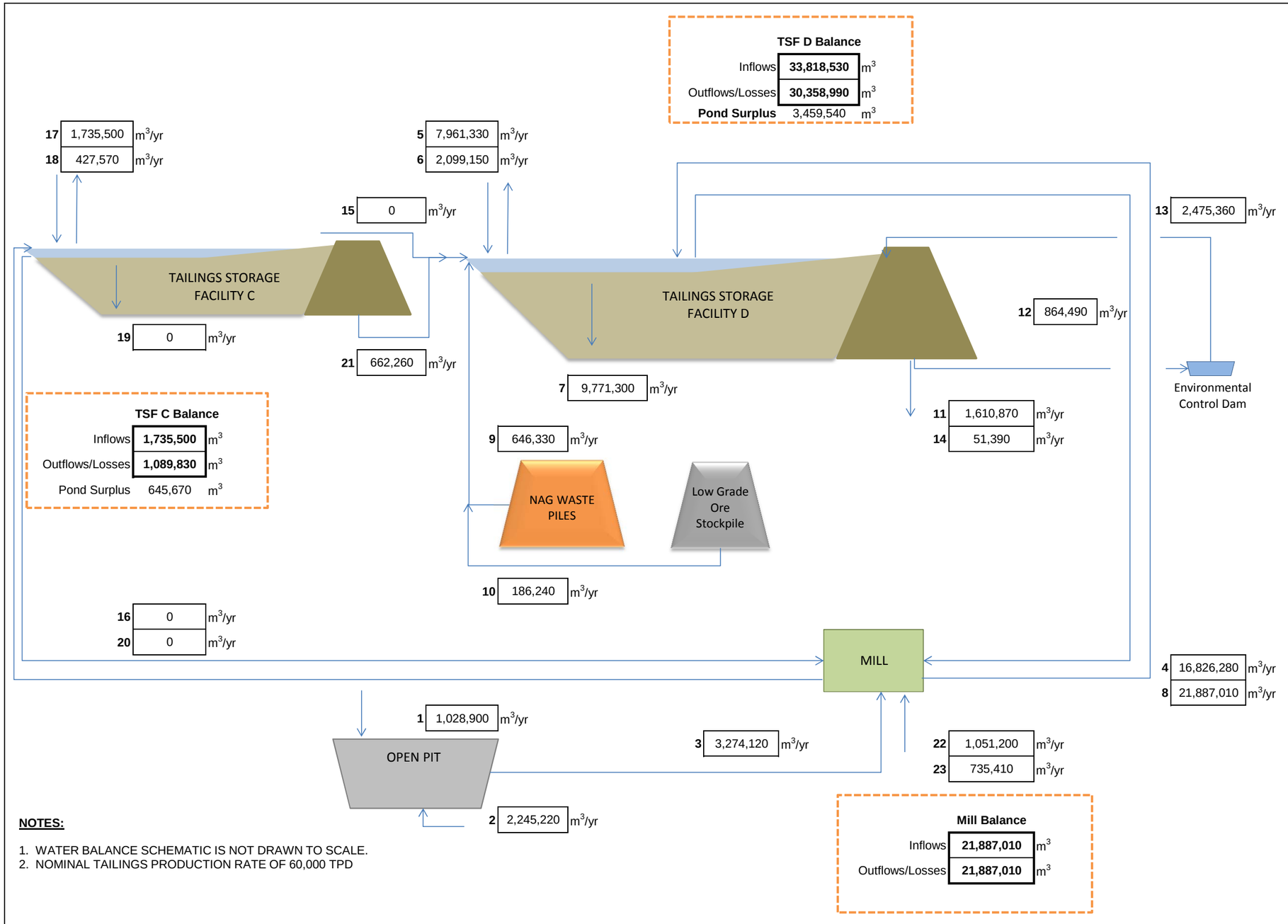

Number	Description
	Open Pit
1	Open Pit direct precipitation and catchment runoff
2	Open Pit groundwater inflows
3	Open Pit dewatering direct to mill
	Tailings Storage Facility D
4	TSF reclaim water
5	TSF catchment and beach runoff; direct precipitation on pond
6	TSF pond evaporation
7	Water trapped in tailings and waste rock void spaces
8	Water in slurry (50% solids content, by weight)
9	NAG waste piles runoff/infiltration
10	Low Grade ore stockpile runoff/infiltration
11	TSF embankment runoff/infiltration and total seepage to ECD
12	TSF embankment runoff/infiltration and catchment runoff to ECD
13	ECD recycle to TSF pond
14	TSF embankment/foundation unrecoverable seepage
15	Overflow from TSF C
	Tailings Storage Facility C
16	TSF reclaim water
17	TSF catchment and beach runoff; direct precipitation on pond
18	TSF pond evaporation
19	Water trapped in tailings and waste rock void spaces
20	Water in slurry (50% solids content, by weight)
21	TSF embankment/foundation seepage (collected in TSF D)
	Mill
22	Freshwater to mill
23	Water in Ore

NOTES:

1. WATER BALANCE SCHEMATIC IS NOT DRAWN TO SCALE.
2. NOMINAL TAILINGS PRODUCTION RATE OF 60,000 TPD

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NEW GOLD INC.

BLACKWATER GOLD PROJECT

TAILINGS STORAGE FACILITY WATER BALANCE SCHEMATIC DURING OPERATIONS - YEAR 13

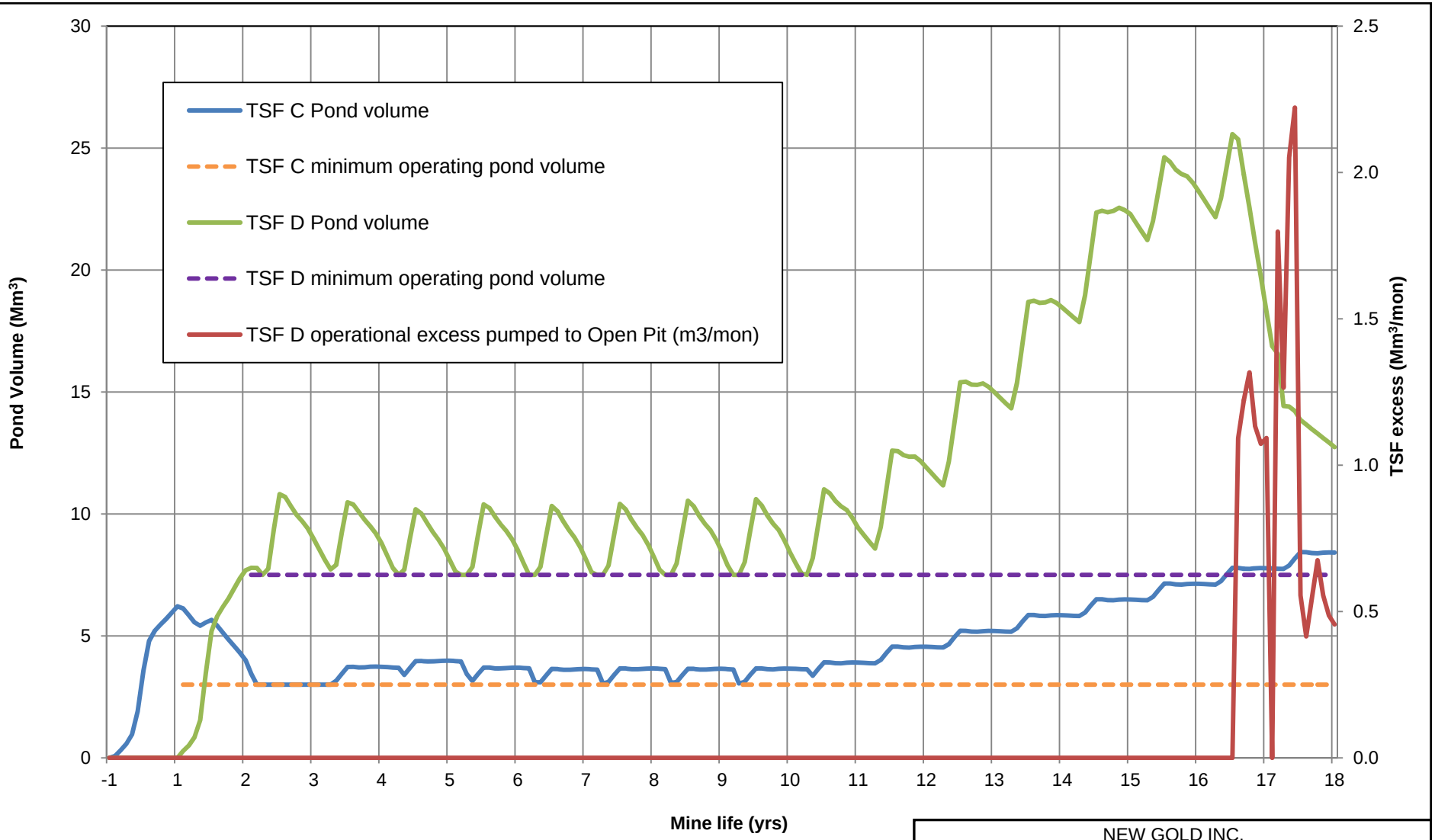
Knight Piésold CONSULTING

P/A NO. VA101-457/6

REF NO. VA13-02400

FIGURE 2

REV 0



NOTES:

1. TSF C OPERATING POND VOLUME ASSUMED TO BE 3 Mm^3.
2. TSF D OPERATING POND VOLUME ASSUMED TO BE EQUAL TO THREE MONTHS PROCESS WATER REQUIREMENT (7.5 Mm^3).

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NEW GOLD INC.

BLACKWATER GOLD PROJECT

TAILINGS STORAGE FACILITY C/D MONTHLY TSF POND VOLUME AVERAGE

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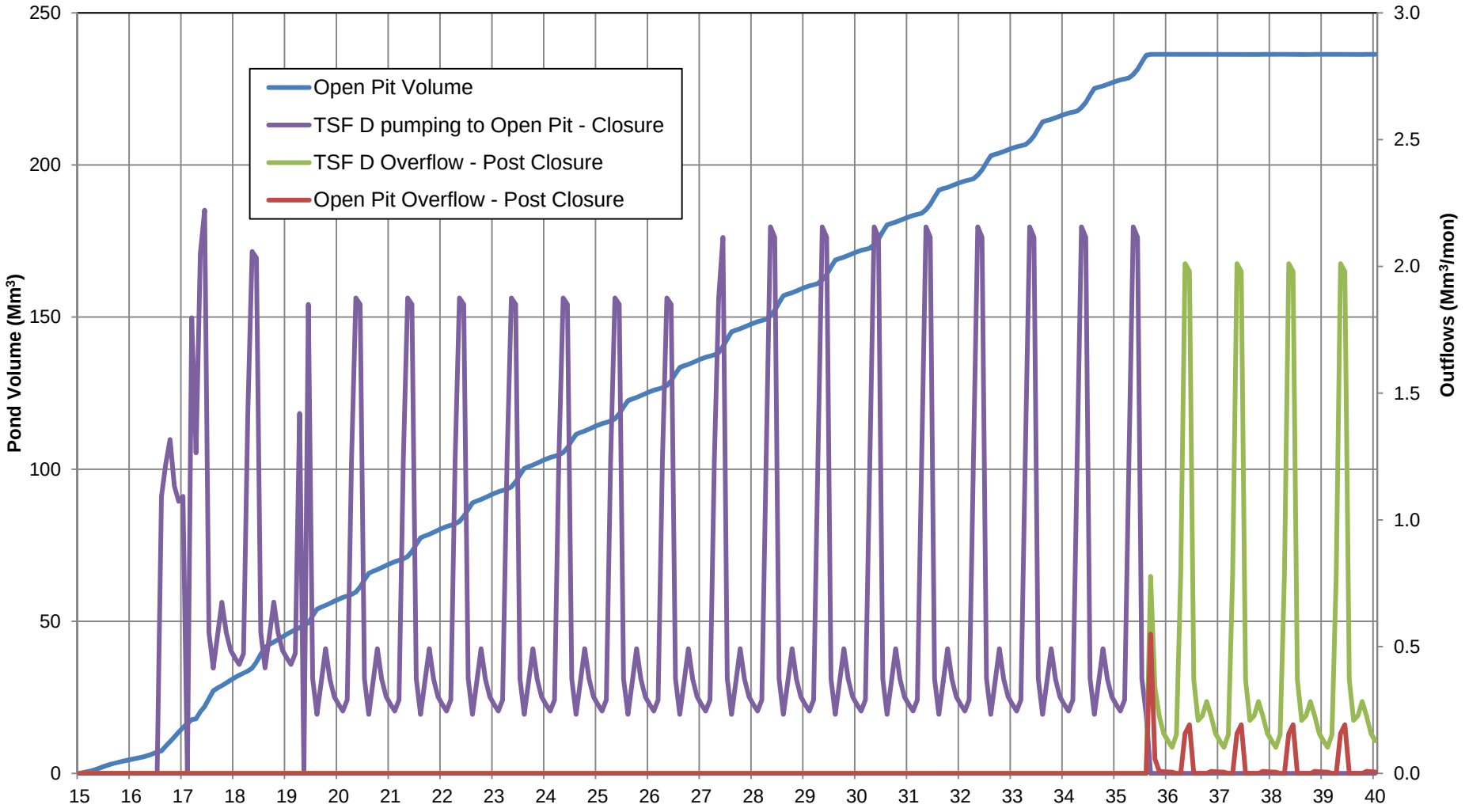
P/A NO. VA101-457/6

REF NO VA13-02400

FIGURE 3

REV 0



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NEW GOLD INC.

BLACKWATER GOLD PROJECT

TAILINGS STORAGE FACILITY C/D
CLOSURE PIT FILLING
AVERAGE

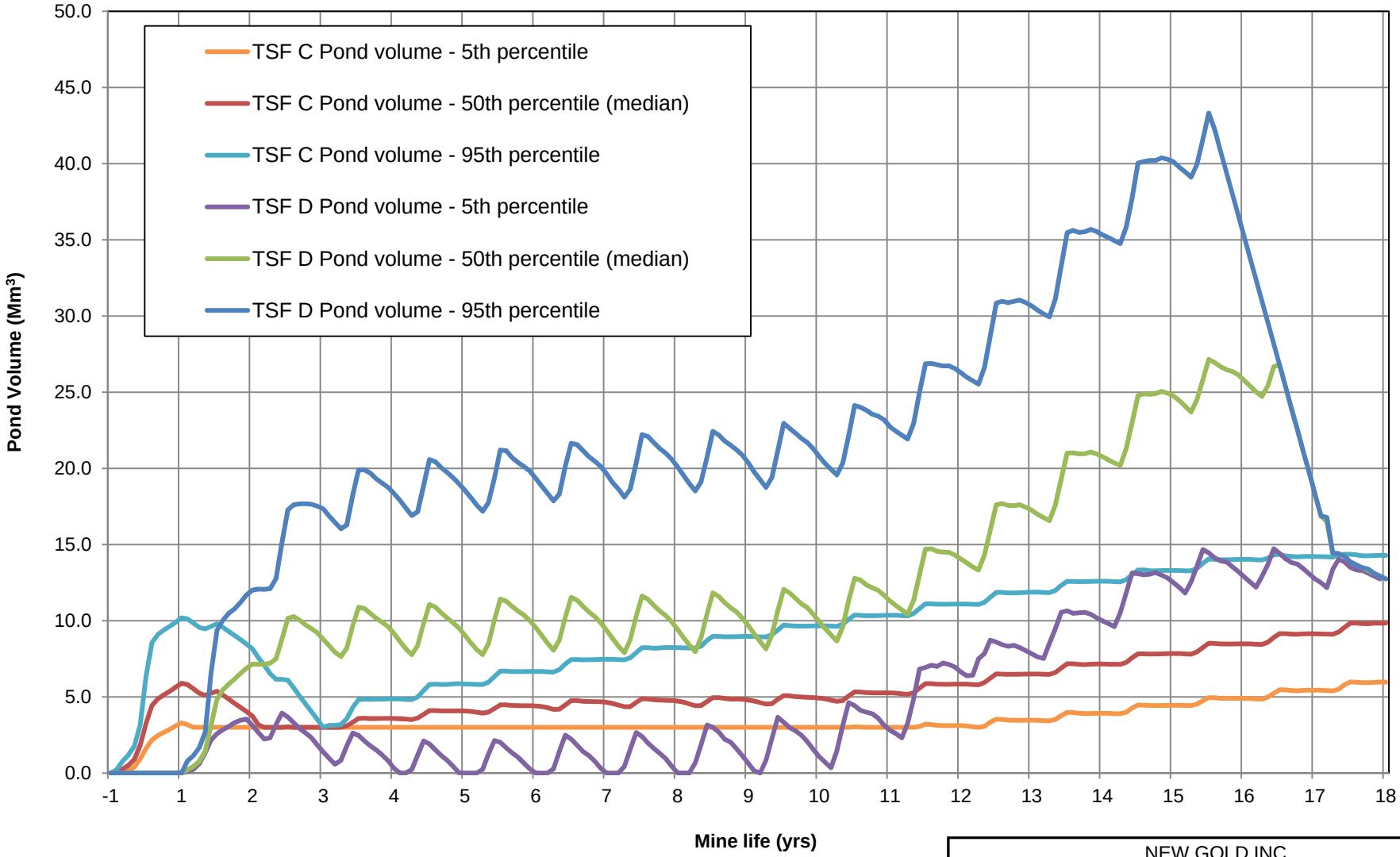
Knight Piésold CONSULTING

P/A NO. VA101-457/6

REF NO VA13-02400

FIGURE 4

REV 0



NOTES:

1. TSF C OPERATING POND VOLUME ASSUMED TO BE 3 Mm^3.
2. TSF D OPERATING POND VOLUME ASSUMED TO BE EQUAL TO THREE MONTHS PROCESS WATER REQUIREMENT (7.5 Mm^3).

REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D
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NEW GOLD INC.

BLACKWATER GOLD PROJECT

TAILINGS STORAGE FACILITY C/D MONTHLY POND VOLUME STOCHASTIC

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P/A NO. VA101-457/6

REF NO VA13-02400

FIGURE 5

REV 0

APPENDIX F

MATERIAL TAKEOFFS

(Pages F-1 to F-32)

TABLE F.1

NEW GOLD INC.
BLACKWATER GOLD PROJECT

MINE WASTE AND WATER MANAGEMENT DESIGN REPORT
MATERIAL TAKEOFF - WBS TASK 1000

A	A	A	D	F	G	H	I
Mandatory	Mandatory	Mandatory	Mandatory	Mandatory	If Required	Mandatory	Mandatory
Blackwater WBS Level 1	**Blackwater WBS Level 2**	**Blackwater WBS Level 3**	**WBS Description**	**Primary Item Description**	**Secondary Item Description**	**Qty**	**Unit of Measure**
1000	1100	1110	Lowgrade Ore Stockpile	Logging and bunching timber		100	ha
1000	1100	1110	Lowgrade Ore Stockpile	Access Trails for Site Preparation	Dozer temporary constructed access. Final road configuration by mining.	4	km
1000	1100	1110	Lowgrade Ore Stockpile	Clear and Grub Footprint		420,000	m2
1000	1100	1110	Lowgrade Ore Stockpile	Foundation Preparation	Assumes 500 mm removal under footprint	210,000	m3
1000	1100	1110	Lowgrade Ore Stockpile	Construct diversion channel and adjacent access road	Excavate 3 m wide by 1 m deep channel	1,700	m
1000	1100	1110	Lowgrade Ore Stockpile	Place wearing course on access road adjacent to diversion channel	Assumes 300 mm wearing course.	510	m3
1000	1100	1110	Lowgrade Ore Stockpile	Allowance for culverts at diversion channel road crossing	Assume 3x1000 mm corrugated metal pipe and 80 m long	3	ea.
1000	1100	1110	Lowgrade Ore Stockpile	Construct diversion ditches around stockpile footprint	Excavate 1 m wide by 1 m deep channel and spoil in windrow	3,600	m
1000	1100	1110	Lowgrade Ore Stockpile	Allowance for culverts at diversion ditch and sump outlet road crossings	Assume 2x800 mm corrugated metal pipe per crossing, 60 m long	4	ea.
1000	1100	1110	Lowgrade Ore Stockpile	Allowance for culverts at diversion ditch road crossings	Assume 2x800 mm corrugated metal pipe per crossing, 20 m long	2	ea.
1000	1100	1110	Lowgrade Ore Stockpile	Load, haul, place, compact Zone S sub-grade	Place two 500 mm lifts of Zone S from pit overburden stripping	210,000	m3
1000	1100	1110	Lowgrade Ore Stockpile	Foundation Drains - Perforated Drain Pipe	1x6" Perforated Corrugated HDPE Type S	2,500	m
1000	1100	1110	Lowgrade Ore Stockpile	Foundation Drains - Geofabric separation	8 oz. non-woven geotextile	10,000	m2
1000	1100	1110	Lowgrade Ore Stockpile	Foundation Drains - Zone D (drain gravel)	Contractor load, haul, spread, compact.	2,750	m3
1000	1100	1110	Lowgrade Ore Stockpile	Foundation Drain Sump and Monitoring Device	$50,000 allowance based on past projects.	1	L.S.
1000	1100	1110	Lowgrade Ore Stockpile	Collection Header - Perforated Drain Pipe	1x12" Perforated Corrugated HDPE Type S	550	m
1000	1100	1110	Lowgrade Ore Stockpile	Collection Drains - Zone D (drain gravel)	Contractor load, haul, spread, compact.	605	m3
1000	1100	1110	Lowgrade Ore Stockpile	Collection Drain Sump and Monitoring Device	$50,000 allowance based on past projects.	1	L.S.
1000	1100	1110	Lowgrade Ore Stockpile	Temporary Equalization Pond (small dam less than 5 m high)	$50,000 allowance based on past projects.	1	L.S.
1000	1100	1120	East Dump	Logging and bunching timber		37	ha
1000	1100	1120	East Dump	Access Trails for Site Preparation	Dozer constructed access. Final road configuration and surface by mining.	2	km
1000	1100	1120	East Dump	Temporary culverts for water management	Allow 4x800 mm corrugated metal pipe culverts per km of trail	8	ea.
1000	1100	1120	East Dump	Foundation Preparation at Dump Toe	Clear and Grub 30 m strip. Windrow topsoil into berm. Excavate ditches.	60,000	m2
1000	1100	1120	East Dump	Logging and bunching timber for Sediment Control Pond	Sediment Control Pond 5	7	ha
1000	1100	1120	East Dump	Clear and Grub Footprint of Sediment Control Pond	Sediment Control Pond 5	41,000	m2
1000	1100	1120	East Dump	Foundation Preparation - 0.5 m removal below footprint	Sediment Control Pond 5	20,500	m3
1000	1100	1120	East Dump	Load, haul, spread compact Zone S for Dam	Sediment Control Pond 5	12,000	m3
1000	1100	1120	East Dump	Construct outfall spillway and channel to KD1 diversion road	Sediment Control Pond 5	600	m
1000	1100	1120	East Dump	Riprap allowance for inlet, outlet, and dam toe buttress	Sediment Control Pond 5	5,100	m3
1000	1100	1130	West Dump	Logging and bunching timber		56	ha
1000	1100	1130	West Dump	Access Trails for Site Preparation	Dozer constructed access. Final road configuration and surface by mining.	2	km
1000	1100	1130	West Dump	Temporary culverts for water management	Allow 4x800 mm corrugated metal pipe culverts per km of trail	8	ea.
1000	1100	1130	West Dump	Foundation Preparation at Dump Toe	Clear and Grub 30 m strip. Windrow topsoil into berm. Excavate ditches.	60,000	m2
1000	1400	1450	Mine Dewatering	Drill and Install Observation Wells (11 OW each 400 m deep at HQ sized hole)	Allow $200 per meter drilling and installation. (2012/2013 Blackwater Drilling)	4,400	m
1000	1400	1450	Mine Dewatering	Instrumentation: Vibrating Wire Piezometers, data loggers, cabling	Allow $10,000 per observation well for instrumentation	11	ea
1000	1400	1450	Mine Dewatering	Drill and Install 8" Pumping Wells (2015) - PW15-1 through PW15-5	Allow $350,000 for each Pumping Well (Drillwell Quote and 2013 Drilling)	5	ea
1000	1400	1450	Mine Dewatering	Drill and Install 8" Pumping Wells (2016) - PW16-1 through PW16-4	Allow $350,000 for each Pumping Well (Drillwell Quote and 2013 Drilling)	4	ea
1000	1400	1450	Mine Dewatering	Drill and Install 10" Backup Pumping Well at PW13-1	Allow $570,000 for each Pumping Well (Drillwell Quote and 2013 Drilling)	5	ea
1000	1400	1450	Mine Dewatering	5" STD Steel	PW13-1 riser pipeline	90	m
1000	1400	1450	Mine Dewatering	6" DR17 HDPE	PW13-1 discharge pipeline	540	m
1000	1400	1450	Mine Dewatering	Discharge pipe support - fill mounded over top at 20 m intervals		60	m3
1000	1400	1450	Mine Dewatering	Peerless Vertical 9LA 11 Stage 75 HP Submersible Turbine Pump	Peerless Pumps Quote Attached (80 m3/h at 160 m TDH, 75 HP, 56 kW)	2	ea
1000	1400	1450	Mine Dewatering	5" Shut-off valve (Class 150)		2	ea
1000	1400	1450	Mine Dewatering	5" Check valve (Class 150)		2	ea
1000	1400	1450	Mine Dewatering	Special Tee (2 x 5", 1 x 6")		1	ea
1000	1400	1450	Mine Dewatering	Transition Coupling (Steel to HDPE)		1	ea

TABLE F.1

NEW GOLD INC.
BLACKWATER GOLD PROJECT

MINE WASTE AND WATER MANAGEMENT DESIGN REPORT
MATERIAL TAKEOFF - WBS TASK 1000

A	A	A	D	F	G	H	I
Mandatory	Mandatory	Mandatory	Mandatory	Mandatory	If Required	Mandatory	Mandatory
Blackwater WBS Level 1	**Blackwater WBS Level 2**	**Blackwater WBS Level 3**	**WBS Description**	**Primary Item Description**	**Secondary Item Description**	**Qty**	**Unit of Measure**
1000	1400	1450	Mine Dewatering	Instrumentation and Controls		1	LS
1000	1400	1450	Mine Dewatering	Electrical Equipment and Installation		1	LS
1000	1400	1450	Mine Dewatering	Submersible pumps and motors (14 m3/h, 245 m TDH)	Pump specifications attached from Smith Cameron Process Solutions	7	ea
1000	1400	1450	Mine Dewatering	Submersible pumps and motors (20 m3/h, 329 m TDH, 35 HP, 26 KW)	Pump specifications attached from Smith Cameron Process Solutions	3	ea
1000	1400	1450	Mine Dewatering	2" Pump Riser Lines (Sch. 40 STD Steel)		2,450	m
1000	1400	1450	Mine Dewatering	3" Pump Riser Lines (Sch. 40 STD Steel)		1,200	m
1000	1400	1450	Mine Dewatering	2" Shut-off valve (Class 150)		7	ea
1000	1400	1450	Mine Dewatering	2" Check valve (Class 150)		7	ea
1000	1400	1450	Mine Dewatering	3" Shut-off valve (Class 150)		3	ea
1000	1400	1450	Mine Dewatering	3" Check valve (Class 150)		3	ea
1000	1400	1450	Mine Dewatering	2" Transition Coupling (Steel to HDPE)		7	ea
1000	1400	1450	Mine Dewatering	3" Transition Coupling (Steel to HDPE)		3	ea
1000	1400	1450	Mine Dewatering	4" Pipeline (DR17 HDPE)		3,500	m
1000	1400	1450	Mine Dewatering	6" Pipeline (DR17 HDPE)		2,500	m
1000	1400	1450	Mine Dewatering	20" Pipeline (DR17 HDPE)	Allow 400 m piping to connect discharge junction header to open channel ditch	400	m
1000	1400	1450	Mine Dewatering	Junction Header: 4" Shut-off valve (Class 150)		1	ea
1000	1400	1450	Mine Dewatering	Junction Header: 4" Check valve (Class 150)		1	ea
1000	1400	1450	Mine Dewatering	Junction Header: 6" Shut-off valve (Class 150)		1	ea
1000	1400	1450	Mine Dewatering	Junction Header: 6" Check valve (Class 150)		1	ea
1000	1400	1450	Mine Dewatering	Junction Header: 8" Shut-off valve (Class 150)		1	ea
1000	1400	1450	Mine Dewatering	Junction Header: 8" Check valve (Class 150)		1	ea
1000	1400	1450	Mine Dewatering	Junction Header: 16" Shut-off valve (Class 150)		1	ea
1000	1400	1450	Mine Dewatering	Junction Header: 16" Check valve (Class 150)		1	ea
				Total Installed Cost Before Owners Cost			

TABLE F.2

NEW GOLD INC.
BLACKWATER GOLD PROJECT

MINE WASTE AND WATER MANAGEMENT DESIGN REPORT
MATERIAL TAKEOFF - WBS TASK 4100

A	A	A	D	F	G	H	I
Mandatory	Mandatory	Mandatory	Mandatory	Mandatory	If Required	Mandatory	Mandatory
Blackwater WBS Level 1	**Blackwater WBS Level 2**	**Blackwater WBS Level 3**	**WBS Description**	**Primary Item Description**	**Secondary Item Description**	**Qty**	**Unit of Measure**
4000	4100	4110	Logging	Road Package 1	Logging and skidding	182	ha
4000	4100	4110	Logging	Site C Main Dam	Logging and skidding	24	ha
4000	4100	4110	Logging	Site C West Dam	Logging and skidding	4	ha
4000	4100	4110	Logging	Site C Local Borrow	Logging and skidding	15	ha
4000	4100	4110	Logging	Aggregate Screening Area	Logging and skidding	41	ha
4000	4100	4110	Logging	TSF Site C Footprint - Stage 1	Logging and skidding	100	ha
4000	4100	4110	Logging	TSF Site D Downstream	Logging and skidding	83	ha
4000	4100	4110	Logging	Site D Main Dam - Stage 1	Logging and skidding	48	ha
4000	4100	4110	Logging	TSF Site D Footprint - Stage 1	Logging and skidding	131	ha
4000	4100	4110	Logging	Site C South Borrow	Logging and skidding	14	ha
4000	4100	4120	Roads	Clear and Grub Road Package 1		182	ha
4000	4100	4120	Roads	KH1 - Mass Excavation	Balance to fill and waste remainder locally.	217,200	m3
4000	4100	4120	Roads	KH1 - Mass Fill	Balance from excavation within 500 m.	163,100	m3
4000	4100	4120	Roads	KH1 - Wearing Course	Assumes 300 mm wearing course.	7,554	m3
4000	4100	4120	Roads	KH1 - Safety Berms	Excavate ditches locally to create safety berms	1,259	m
4000	4100	4120	Roads	KH2 - Mass Excavation	Balance to fill and waste remainder locally.	754,800	m3
4000	4100	4120	Roads	KH2 - Mass Fill	Balance from excavation within 500 m.	535,400	m3
4000	4100	4120	Roads	KH2 - Wearing Course	Assumes 300 mm wearing course.	39,816	m3
4000	4100	4120	Roads	KH2 - Safety Berms	Excavate ditches locally to create safety berms	6,636	m
4000	4100	4120	Roads	KH3 - Mass Excavation	Balance to fill and waste remainder locally.	100,900	m3
4000	4100	4120	Roads	KH3 - Mass Fill	Balance from excavation within 500 m.	68,300	m3
4000	4100	4120	Roads	KH3 - Wearing Course	Assumes 300 mm wearing course.	9,486	m3
4000	4100	4120	Roads	KH3 - Safety Berms	Excavate ditches locally to create safety berms	1,581	m
4000	4100	4120	Roads	KH4 - Mass Excavation	Balance to fill locally.	79,200	m3
4000	4100	4120	Roads	KH4 - Mass Fill	Additional local borrow required within 500 m.	473,100	m3
4000	4100	4120	Roads	KH4 - Wearing Course	Assumes 300 mm wearing course.	22,728	m3
4000	4100	4120	Roads	KH4 - Safety Berms	Excavate ditches locally to create safety berms	3,788	m
4000	4100	4120	Roads	KS1 - Mass Excavation	Balance to fill locally.	240,800	m3
4000	4100	4120	Roads	KS1 - Mass Fill	Additional local borrow required within 500 m.	477,500	m3
4000	4100	4120	Roads	KS1 - Wearing Course and Safety Berms	Assumes 300 mm wearing course.	29,453	m3
4000	4100	4120	Roads	KD1 - Mass Excavation	Balance to fill and waste remainder locally.	99,900	m3
4000	4100	4120	Roads	KD1 - Mass Fill	Balance from excavation within 500 m.	11,600	m3
4000	4100	4120	Roads	KD1 - Wearing Course	Assumes 300 mm wearing course.	3,643	m3
4000	4100	4130	Sediment and Erosion Control	Sediment Control Pond 1 - Mass Excavation		20,000	m3
4000	4100	4130	Sediment and Erosion Control	Sediment Control Pond 1 - Fill	Assumes 25% of mass excavation placed as fill locally.	5,000	m3
4000	4100	4130	Sediment and Erosion Control	Sediment Control Pond 1 - Liner	Load, haul, spread, compact 1000 mm Zone S blanket.	4,400	m3
4000	4100	4130	Sediment and Erosion Control	Sediment Control Pond 1 - Inlet and Spillway Riprap	Allow for 5 m x 10 m by 500 mm riprap at inlet and spillway.	50	m3
4000	4100	4130	Sediment and Erosion Control	Sediment Control Pond 1 - 10" HDPE Outlet Piping	Allowance for riser, low level outlet, and drain pipes.	50	m

TABLE F.2

NEW GOLD INC.
BLACKWATER GOLD PROJECT

MINE WASTE AND WATER MANAGEMENT DESIGN REPORT
MATERIAL TAKEOFF - WBS TASK 4100

A	A	A	D	F	G	H	I
Mandatory	Mandatory	Mandatory	Mandatory	Mandatory	If Required	Mandatory	Mandatory
Blackwater WBS Level 1	**Blackwater WBS Level 2**	**Blackwater WBS Level 3**	**WBS Description**	**Primary Item Description**	**Secondary Item Description**	**Qty**	**Unit of Measure**
4000	4100	4130	Sediment and Erosion Control	Sediment Control Pond 1 - Foundation Drains	Provisional sum allowance for 100 m of drain.	100	m
4000	4100	4130	Sediment and Erosion Control	Sediment Control Pond 2 - Mass Excavation		20,000	m3
4000	4100	4130	Sediment and Erosion Control	Sediment Control Pond 2 - Fill	Assumes 25% of mass excavation placed as fill locally.	5,000	m3
4000	4100	4130	Sediment and Erosion Control	Sediment Control Pond 2 - Liner	Load, haul, spread, compact 1000 mm Zone S blanket.	4,400	m3
4000	4100	4130	Sediment and Erosion Control	Sediment Control Pond 2 - Inlet and Spillway Riprap	Allow for 5 m x 10 m by 500 mm riprap at inlet and spillway.	50	m3
4000	4100	4130	Sediment and Erosion Control	Sediment Control Pond 2 - 10" HDPE Outlet Piping	Allowance for riser, low level outlet, and drain pipes.	50	m
4000	4100	4130	Sediment and Erosion Control	Sediment Control Pond 2 - Foundation Drains	Provisional sum allowance for 100 m of drain.	100	m
4000	4100	4130	Sediment and Erosion Control	Sediment Control Pond 3 - Mass Excavation		27,000	m3
4000	4100	4130	Sediment and Erosion Control	Sediment Control Pond 3 - Fill	Assumes 25% of mass excavation placed as fill locally.	6,750	m3
4000	4100	4130	Sediment and Erosion Control	Sediment Control Pond 3 - Liner	Load, haul, spread, compact 1000 mm Zone S blanket.	6,250	m3
4000	4100	4130	Sediment and Erosion Control	Sediment Control Pond 3 - Inlet and Spillway Riprap	Allow for 5 m x 10 m by 500 mm riprap at inlet and spillway.	50	m3
4000	4100	4130	Sediment and Erosion Control	Sediment Control Pond 3 - 10" HDPE Outlet Piping	Allowance for riser, low level outlet, and drain pipes.	50	m
4000	4100	4130	Sediment and Erosion Control	Sediment Control Pond 3 - Foundation Drains	Provisional sum allowance for 100 m of drain.	100	m
4000	4100	4130	Sediment and Erosion Control	Sediment Control Pond 4 - Mass Excavation		23,000	m3
4000	4100	4130	Sediment and Erosion Control	Sediment Control Pond 4 - Fill	Assumes 25% of mass excavation placed as fill locally.	5,750	m3
4000	4100	4130	Sediment and Erosion Control	Sediment Control Pond 4 - Liner	Load, haul, spread, compact 1000 mm Zone S blanket.	5,060	m3
4000	4100	4130	Sediment and Erosion Control	Sediment Control Pond 4 - Inlet and Spillway Riprap	Allow for 5 m x 10 m by 500 mm riprap at inlet and spillway.	50	m3
4000	4100	4130	Sediment and Erosion Control	Sediment Control Pond 4 - 10" HDPE Outlet Piping	Allowance for riser, low level outlet, and drain pipes.	50	m
4000	4100	4130	Sediment and Erosion Control	Sediment Control Pond 4 - Foundation Drains	Provisional sum allowance for 100 m of drain.	100	m
4000	4100	4130	Sediment and Erosion Control	Site C Main Dam Sediment Control Pond - SCP 6	Contractor load, haul, spread, compact Zone S.	10,000	m3
4000	4100	4130	Sediment and Erosion Control	Site D Main Dam Sediment Control Pond - SCP 7	Contractor load, haul, spread, compact Zone S.	10,000	m3
4000	4100	4140	Borrow Development and Laydowns	Aggregate Screening Area - Clear and Grub Footprint		410,000	m2
4000	4100	4140	Borrow Development and Laydowns	Aggregate Screening Area - Remove Topsoil	Assumes 1 m removal under footprint	410,000	m3
4000	4100	4140	Borrow Development and Laydowns	Contractor Laydown - Clear and Grub Footprint		90,000	m2
4000	4100	4140	Borrow Development and Laydowns	Contractor Laydown - Foundation Preparation	Assumes 1 m removal under footprint	90,000	m3
4000	4100	4140	Borrow Development and Laydowns	Contractor Laydown - Wearing Course	Assumes 300 mm wearing course.	27,000	m3
4000	4100	4140	Borrow Development and Laydowns	Site C Local Borrow - Clear and Grub Footprint		150,000	m2
4000	4100	4140	Borrow Development and Laydowns	Site C Local Borrow - Remove Topsoil	Assumes 1 m removal under footprint	150,000	m3
				Total Installed Cost Before Owners Cost			

TABLE F.3

NEW GOLD INC.
BLACKWATER GOLD PROJECT

MINE WASTE AND WATER MANAGEMENT DESIGN REPORT
MATERIAL TAKEOFF - WBS TASK 4200

A	A	A	D	F	G	H	I
Mandatory	Mandatory	Mandatory	Mandatory	Mandatory	If Required	Mandatory	Mandatory
Blackwater WBS Level 1	**Blackwater WBS Level 2**	**Blackwater WBS Level 3**	**WBS Description**	**Primary Item Description**	**Secondary Item Description**	**Qty**	**Unit of Measure**
4000	4200	4210	Cofferdams	Clear and Grub Footprint	Includes Main and West cofferdams	24,000	m2
4000	4200	4210	Cofferdams	Foundation Preparation	Assumes 1 m removal under footprint	24,000	m3
4000	4200	4210	Cofferdams	Construct cofferdam upstream of Site C - Main Dam	Contractor load, haul, spread, compact.	185,000	m3
4000	4200	4210	Cofferdams	Construct cofferdam upstream of Site C - West Dam	Contractor load, haul, spread, compact.	37,000	m3
4000	4200	4210	Cofferdams	Complete fish salvage from Davidson Creek		2	weeks
4000	4200	4210	Cofferdams	Temporary Construction Dewatering		Construction	days
4000	4200	4220	Site C - Main Dam (up to EL. 1300 m)	Clear and Grub Footprint		44,560	m2
4000	4200	4220	Site C - Main Dam (up to EL. 1300 m)	Foundation Preparation	Assumes 1 m removal under footprint	44,560	m3
4000	4200	4220	Site C - Main Dam (up to EL. 1300 m)	Foundation Drain - Zone D (drain gravel)	Contractor load, haul, spread, compact.	800	m3
4000	4200	4220	Site C - Main Dam (up to EL. 1300 m)	Foundation Drain - Perforated Drain Pipe	3x6" Perforated Corrugated HDPE Type S	240	m
4000	4200	4220	Site C - Main Dam (up to EL. 1300 m)	Foundation Drain - Geofabric separation	8 oz. non-woven geotextile	1,600	m2
4000	4200	4220	Site C - Main Dam (up to EL. 1300 m)	Load, Haul, Place, Compact - Zone C (contractor)	Contractor load, haul, spread, compact.	645,788	m3
4000	4200	4220	Site C - Main Dam (up to EL. 1300 m)	Load, Haul, Place, Compact - Zone F (contractor)	Contractor load, haul, spread, compact.	18,021	m3
4000	4200	4220	Site C - Main Dam (up to EL. 1300 m)	Load, Haul, Place, Compact - Zone T (contractor)	Contractor load, haul, spread, compact.	18,051	m3
4000	4200	4220	Site C - Main Dam (up to EL. 1300 m)	Load, Haul, Place, Compact - Zone S (contractor)	Contractor load, haul, spread, compact.	133,527	m3
4000	4200	4220	Site C - Main Dam (up to EL. 1300 m)	Light Plants		Construction	days
4000	4200	4220	Site C - Main Dam (up to EL. 1300 m)	Winter Construction Premium - Type 1	Crew 1 - additional dozer equipment.	Construction	days
4000	4200	4230	Site C - Main Dam (up to EL. 1325 m)	Clear and Grub Footprint		73,930	m2
4000	4200	4230	Site C - Main Dam (up to EL. 1325 m)	Foundation Preparation	Assumes 1 m removal under footprint	73,930	m3
4000	4200	4230	Site C - Main Dam (up to EL. 1325 m)	Foundation Drain - Zone D (drain gravel)	Contractor load, haul, spread, compact.	1,200	m3
4000	4200	4230	Site C - Main Dam (up to EL. 1325 m)	Foundation Drain - Perforated Drain Pipe	3x6" Perforated Corrugated HDPE Type S	360	m
4000	4200	4230	Site C - Main Dam (up to EL. 1325 m)	Foundation Drain - Geofabric separation	8 oz. non-woven geotextile	2,400	m2
4000	4200	4230	Site C - Main Dam (up to EL. 1325 m)	Load, Haul, Place, Compact - Zone C (mining)	Mining load, haul, compact. Contractor spread.	1,953,988	m3
4000	4200	4230	Site C - Main Dam (up to EL. 1325 m)	Load, Haul, Place, Compact - Zone F (contractor)	Contractor load, haul, spread, compact.	24,029	m3
4000	4200	4230	Site C - Main Dam (up to EL. 1325 m)	Load, Haul, Place, Compact - Zone T (contractor)	Contractor load, haul, spread, compact.	23,978	m3
4000	4200	4230	Site C - Main Dam (up to EL. 1325 m)	Load, Haul, Place, Compact - Zone S (contractor)	Contractor load, haul, spread, compact.	181,949	m3
4000	4200	4230	Site C - Main Dam (up to EL. 1325 m)	Light Plants		Construction	days
4000	4200	4230	Site C - Main Dam (up to EL. 1325 m)	Winter Construction Premium - Type 1	Crew 1 - additional dozer equipment.	Construction	days
4000	4200	4230	Site C - Main Dam (up to EL. 1325 m)	Winter Construction Premium - Type 2	Crew 2 - winter foundation prep required.	Construction	days
4000	4200	4240	Site C - Main Dam (up to EL. 1340 m)	Clear and Grub Footprint		57,000	m2
4000	4200	4240	Site C - Main Dam (up to EL. 1340 m)	Foundation Preparation	Assumes 1 m removal under footprint	57,000	m3
4000	4200	4240	Site C - Main Dam (up to EL. 1340 m)	Foundation Drain - Zone D (drain gravel)	Contractor load, haul, spread, compact.	600	m3
4000	4200	4240	Site C - Main Dam (up to EL. 1340 m)	Foundation Drain - Perforated Drain Pipe	3x6" Perforated Corrugated HDPE Type S	180	m
4000	4200	4240	Site C - Main Dam (up to EL. 1340 m)	Foundation Drain - Geofabric separation	8 oz. non-woven geotextile	1,200	m2
4000	4200	4240	Site C - Main Dam (up to EL. 1340 m)	Load, Haul, Place, Compact - Zone C (mining)	Mining load, haul, compact. Contractor spread.	2,189,553	m3
4000	4200	4240	Site C - Main Dam (up to EL. 1340 m)	Load, Haul, Place, Compact - Zone F (contractor)	Contractor load, haul, spread, compact.	22,280	m3
4000	4200	4240	Site C - Main Dam (up to EL. 1340 m)	Load, Haul, Place, Compact - Zone T (contractor)	Contractor load, haul, spread, compact.	22,335	m3
4000	4200	4240	Site C - Main Dam (up to EL. 1340 m)	Load, Haul, Place, Compact - Zone S (contractor)	Contractor load, haul, spread, compact.	165,040	m3
4000	4200	4240	Site C - Main Dam (up to EL. 1340 m)	Light Plants		Construction	days
4000	4200	4240	Site C - Main Dam (up to EL. 1340 m)	Winter Construction Premium - Type 1	Crew 1 - additional dozer equipment.	Construction	days
4000	4200	4250	Site C - Instrumentation	Allowance for Instrumentation	$300,000 allowance for dam instrumentation plane.	1	L.S.
				Total Installed Cost Before Owners Cost			

TABLE F.4

NEW GOLD INC.
BLACKWATER GOLD PROJECT

MINE WASTE AND WATER MANAGEMENT DESIGN REPORT
MATERIAL TAKEOFF - WBS TASK 4300

A	A	A	D	F	G	H	I
Mandatory	Mandatory	Mandatory	Mandatory	Mandatory	If Required	Mandatory	Mandatory
Blackwater WBS Level 1	**Blackwater WBS Level 2**	**Blackwater WBS Level 3**	**WBS Description**	**Primary Item Description**	**Secondary Item Description**	**Qty**	**Unit of Measure**
4000	4300	4310	Cofferdams	Clear and Grub Footprint		8,000	m2
4000	4300	4310	Cofferdams	Foundation Preparation	Assumes 1 m removal under footprint	8,000	m3
4000	4300	4310	Cofferdams	Construct cofferdam upstream of Site D - Main Dam		50,000	m3
4000	4300	4310	Cofferdams	Godwin HL160M Dri-Prime (CAT 3406C Diesel Engine)	Install Freshet Water Collection Pumps	6	each
4000	4300	4310	Cofferdams	Pipeline - 24" HDPE DR9	Install Pipeline from Site D to Site C along road KH2	3,100	m
4000	4300	4310	Cofferdams	Diesel Pump Fuel Consumption (77 L/hr at 1800 rpm for each pump operating)	Pump water from Site D to Site C for storage		L
4000	4300	4310	Cofferdams	24" to 8" flexible discharge connection for pumps to pipeline	Allowance	1	each
4000	4300	4320	Site D - Cut-off Trench	Clear and Grub Footprint		66,280	m2
4000	4300	4320	Site D - Cut-off Trench	Excavate Cut-Off Trench (up to EL. 1240 m)	75% to construction and 25% to waste	544,768	m3
4000	4300	4320	Site D - Cut-off Trench	Haul and Dump Cut-Off Trench Waste	Waste to TSF Site D	136,192	m3
4000	4300	4320	Site D - Cut-off Trench	Load, Haul, Dump - Zone S (mining)	Rehandle, Place, Compact - Zone S (contractor)	270,627	m3
4000	4300	4320	Site D - Cut-off Trench	Load, Haul, Place, Compact - Zone S (contractor)	From Site C Local Borrow	274,141	m3
4000	4300	4320	Site D - Cut-off Trench	Load, Haul, Place, Compact - Zone F (contractor)	From Aggregate Screening Area	14,578	m3
4000	4300	4320	Site D - Cut-off Trench	Excavation Dewatering	Crew and equipment cost per day		days
4000	4300	4320	Site D - Cut-off Trench	Light Plants			days
4000	4300	4320	Site D - Cut-off Trench	Winter Construction Premium - Type 1	Crew 1 - additional dozer equipment.		days
4000	4300	4330	Site D - Main Dam (up to EL. 1240 m)	Clear and Grub Footprint		38,320	m2
4000	4300	4330	Site D - Main Dam (up to EL. 1240 m)	Foundation Preparation	Assumes 1 m removal under footprint	38,320	m3
4000	4300	4330	Site D - Main Dam (up to EL. 1240 m)	Foundation Drain along Creek bottom - Zone D (drain gravel)	Contractor load, haul, spread, compact.	1,000	m3
4000	4300	4330	Site D - Main Dam (up to EL. 1240 m)	Foundation Drain along Creek bottom - Perforated Drain Pipe	3x6" Perforated Corrugated HDPE Type S	300	m
4000	4300	4330	Site D - Main Dam (up to EL. 1240 m)	Foundation Drain along Creek bottom - Geofabric separation	8 oz. non-woven geotextile	2,000	m2
4000	4300	4330	Site D - Main Dam (up to EL. 1240 m)	Foundation Drains - Zone D (drain gravel)	Contractor load, haul, spread, compact.	200	m3
4000	4300	4330	Site D - Main Dam (up to EL. 1240 m)	Foundation Drains - Perforated Drain Pipe	1x6" Perforated Corrugated HDPE Type S	100	m
4000	4300	4330	Site D - Main Dam (up to EL. 1240 m)	Foundation Drains - Geofabric separation	8 oz. non-woven geotextile	800	m2
4000	4300	4330	Site D - Main Dam (up to EL. 1240 m)	Embankment Drain - Longitudinal Perforated Drain Pipe	1x6" Perforated Corrugated HDPE Type S	1,400	m
4000	4300	4330	Site D - Main Dam (up to EL. 1240 m)	Embankment Drain - Longitudinal Zone D (drain gravel)	Contractor load, haul, spread, compact.	210	m3
4000	4300	4330	Site D - Main Dam (up to EL. 1240 m)	Embankment Drain Outlet - Perforated Drain Pipe	1x8" Perforated Corrugated HDPE Type S	100	m
4000	4300	4330	Site D - Main Dam (up to EL. 1240 m)	Embankment Drain Outlet - Zone D (drain gravel)	Contractor load, haul, spread, compact.	250	m3
4000	4300	4330	Site D - Main Dam (up to EL. 1240 m)	Embankment Drain Outlet - Zone F (filter zone)	Contractor load, haul, spread, compact.	250	m3
4000	4300	4330	Site D - Main Dam (up to EL. 1240 m)	Load, Haul, Place, Compact - Zone C (mining) - U/S Zone C	Mining load, haul, compact. Contractor spread.	363,636	m3
4000	4300	4330	Site D - Main Dam (up to EL. 1240 m)	Load, Haul, Place, Compact - Zone C (mining) - D/S Zone C	Mining load, haul, compact. Contractor spread.	90,909	m3
4000	4300	4330	Site D - Main Dam (up to EL. 1240 m)	Load, Haul, Place - Zone S (mining)	Spread and Compact (contractor)	329,373	m3
4000	4300	4330	Site D - Main Dam (up to EL. 1240 m)	Haul, Place, Compact - Zone C (contractor) - U/S Zone C	From Cut-off Trench Excavation (loading under 4320)	269,234	m3
4000	4300	4330	Site D - Main Dam (up to EL. 1240 m)	Haul, Place, Compact - Zone C (contractor) - D/S Zone C	From Cut-off Trench Excavation (loading under 4320)	139,342	m3
4000	4300	4330	Site D - Main Dam (up to EL. 1240 m)	Load, Haul, Place, Compact - Zone C (contractor) - D/S Zone C	From Site C Local Borrow	230,115	m3
4000	4300	4330	Site D - Main Dam (up to EL. 1240 m)	Load, Haul, Place, Compact - Zone F (contractor)	From Aggregate Screening Area	40,925	m3
4000	4300	4330	Site D - Main Dam (up to EL. 1240 m)	Load, Haul, Place, Compact - Zone T (contractor)	From Aggregate Screening Area	41,050	m3
4000	4300	4330	Site D - Main Dam (up to EL. 1240 m)	Light Plants			days
4000	4300	4330	Site D - Main Dam (up to EL. 1240 m)	Winter Construction Premium - Type 1	Crew 1 - additional dozer equipment.		days
4000	4300	4340	Site D - Instrumentation	Allowance for Instrumentation	$165,000 allowance for dam instrumentation plane.	1	L.S.
				Total Installed Cost Before Owners Cost			

TABLE F.5

NEW GOLD INC.
BLACKWATER GOLD PROJECT

MINE WASTE AND WATER MANAGEMENT DESIGN REPORT
MATERIAL TAKEOFF - WBS TASK 4400

A	A	A	D	F	G	H	I
Mandatory	Mandatory	Mandatory	Mandatory	Mandatory	If Required	Mandatory	Mandatory
Blackwater WBS Level 1	**Blackwater WBS Level 2**	**Blackwater WBS Level 3**	**WBS Description**	**Primary Item Description**	**Secondary Item Description**	**Qty**	**Unit of Measure**
4000	4400	4410	Service Roads	Clear and Grub Footprint	Reclaim causway and barge assembly area	1	ha
4000	4400	4410	Service Roads	Foundation Preparation	0.5 m removal on reclaim causway and barge assembly area	6,000	m3
4000	4400	4410	Service Roads	Reclaim causeway cut to fill (500 m length by 20 m wide)	Assume dozer construction with less than 150 m push distance	30,000	m3
4000	4400	4410	Service Roads	Sub base fill for barge assembly area - shot rock	Assumes 2 m thick for 40 m x 40 barge assembly area	3,200	m3
4000	4400	4410	Service Roads	Barge assembly area - wearing course	Assumes 300 mm wearing course	480	m3
4000	4400	4410	Service Roads	Reclaim causeway - wearing course	Assumes 300 mm wearing course	3,000	m3
4000	4400	4420	Water Reclaim System - Site C	Reclaim Barge - Chamco Barge Package	Barge package quote provided with transmittal VA13-01884	1	L.S.
4000	4400	4420	Water Reclaim System - Site C	Barge Transportation, Installation and Commissioning at Site C	$2 million allowance suggested by Chamco	1	L.S.
4000	4400	4420	Water Reclaim System - Site C	30" Steel Piping, Schedule 40, A53 Grade A Pipe (Class 150 flanges and fittings)		220	m
4000	4400	4420	Water Reclaim System - Site C	32" HDPE DR13.5 Piping		1,330	m
4000	4400	4420	Water Reclaim System - Site C	32" HDPE DR17 Piping		1,560	m
4000	4400	4420	Water Reclaim System - Site C	30" Check valve (Class 150)	Steel	2	ea
4000	4400	4420	Water Reclaim System - Site C	30" Shut-off valve (Class 150)	Steel	2	ea
4000	4400	4420	Water Reclaim System - Site C	Allowance for air relief valves		1	L.S.
4000	4400	4420	Water Reclaim System - Site C	Allowance for misc. flanges and fittings	3% of pipe cost	1	L.S.
4000	4400	4420	Water Reclaim System - Site C	Allowance for pipe restraints along the piping corridors	10% of pipe cost	1	L.S.
4000	4400	4430	Tailings Distribution System - Site C	Clear and Grub Footprint	Drop box	325	m2
4000	4400	4430	Tailings Distribution System - Site C	Excavation	Drop box	1,950	m3
4000	4400	4430	Tailings Distribution System - Site C	Shot Rock Platform	Free draining structural fill	760	m3
4000	4400	4430	Tailings Distribution System - Site C	Concrete	Foundation slab for drop box	17	m3
4000	4400	4430	Tailings Distribution System - Site C	Concrete	Walls including fillets for drop box	63	m3
4000	4400	4430	Tailings Distribution System - Site C	Concrete (pre-cast) Roof Panel for Drop Box	Roof panel 4.8 m x 4.8 m x 300 mm	7	m3
4000	4400	4430	Tailings Distribution System - Site C	1/2" Rubber Lining Inside Drop Box	Assumed up to 4 m high x 4 m x 4 m base)	64	m2
4000	4400	4430	Tailings Distribution System - Site C	Allowance for Misc. Metals Access/Ladder/guardrails		500	kg
4000	4400	4430	Tailings Distribution System - Site C	30" HDPE DR11 Piping between Plant and Drop Box	2 parallel lines, each 1120 m long	2,240	m
4000	4400	4430	Tailings Distribution System - Site C	26" STD Steel Piping 1/2" Rubber Lined	Piping around the drop box	40	m
4000	4400	4430	Tailings Distribution System - Site C	26" Steel Tees (Class 150) 1/2" Rubber Lined for Drop Box	Drop box piping and bypass	9	ea
4000	4400	4430	Tailings Distribution System - Site C	26" Steel Elbows(Class 150) 90 Degree 1/2" Rubber Lined	Drop Box Bypasses	10	ea
4000	4400	4430	Tailings Distribution System - Site C	26" Steel Wye (Class 150) for Drop Box Emergency Lines	Drop box piping and bypass	1	ea
4000	4400	4430	Tailings Distribution System - Site C	26" Steel Knife Gate Valve (Class 150) w/ hydraulic actuator	Drop Box Discharge Control	11	ea
4000	4400	4430	Tailings Distribution System - Site C	30" HDPE DR13.5 Piping	Drop Box to Site C Main Dam	1,700	m
4000	4400	4430	Tailings Distribution System - Site C	30" HDPE DR13.5 Piping	Site C Emergency Discharge Line starting at Drop Box to Site C	1,000	m
4000	4400	4430	Tailings Distribution System - Site C	30" Steel Knife Gate Valve (Class 150) w/ hydraulic actuator	Site C Main Dam Tailings Delivery Line	3	ea
4000	4400	4430	Tailings Distribution System - Site C	30" Steel (Class 150) Rubber Lined Tee Piece	Site C Main Dam/West Saddle Dam	1	ea
4000	4400	4430	Tailings Distribution System - Site C	30" (x2) to 12" (x1) Steel (Class 150) 1/2" Rubber Lined Tee Piece for Offtakes	Site C Main Dam	4	ea
4000	4400	4430	Tailings Distribution System - Site C	12" Steel Knife Gate Valve (Class 150) w/ hydraulic actuator	Site C Main Dam offtakes	4	ea
4000	4400	4430	Tailings Distribution System - Site C	12" Butterfly Valve w/ hydraulic actuator	Site C Main Dam offtakes	4	ea
4000	4400	4430	Tailings Distribution System - Site C	12" HDPE DR21 for offtakes	Site C Main Dam offtakes (20 m x 4)	80	m
4000	4400	4430	Tailings Distribution System - Site C	Allowance for air relief valves		1	L.S.
4000	4400	4430	Tailings Distribution System - Site C	Allowance for misc. flanges and fittings	3% of pipe cost	1	L.S.
4000	4400	4430	Tailings Distribution System - Site C	Allowance for pipe restraints along the piping corridors	10% of pipe cost	1	L.S.
				Total Installed Cost Before Owners Cost			

TABLE F.6

NEW GOLD INC.
BLACKWATER GOLD PROJECT

MINE WASTE AND WATER MANAGEMENT DESIGN REPORT
MATERIAL TAKEOFF - WBS TASK 4500

A	A	A	D	F	G	H	I
Mandatory	Mandatory	Mandatory	Mandatory	Mandatory	If Required	Mandatory	Mandatory
Blackwater WBS Level 1	**Blackwater WBS Level 2**	**Blackwater WBS Level 3**	**WBS Description**	**Primary Item Description**	**Secondary Item Description**	**Qty**	**Unit of Measure**
4000	4500	4510	TSF Power Line	Ampgard Medium Voltage MCC, ARC Resistant, 4160V, 2000Amps Main Bus	Main Breaker 2000Amps/250MVA, Breaker Control switch.	2	ea
4000	4500	4510	TSF Power Line	600 Voltage MCC, ARC Resistant ,600V, 600Amps Main Bus	Main Breaker 200Amps	2	ea
4000	4500	4510	TSF Power Line	Panelboard, NEMA 12 enclosure, 208/120. 3phase 4wire	60Hz, solid neutral, copper bus bar, 100 A 3-pole main breaker, Isc > 10kA, 24 circuits	2	ea
4000	4500	4510	TSF Power Line	Pad Mounted Transformer, 3750 kVA, 25000D/4160YV, 3PH,60 Hz	High resistance grounded neutral, copper windings, outdoor oil filed type	2	ea
4000	4500	4510	TSF Power Line	Floor Mounted Transformer, 150 kVA, 600-208/120V 3PH, 4 WIRES, 60HZ	Solid grounded neutral, copper windings, indoor dry-type ventilated	2	ea
4000	4500	4510	TSF Power Line	25 kV MV Cable, 133% Class, 3C#2/0 kcmil +1c ground, Teck 90	Plant Site to 25kV/4.16kV, 4 MVA Reclaim Barge Transformer	3,000	m
4000	4500	4510	TSF Power Line	5kV MC Cable, 133% Class 2X3C#500 kcmil +1c ground, Teck 90	25kV/4.16kV, 4 MVA Reclaim Barge Transformer to 5 kV Reclaim Barge MCC	2,000	m
4000	4500	4510	TSF Power Line	5kV Cable, 133% Class, Teck 3C#250 kcmil +1c ground, Teck 90	5 kV Reclaim Barge MCC to 1000 hp reclaim pumps	160	m
4000	4500	4510	TSF Power Line	1 kV Cable, 100% Class, Teck 3C#10 kcmil	Reclaim Lighting Contactor Panel	60	m
4000	4500	4510	TSF Power Line	400W, 120V metal halide, acrylic prismatic reflector		4	ea
4000	4500	4510	TSF Power Line	2X40W, 120V fluorescent fixture, waterproof		18	ea
4000	4500	4510	TSF Power Line	Outdoor lighting contractor panel, 120V, 20A mounted in NEMA 4 enclosure	Complete with door mounted H-O-A swtich, 3 position maintained contact.	2	ea
4000	4500	4510	TSF Power Line	Photocell with weatherproof polycarbonate housing	Field adjustable with light sensitivity level, 120V, 15 second time delay	2	ea
4000	4500	4510	TSF Power Line	Allowance for PLC with Remote I/O Panel, complete with NEMA 12 enclosure.	Processor, power supply, ethernet switch, fibre optic module, analog and digitial I/O	2	ea
4000	4500	4510	TSF Power Line	Allowance for Local Control Station, completely assembled	Top 2 position local-remote selector switch, and start and stop push buttons	2	ea
4000	4500	4510	TSF Power Line	Allowance for recepticles, switches, and junction boxes		2	ea
4000	4500	4510	TSF Power Line	Allowance for cable trays and fittings		2	ea
4000	4500	4510	TSF Power Line	Allowance for grounding - reclaim		2	L.S.
				Total Installed Cost Before Owners Cost			

TABLE F.7

NEW GOLD INC.
BLACKWATER GOLD PROJECT

MINE WASTE AND WATER MANAGEMENT DESIGN REPORT
MATERIAL TAKEOFF - WBS TASK 6200

A	A	A	D	F	G	H	I
Mandatory	Mandatory	Mandatory	Mandatory	Mandatory	If Required	Mandatory	Mandatory
Blackwater WBS Level 1	**Blackwater WBS Level 2**	**Blackwater WBS Level 3**	**WBS Description**	**Primary Item Description**	**Secondary Item Description**	**Qty**	**Unit of Measure**
6000	6200	6220	Tatelkuz Lake Intake and Pump Station	Clear and Grub Footprint		1,160	m2
6000	6200	6220	Tatelkuz Lake Intake and Pump Station	Excavation	Soft Excavation. Allows access for directional drilling.	3,500	m3
6000	6200	6220	Tatelkuz Lake Intake and Pump Station	Directional Drilling for 24" Intake Pipelines	Includes drilling and grouting	86	m
6000	6200	6220	Tatelkuz Lake Intake and Pump Station	24" DR17 HDPE Intake Piping		86	m
6000	6200	6220	Tatelkuz Lake Intake and Pump Station	36" Tee Intake Screen with 24" Outlet Flange	Intake with fish screen	2	ea
6000	6200	6220	Tatelkuz Lake Intake and Pump Station	24" Knife Gate Valve with 6 m long actuation handle		2	ea
6000	6200	6220	Tatelkuz Lake Intake and Pump Station	Concrete	Slabs	111	m3
6000	6200	6220	Tatelkuz Lake Intake and Pump Station	Concrete	Walls	93	m3
6000	6200	6220	Tatelkuz Lake Intake and Pump Station	Concrete	Beams	11	m3
6000	6200	6220	Tatelkuz Lake Intake and Pump Station	Concrete	Columns	16	m3
6000	6200	6220	Tatelkuz Lake Intake and Pump Station	Concrete	Footings	7	m3
6000	6200	6220	Tatelkuz Lake Intake and Pump Station	Concrete	Pump mountings and pipe supports	13	m3
6000	6200	6220	Tatelkuz Lake Intake and Pump Station	General Backfill		2,250	m3
6000	6200	6220	Tatelkuz Lake Intake and Pump Station	Structural Fill	Backfill below structures.	950	m3
6000	6200	6220	Tatelkuz Lake Intake and Pump Station	Excavation Dewatering	Crew and equipment cost per shift, day, or month		days
6000	6200	6220	Tatelkuz Lake Intake and Pump Station	Access/Ladder - includes access hatch		1	ea
6000	6200	6220	Tatelkuz Lake Intake and Pump Station	Steel Superstructure	With roof hatch for pump removal	145	m2
6000	6200	6220	Tatelkuz Lake Intake and Pump Station	Lighting, HVAC, Fire Protection		145	m2
6000	6200	6220	Tatelkuz Lake Intake and Pump Station	1 metric tonne under running bridge crane, single hook	10.7 m span	1	ea
6000	6200	6220	Tatelkuz Lake Intake and Pump Station	Peerless Vertical 16HXB 6 Stage Pump with 700 hp motor	With extended motor shaft	4	ea
6000	6200	6220	Tatelkuz Lake Intake and Pump Station	14" Air inlet/release valve	Class 150	4	ea
6000	6200	6220	Tatelkuz Lake Intake and Pump Station	14" Check Valve	Class 150, non-slam type	4	ea
6000	6200	6220	Tatelkuz Lake Intake and Pump Station	14" Shut-off Valve	Class 150, handwheel operated	4	ea
6000	6200	6220	Tatelkuz Lake Intake and Pump Station	24" Control Valve	Class 150, handwheel operated	1	ea
6000	6200	6220	Tatelkuz Lake Intake and Pump Station	14" Pressure relief valve	Class 150	2	ea
6000	6200	6220	Tatelkuz Lake Intake and Pump Station	14" Steel Piping, Schedule 10, A53 Grade A Pipe	Class 150 flanges and fittings	4	m
6000	6200	6220	Tatelkuz Lake Intake and Pump Station	24" Steel Piping, Schedule 10, A53 Grade A Pipe	Class 150 flanges and fittings	10	m
6000	6200	6220	Tatelkuz Lake Intake and Pump Station	14" (x2) to 24" (x2) Pipe Special Tee Piece	Class 150	1	ea
6000	6200	6220	Tatelkuz Lake Intake and Pump Station	14" (x2) to 24" Pipe Special Wye Piece	Class 150	2	ea
6000	6200	6220	Tatelkuz Lake Intake and Pump Station	Instrumentation	5% of equipment costs	1	L.S.
6000	6200	6220	Tatelkuz Lake Intake and Pump Station	Testing and Commissioning		1	L.S.
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Clear and Grub Footprint	Booster Station 1	360	m2
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Excavation for Foundation	Booster Station 1	104	m3
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Vertical boring (0.7 m diameter) for turbine pump installation	Booster Station 1	16	m
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Structural Fill	Booster Station 1	10	m3
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Concrete Foundation Slab	Booster Station 1	103	m3
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Foundation Insulation	Booster Station 4	400	m2
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Concrete Pipe Supports	Booster Station 1	6	m3
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Steel Superstructure	Booster Station 1	193	m2
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Lighting, HVAC, Fire Protection	Booster Station 1	193	m2
6000	6200	6230	Fresh Water Supply Booster Pump Stations	1 metric tonne under running single girder crane (width 13 m x runway 12 m)	Booster Station 1	1	ea.
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Peerless Vertical 16HXB 6 Stage Pump with 700 hp motor	Booster Station 1 - 3 operational and 1 installed spare	4	ea
6000	6200	6230	Fresh Water Supply Booster Pump Stations	14" Shut-off valve (Class 150)	Booster Station 1	10	ea
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Air Relief valve	Booster Station 1	5	ea
6000	6200	6230	Fresh Water Supply Booster Pump Stations	14" Check valve (Class 150)	Booster Station 1	4	ea
6000	6200	6230	Fresh Water Supply Booster Pump Stations	14" Pressure Release Valve (Class 150)	Booster Station 1	2	ea
6000	6200	6230	Fresh Water Supply Booster Pump Stations	14" Steel Piping, Schedule 10, A53 Grade A Pipe (Class 150 flanges and fittings)	Booster Station 1	24	m
6000	6200	6230	Fresh Water Supply Booster Pump Stations	24" Steel Piping, Schedule 10, A53 Grade A Pipe (Class 150 flanges and fittings)	Booster Station 1	40	m
6000	6200	6230	Fresh Water Supply Booster Pump Stations	24" 'tee' fitting (Class 150)	Booster Station 1	1	ea
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Reducer/Tapping Connection (Class 150)	Booster Station 1	8	ea

TABLE F.7

NEW GOLD INC.
BLACKWATER GOLD PROJECT

MINE WASTE AND WATER MANAGEMENT DESIGN REPORT
MATERIAL TAKEOFF - WBS TASK 6200

A	A	A	D	F	G	H	I
Mandatory	Mandatory	Mandatory	Mandatory	Mandatory	If Required	Mandatory	Mandatory
Blackwater WBS Level 1	**Blackwater WBS Level 2**	**Blackwater WBS Level 3**	**WBS Description**	**Primary Item Description**	**Secondary Item Description**	**Qty**	**Unit of Measure**
6000	6200	6230	Fresh Water Supply Booster Pump Stations	14" elbow fitting (Class 150)	Booster Station 1	4	ea
6000	6200	6230	Fresh Water Supply Booster Pump Stations	24" elbow fitting (Class 150)	Booster Station 1	4	ea
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Instrumentation: Continuous flow/pressure meter (Class 150)	Booster Station 1	1	ea
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Testing and Commissioning	Booster Station 1	1	L.S.
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Tank: Clear and Grub Footprint	Booster Station 1	60	m2
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Tank: Excavation for Foundation	Booster Station 1	625	m3
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Tank: Structural Fill	Booster Station 1	450	m3
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Tank: Concrete Foundation Slab	Booster Station 1	100	m3
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Bolted Epoxy Steel Storage Tank - 6.5m Diameter by 5m Height	Booster Station 1	1	ea
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Tank: 24" diameter HDPE pipe (Intake)	Booster Station 1	5	m
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Tank: 24" diameter HDPE pipe (Discharge to Booster Station 1)	Booster Station 1	5	m
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Tank: 24" Shut-off Valve (Class 150)	Booster Station 1	2	ea
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Tank: Heater - Immersion Type	Booster Station 1	1	ea
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Tank: Pipeline Heat Tracing	Booster Station 1	10	m
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Tank: Testing and Commissioning	Booster Station 1	1	L.S.
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Clear and Grub Footprint	Booster Station 2 and 3	370	m2
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Excavation for Foundation	Booster Station 2 and 3	105	m3
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Vertical boring (0.7 m diameter) for turbine pump installation	Booster Station 3	16	m
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Vertical boring (0.5 m diameter) for turbine pump installation	Booster Sation 2	8	m
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Structural Fill	Booster Station 2 and 3	11	m3
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Concrete Foundation Slab	Booster Station 2 and 3	105	m3
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Foundation Insulation	Booster Station 2 and 3	410	m2
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Concrete Pipe Supports	Booster Station 2 and 3	6	m3
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Steel Superstructure	Booster Station 2 and 3	195	m2
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Lighting, HVAC, Fire Protection	Booster Station 2 and 3	195	m2
6000	6200	6230	Fresh Water Supply Booster Pump Stations	1 metric tonne under running single girder crane (width 10 m x runway 16.5 m)	Booster Station 2 and 3	1	ea.
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Peerless Vertical 12LDT 6 Stage Pump with 100 hp motor	Booster Station 2 - 1 operational and 1 installed spare	2	ea
6000	6200	6230	Fresh Water Supply Booster Pump Stations	8" Shut-off valve (Class 150)	Booster Station 2	6	ea
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Air Relief valve	Booster Station 2	3	ea
6000	6200	6230	Fresh Water Supply Booster Pump Stations	8" Check valve (Class 150)	Booster Station 2	2	ea
6000	6200	6230	Fresh Water Supply Booster Pump Stations	8" Pressure Release Valve (Class 150)	Booster Station 2	2	ea
6000	6200	6230	Fresh Water Supply Booster Pump Stations	8" Steel Piping, Schedule 10, A53 Grade A Pipe (Class 150 flanges and fittings)	Booster Station 2	6	m
6000	6200	6230	Fresh Water Supply Booster Pump Stations	8" Steel Piping, Schedule 10, A53 Grade A Pipe (Class 150 flanges and fittings)	Booster Station 2	17	m
6000	6200	6230	Fresh Water Supply Booster Pump Stations	8" 'tee' fitting (Class 150)	Booster Station 2	1	ea
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Reducer/Tapping Connection (Class 150)	Booster Station 2	4	ea
6000	6200	6230	Fresh Water Supply Booster Pump Stations	8" elbow fitting (Class 150)	Booster Station 2	6	ea
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Instrumentation: Continuous flow/pressure meter (Class 150)	Booster Station 2	1	ea
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Testing and Commissioning	Booster Station 2	1	L.S.
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Tank: Clear and Grub Footprint	Booster Station 2 and 3	60	m2
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Tank: Excavation for Foundation	Booster Station 2 and 3	625	m3
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Tank: Structural Fill	Booster Station 2 and 3	450	m3
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Tank: Concrete Foundation Slab	Booster Station 2 and 3	100	m3
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Bolted Epoxy Steel Storage Tank - 6.5m Diameter by 5m Height	Booster Station 2 and 3	1	ea
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Tank: 24" diameter HDPE pipe (Intake)	Booster Station 2 and 3	5	m
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Tank: 24" diameter HDPE pipe (Discharge to Booster Station 2/3)	Booster Station 2 and 3	5	m
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Tank: 24" Shut-off Valve (Class 150)	Booster Station 2 and 3	2	ea
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Tank: Heater - Immersion Type	Booster Station 2 and 3	1	ea
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Tank: Pipeline Heat Tracing	Booster Station 2 and 3	10	m
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Tank: Testing and Commissioning	Booster Station 2 and 3	1	L.S.
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Clear and Grub Footprint	Booster Station 4	130	m2
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Excavation for Foundation	Booster Station 4	23	m3

TABLE F.7

NEW GOLD INC.
BLACKWATER GOLD PROJECT

MINE WASTE AND WATER MANAGEMENT DESIGN REPORT
MATERIAL TAKEOFF - WBS TASK 6200

A	A	A	D	F	G	H	I
Mandatory	Mandatory	Mandatory	Mandatory	Mandatory	If Required	Mandatory	Mandatory
Blackwater WBS Level 1	**Blackwater WBS Level 2**	**Blackwater WBS Level 3**	**WBS Description**	**Primary Item Description**	**Secondary Item Description**	**Qty**	**Unit of Measure**
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Vertical boring (0.5 m diameter) for turbine pump installation	Booster Sation 4	8	m
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Structural Fill	Booster Station 4	2	m3
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Concrete Foundation Slab	Booster Station 4	23	m3
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Foundation Insulation	Booster Station 4	200	m2
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Concrete Pipe Supports	Booster Station 4	3	m3
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Steel Superstructure	Booster Station 4	39	m2
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Lighting, HVAC, Fire Protection	Booster Station 4	39	m2
6000	6200	6230	Fresh Water Supply Booster Pump Stations	1 metric tonne under running single girder crane (width 6.5 m x runway 6 m)	Booster Station 4	1	ea.
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Peerless Vertical 12LDT 6 Stage Pump with 100 hp motor	Booster Station 4 - 1 operational and 1 installed spare	2	ea
6000	6200	6230	Fresh Water Supply Booster Pump Stations	8" Shut-off valve (Class 150)	Booster Station 4	6	ea
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Air Relief valve	Booster Station 4	3	ea
6000	6200	6230	Fresh Water Supply Booster Pump Stations	8" Check valve (Class 150)	Booster Station 4	2	ea
6000	6200	6230	Fresh Water Supply Booster Pump Stations	8" Pressure Release Valve (Class 150)	Booster Station 4	2	ea
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Instrumentation: continuous flow/pressure meter (Class 150)	Booster Station 4	1	ea
6000	6200	6230	Fresh Water Supply Booster Pump Stations	8" Steel Piping, Schedule 10, A53 Grade A Pipe (Class 150 flanges and fittings)	Booster Station 4	6	m
6000	6200	6230	Fresh Water Supply Booster Pump Stations	8" Steel Piping, Schedule 10, A53 Grade A Pipe (Class 150 flanges and fittings)	Booster Station 4	17	m
6000	6200	6230	Fresh Water Supply Booster Pump Stations	8" 'tee' fitting (Class 150)	Booster Station 4	1	ea
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Reducer/Tapping Connection (Class 150)	Booster Station 4	4	ea
6000	6200	6230	Fresh Water Supply Booster Pump Stations	8" elbow fitting (Class 150)	Booster Station 4	6	ea
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Testing and Commissioning	Booster Station 4	1	L.S.
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Tank: Foundation Clearing and Preparation	Booster Station 4	10	m2
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Tank: Excavation for Foundation	Booster Station 4	100	m3
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Tank: Structural Fill	Booster Station 4	75	m3
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Tank: Concrete Foundation	Booster Station 4	25	m3
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Tank: Welded Steel Storage Tank - 2.5m Dia x 2m Tall	Booster Station 4	1	ea
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Tank: 8" diameter HDPE pipe (Intake)	Booster Station 4	5	m
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Tank: 8" diameter HDPE pipe (Discharge to Booster Station 4)	Booster Station 4	5	m
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Tank: Shut-off Valve, 8" - Class 150	Booster Station 4	2	ea
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Tank: Heater - Immersion Type	Booster Station 4	1	ea
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Tank: Pipeline Heat Tracing	Booster Station 4	10	m
6000	6200	6230	Fresh Water Supply Booster Pump Stations	Tank: Testing and Commissioning	Booster Station 4	1	L.S.
6000	6200	6240	Fresh Water Supply Pipeline	24" Steel Piping, Schedule 10, A53 Grade A Pipe	Intake to Booster Station 1	3,000	m
6000	6200	6240	Fresh Water Supply Pipeline	28" DR17 HDPE Piping	Intake to Booster Station 1	3,000	m
6000	6200	6240	Fresh Water Supply Pipeline	24" Steel Piping, Schedule 10, A53 Grade A Pipe	Booster Station 1 to Booster Station 3	3,900	m
6000	6200	6240	Fresh Water Supply Pipeline	28" DR17 HDPE Piping	Booster Station 1 to Booster Station 3	3,820	m
6000	6200	6240	Fresh Water Supply Pipeline	8" Steel Piping, Schedule 10, A53 Grade A Pipe	Booster Station 2 to Booster Station 4	1,800	m
6000	6200	6240	Fresh Water Supply Pipeline	8" DR17 HDPE Piping	Booster Station 2 to Booster Station 4	2,560	m
6000	6200	6240	Fresh Water Supply Pipeline	8" Steel Piping, Schedule 10, A53 Grade A Pipe	Booster Station 4 to Plant Site	700	m
6000	6200	6240	Fresh Water Supply Pipeline	8" DR17 HDPE Piping	Booster Station 4 to Plant Site	1,500	m
6000	6200	6240	Fresh Water Supply Pipeline	6" DR17 HDPE Piping	Camp water supply	470	m
6000	6200	6240	Fresh Water Supply Pipeline	28" DR17 HDPE Piping	Booster Station 3 to Fresh Water Reservoir	200	m
6000	6200	6240	Fresh Water Supply Pipeline	6" DR 17 HDPE Piping	Discharge to temperature and flow control system	200	m
6000	6200	6240	Fresh Water Supply Pipeline	28" DR17 HDPE Piping	Discharge to TSF	500	m
6000	6200	6240	Fresh Water Supply Pipeline	Excavation (for 24" Piping)	Soft Excavation	14,214	m3
6000	6200	6240	Fresh Water Supply Pipeline	Backfill (for 24" Piping)	Random fill from excavation	11,746	m3
6000	6200	6240	Fresh Water Supply Pipeline	Bedding Sand (for 24" Piping in mounded sections)	150 mm bedding sand	443	m3
6000	6200	6240	Fresh Water Supply Pipeline	Mounded Backfill (for 24" Piping in mounded sections)	Random fill from nearby excavation	1,855	m3
6000	6200	6240	Fresh Water Supply Pipeline	Excavation (for 28" Piping)	Soft Excavation	14,334	m3
6000	6200	6240	Fresh Water Supply Pipeline	Backfill (for 28" Piping)	Random fill from excavation	11,163	m3
6000	6200	6240	Fresh Water Supply Pipeline	Bedding Sand (for 28" Piping in mounded sections)	150 mm bedding sand	412	m3
6000	6200	6240	Fresh Water Supply Pipeline	Mounded Backfill (for 28" Piping in mounded sections)	Random fill from nearby excavation	1,974	m3

TABLE F.7

NEW GOLD INC.
BLACKWATER GOLD PROJECT

MINE WASTE AND WATER MANAGEMENT DESIGN REPORT
MATERIAL TAKEOFF - WBS TASK 6200

A	A	A	D	F	G	H	I
Mandatory	Mandatory	Mandatory	Mandatory	Mandatory	If Required	Mandatory	Mandatory
Blackwater WBS Level 1	**Blackwater WBS Level 2**	**Blackwater WBS Level 3**	**WBS Description**	**Primary Item Description**	**Secondary Item Description**	**Qty**	**Unit of Measure**
6000	6200	6240	Fresh Water Supply Pipeline	Excavation (for 8" Piping)	Soft Excavation	2,729	m3
6000	6200	6240	Fresh Water Supply Pipeline	Backfill (for 8" Piping)	Random fill from excavation	2,566	m3
6000	6200	6240	Fresh Water Supply Pipeline	Bedding Sand (for 8" Piping in mounded sections)	150 mm bedding sand	131	m3
6000	6200	6240	Fresh Water Supply Pipeline	Mounded Backfill (for 8" Piping in mounded sections)	Random fill from nearby excavation	567	m3
6000	6200	6240	Fresh Water Supply Pipeline	Excavation (for 6" Piping)	Soft Excavation	230	m3
6000	6200	6240	Fresh Water Supply Pipeline	Backfill (for 6" Piping)	Random fill from excavation	221	m3
6000	6200	6240	Fresh Water Supply Pipeline	Bedding Sand (for 6" Piping in mounded sections)	150 mm bedding sand	12	m3
6000	6200	6240	Fresh Water Supply Pipeline	Mounded Backfill (for 6" Piping in mounded sections)	Random fill from nearby excavation	51	m3
6000	6200	6250	Fresh Water Reservoir	Clear and Grub Footprint	Dam and TFCS Building	9,000	m2
6000	6200	6250	Fresh Water Reservoir	Foundation Preparation	Assumes 0.5 m removal under footprint and haul within 1 km	4,500	m3
6000	6200	6250	Fresh Water Reservoir	Load, Haul, Place, Compact - Zone C (contractor)	500 m one way haul from internal borrow area	25,000	m3
6000	6200	6250	Fresh Water Reservoir	Load, Haul, Place, Compact - Zone F (contractor)	1 km one way haul from aggregate screening area	5,000	m3
6000	6200	6250	Fresh Water Reservoir	Load, Haul, Place, Compact - Zone T (contractor)	1 km one way haul from aggregate screening area	5,000	m3
6000	6200	6250	Fresh Water Reservoir	Load, Haul, Place, Compact - Zone S (contractor)	500 m one way haul from internal borrow area	20,000	m3
6000	6200	6250	Fresh Water Reservoir	Rip Rap Armouring Upstream Face		2,500	m3
6000	6200	6250	Fresh Water Reservoir	Dam Crest - Wearing Course	Assumes 300 mm wearing course.	500	m3
6000	6200	6250	Fresh Water Reservoir	Allowance for Instrumentation	$200,000 allowance for dam instrumentation plane.	1	L.S.
6000	6200	6250	Fresh Water Reservoir	Clear and Grub Footprint	Reservoir	80,000	m2
6000	6200	6250	Fresh Water Reservoir	Foundation Preparation	Assumes 0.5 m removal under footprint and haul within 1 km	40,000	m3
6000	6200	6250	Fresh Water Reservoir	Surplus mass excavation to unsuitable stockpile	Load, Haul, Dump with 250 m one way haul distance from reservoir excavation	100,000	m3
6000	6200	6250	Fresh Water Reservoir	Rip Rap Armouring - Reservoir		40,000	m3
6000	6200	6250	Fresh Water Reservoir	Spillway - Excavation	Soft Excavation	2,500	m3
6000	6200	6250	Fresh Water Reservoir	Spillway - Structural Fill Bedding		700	m3
6000	6200	6250	Fresh Water Reservoir	Spillway - Concrete	Base surface	270	m3
6000	6200	6250	Fresh Water Reservoir	Spillway - Concrete	Sloped edges	65	m3
6000	6200	6250	Fresh Water Reservoir	Spillway - Riprap for trapazoidal lining and energy dissipation		2,500	m3
6000	6200	6250	Fresh Water Reservoir	Intake Screen Assembly		1	L.S.
6000	6200	6250	Fresh Water Reservoir	24" Steel Piping, Schedule 10, A53 Grade A Pipe	Freshwater Reservoir to TFCS Building	85	m
6000	6200	6250	Fresh Water Reservoir	Concrete - Encasement for Pipeline		80	m3
6000	6200	6250	Fresh Water Reservoir	Rip Armouring Pipeline Outfall		20	m3
6000	6200	6250	Fresh Water Reservoir	Temporary Water Management	Crew and equipment cost per shift, day, or month		days
6000	6200	6250	Fresh Water Reservoir	Light Plants			days
6000	6200	6250	Fresh Water Reservoir	Winter Construction Premium - Type 1	Crew 1 - additional dozer equipment.		days
6000	6200	6250	Fresh Water Reservoir	Concrete Foundation Slab	TFCS Building	27	m3
6000	6200	6250	Fresh Water Reservoir	Foundation Insulation	TFCS Building	150	m2
6000	6200	6250	Fresh Water Reservoir	Concrete Pipe Supports	TFCS Building	12	m3
6000	6200	6250	Fresh Water Reservoir	Steel Superstructure	TFCS Building	47	m2
6000	6200	6250	Fresh Water Reservoir	Lighting, HVAC, Fire Protection	TFCS Building	47	m2
6000	6200	6250	Fresh Water Reservoir	24" Steel Piping, Schedule 10, A53 Grade A Pipe	TFCS Building	9	m
6000	6200	6250	Fresh Water Reservoir	6" Steel Piping, Schedule 10, A53 Grade A Pipe	TFCS Building	12	m
6000	6200	6250	Fresh Water Reservoir	Special Tee, 4 x 6"	TFCS Building	1	ea
6000	6200	6250	Fresh Water Reservoir	24" Fish screen flange	TFCS Building	1	ea
6000	6200	6250	Fresh Water Reservoir	6" Fish screen flange	TFCS Building	1	ea
6000	6200	6250	Fresh Water Reservoir	6" Lockable Ball Valve, stainless, handwheel operated	TFCS Building	1	ea
6000	6200	6250	Fresh Water Reservoir	6" Lockable Butterfly Valve, stainless, hand lever operated	TFCS Building	4	ea
6000	6200	6250	Fresh Water Reservoir	24" Lockable Butterfly Valve, stainless, handwheel operated	TFCS Building	2	ea
6000	6200	6250	Fresh Water Reservoir	6" Pressure Regulating Valve (285 PSI to 30 PSI)	TFCS Building	1	ea
6000	6200	6250	Fresh Water Reservoir	6" Check Valve, stainless	TFCS Building	2	ea
6000	6200	6250	Fresh Water Reservoir	6" V-notch Ball Valve, stainless, motor operated	TFCS Building	2	ea
6000	6200	6250	Fresh Water Reservoir	Immersion style RTD, with temperature indicating transmitter	TFCS Building	3	ea
6000	6200	6250	Fresh Water Reservoir	Stainless steel turbine flow meter, with flow indicating transmitter	TFCS Building	1	ea

TABLE F.7

NEW GOLD INC.
BLACKWATER GOLD PROJECT

MINE WASTE AND WATER MANAGEMENT DESIGN REPORT
MATERIAL TAKEOFF - WBS TASK 6200

A	A	A	D	F	G	H	I
Mandatory	Mandatory	Mandatory	Mandatory	Mandatory	If Required	Mandatory	Mandatory
Blackwater WBS Level 1	**Blackwater WBS Level 2**	**Blackwater WBS Level 3**	**WBS Description**	**Primary Item Description**	**Secondary Item Description**	**Qty**	**Unit of Measure**
6000	6200	6250	Fresh Water Reservoir	Position switch (N.O. manual isolation valves)	TFCS Building	5	ea
6000	6200	6250	Fresh Water Reservoir	Pressure gauge, liquid in glass, complete with ball valve	TFCS Building	2	ea
6000	6200	6250	Fresh Water Reservoir	Testing and Commissioning	TFCS Building	1	L.S.
6000	6200	6260	Water Supply Power Distribution	Ampgard Medium Voltage MCC, ARC Resistant, 4160V, 2000Amps Main Bus	Main Breaker 2000Amps/250MVA, Breaker Control switch.	2	ea
6000	6200	6260	Water Supply Power Distribution	600 Voltage MCC, ARC Resistant ,600V, 600Amps Main Bus	Main Breaker 200Amps	2	ea
6000	6200	6260	Water Supply Power Distribution	600 Voltage MCC, ARC Resistant ,600V, 600Amps Main Bus	Main Breaker 400Amps	2	ea
6000	6200	6260	Water Supply Power Distribution	Panelboard, NEMA 12 enclosure, 208/120. 3phase 4wire	60Hz, solid neutral, copper bus bar, 100 A 3-pole main breaker, Isc > 10kA, 24 circuits	4	ea
6000	6200	6260	Water Supply Power Distribution	Pad Mounted Transformer, 3750 kVA, 25000D/4160YV, 3PH,60 Hz	High resistance grounded neutral, copper windings, outdoor oil filed type	2	ea
6000	6200	6260	Water Supply Power Distribution	Pole Mounted Transformer, 3x100 kVa, 25000V-600V, 3PH, 4 wires, 60HZ	Solid grounded neutral, epoxy encapsulated, copper windings, outdoor pole mounted	2	ea
6000	6200	6260	Water Supply Power Distribution	Floor Mounted Transformer, 150 kVA, 600-208/120V 3PH, 4 WIRES, 60HZ	Solid grounded neutral, copper windings, indoor dry-type ventilated	4	ea
6000	6200	6260	Water Supply Power Distribution	25 kV MV Cable, 133% Class, 3C#2/0 kcmil +1c ground, Teck 90	Pole to 25kV/4.16kV, 3750 KVA Intake Transformer	50	m
6000	6200	6260	Water Supply Power Distribution	25 kV MV Cable, 133% Class, 3C#1/0 kcmil +1c ground, Teck 90	Pole to 25kV/4.16kV, 3.75 MVA Booster Station 1 Transformer	30	m
6000	6200	6260	Water Supply Power Distribution	5kV MC Cable, 133% Class 2X3C#350 kcmil +1c ground, Teck 90	25kV/4.16kV, 3750 KVA Intake Transformer to MCC	100	m
6000	6200	6260	Water Supply Power Distribution	5kV Cable, 133% Class, Teck 3C#2/0 kcmil +1c ground, Teck 90	5 kV Intake Station MCC to 700 hp pumps	150	m
6000	6200	6260	Water Supply Power Distribution	5kV MC Cable, 133% Class 2X(3C#500 kcmil +1c ground), Teck 90	25kV/4.16kV, 3750 KVA Booster Station 1 Transformer to MCC	60	m
6000	6200	6260	Water Supply Power Distribution	5kV Cable, 133% Class, Teck 3C#2/0 kcmil +1c ground, Teck 90	5 kV Booster Station 1 MCC to 700 hp pumps	200	m
6000	6200	6260	Water Supply Power Distribution	1kV Cable, 3C#250 kcmil with #4 AWG CU GND, Teck 90	25kV/0.6kV, 3X100 KVA Booster Station 2 Pole Mounted Transformer to MCC	50	m
6000	6200	6260	Water Supply Power Distribution	1kV Cable, 3C#1/0 kcmil with #4 AWG CU GND, Teck 90	0.6 kV Booster Station 2 MCC to 100 hp pumps	40	m
6000	6200	6260	Water Supply Power Distribution	1kV Cable, 3C#250 kcmil with #4 AWG CU GND, Teck 90	25kV/0.6kV, 3X100 KVA Booster Station 4 Pole Mounted Transformer to MCC	50	m
6000	6200	6260	Water Supply Power Distribution	1kV Cable, 3C#1/0 kcmil with #4 AWG CU GND, Teck 90	0.6 kV Booster Station 4 MCC to 100 hp pumps	40	m
6000	6200	6260	Water Supply Power Distribution	1 kV Cable, 100% Class, Teck 3C#10 kcmil	Booster Station 2&3 Lighting Contactor Panel	60	m
6000	6200	6260	Water Supply Power Distribution	1 kV Cable, 100% Class, Teck 3C#10 kcmil	Booster Station 4 Lighting Contactor Panel	30	m
6000	6200	6260	Water Supply Power Distribution	1 kV Cable, 100% Class, Teck 3C#10 kcmil	Booster 1 Lighting Contactor Panel	30	m
6000	6200	6260	Water Supply Power Distribution	1 kV Cable, 100% Class, Teck 3C#10 kcmil	Intake Station Lighting Contactor Panel	30	m
6000	6200	6260	Water Supply Power Distribution	400W, 120V metal halide, acrylic prismatic reflector		8	ea
6000	6200	6260	Water Supply Power Distribution	2X40W, 120V fluorescent fixture, waterproof		36	ea
6000	6200	6260	Water Supply Power Distribution	Outdoor lighting contractor panel, 120V, 20A mounted in NEMA 4 enclosure	Complete with door mounted H-O-A swtich, 3 position maintained contact.	4	ea
6000	6200	6260	Water Supply Power Distribution	Photocell with weatherproof polycarbonate housing	Field adjustable with light sensitivity level, 120V, 15 second time delay	4	ea
6000	6200	6260	Water Supply Power Distribution	Allowance for PLC with Remote I/O Panel, complete with NEMA 12 enclosure.	Processor, power supply, ethernet switch, fibre optic module, analog and digitial I/O	4	ea
6000	6200	6260	Water Supply Power Distribution	Allowance for Local Control Station, completely assembled	Top 2 position local-remote selector switch, and start and stop push buttons	4	ea
6000	6200	6260	Water Supply Power Distribution	Allowance for recepticles, switches, and junction boxes		4	ea
6000	6200	6260	Water Supply Power Distribution	Allowance for cable trays and fittings		4	ea
6000	6200	6260	Water Supply Power Distribution	Allowance for grounding - Intake		1	L.S.
6000	6200	6260	Water Supply Power Distribution	Allowance for grounding - Booster Station 1		1	L.S.
6000	6200	6260	Water Supply Power Distribution	Allowance for grounding - Booster Station 2&3		1	L.S.
6000	6200	6260	Water Supply Power Distribution	Allowance for grounding - Booster Station 4		1	L.S.
				Total Installed Cost Before Owners Cost			

TABLE F.8

NEW GOLD INC.
BLACKWATER GOLD PROJECT

MINE WASTE AND WATER MANAGEMENT DESIGN REPORT
MATERIAL TAKEOFF - WBS TASK 8950

A	A	A	D	F	G	H	I
Mandatory	Mandatory	Mandatory	Mandatory	Mandatory	If Required	Mandatory	Mandatory
Blackwater WBS Level 1	**Blackwater WBS Level 2**	**Blackwater WBS Level 3**	**WBS Description**	**Primary Item Description**	**Secondary Item Description**	**Qty**	**Unit of Measure**
		N/A		SITE C MAIN DAM (STEP OUT FOR LIFT UP TO EL. 1353 m)		N/A	
8000	8900	8950	Start-Up: TSF Construction	Clear and Grub Footprint		57,000	m2
8000	8900	8950	Start-Up: TSF Construction	Foundation Preparation	Assumes 1 m removal under footprint	57,000	m3
8000	8900	8950	Start-Up: TSF Construction	Foundation Drain - Zone D (drain gravel)	Contractor load, haul, spread, compact.	600	m3
8000	8900	8950	Start-Up: TSF Construction	Foundation Drain - Perforated Drain Pipe	3x6" Perforated Corrugated HDPE Type S	180	m
8000	8900	8950	Start-Up: TSF Construction	Foundation Drain - Geofabric separation		1,200	m2
8000	8900	8950	Start-Up: TSF Construction	Load, Haul, Dump, Compact - Zone C (mining)	Mining load, haul, compact. Contractor spread.	1,166,627	m3
8000	8900	8950	Start-Up: TSF Construction	Light Plants			months
8000	8900	8950	Start-Up: TSF Construction	Winter Construction Premium			months
		N/A		SITE D MAIN DAM (EXPAND FOOTPRINT AT EL. 1240 m)		N/A	
8000	8900	8950	Start-Up: TSF Construction	Clear and Grub Footprint		323,500	m2
8000	8900	8950	Start-Up: TSF Construction	Foundation Preparation	Assumes 1 m removal under footprint	323,500	m3
8000	8900	8950	Start-Up: TSF Construction	Foundation Drain along Creek bottom - Zone D (drain gravel)	Contractor load, haul, spread, compact.	800	m3
8000	8900	8950	Start-Up: TSF Construction	Foundation Drain along Creek bottom - Perforated Drain Pipe	3x6" Perforated Corrugated HDPE Type S	240	m
8000	8900	8950	Start-Up: TSF Construction	Foundation Drain along Creek bottom - Geofabric separation	8 oz. non-woven geotextile	1,600	m2
8000	8900	8950	Start-Up: TSF Construction	Foundation Drains - Zone D (drain gravel)	Contractor load, haul, spread, compact.	100	m3
8000	8900	8950	Start-Up: TSF Construction	Foundation Drains - Perforated Drain Pipe	1x6" Perforated Corrugated HDPE Type S	50	m
8000	8900	8950	Start-Up: TSF Construction	Foundation Drains - Geofabric separation	8 oz. non-woven geotextile	400	m2
8000	8900	8950	Start-Up: TSF Construction	Embankment Drain Outlet - Perforated Drain Pipe	1x8" Perforated Corrugated HDPE Type S	80	m
8000	8900	8950	Start-Up: TSF Construction	Embankment Drain Outlet - Zone D (drain gravel)	Contractor load, haul, spread, compact.	200	m3
8000	8900	8950	Start-Up: TSF Construction	Embankment Drain Outlet - Zone F (filter zone)	Contractor load, haul, spread, compact.	200	m3
8000	8900	8950	Start-Up: TSF Construction	Load, Haul, Dump, Compact - Zone C (mining)	Mining load, haul, compact. Contractor spread.	1,920,335	m3
8000	8900	8950	Start-Up: TSF Construction	Light Plants			months
8000	8900	8950	Start-Up: TSF Construction	Winter Construction Premium			months
				Total Installed Cost Before Owners Cost			

TABLE F.9

NEW GOLD INC.
BLACKWATER GOLD PROJECT

MINE WASTE AND WATER MANAGEMENT DESIGN REPORT
MATERIAL TAKEOFF - SUSTAINING YEAR 1 - WBS TASK 4600

A	A	A	D	F	G	H	I
Mandatory	Mandatory	Mandatory	Mandatory	Mandatory	If Required	Mandatory	Mandatory
Blackwater WBS Level 1	**Blackwater WBS Level 2**	**Blackwater WBS Level 3**	**WBS Description**	**Primary Item Description**	**Secondary Item Description**	**Qty**	**Unit of Measure**
				YEAR 1			
4000	4600	4610	TSF Site Preparation	Road Package 2		42	ha
4000	4600	4610	TSF Site Preparation	TSF Site C Footprint - Final		142	ha
4000	4600	4610	TSF Site Preparation	Site D Main Dam - Stage 2		30	ha
4000	4600	4610	TSF Site Preparation	TSF Site D Footprint - Stage 2		80	ha
4000	4600	4610	TSF Site Preparation	ECD Interception Trench		27	ha
4000	4600	4610	TSF Site Preparation	Clear and Grub Road Package 2		42	ha
4000	4600	4610	TSF Site Preparation	Sediment and Erosion Control BMPs	Allowance for on-going sediment and erosion control	1	L.S.
4000	4600	4610	TSF Site Preparation	Clear and Grub	Aggregate screening borrow area	2	ha
4000	4600	4610	TSF Site Preparation	Topsoil removal	Aggregate screening borrow area	10,000	m3
4000	4600	4620	TSF Site C	Load, Haul, Dump, Compact - Zone C (mining)	Mining load, haul, compact. Contractor spread.	1,285,000	m3
4000	4600	4620	TSF Site C	Load, Haul, Place, Compact - Zone F (contractor)	From Aggregate Screening Area	25,500	m3
4000	4600	4620	TSF Site C	Load, Haul, Place, Compact - Zone T (contractor)	From Aggregate Screening Area	25,500	m3
4000	4600	4620	TSF Site C	Load, Haul, Place, Compact - Zone S (contractor)	From Local Borrow	188,000	m3
4000	4600	4620	TSF Site C	Clear and Grub Footprint		17,850	m2
4000	4600	4620	TSF Site C	Foundation Preparation	Assumes 1 m removal under footprint	17,850	m3
4000	4600	4620	TSF Site C	Cut-Off Trench Excavation		41,500	m3
4000	4600	4620	TSF Site C	Cut-Off Trench Backfill - Zone S	Contractor	39,000	m3
4000	4600	4620	TSF Site C	Cut-Off Trench Backfill - Zone F	Contractor	2,500	m3
4000	4600	4620	TSF Site C	Load, Haul, Place, Compact - Zone C (contractor)		141,000	m3
4000	4600	4620	TSF Site C	Load, Haul, Place, Compact - Zone F (contractor)		4,750	m3
4000	4600	4620	TSF Site C	Load, Haul, Place, Compact - Zone T (contractor)		4,750	m3
4000	4600	4620	TSF Site C	Load, Haul, Place, Compact - Zone S (contractor)		24,000	m3
4000	4600	4620	TSF Site C	Embankment Drain - Longitudinal Perforated Drain Pipe	1x6" Perforated Corrugated HDPE Type S	400	m
4000	4600	4620	TSF Site C	Embankment Drain - Longitudinal Zone D (drain gravel)	Contractor load, haul, spread, compact.	60	m3
4000	4600	4620	TSF Site C	Embankment Drain Outlet - Perforated Drain Pipe	1x8" Perforated Corrugated HDPE Type S	100	m
4000	4600	4620	TSF Site C	Embankment Drain Outlet - Zone D (drain gravel)	Contractor load, haul, spread, compact.	250	m3
4000	4600	4620	TSF Site C	Embankment Drain Outlet - Zone F (filter zone)	Contractor load, haul, spread, compact.	250	m3
4000	4600	4620	TSF Site C	Allowance for Seepage Collection Sump	Suggest $50,000 allowance based on previous projects.	1	ea
4000	4600	4620	TSF Site C	Seepage Recycle Pump	Suggest $10,000 allowance per pump.	2	ea
4000	4600	4620	TSF Site C	Seepage Recycle Pipeline - 4" HDPE DR21		200	m
4000	4600	4620	TSF Site C	Allowance for Dam Instrumentation - Site C Main Dam		1	L.S.
4000	4600	4620	TSF Site C	Allowance for Dam Instrumentation - Site C West Dam		1	L.S.
4000	4600	4630	TSF Site D	Load, Haul, Dump, Compact - Zone C (mining)	Mining load, haul, compact. Contractor spread.	771,000	m3
4000	4600	4630	TSF Site D	Clear and Grub Footprint		76,000	m2
4000	4600	4630	TSF Site D	Foundation Preparation	Assumes 1 m removal under footprint	76,000	m3
4000	4600	4630	TSF Site D	Load, Haul, Dump, Compact - Zone C (mining)	Mining load, haul, compact. Contractor spread.	1,384,000	m3
4000	4600	4630	TSF Site D	Allowance for Dam Instrumentation - Site D Main Dam		1	L.S.
4000	4600	4640	Tailings Distribution and Water Reclaim	30" HDPE DR13.5 Piping	Tailings pipeline to West Dam	4,200	m
4000	4600	4640	Tailings Distribution and Water Reclaim	30" HDPE DR13.5 Piping	Tailings pipeline extension on Main Dam (new pipe)	200	m
4000	4600	4640	Tailings Distribution and Water Reclaim	30" Steel Knife Gate Valve (Class 150) for Tailings Delivery Line w/ hydraulic actuator	Along south side of Site C TSF	5	ea
4000	4600	4640	Tailings Distribution and Water Reclaim	12" Steel Knife Gate Valve (Class 150) for Offtakes w/ hydraulic actuator	Isolation Valves	16	ea
4000	4600	4640	Tailings Distribution and Water Reclaim	12" Butterfly Valve for Offtakes w/ hydraulic actuator	Pressure reducing valves	4	ea
4000	4600	4640	Tailings Distribution and Water Reclaim	12" HDPE DR21 for offtakes	Offtakes spaced 150 m apart (20 m x 16)	320	m
4000	4600	4640	Tailings Distribution and Water Reclaim	30" (x2) to 12" (x1) Steel (Class 150) 1/2" Rubber Lined Tee Piece	For Offtakes	16	ea
4000	4600	4640	Tailings Distribution and Water Reclaim	Allowance for misc. flanges and fittings	3% of pipe value (low as most fittings are accounted for)	1	L.S.
4000	4600	4640	Tailings Distribution and Water Reclaim	Allowance for pipe restraints along the piping corridors	10% of pipe value (only new pipe to West Dam past the Emerg. Line)	1	L.S.
4000	4600	4660	Environmental Control Dam	Clearing and grubbing - ECD pond area and dam footprint		170,000	m2
4000	4600	4660	Environmental Control Dam	Topsoil stripping - ECD pond area and dam footprint (0.5 m removal)	Haul within 1 km to topsoil stockpile.	85,000	m3
4000	4600	4660	Environmental Control Dam	Load, Haul, Place, Compact - Zone C (contractor)	Material from adjacent borrow sites as indicated on Drawing D0222.	16,000	m3

TABLE F.9

NEW GOLD INC.
BLACKWATER GOLD PROJECT

MINE WASTE AND WATER MANAGEMENT DESIGN REPORT
MATERIAL TAKEOFF - SUSTAINING YEAR 1 - WBS TASK 4600

A	A	A	D	F	G	H	I
Mandatory	Mandatory	Mandatory	Mandatory	Mandatory	If Required	Mandatory	Mandatory
Blackwater WBS Level 1	**Blackwater WBS Level 2**	**Blackwater WBS Level 3**	**WBS Description**	**Primary Item Description**	**Secondary Item Description**	**Qty**	**Unit of Measure**
4000	4600	4660	Environmental Control Dam	Load, Haul, Place, Compact - Zone F (contractor)	From Zone F and T borrow.	4,000	m3
4000	4600	4660	Environmental Control Dam	Load, Haul, Place, Compact - Zone T (contractor)	From Zone F and T borrow.	4,000	m3
4000	4600	4660	Environmental Control Dam	Load, Haul, Place, Compact - Zone S (contractor)	Contractor load, haul, spread, compact.	8,000	m3
4000	4600	4660	Environmental Control Dam	Dam Crest - Wearing Course	Assumes 300 mm wearing course from Zone F and T borrow.	500	m3
4000	4600	4660	Environmental Control Dam	Rip Rap Armouring Dam Upstream Face	Mine provided. Contractor place only.	1,000	m3
4000	4600	4660	Environmental Control Dam	Spillway - Detailed Excavation		6,000	m3
4000	4600	4660	Environmental Control Dam	Spillway - Geotextile	8 oz. non-woven geotextile	1,500	m2
4000	4600	4660	Environmental Control Dam	Spillway - Riprap - 800 mm nominal thickness and plunge pool	Mine provided. Contractor place only.	2,400	m3
4000	4600	4660	Environmental Control Dam	Temporary Water Management	Crew and equipment cost per shift, day, or month		day/month
4000	4600	4660	Environmental Control Dam	Clear and grub interception trench footprint		270,000	m2
4000	4600	4660	Environmental Control Dam	Topsoil stripping (assume 0.5 m depth of removal)	Move to topsoil stockpile (1.5 km round trip)	135,000	m3
4000	4600	4660	Environmental Control Dam	Excavate north interception trench	Place excavated material adjacent to trench within 300 m to create access trail	231,000	m3
4000	4600	4660	Environmental Control Dam	Excavate south interception trench	Place excavated material adjacent to trench within 300 m to create access trail	137,000	m3
4000	4600	4660	Environmental Control Dam	Allowance for 2000 mm culverts at KH2 road crossing	2x2000 mm diameter culvert, each 40 m long	2	ea
4000	4600	4660	Environmental Control Dam	Drill and install 10" pumping wells to 15 m-deep for monitoring.	Downstream of north interception trench, no installed pumps.	4	ea
4000	4600	4660	Environmental Control Dam	Clearing and Grubbing		4,500	m2
4000	4600	4660	Environmental Control Dam	Foundation Excavation		18,500	m3
4000	4600	4660	Environmental Control Dam	Foundation Backfill (Structural Fill Material, 0.5m Lift)		125	m3
4000	4600	4660	Environmental Control Dam	Backfill (Select Fill Material)		5,000	m3
4000	4600	4660	Environmental Control Dam	Rip-Rap (1000mm Lift)		825	m3
4000	4600	4660	Environmental Control Dam	Lock Block (Full)		86	ea
4000	4600	4660	Environmental Control Dam	Lock Block (Half)		8	ea
4000	4600	4660	Environmental Control Dam	Reinforced Concrete Footings		125	m3
4000	4600	4660	Environmental Control Dam	Reinforced Concrete Slabs		75	m3
4000	4600	4660	Environmental Control Dam	Reinforced Concrete Walls		430	m3
4000	4600	4660	Environmental Control Dam	Steel I-Beams (W360x744)		34	m
4000	4600	4660	Environmental Control Dam	Steel I-Beam (W310x158)		84	m
4000	4600	4660	Environmental Control Dam	Stoplogs (Aluminum, 4.5m Wide)		13	m
4000	4600	4660	Environmental Control Dam	Trash Rack (HDPE, 4.5m Wide)		13	m
4000	4600	4660	Environmental Control Dam	Roof Hatches (1.9m x 1.9m Opening)		4	ea
4000	4600	4660	Environmental Control Dam	Steel Grating		30	m2
4000	4600	4660	Environmental Control Dam	Hand Rails		24	m
4000	4600	4660	Environmental Control Dam	Access Doors (Single)		1	ea
4000	4600	4660	Environmental Control Dam	Access Doors (Double)		1	ea
4000	4600	4660	Environmental Control Dam	Lighting/HVAC/Fire Protection		1	L.S.
4000	4600	4660	Environmental Control Dam	Peerless Vertical 14MC 8 Stage Pump with 500 hp (373 kW) motor	See attached quote.	4	ea
4000	4600	4660	Environmental Control Dam	10" Cast Steel Shutoff Valve (Class 300)		6	ea
4000	4600	4660	Environmental Control Dam	10" Cast Steel Check Valve (Class 300)		4	ea
4000	4600	4660	Environmental Control Dam	10" Cast Steel Air Relief Valve (Class 300)		4	ea
4000	4600	4660	Environmental Control Dam	10" Cast Steel Pressure Relief Valve (Class 300)		2	ea
4000	4600	4660	Environmental Control Dam	14" Steel Wye Fitting (Class 300)		2	ea
4000	4600	4660	Environmental Control Dam	14" STD Steel Piping (Class 300)		3	m
4000	4600	4660	Environmental Control Dam	18" STD Steel Piping (Class 300)		2,500	m
4000	4600	4660	Environmental Control Dam	18"x18"x10" Steel Wye Fitting (Class 300)		2	ea
4000	4600	4660	Environmental Control Dam	Allowance for Seepage Collection Sump	Suggest $50,000 allowance based on previous projects.	1	ea
4000	4600	4660	Environmental Control Dam	Seepage Recycle Pump	Suggest $10,000 allowance per pump.	2	ea
4000	4600	4660	Environmental Control Dam	Seepage Recycle Pipeline - 4" HDPE DR21		200	m
4000	4600	4660	Environmental Control Dam	Allowance for Testing and Commisioning		1	L.S.
4000	4600	4670	Mine Dewatering	Drill and Install 8" Backup Pumping Wells (2016) - at PW15-1 through PW15-5	Allow $350,000 for each Pumping Well (Drillwell Quote and 2013 Drilling)	5	ea
				Total Installed Cost Before Owners Cost			

TABLE F.10

NEW GOLD INC.
BLACKWATER GOLD PROJECT

MINE WASTE AND WATER MANAGEMENT DESIGN REPORT
MATERIAL TAKEOFF - SUSTAINING YEAR 2 - WBS TASK 4600

A	A	A	D	F	G	H	I
Mandatory	Mandatory	Mandatory	Mandatory	Mandatory	If Required	Mandatory	Mandatory
Blackwater WBS Level 1	**Blackwater WBS Level 2**	**Blackwater WBS Level 3**	**WBS Description**	**Primary Item Description**	**Secondary Item Description**	**Qty**	**Unit of Measure**
				YEAR 2			
4000	4600	4610	TSF Site Prepartion	Road Package 2		63	ha
4000	4600	4610	TSF Site Prepartion	TSF Site D Footprint - Stage 2		160	ha
4000	4600	4610	TSF Site Prepartion	Clear and Grub Road Package 2		63	ha
4000	4600	4610	TSF Site Prepartion	KS2 - Mass Excavation	Balance to fill locally.	186,300	m3
4000	4600	4610	TSF Site Prepartion	KS2 - Mass Fill	Fill from excavation locally.	8,500	m3
4000	4600	4610	TSF Site Prepartion	KS2 - Waste Remaining Material	Waste locally or widen road locally.	177,800	m3
4000	4600	4610	TSF Site Prepartion	KS2 - Wearing Course and Safety Berms	Assumes 300 mm wearing course.	11,850	m3
4000	4600	4610	TSF Site Prepartion	KS3 - Mass Excavation	Balance to fill locally.	103,000	m3
4000	4600	4610	TSF Site Prepartion	KS3 - Mass Fill	Fill from excavation locally.	73,000	m3
4000	4600	4610	TSF Site Prepartion	KS3 - Waste Remaining Material	Waste locally or widen road locally.	30,000	m3
4000	4600	4610	TSF Site Prepartion	KS3 - Wearing Course and Safety Berms	Assumes 300 mm wearing course.	17,625	m3
4000	4600	4610	TSF Site Prepartion	KS5 - Mass Excavation	Balance to fill locally.	13,000	m3
4000	4600	4610	TSF Site Prepartion	KS5 - Mass Fill	Fill from excavation locally.	4,000	m3
4000	4600	4610	TSF Site Prepartion	KS5 - Waste Remaining Material	Waste locally or widen road locally.	9,000	m3
4000	4600	4610	TSF Site Prepartion	KS5 - Wearing Course and Safety Berms	Assumes 300 mm wearing course.	3,525	m3
4000	4600	4610	TSF Site Prepartion	Sediment and Erosion Control BMPs	Allowance for on-going sediment and erosion control	1	L.S.
4000	4600	4610	TSF Site Prepartion	Clear and Grub	Aggregate screening borrow area	1	ha
4000	4600	4610	TSF Site Prepartion	Topsoil removal	Aggregate screening borrow area	5,000	m3
4000	4600	4630	TSF Site D	Clear and Grub Footprint		192,000	m2
4000	4600	4630	TSF Site D	Foundation Preparation	Assumes 1 m removal under footprint	192,000	m3
4000	4600	4630	TSF Site D	Excavate Cut-Off Trench (COT)		965,500	m3
4000	4600	4630	TSF Site D	Haul, Place, Compact - Zone C - U/S Zone C	From Cut-off Trench Excavation	724,000	m3
4000	4600	4630	TSF Site D	Haul and Dump Cut-Off Trench Waste	From Cut-off Trench Excavation	241,500	m3
4000	4600	4630	TSF Site D	COT Load, Haul, Dump - Zone S (mining)	Rehandle, Place, Compact - Zone S (contractor)	965,500	m3
4000	4600	4630	TSF Site D	COT Load, Haul, Place, Compact - Zone F (contractor)	From Aggregate Screening Area	26,000	m3
4000	4600	4630	TSF Site D	Load, Haul, Dump, Compact - Zone C (mining)	Mining load, haul, compact. Contractor spread.	7,912,500	m3
4000	4600	4630	TSF Site D	Load, Haul, Place - Zone S (mining)	Spread and Compact - Zone S (contractor)	648,000	m3
4000	4600	4630	TSF Site D	Load, Haul, Place, Compact - Zone F (contractor)		129,500	m3
4000	4600	4630	TSF Site D	Load, Haul, Place, Compact - Zone T (contractor)		129,500	m3
4000	4600	4630	TSF Site D	Allowance for Embankment Drains	Suggest $15,000 annual allowance	1	L.S.
4000	4600	4630	TSF Site D	Allowance for Foundation Drains	Suggest $15,000 annual allowance	1	L.S.
4000	4600	4630	TSF Site D	Allowance for Dam Instrumentation	$150,000 allowance for dam instrumentation plane expansion.	1	L.S.
4000	4600	4630	TSF Site D	Allowance for Inclinometer Installations (3 planes)	$500,000 allowance for inclinometer installations	1	L.S.
4000	4600	4640	Tailings Distribution and Water Reclaim	Clear and Grub Footprint	Reclaim causway and barge assembly area	1	ha
4000	4600	4640	Tailings Distribution and Water Reclaim	Foundation Preparation	1 m removal on barge assembly area with 10 m buffer all sides	3,600	m3
4000	4600	4640	Tailings Distribution and Water Reclaim	Sub base fill for barge assembly area - shot rock	Assumes 2 m thick for 40 m x 40 barge assembly area	3,200	m3
4000	4600	4640	Tailings Distribution and Water Reclaim	Barge assembly area - wearing course	Assumes 300 mm wearing course	480	m3
4000	4600	4640	Tailings Distribution and Water Reclaim	Clear and Grub Footprint	Site C Decant Structure	1	ha
4000	4600	4640	Tailings Distribution and Water Reclaim	Foundation excavation	Site C Decant Structure	3,000	m3
4000	4600	4640	Tailings Distribution and Water Reclaim	Foundation backfill - structural fill - 0.5 m lift	Site C Decant Structure	60	m3
4000	4600	4640	Tailings Distribution and Water Reclaim	General backfill - select fill	Site C Decant Structure	1,000	m3
4000	4600	4640	Tailings Distribution and Water Reclaim	Riprap	Site C Decant Structure	150	m3
4000	4600	4640	Tailings Distribution and Water Reclaim	Reinforced Concrete Footings	Site C Decant Structure	65	m3
4000	4600	4640	Tailings Distribution and Water Reclaim	Reinforced Concrete Slabs	Site C Decant Structure	75	m3
4000	4600	4640	Tailings Distribution and Water Reclaim	Reinforced Concrete Walls	Site C Decant Structure	165	m3
4000	4600	4640	Tailings Distribution and Water Reclaim	Steel I-Beams (W360x744)	Site C Decant Structure	35	m
4000	4600	4640	Tailings Distribution and Water Reclaim	Steel I-Beam (W310x158)	Site C Decant Structure	30	m
4000	4600	4640	Tailings Distribution and Water Reclaim	Stoplogs (Aluminum, 4.5m Wide)	Site C Decant Structure	7	m
4000	4600	4640	Tailings Distribution and Water Reclaim	Trash Rack (HDPE, 4.5m Wide)	Site C Decant Structure	7	m
4000	4600	4640	Tailings Distribution and Water Reclaim	Roof Hatches (1.9m x 1.9m Opening)	Site C Decant Structure	4	ea

TABLE F.10

NEW GOLD INC.
BLACKWATER GOLD PROJECT

MINE WASTE AND WATER MANAGEMENT DESIGN REPORT
MATERIAL TAKEOFF - SUSTAINING YEAR 2 - WBS TASK 4600

A	A	A	D	F	G	H	I
Mandatory	Mandatory	Mandatory	Mandatory	Mandatory	If Required	Mandatory	Mandatory
Blackwater WBS Level 1	**Blackwater WBS Level 2**	**Blackwater WBS Level 3**	**WBS Description**	**Primary Item Description**	**Secondary Item Description**	**Qty**	**Unit of Measure**
4000	4600	4640	Tailings Distribution and Water Reclaim	Steel Grating	Site C Decant Structure	30	m2
4000	4600	4640	Tailings Distribution and Water Reclaim	Hand Rails	Site C Decant Structure	25	m
4000	4600	4640	Tailings Distribution and Water Reclaim	Access Doors (Single)	Site C Decant Structure	1	ea
4000	4600	4640	Tailings Distribution and Water Reclaim	Access Doors (Double)	Site C Decant Structure	1	ea
4000	4600	4640	Tailings Distribution and Water Reclaim	Lighting/HVAC/Fire Protection	Site C Decant Structure	1	L.S.
4000	4600	4640	Tailings Distribution and Water Reclaim	Peerless Vertical - 18 HXB 5 stage pump with 800 hp motor (or equivalent)	Site C Decant Structure	4	ea
4000	4600	4640	Tailings Distribution and Water Reclaim	16" Steel Piping, Schedule 40, A53 Grade A Pipe (Class 150)	Site C Decant Structure	3	m
4000	4600	4640	Tailings Distribution and Water Reclaim	16" Cast Steel Butterfly Valve (Class 150)	Site C Decant Structure	4	ea
4000	4600	4640	Tailings Distribution and Water Reclaim	16 Cast Steel Check Valve (Class 150)	Site C Decant Structure	4	ea
4000	4600	4640	Tailings Distribution and Water Reclaim	16" Steel Wye Fitting (Class 150)	Site C Decant Structure	2	ea
4000	4600	4640	Tailings Distribution and Water Reclaim	24" Steel Piping	Site C Decant Structure	2	m
4000	4600	4640	Tailings Distribution and Water Reclaim	30" STD Steel Piping (Class 150 flanges and fittings)	Site C Decant Structure	300	m
4000	4600	4640	Tailings Distribution and Water Reclaim	Pressure release valve	Site C Decant Structure	2	ea
4000	4600	4640	Tailings Distribution and Water Reclaim	4" Cast Steel Butterfly Valve (Class 150)	Site C Decant Structure	2	ea
4000	4600	4640	Tailings Distribution and Water Reclaim	4" STD Steel Piping tapped into header (Class 150)	Site C Decant Structure	2	m
4000	4600	4640	Tailings Distribution and Water Reclaim	Allowance for testing and commissioning	Site C Decant Structure	1	L.S.
4000	4600	4640	Tailings Distribution and Water Reclaim	Engineering and fabrication of skid for relocation of Reclaim Barge	Chamco suggests 5% of barge costs - $325,000 allowance.	1	L.S.
4000	4600	4640	Tailings Distribution and Water Reclaim	Barge Transportation, Installation and Re-commissioning at Site D	Assume 50% of initial commissioning - $1,000,000 allowance	1	L.S.
4000	4600	4640	Tailings Distribution and Water Reclaim	30" Steel Piping, Schedule 40, A53 Grade A Pipe (Class 150 flanges and fittings)		1,620	m
4000	4600	4640	Tailings Distribution and Water Reclaim	32" HDPE DR13.5 Piping		450	m
4000	4600	4640	Tailings Distribution and Water Reclaim	32" HDPE DR17 Piping		1,570	m
4000	4600	4640	Tailings Distribution and Water Reclaim	Allowance for air relief valves		1	L.S.
4000	4600	4640	Tailings Distribution and Water Reclaim	Allowance for misc. flanges and fittings	3% of pipe cost	1	L.S.
4000	4600	4640	Tailings Distribution and Water Reclaim	Allowance for pipe restraints along the piping corridors	10% of pipe cost	1	L.S.
4000	4600	4640	Tailings Distribution and Water Reclaim	30" HDPE DR13.5 Piping	Tailings Pipeline to Main Dam	6,400	m
4000	4600	4640	Tailings Distribution and Water Reclaim	30" HDPE DR13.5 Piping	Emergency Discharge Line for Site D	2,700	m
4000	4600	4640	Tailings Distribution and Water Reclaim	16" HDPE DR11 Piping	Choke station w REPLACEMENT	30	m
4000	4600	4640	Tailings Distribution and Water Reclaim	26" HDPE DR 21 Piping	Choke station w REPLACEMENT	30	m
4000	4600	4640	Tailings Distribution and Water Reclaim	26" STD Steel Piping 1/2" Rubber Lined	Allowance for choke station w REPLACEMENT	30	m
4000	4600	4640	Tailings Distribution and Water Reclaim	12" HDPE DR21 for offtakes	Offtakes spaced 150 m apart (# of offtakes x 20 m each)	400	m
4000	4600	4640	Tailings Distribution and Water Reclaim	30" Steel Knife Gate Valve (Class 150) for Tailings Delivery Line w/ hydraulic actuator	Isolation valves along the main tailing delivery line	6	ea
4000	4600	4640	Tailings Distribution and Water Reclaim	26" Steel Knife Gate Valve (Class 150) for Choking Station w/ hydraulic actuator	Isolation valves for the choke station bypass w REPLACEMENT	2	ea
4000	4600	4640	Tailings Distribution and Water Reclaim	12" Steel Knife Gate Valve (Class 150) for Offtakes w/ hydraulic actuator	Isolation vlaves for offtakes	20	ea
4000	4600	4640	Tailings Distribution and Water Reclaim	12" Butterfly Valve for Offtakes w/ hydraulic actuator	Pressure reducing valve for offtakes	7	ea
4000	4600	4640	Tailings Distribution and Water Reclaim	30" (x2) to 12" (x1) Steel Tee (Class 150) 1/2" Rubber Lined	Offtakes	20	ea
4000	4600	4640	Tailings Distribution and Water Reclaim	26" Steel Tees (Class 150) 1/2" Rubber Lined for choke station	Choke station bypass w REPLACEMENT	2	ea
4000	4600	4640	Tailings Distribution and Water Reclaim	26" Steel Elbows(Class 150) 90 Degree 1/2" Rubber Lined	Choke station bypass w REPLACEMENT	2	ea
4000	4600	4640	Tailings Distribution and Water Reclaim	26" to 16" Reducer Steel (Class 150) 1/2" Rubber Lined	Choke station bypass w REPLACEMENT	2	ea
4000	4600	4640	Tailings Distribution and Water Reclaim	Allowance for air relief/vacuum valves		1	L.S.
4000	4600	4640	Tailings Distribution and Water Reclaim	Allowance for misc. flanges and fittings	3% of pipe cost	1	L.S.
4000	4600	4640	Tailings Distribution and Water Reclaim	Allowance for pipe restraints along the piping corridors	10% of pipe cost	1	L.S.
4000	4600	4640	Tailings Distribution and Water Reclaim	Concrete Containment Box	Choke station (pre-cast)	3	m3
4000	4600	4640	Tailings Distribution and Water Reclaim	Level Sensor for Containment Box	Choke station	1	ea
4000	4600	4670	Mine Stockpiles and Waste	Access Trails for Site Preparation	Dozer temporary constructed access. Final road configuration by mining.	1	km
4000	4600	4670	Mine Stockpiles and Waste	Clear and Grub Footprint		250,000	m2
4000	4600	4670	Mine Stockpiles and Waste	Foundation Preparation	Assumes 500 mm removal under footprint	125,000	m3
4000	4600	4670	Mine Stockpiles and Waste	Load, haul, place, compact Zone S sub-grade	Place two 500 mm lifts of Zone S from pit overburden stripping	125,000	m3
4000	4600	4670	Mine Stockpiles and Waste	Foundation Drains - Perforated Drain Pipe	1x6" Perforated Corrugated HDPE Type S	1,800	m
4000	4600	4670	Mine Stockpiles and Waste	Foundation Drains - Geofabric separation	8 oz. non-woven geotextile	7,200	m2
4000	4600	4670	Mine Stockpiles and Waste	Foundation Drains - Zone D (drain gravel)	Contractor load, haul, spread, compact.	1,980	m3
4000	4600	4670	Mine Stockpiles and Waste	Collection Header - Perforated Drain Pipe	1x12" Perforated Corrugated HDPE Type S	350	m

TABLE F.10

NEW GOLD INC.
BLACKWATER GOLD PROJECT

MINE WASTE AND WATER MANAGEMENT DESIGN REPORT
MATERIAL TAKEOFF - SUSTAINING YEAR 2 - WBS TASK 4600

A	A	A	D	F	G	H	I
Mandatory	Mandatory	Mandatory	Mandatory	Mandatory	If Required	Mandatory	Mandatory
Blackwater WBS Level 1	**Blackwater WBS Level 2**	**Blackwater WBS Level 3**	**WBS Description**	**Primary Item Description**	**Secondary Item Description**	**Qty**	**Unit of Measure**
4000	4600	4670	Mine Stockpiles and Waste	Collection Drains - Zone D (drain gravel)	Contractor load, haul, spread, compact.	385	m3
4000	4600	4670	Mine Dewatering	Drill and Install 8" Backup Pumping Wells (2016) - at PW16-1 through PW16-4	Allow $350,000 for each Pumping Well (Drillwell Quote and 2013 Drilling)	4	ea
4000	4600	4670	Mine Dewatering	5" STD Steel Pipe	PW13-1 riser pipeline	60	m
4000	4600	4670	Mine Dewatering	8" DR9 HDPE Pipe	PW22-17 discharge pipeline	1,230	m
4000	4600	4670	Mine Dewatering	Discharge pipe support - fill mounded over top (1050 m pipeline placed on ground)		105	m3
4000	4600	4670	Mine Dewatering	Discharge pipe support - anchors into pit wall every 4 m (180 m pipeline up pit wall)		45	ea
4000	4600	4680	Fresh Water Supply System	Peerless Vertical 14MD 9 Stage Pump with 600 hp motor	Booster Station 3 - 4 operational	4	ea
4000	4600	4680	Fresh Water Supply System	Peerless Vertical 14MD 9 Stage Pump with 600 hp motor	Booster Station 3 - uninstalled spare	1	ea
4000	4600	4680	Fresh Water Supply System	8" Shut-off valve (Class 150)	Booster Station 3	4	ea
4000	4600	4680	Fresh Water Supply System	8" Shut-off valve (Class 300)	Booster Station 3	4	ea
4000	4600	4680	Fresh Water Supply System	24" Shut-off valve (Class 150)	Booster Station 3	1	ea
4000	4600	4680	Fresh Water Supply System	Air Relief valve (Class 300)	Booster Station 3	5	ea
4000	4600	4680	Fresh Water Supply System	8" Check valve (Class 300)	Booster Station 3	4	ea
4000	4600	4680	Fresh Water Supply System	8" Pressure Release Valve (Class 300)	Booster Station 3	3	ea
4000	4600	4680	Fresh Water Supply System	8" Steel Piping, Schedule 10, A53 Grade A Pipe (Class 150 flanges and fittings)	Booster Station 3	20	m
4000	4600	4680	Fresh Water Supply System	24" Steel Piping, Schedule 10, A53 Grade A Pipe (Class 150 flanges and fittings)	Booster Station 3	49	m
4000	4600	4680	Fresh Water Supply System	8" 'tee' fitting (Class 150)	Booster Station 3	1	ea
4000	4600	4680	Fresh Water Supply System	Reducer/Tapping Connection (Class 300)	Booster Station 3	8	ea
4000	4600	4680	Fresh Water Supply System	24" elbow fitting (Class 150)	Booster Station 3	1	ea
4000	4600	4680	Fresh Water Supply System	24" elbow fitting (Class 300)	Booster Station 3	4	ea
4000	4600	4680	Fresh Water Supply System	Instrumentation: Continuous flow/pressure meter (Class 300)	Booster Station 3	1	ea
4000	4600	4680	Fresh Water Supply System	Testing and Commissioning	Booster Station 3	1	L.S.
4000	4600	4680	Fresh Water Supply System	24" Steel Piping (Schedule 10, A53 Grade A pipe)	Booster Station 3 to TSF	4,000	m
4000	4600	4680	Fresh Water Supply System	28" DR17 HDPE Piping	Booster Station 3 to TSF	2,490	m
4000	4600	4680	Fresh Water Supply System	Ampgard Medium Voltage MCC, ARC Resistant, 4160V, 2000Amps Main Bus	Main Breaker 2000Amps/250MVA, Breaker Control switch.	1	ea
4000	4600	4680	Fresh Water Supply System	600 Voltage MCC, ARC Resistant ,600V, 600Amps Main Bus	Main Breaker 200Amps	1	ea
4000	4600	4680	Fresh Water Supply System	Panelboard, NEMA 12 enclosure, 208/120. 3phase 4wire	60Hz, solid neutral, copper bus bar, 100 A 3-pole main breaker, Isc > 10kA, 24 circuits	1	ea
4000	4600	4680	Fresh Water Supply System	Pad Mounted Transformer, 3750 kVA, 25000D/4160YV, 3PH,60 Hz	High resistance grounded neutral, copper windings, outdoor oil filed type	1	ea
4000	4600	4680	Fresh Water Supply System	Floor Mounted Transformer, 150 kVA, 600-208/120V 3PH, 4 WIRES, 60HZ	Solid grounded neutral, copper windings, indoor dry-type ventilated	1	ea
4000	4600	4680	Fresh Water Supply System	25 kV MV Cable, 133% Class, 3C#2/0 kcmil +1c ground, Teck 90	Pole to 25kV/4.16kV, 3.75 MVA Booster Station 3 Transformer	40	m
4000	4600	4680	Fresh Water Supply System	5kV MC Cable, 133% Class 2X3C#500 kcmil +1c ground, Teck 90	25kV/4.16kV, 3750 KVA Booster Station 3 Transformer to MCC	30	m
4000	4600	4680	Fresh Water Supply System	5kV Cable, 133% Class, Teck 3C#2/0 kcmil +1c ground, Teck 90	5 kV Booster Station 3 MCC to 600 hp pumps	80	m
4000	4600	4680	Fresh Water Supply System	Allowance for PLC with Remote I/O Panel, complete with NEMA 12 enclosure.	Processor, power supply, ethernet switch, fibre optic module, analog and digitial I/O	1	ea
4000	4600	4680	Fresh Water Supply System	Allowance for Local Control Station, completely assembled	Top 2 position local-remote selector switch, and start and stop push buttons	1	ea
4000	4600	4680	Fresh Water Supply System	Allowance for recepticles, switches, and junction boxes		1	ea
4000	4600	4680	Fresh Water Supply System	Allowance for cable trays and fittings		1	ea
				Total Installed Cost Before Owners Cost			

TABLE F.11

NEW GOLD INC.
BLACKWATER GOLD PROJECT

MINE WASTE AND WATER MANAGEMENT DESIGN REPORT
MATERIAL TAKEOFF - SUSTAINING YEAR 3 - WBS TASK 4600

A	A	A	D	F	G	H	I
Mandatory	Mandatory	Mandatory	Mandatory	Mandatory	If Required	Mandatory	Mandatory
Blackwater WBS Level 1	**Blackwater WBS Level 2**	**Blackwater WBS Level 3**	**WBS Description**	**Primary Item Description**	**Secondary Item Description**	**Qty**	**Unit of Measure**
				YEAR 3			
4000	4600	4610	TSF Site Preparation	Site D Main Dam - Stage 3		20	ha
4000	4600	4610	TSF Site Preparation	TSF Site D Footprint - Stage 3		80	ha
4000	4600	4610	TSF Site Preparation	KS4 - Mass Excavation	Balance to fill locally.	27,000	m3
4000	4600	4610	TSF Site Preparation	KS4 - Mass Fill	Fill from excavation locally - assume 70% suitable	18,900	m3
4000	4600	4610	TSF Site Preparation	KS4 - Waste Unsuitable Material	Waste locally into TSF - assume 30% unsuitable	8,100	m3
4000	4600	4610	TSF Site Preparation	KS4 - Mass Fill	Additional borrow from Site C Local Borrow	94,100	m3
4000	4600	4610	TSF Site Preparation	KS4 - Wearing Course and Safety Berms	Assumes 300 mm wearing course.	13,200	m3
4000	4600	4610	TSF Site Preparation	Sediment and Erosion Control BMPs	Allowance for on-going sediment and erosion control	1	L.S.
4000	4600	4610	TSF Site Preparation	Clear and Grub	Aggregate screening borrow area	1	ha
4000	4600	4610	TSF Site Preparation	Topsoil removal	Aggregate screening borrow area	5,000	m3
4000	4600	4630	TSF Site D	Clear and Grub Footprint		299,000	m2
4000	4600	4630	TSF Site D	Foundation Preparation	Assumes 1 m removal under footprint	299,000	m3
4000	4600	4630	TSF Site D	Excavate Cut-Off Trench (COT)		445,000	m3
4000	4600	4630	TSF Site D	Haul, Place, Compact - Zone C - U/S Zone C	From Cut-off Trench Excavation	334,000	m3
4000	4600	4630	TSF Site D	Haul and Dump Cut-Off Trench Waste	From Cut-off Trench Excavation	111,000	m3
4000	4600	4630	TSF Site D	COT Load, Haul, Dump - Zone S (mining)	Rehandle, Place, Compact - Zone S (contractor)	445,000	m3
4000	4600	4630	TSF Site D	COT Load, Haul, Place, Compact - Zone F (contractor)	From Aggregate Screening Area	10,000	m3
4000	4600	4630	TSF Site D	Load, Haul, Dump, Compact - Zone C (mining)	Mining load, haul, compact. Contractor spread.	8,402,000	m3
4000	4600	4630	TSF Site D	Load, Haul, Place - Zone S (mining)	Spread and Compact - Zone S (contractor)	344,000	m3
4000	4600	4630	TSF Site D	Load, Haul, Place, Compact - Zone F (contractor)		69,000	m3
4000	4600	4630	TSF Site D	Load, Haul, Place, Compact - Zone T (contractor)		69,000	m3
4000	4600	4630	TSF Site D	Allowance for Embankment Drains	Suggest $15,000 annual allowance	1	L.S.
4000	4600	4630	TSF Site D	Allowance for Foundation Drains	Suggest $15,000 annual allowance	1	L.S.
4000	4600	4630	TSF Site D	Allowance for Dam Instrumentation		1	L.S.
4000	4600	4640	Tailings Distribution and Water Reclaim	Decomission 30" HDPE DR 13.5 Piping	Tailings pipeline to West Dam	4,200	m
4000	4600	4640	Tailings Distribution and Water Reclaim	Decomission Steel Knife Gate Valve (Class 150) w/ hydraulic actuator	Tailings delivery line	6	ea
4000	4600	4640	Tailings Distribution and Water Reclaim	Decomission 12" Steel Knife Gate Valve (Class 150) w/ hydraulic actuator	Offtakes	20	ea
4000	4600	4640	Tailings Distribution and Water Reclaim	Decomission 12" Butterfly Valve for Offtakes w/ hydraulic actuator	Offtakes	8	ea
4000	4600	4640	Tailings Distribution and Water Reclaim	Decomission Pipe Restraint Along the Piping Corridor	5% of pipe value (pipe length to West Dam)	1	L.S.
4000	4600	4640	Tailings Distribution and Water Reclaim	30" HDPE DR13.5 Piping	Tailings Pipeline to Main Dam	600	m
4000	4600	4640	Tailings Distribution and Water Reclaim	30" HDPE DR13.5 Piping	Tailings pipeline along West perimeter road	1,800	m
4000	4600	4640	Tailings Distribution and Water Reclaim	30" Steel Knife Gate Valve (Class 150) for Tailings Delivery Line w/ hydraulic	Isolation valves along the main tailing delivery line	1	ea
4000	4600	4640	Tailings Distribution and Water Reclaim	12" Steel Knife Gate Valve (Class 150) for Offtakes w/ hydraulic actuator	Isolation vlaves for offtakes	11	ea
4000	4600	4640	Tailings Distribution and Water Reclaim	30" (x2) to 12" (x1) Steel Tee (Class 150) 1/2" Rubber Lined	Offtakes	11	ea
4000	4600	4640	Tailings Distribution and Water Reclaim	Allowance for air relief/vacuum valves		1	L.S.
4000	4600	4640	Tailings Distribution and Water Reclaim	Allowance for misc. flanges and fittings	3% of pipe cost	1	L.S.
4000	4600	4640	Tailings Distribution and Water Reclaim	Allowance for pipe restraints along the piping corridors	10% of pipe cost	1	L.S.
4000	4600	4670	Mine Dewatering	Drill and Install Observation Wells (2016) (8 OW each 400 m deep at HQ sized	Allow $200 per meter drilling and installation.	3,200	m
4000	4600	4670	Mine Dewatering	Instrumentation: Vibrating Wire Piezometers, data loggers, cabling	Allow $10,000 per observation well for instrumentation	8	ea
4000	4600	4670	Mine Dewatering	5" STD Steel Pipe	PW13-1 riser pipeline	55	m
				Total Installed Cost Before Owners Cost			

TABLE F.12

NEW GOLD INC.
BLACKWATER GOLD PROJECT

MINE WASTE AND WATER MANAGEMENT DESIGN REPORT
MATERIAL TAKEOFF - SUSTAINING YEAR 4 - WBS TASK 4600

A	A	A	D	F	G	H	I
Mandatory	Mandatory	Mandatory	Mandatory	Mandatory	If Required	Mandatory	Mandatory
Blackwater WBS Level 1	**Blackwater WBS Level 2**	**Blackwater WBS Level 3**	**WBS Description**	**Primary Item Description**	**Secondary Item Description**	**Qty**	**Unit of Measure**
				YEAR 4			
4000	4600	4610	TSF Site Preparation	TSF Site D Footprint - Stage 3		80	ha
4000	4600	4610	TSF Site Preparation	Sediment and Erosion Control BMPs	Allowance for on-going sediment and erosion control	1	L.S.
4000	4600	4610	TSF Site Preparation	Clear and Grub	Aggregate screening borrow area	1	ha
4000	4600	4610	TSF Site Preparation	Topsoil removal	Aggregate screening borrow area	5,000	m3
4000	4600	4630	TSF Site D	Clear and Grub Footprint		-	m2
4000	4600	4630	TSF Site D	Foundation Preparation	Assumes 1 m removal under footprint	-	m3
4000	4600	4630	TSF Site D	Excavate Cut-Off Trench (COT)		740,000	m3
4000	4600	4630	TSF Site D	Haul, Place, Compact - Zone C - U/S Zone C	From Cut-off Trench Excavation	555,000	m3
4000	4600	4630	TSF Site D	Haul and Dump Cut-Off Trench Waste	From Cut-off Trench Excavation	185,000	m3
4000	4600	4630	TSF Site D	COT Load, Haul, Dump - Zone S (mining)	Rehandle, Place, Compact - Zone S (contractor)	740,000	m3
4000	4600	4630	TSF Site D	COT Load, Haul, Place, Compact - Zone F (contractor)	From Aggregate Screening Area	15,000	m3
4000	4600	4630	TSF Site D	Load, Haul, Dump, Compact - Zone C (mining)	Mining load, haul, compact. Contractor spread.	7,831,000	m3
4000	4600	4630	TSF Site D	Load, Haul, Place - Zone S (mining)	Spread and Compact - Zone S (contractor)	330,000	m3
4000	4600	4630	TSF Site D	Load, Haul, Place, Compact - Zone F (contractor)		65,500	m3
4000	4600	4630	TSF Site D	Load, Haul, Place, Compact - Zone T (contractor)		65,500	m3
4000	4600	4630	TSF Site D	Allowance for Embankment Drains	Suggest $15,000 annual allowance	1	L.S.
4000	4600	4630	TSF Site D	Allowance for Foundation Drains	Suggest $15,000 annual allowance	1	L.S.
4000	4600	4630	TSF Site D	Allowance for Dam Instrumentation		1	L.S.
4000	4600	4640	Tailings Distribution and Water Reclaim	Decomission 30" HDPE DR 13.5 Piping	Emergency tailings pipeline for Site C	2,600	m
4000	4600	4670	Mine Stockpiles and Waste	LGO: Clear and Grub Footprint		200,000	m2
4000	4600	4670	Mine Stockpiles and Waste	LGO: Foundation Preparation	Assumes 500 mm removal under footprint	100,000	m3
4000	4600	4670	Mine Stockpiles and Waste	LGO: Load, haul, place, compact Zone S sub-grade	Place two 500 mm lifts of Zone S from pit overburden	100,000	m3
4000	4600	4670	Mine Stockpiles and Waste	LGO: Foundation Drains - Perforated Drain Pipe	1x6" Perforated Corrugated HDPE Type S	250	m
4000	4600	4670	Mine Stockpiles and Waste	LGO: Foundation Drains - Geofabric separation	8 oz. non-woven geotextile	1,000	m2
4000	4600	4670	Mine Stockpiles and Waste	LGO: Foundation Drains - Zone D (drain gravel)	Contractor load, haul, spread, compact.	275	m3
				Total Installed Cost Before Owners Cost			

TABLE F.13

NEW GOLD INC.
BLACKWATER GOLD PROJECT

MINE WASTE AND WATER MANAGEMENT DESIGN REPORT
MATERIAL TAKEOFF - SUSTAINING YEAR 5 - WBS TASK 4600

A	A	A	D	F	G	H	I
Mandatory	Mandatory	Mandatory	Mandatory	Mandatory	If Required	Mandatory	Mandatory
Blackwater WBS Level 1	**Blackwater WBS Level 2**	**Blackwater WBS Level 3**	**WBS Description**	**Primary Item Description**	**Secondary Item Description**	**Qty**	**Unit of Measure**
				YEAR 5			
4000	4600	4610	TSF Site Preparation	TSF Site D Footprint - Stage 3		80	ha
4000	4600	4610	TSF Site Preparation	Sediment and Erosion Control BMPs	Allowance for on-going sediment and erosion control	1	L.S.
4000	4600	4610	TSF Site Preparation	Clear and Grub	Aggregate screening borrow area	1	ha
4000	4600	4610	TSF Site Preparation	Topsoil removal	Aggregate screening borrow area	5,000	m3
4000	4600	4630	TSF Site D	Clear and Grub Footprint		-	m2
4000	4600	4630	TSF Site D	Foundation Preparation	Assumes 1 m removal under footprint	-	m3
4000	4600	4630	TSF Site D	Excavate Cut-Off Trench (COT)		95,000	m3
4000	4600	4630	TSF Site D	Haul, Place, Compact - Zone C - U/S Zone C	From Cut-off Trench Excavation	71,000	m3
4000	4600	4630	TSF Site D	Haul and Dump Cut-Off Trench Waste	From Cut-off Trench Excavation	24,000	m3
4000	4600	4630	TSF Site D	COT Load, Haul, Dump - Zone S (mining)	Rehandle, Place, Compact - Zone S (contractor)	95,000	m3
4000	4600	4630	TSF Site D	COT Load, Haul, Place, Compact - Zone F (contractor)	From Aggregate Screening Area	2,000	m3
4000	4600	4630	TSF Site D	Load, Haul, Dump, Compact - Zone C (mining)	Mining load, haul, compact. Contractor spread.	5,777,000	m3
4000	4600	4630	TSF Site D	Load, Haul, Place - Zone S (mining)	Spread and Compact - Zone S (contractor)	326,000	m3
4000	4600	4630	TSF Site D	Load, Haul, Place, Compact - Zone F (contractor)		65,500	m3
4000	4600	4630	TSF Site D	Load, Haul, Place, Compact - Zone T (contractor)		65,500	m3
4000	4600	4630	TSF Site D	Allowance for Embankment Drains	Suggest $15,000 annual allowance	1	L.S.
4000	4600	4630	TSF Site D	Allowance for Foundation Drains	Suggest $15,000 annual allowance	1	L.S.
4000	4600	4630	TSF Site D	Allowance for Dam Instrumentation		1	L.S.
4000	4600	4640	Tailings Distribution and Water Reclaim	30" HDPE DR13.5 Piping	Tailings Pipeline to Main Dam	600	m
4000	4600	4640	Tailings Distribution and Water Reclaim	30" Steel Knife Gate Valve (Class 150) for Tailings Delivery Line w/ hydraulic	Isolation valves along the main tailing delivery line	2	ea
4000	4600	4640	Tailings Distribution and Water Reclaim	12" Steel Knife Gate Valve (Class 150) for Offtakes w/ hydraulic actuator	Isolation vlaves for offtakes	6	ea
4000	4600	4640	Tailings Distribution and Water Reclaim	30" (x2) to 12" (x1) Steel Tee (Class 150) 1/2" Rubber Lined	Offtakes	6	ea
4000	4600	4640	Tailings Distribution and Water Reclaim	Allowance for air relief/vacuum valves		1	L.S.
4000	4600	4640	Tailings Distribution and Water Reclaim	Allowance for misc. flanges and fittings	3% of pipe cost	1	L.S.
4000	4600	4640	Tailings Distribution and Water Reclaim	Allowance for pipe restraints along the piping corridors	10% of pipe cost	1	L.S.
				Total Installed Cost Before Owners Cost			

TABLE F.14

NEW GOLD INC.
BLACKWATER GOLD PROJECT

MINE WASTE AND WATER MANAGEMENT DESIGN REPORT
MATERIAL TAKEOFF - SUSTAINING YEAR 6 - WBS TASK 4600

A	A	A	D	F	G	H	I
Mandatory	Mandatory	Mandatory	Mandatory	Mandatory	If Required	Mandatory	Mandatory
Blackwater WBS Level 1	**Blackwater WBS Level 2**	**Blackwater WBS Level 3**	**WBS Description**	**Primary Item Description**	**Secondary Item Description**	**Qty**	**Unit of Measure**
				YEAR 6			
4000	4600	4610	TSF Site Preparation	TSF Site D Footprint - Stage 3		80	ha
4000	4600	4610	TSF Site Preparation	Sediment and Erosion Control BMPs	Allowance for on-going sediment and erosion control	1	L.S.
4000	4600	4610	TSF Site Preparation	Clear and Grub	Aggregate screening borrow area	1	ha
4000	4600	4610	TSF Site Preparation	Topsoil removal	Aggregate screening borrow area	5,000	m3
4000	4600	4630	TSF Site D	Clear and Grub Footprint		-	m2
4000	4600	4630	TSF Site D	Foundation Preparation	Assumes 1 m removal under footprint	-	m3
4000	4600	4630	TSF Site D	Excavate Cut-Off Trench (COT)		187,000	m3
4000	4600	4630	TSF Site D	Haul, Place, Compact - Zone C - U/S Zone C	From Cut-off Trench Excavation	140,000	m3
4000	4600	4630	TSF Site D	Haul and Dump Cut-Off Trench Waste	From Cut-off Trench Excavation	47,000	m3
4000	4600	4630	TSF Site D	COT Load, Haul, Dump - Zone S (mining)	Rehandle, Place, Compact - Zone S (contractor)	187,000	m3
4000	4600	4630	TSF Site D	COT Load, Haul, Place, Compact - Zone F (contractor)	From Aggregate Screening Area	5,000	m3
4000	4600	4630	TSF Site D	Load, Haul, Dump, Compact - Zone C (mining)	Mining load, haul, compact. Contractor spread.	3,708,000	m3
4000	4600	4630	TSF Site D	Load, Haul, Place - Zone S (mining)	Spread and Compact - Zone S (contractor)	297,000	m3
4000	4600	4630	TSF Site D	Load, Haul, Place, Compact - Zone F (contractor)		60,000	m3
4000	4600	4630	TSF Site D	Load, Haul, Place, Compact - Zone T (contractor)		60,000	m3
4000	4600	4630	TSF Site D	Allowance for Embankment Drains	Suggest $15,000 annual allowance	1	L.S.
4000	4600	4630	TSF Site D	Allowance for Foundation Drains	Suggest $15,000 annual allowance	1	L.S.
4000	4600	4630	TSF Site D	Allowance for Dam Instrumentation		1	L.S.
4000	4600	4670	Mine Dewatering	Drill and Install 10" Pumping Well at PW22-17	Allow $570,000 for each Pumping Well (Drillwell Quote and 2013 Drilling)	1	ea
4000	4600	4670	Mine Dewatering	Drill and Install 10" Backup Pumping Well at PW22-17	Allow $570,000 for each Pumping Well (Drillwell Quote and 2013 Drilling)	1	ea
4000	4600	4670	Mine Dewatering	8" STD Steel Pipe	PW22-17 riser pipeline	230	m
4000	4600	4670	Mine Dewatering	8" Shut-off valve (Class 150)		2	ea
4000	4600	4670	Mine Dewatering	8" Check valve (Class 150)		2	ea
4000	4600	4670	Mine Dewatering	Special Tee (2 x 8", 1 x 8")		1	ea
4000	4600	4670	Mine Dewatering	Transition Coupling (Steel to HDPE)		1	L.S.
4000	4600	4670	Mine Dewatering	HDPE Tee (1 x 6" to 2 x 16")		1	ea
4000	4600	4670	Mine Dewatering	Peerless Vertical 8HXB 11 Stage Pump with 250 hp motor		2	ea
4000	4600	4670	Mine Dewatering	Instrumentation and Controls - PW22-17		1	LS
4000	4600	4670	Mine Dewatering	Electrical Equipment and Installation - PW22-17		1	LS
4000	4600	4670	Mine Dewatering	Godwin HL160M Dri-Prime (CAT 3406C Diesel Engine)	No pump cost - installation only. Pumps reused from freshet pump system.	2	ea
4000	4600	4670	Mine Dewatering	Pump Conversion (HL160M to HL250M)	Quote attached for conversion. Allow $22,000 per pump.	2	ea
4000	4600	4670	Mine Dewatering	8" Suction Hose (7 m length)		2	ea
4000	4600	4670	Mine Dewatering	8" Suction Screen		2	ea
4000	4600	4670	Mine Dewatering	Flanged Reducer (6" x 16")		2	ea
4000	4600	4670	Mine Dewatering	16" Check Valve (Class 150)		2	ea
4000	4600	4670	Mine Dewatering	16" HDPE DR17 Dewatering Pipeline		2,250	m
				Total Installed Cost Before Owners Cost			

TABLE F.15

NEW GOLD INC.
BLACKWATER GOLD PROJECT

MINE WASTE AND WATER MANAGEMENT DESIGN REPORT
MATERIAL TAKEOFF - SUSTAINING YEAR 7 - WBS TASK 4600

A	A	A	D	F	G	H	I
Mandatory	Mandatory	Mandatory	Mandatory	Mandatory	If Required	Mandatory	Mandatory
Blackwater WBS Level 1	**Blackwater WBS Level 2**	**Blackwater WBS Level 3**	**WBS Description**	**Primary Item Description**	**Secondary Item Description**	**Qty**	**Unit of Measure**
				YEAR 7			
4000	4600	4610	TSF Site Preparation	TSF Site D Footprint - Stage 3		80	ha
4000	4600	4610	TSF Site Preparation	KH5 - Mass Excavation	Balance to fill locally.	505,500	m3
4000	4600	4610	TSF Site Preparation	KH5 - Mass Fill	Fill from excavation locally.	370,200	m3
4000	4600	4610	TSF Site Preparation	KH5 - Waste Remaining Material	Waste locally or widen road locally.	135,300	m3
4000	4600	4610	TSF Site Preparation	KH5 - Wearing Course	Assumes 300 mm wearing course.	23,580	m3
4000	4600	4610	TSF Site Preparation	KH5 - Safety Berms	Excavate ditches locally to create safety berms	3,930	m
4000	4600	4610	TSF Site Preparation	Sediment and Erosion Control BMPs	Allowance for on-going sediment and erosion control	1	L.S.
4000	4600	4610	TSF Site Preparation	Clear and Grub	Aggregate screening borrow area	1	ha
4000	4600	4610	TSF Site Preparation	Topsoil removal	Aggregate screening borrow area	5,000	m3
4000	4600	4630	TSF Site D	Clear and Grub Footprint		-	m2
4000	4600	4630	TSF Site D	Foundation Preparation	Assumes 1 m removal under footprint	-	m3
4000	4600	4630	TSF Site D	Excavate Cut-Off Trench (COT)		320,000	m3
4000	4600	4630	TSF Site D	Haul, Place, Compact - Zone C - U/S Zone C	From Cut-off Trench Excavation	240,000	m3
4000	4600	4630	TSF Site D	Haul and Dump Cut-Off Trench Waste	From Cut-off Trench Excavation	80,000	m3
4000	4600	4630	TSF Site D	COT Load, Haul, Dump - Zone S (mining)	Rehandle, Place, Compact - Zone S (contractor)	320,000	m3
4000	4600	4630	TSF Site D	COT Load, Haul, Place, Compact - Zone F (contractor)	From Aggregate Screening Area	3,000	m3
4000	4600	4630	TSF Site D	Load, Haul, Dump, Compact - Zone C (mining)	Mining load, haul, compact. Contractor spread.	3,152,000	m3
4000	4600	4630	TSF Site D	Load, Haul, Place - Zone S (mining)	Spread and Compact - Zone S (contractor)	310,000	m3
4000	4600	4630	TSF Site D	Load, Haul, Place, Compact - Zone F (contractor)		62,000	m3
4000	4600	4630	TSF Site D	Load, Haul, Place, Compact - Zone T (contractor)		62,000	m3
4000	4600	4630	TSF Site D	Allowance for Embankment Drains	Suggest $15,000 annual allowance	1	L.S.
4000	4600	4630	TSF Site D	Allowance for Foundation Drains	Suggest $15,000 annual allowance	1	L.S.
4000	4600	4630	TSF Site D	Allowance for Dam Instrumentation		1	L.S.
4000	4600	4640	Tailings Distribution and Water Reclaim	30" HDPE DR13.5 Piping	Tailings Pipeline to Main Dam	600	m
4000	4600	4640	Tailings Distribution and Water Reclaim	16" HDPE DR11 Piping	Choke station w REPLACEMENT	30	m
4000	4600	4640	Tailings Distribution and Water Reclaim	26" HDPE DR 21 Piping	Choke station w REPLACEMENT	30	m
4000	4600	4640	Tailings Distribution and Water Reclaim	26" STD Steel Piping 1/2" Rubber Lined	Allowance for choke station w REPLACEMENT	30	m
4000	4600	4640	Tailings Distribution and Water Reclaim	30" Steel Knife Gate Valve (Class 150) for Tailings Delivery Line w/ hydraulic	Isolation valves along the main tailing delivery line	1	ea
4000	4600	4640	Tailings Distribution and Water Reclaim	26" Steel Knife Gate Valve (Class 150) for Choking Station w/ hydraulic	Isolation valves for the choke station bypass w	2	ea
4000	4600	4640	Tailings Distribution and Water Reclaim	12" Steel Knife Gate Valve (Class 150) for Offtakes w/ hydraulic actuator	Isolation vlaves for offtakes	3	ea
4000	4600	4640	Tailings Distribution and Water Reclaim	30" (x2) to 12" (x1) Steel Tee (Class 150) 1/2" Rubber Lined	Offtakes	3	ea
4000	4600	4640	Tailings Distribution and Water Reclaim	26" Steel Tees (Class 150) 1/2" Rubber Lined for choke station	Choke station bypass w REPLACEMENT	2	ea
4000	4600	4640	Tailings Distribution and Water Reclaim	26" Steel Elbows(Class 150) 90 Degree 1/2" Rubber Lined	Choke station bypass w REPLACEMENT	2	ea
4000	4600	4640	Tailings Distribution and Water Reclaim	26" to 16" Reducer Steel (Class 150) 1/2" Rubber Lined	Choke station bypass w REPLACEMENT	2	ea
4000	4600	4640	Tailings Distribution and Water Reclaim	Allowance for air relief/vacuum valves		1	L.S.
4000	4600	4640	Tailings Distribution and Water Reclaim	Allowance for misc. flanges and fittings	3% of pipe cost	1	L.S.
4000	4600	4640	Tailings Distribution and Water Reclaim	Allowance for pipe restraints along the piping corridors	10% of pipe cost	1	L.S.
				Total Installed Cost Before Owners Cost			

TABLE F.16

NEW GOLD INC.
BLACKWATER GOLD PROJECT

MINE WASTE AND WATER MANAGEMENT DESIGN REPORT
MATERIAL TAKEOFF - SUSTAINING YEAR 8 - WBS TASK 4600

A	A	A	D	F	G	H	I
Mandatory	Mandatory	Mandatory	Mandatory	Mandatory	If Required	Mandatory	Mandatory
Blackwater WBS Level 1	**Blackwater WBS Level 2**	**Blackwater WBS Level 3**	**WBS Description**	**Primary Item Description**	**Secondary Item Description**	**Qty**	**Unit of Measure**
				YEAR 8			
4000	4600	4610	TSF Site Preparation	TSF Site D Footprint - Stage 3		67	ha
4000	4600	4610	TSF Site Preparation	KS2 - Mass Excavation	Balance to fill locally.	46,000	m3
4000	4600	4610	TSF Site Preparation	KS2 - Mass Fill	Fill from excavation locally.	29,000	m3
4000	4600	4610	TSF Site Preparation	KS2 - Waste Remaining Material	Waste locally or widen road locally.	17,000	m3
4000	4600	4610	TSF Site Preparation	KS2 - Wearing Course and Safety Berms	Assumes 300 mm wearing course.	10,050	m3
4000	4600	4610	TSF Site Preparation	Sediment and Erosion Control BMPs	Allowance for on-going sediment and erosion control	1	L.S.
4000	4600	4610	TSF Site Preparation	Clear and Grub	Aggregate screening borrow area	1	ha
4000	4600	4610	TSF Site Preparation	Topsoil removal	Aggregate screening borrow area	5,000	m3
4000	4600	4630	TSF Site D	Clear and Grub Footprint		274,000	m2
4000	4600	4630	TSF Site D	Foundation Preparation	Assumes 1 m removal under footprint	274,000	m3
4000	4600	4630	TSF Site D	Excavate Cut-Off Trench (COT)		766,000	m3
4000	4600	4630	TSF Site D	Haul, Place, Compact - Zone C - U/S Zone C	From Cut-off Trench Excavation	574,000	m3
4000	4600	4630	TSF Site D	Haul and Dump Cut-Off Trench Waste	From Cut-off Trench Excavation	192,000	m3
4000	4600	4630	TSF Site D	COT Load, Haul, Dump - Zone S (mining)	Rehandle, Place, Compact - Zone S (contractor)	766,000	m3
4000	4600	4630	TSF Site D	COT Load, Haul, Place, Compact - Zone F (contractor)	From Aggregate Screening Area	13,000	m3
4000	4600	4630	TSF Site D	Load, Haul, Dump, Compact - Zone C (mining)	Mining load, haul, compact. Contractor spread.	2,713,000	m3
4000	4600	4630	TSF Site D	Load, Haul, Place - Zone S (mining)	Spread and Compact - Zone S (contractor)	272,000	m3
4000	4600	4630	TSF Site D	Load, Haul, Place, Compact - Zone F (contractor)		56,500	m3
4000	4600	4630	TSF Site D	Load, Haul, Place, Compact - Zone T (contractor)		56,500	m3
4000	4600	4630	TSF Site D	Allowance for Embankment Drains	Suggest $15,000 annual allowance	1	L.S.
4000	4600	4630	TSF Site D	Allowance for Foundation Drains	Suggest $15,000 annual allowance	1	L.S.
4000	4600	4630	TSF Site D	Allowance for Dam Instrumentation		1	L.S.
4000	4600	4640	Tailings Distribution and Water Reclaim	30" HDPE DR11 Piping between Plant and Drop Box	2 parallel lines, each 1120 m long - REPLACEMENT	2,240	m
4000	4600	4640	Tailings Distribution and Water Reclaim	26" STD Steel Piping 1/2" Rubber Lined	Piping around the drop box - REPLACEMENT	40	m
4000	4600	4640	Tailings Distribution and Water Reclaim	1/2" Rubber Lining Inside Drop Box	Assumed up to 4 m high x 4 m x 4 m base)	64	m2
4000	4600	4640	Tailings Distribution and Water Reclaim	26" Steel Tees (Class 150) 1/2" Rubber Lined for Drop Box	Drop box piping and bypass - REPLACEMENT	9	ea
4000	4600	4640	Tailings Distribution and Water Reclaim	26" Steel 90 Degree Elbow (Class 150) 1/2" Rubber Lined	Drop Box Bypasses - REPLACEMENT	10	ea
4000	4600	4640	Tailings Distribution and Water Reclaim	26" Steel Wye (Class 150) for Drop Box Emergency Lines	Drop box piping and bypass - REPLACEMENT	1	ea
4000	4600	4640	Tailings Distribution and Water Reclaim	26" Steel Knife Gate Valve (Class 150) w/ hydraulic actuator	Drop Box Discharge Control - REPLACEMENT	11	ea
4000	4600	4640	Tailings Distribution and Water Reclaim	24" HDPE DR13.5 for offtake	First offtake, full size	20	m
4000	4600	4640	Tailings Distribution and Water Reclaim	30" Steel Knife Gate Valve (Class 150) for Tailings Delivery Line w/ hydraulic	Isolation valves along the main tailing delivery line	2	ea
4000	4600	4640	Tailings Distribution and Water Reclaim	Allowance for misc. flanges and fittings	3% of pipe cost	1	L.S.
4000	4600	4640	Tailings Distribution and Water Reclaim	Allowance for pipe restraints along the piping corridors	10% of pipe cost	1	L.S.
				Total Installed Cost Before Owners Cost			

TABLE F.17

NEW GOLD INC.
BLACKWATER GOLD PROJECT

MINE WASTE AND WATER MANAGEMENT DESIGN REPORT
MATERIAL TAKEOFF - SUSTAINING YEAR 9 - WBS TASK 4600

A	A	A	D	F	G	H	I
Mandatory	Mandatory	Mandatory	Mandatory	Mandatory	If Required	Mandatory	Mandatory
Blackwater WBS Level 1	**Blackwater WBS Level 2**	**Blackwater WBS Level 3**	**WBS Description**	**Primary Item Description**	**Secondary Item Description**	**Qty**	**Unit of Measure**
				YEAR 9			
4000	4600	4610	TSF Site Preparation	Sediment and Erosion Control BMPs	Allowance for on-going sediment and erosion control	1	L.S.
4000	4600	4610	TSF Site Preparation	Clear and Grub	Aggregate screening borrow area	1	ha
4000	4600	4610	TSF Site Preparation	Topsoil removal	Aggregate screening borrow area	5,000	m3
4000	4600	4630	TSF Site D	Clear and Grub Footprint		-	m2
4000	4600	4630	TSF Site D	Foundation Preparation	Assumes 1 m removal under footprint	-	m3
4000	4600	4630	TSF Site D	Excavate Cut-Off Trench (COT)		575,000	m3
4000	4600	4630	TSF Site D	Haul, Place, Compact - Zone C - U/S Zone C	From Cut-off Trench Excavation	431,000	m3
4000	4600	4630	TSF Site D	Haul and Dump Cut-Off Trench Waste	From Cut-off Trench Excavation	144,000	m3
4000	4600	4630	TSF Site D	COT Load, Haul, Dump - Zone S (mining)	Rehandle, Place, Compact - Zone S (contractor)	-	m3
4000	4600	4630	TSF Site D	COT Load, Haul, Place, Compact - Zone F (contractor)	From Aggregate Screening Area	9,000	m3
4000	4600	4630	TSF Site D	Load, Haul, Dump, Compact - Zone C (mining)	Mining load, haul, compact. Contractor spread.	2,013,000	m3
4000	4600	4630	TSF Site D	Load, Haul, Place - Zone S (mining)	Spread and Compact - Zone S (contractor)	831,000	m3
4000	4600	4630	TSF Site D	Load, Haul, Place, Compact - Zone F (contractor)		51,500	m3
4000	4600	4630	TSF Site D	Load, Haul, Place, Compact - Zone T (contractor)		51,500	m3
4000	4600	4630	TSF Site D	Allowance for Embankment Drains	Suggest $15,000 annual allowance	-	L.S.
4000	4600	4630	TSF Site D	Allowance for Foundation Drains	Suggest $15,000 annual allowance	-	L.S.
4000	4600	4630	TSF Site D	Allowance for Dam Instrumentation		-	L.S.
4000	4600	4640	Tailings Distribution and Water Reclaim	30" HDPE DR13.5 Piping Relocation	Section along South side	1,700	m
4000	4600	4640	Tailings Distribution and Water Reclaim	30" Steel Knife Gate Valve (Class 150) for Tailings Delivery Line w/ hydraulic	Isolation valves along the main tailing delivery line	2	ea
4000	4600	4640	Tailings Distribution and Water Reclaim	24" Steel Knife Gate Valve (Class 150) for Offtake Line w/ hydraulic actuator	Isolation line for the first full size offtake	1	ea
4000	4600	4640	Tailings Distribution and Water Reclaim	24" Butterfly Valve for Offtake w/ hydraulic actuator	Pressure reducing valve for the first offtake, full size	1	ea
4000	4600	4640	Tailings Distribution and Water Reclaim	12" Steel Knife Gate Valve (Class 150) for Offtakes w/ hydraulic actuator	Isolation vlaves for offtakes	3	ea
4000	4600	4640	Tailings Distribution and Water Reclaim	30" (x2) to 12" (x1) Steel Tee (Class 150) 1/2" Rubber Lined	Offtakes	3	ea
4000	4600	4640	Tailings Distribution and Water Reclaim	30" (x2) to 24" (x1) Steel Tee (Class 150) 1/2" Rubber Lined	First offtake, full size	1	ea
				Total Installed Cost Before Owners Cost			

TABLE F.18

NEW GOLD INC.
BLACKWATER GOLD PROJECT

MINE WASTE AND WATER MANAGEMENT DESIGN REPORT
MATERIAL TAKEOFF - SUSTAINING YEAR 10 - WBS TASK 4600

A	A	A	D	F	G	H	I
Mandatory	Mandatory	Mandatory	Mandatory	Mandatory	If Required	Mandatory	Mandatory
Blackwater WBS Level 1	**Blackwater WBS Level 2**	**Blackwater WBS Level 3**	**WBS Description**	**Primary Item Description**	**Secondary Item Description**	**Qty**	**Unit of Measure**
				YEAR 10			
4000	4600	4610	TSF Site Preparation	Sediment and Erosion Control BMPs	Allowance for on-going sediment and erosion control	1	L.S.
4000	4600	4610	TSF Site Preparation	Clear and Grub	Aggregate screening borrow area	1	ha
4000	4600	4610	TSF Site Preparation	Topsoil removal	Aggregate screening borrow area	5,000	m3
4000	4600	4630	TSF Site D	Clear and Grub Footprint		-	m2
4000	4600	4630	TSF Site D	Foundation Preparation	Assumes 1 m removal under footprint	-	m3
4000	4600	4630	TSF Site D	Excavate Cut-Off Trench (COT)		151,000	m3
4000	4600	4630	TSF Site D	Haul, Place, Compact - Zone C - U/S Zone C	From Cut-off Trench Excavation	113,000	m3
4000	4600	4630	TSF Site D	Haul and Dump Cut-Off Trench Waste	From Cut-off Trench Excavation	38,000	m3
4000	4600	4630	TSF Site D	COT Load, Haul, Dump - Zone S (mining)	Rehandle, Place, Compact - Zone S (contractor)	-	m3
4000	4600	4630	TSF Site D	COT Load, Haul, Place, Compact - Zone F (contractor)	From Aggregate Screening Area	3,000	m3
4000	4600	4630	TSF Site D	Load, Haul, Dump, Compact - Zone C (mining)	Mining load, haul, compact. Contractor spread.	945,000	m3
4000	4600	4630	TSF Site D	Load, Haul, Place - Zone S (mining)	Spread and Compact - Zone S (contractor)	310,500	m3
4000	4600	4630	TSF Site D	Load, Haul, Place, Compact - Zone F (contractor)		32,000	m3
4000	4600	4630	TSF Site D	Load, Haul, Place, Compact - Zone T (contractor)		32,000	m3
4000	4600	4630	TSF Site D	Allowance for Embankment Drains	Suggest $15,000 annual allowance	-	L.S.
4000	4600	4630	TSF Site D	Allowance for Foundation Drains	Suggest $15,000 annual allowance	-	L.S.
4000	4600	4630	TSF Site D	Allowance for Dam Instrumentation		-	L.S.
4000	4600	4670	Mine Dewatering	Godwin HL160M Dri-Prime (CAT 3406C Diesel Engine)	No pump cost - installation only. Pumps reused from	1	ea
4000	4600	4670	Mine Dewatering	Pump Conversion (HL160M to HL250M)	Quote attached for conversion. Allow $22,000 per	1	ea
4000	4600	4670	Mine Dewatering	Flanged Reducer (16" x 8")		2	ea
4000	4600	4670	Mine Dewatering	Flanged Reducer (6" x 16")		1	ea
4000	4600	4670	Mine Dewatering	16" Check Valve (Class 150)		1	ea
				Total Installed Cost Before Owners Cost			

TABLE F.19

NEW GOLD INC.
BLACKWATER GOLD PROJECT

MINE WASTE AND WATER MANAGEMENT DESIGN REPORT
MATERIAL TAKEOFF - SUSTAINING YEAR 11 - WBS TASK 4600

A	A	A	D	F	G	H	I
Mandatory	Mandatory	Mandatory	Mandatory	Mandatory	If Required	Mandatory	Mandatory
Blackwater WBS Level 1	**Blackwater WBS Level 2**	**Blackwater WBS Level 3**	**WBS Description**	**Primary Item Description**	**Secondary Item Description**	**Qty**	**Unit of Measure**
				YEAR 11			
4000	4600	4610	TSF Site Preparation	Sediment and Erosion Control BMPs	Allowance for on-going sediment and erosion control	1	L.S.
4000	4600	4610	TSF Site Preparation	Clear and Grub	Aggregate screening borrow area	1	ha
4000	4600	4610	TSF Site Preparation	Topsoil removal	Aggregate screening borrow area	5,000	m3
4000	4600	4630	TSF Site D	Clear and Grub Footprint		-	m2
4000	4600	4630	TSF Site D	Foundation Preparation	Assumes 1 m removal under footprint	-	m3
4000	4600	4630	TSF Site D	Excavate Cut-Off Trench (COT)		126,000	m3
4000	4600	4630	TSF Site D	Haul, Place, Compact - Zone C - U/S Zone C	From Cut-off Trench Excavation	94,000	m3
4000	4600	4630	TSF Site D	Haul and Dump Cut-Off Trench Waste	From Cut-off Trench Excavation	32,000	m3
4000	4600	4630	TSF Site D	COT Load, Haul, Dump - Zone S (mining)	Rehandle, Place, Compact - Zone S (contractor)	-	m3
4000	4600	4630	TSF Site D	COT Load, Haul, Place, Compact - Zone F (contractor)	From Aggregate Screening Area	2,500	m3
4000	4600	4630	TSF Site D	Load, Haul, Dump, Compact - Zone C (mining)	Mining load, haul, compact. Contractor spread.	920,000	m3
4000	4600	4630	TSF Site D	Load, Haul, Place - Zone S (mining)	Spread and Compact - Zone S (contractor)	287,500	m3
4000	4600	4630	TSF Site D	Load, Haul, Place, Compact - Zone F (contractor)		32,500	m3
4000	4600	4630	TSF Site D	Load, Haul, Place, Compact - Zone T (contractor)		32,500	m3
4000	4600	4630	TSF Site D	Allowance for Embankment Drains	Suggest $15,000 annual allowance	-	L.S.
4000	4600	4630	TSF Site D	Allowance for Foundation Drains	Suggest $15,000 annual allowance	-	L.S.
4000	4600	4630	TSF Site D	Allowance for Dam Instrumentation		-	L.S.
				Total Installed Cost Before Owners Cost			

TABLE F.20

NEW GOLD INC.
BLACKWATER GOLD PROJECT

MINE WASTE AND WATER MANAGEMENT DESIGN REPORT
MATERIAL TAKEOFF - SUSTAINING YEAR 12 - WBS TASK 4600

A	A	A	D	F	G	H	I
Mandatory	Mandatory	Mandatory	Mandatory	Mandatory	If Required	Mandatory	Mandatory
Blackwater WBS Level 1	**Blackwater WBS Level 2**	**Blackwater WBS Level 3**	**WBS Description**	**Primary Item Description**	**Secondary Item Description**	**Qty**	**Unit of Measure**
				YEAR 12			
4000	4600	4610	TSF Site Preparation	Sediment and Erosion Control BMPs	Allowance for on-going sediment and erosion control	1	L.S.
4000	4600	4610	TSF Site Preparation	Clear and Grub	Aggregate screening borrow area	1	ha
4000	4600	4610	TSF Site Preparation	Topsoil removal	Aggregate screening borrow area	5,000	m3
4000	4600	4630	TSF Site D	Clear and Grub Footprint		-	m2
4000	4600	4630	TSF Site D	Foundation Preparation	Assumes 1 m removal under footprint	-	m3
4000	4600	4630	TSF Site D	Excavate Cut-Off Trench (COT)		296,000	m3
4000	4600	4630	TSF Site D	Haul, Place, Compact - Zone C - U/S Zone C	From Cut-off Trench Excavation	222,000	m3
4000	4600	4630	TSF Site D	Haul and Dump Cut-Off Trench Waste	From Cut-off Trench Excavation	74,000	m3
4000	4600	4630	TSF Site D	COT Load, Haul, Dump - Zone S (mining)	Rehandle, Place, Compact - Zone S (contractor)	-	m3
4000	4600	4630	TSF Site D	COT Load, Haul, Place, Compact - Zone F (contractor)	From Aggregate Screening Area	4,500	m3
4000	4600	4630	TSF Site D	Load, Haul, Dump, Compact - Zone C (mining)	Mining load, haul, compact. Contractor spread.	466,000	m3
4000	4600	4630	TSF Site D	Load, Haul, Place - Zone S (mining)	Spread and Compact - Zone S (contractor)	405,500	m3
4000	4600	4630	TSF Site D	Load, Haul, Place, Compact - Zone F (contractor)		22,500	m3
4000	4600	4630	TSF Site D	Load, Haul, Place, Compact - Zone T (contractor)		22,500	m3
4000	4600	4630	TSF Site D	Allowance for Embankment Drains	Suggest $15,000 annual allowance	-	L.S.
4000	4600	4630	TSF Site D	Allowance for Foundation Drains	Suggest $15,000 annual allowance	-	L.S.
4000	4600	4630	TSF Site D	Allowance for Dam Instrumentation		-	L.S.
4000	4600	4640	Tailings Distribution and Water Reclaim	16" HDPE DR11 Piping	Choke station w REPLACEMENT	30	m
4000	4600	4640	Tailings Distribution and Water Reclaim	26" HDPE DR 21 Piping	Choke station w REPLACEMENT	30	m
4000	4600	4640	Tailings Distribution and Water Reclaim	26" STD Steel Piping 1/2" Rubber Lined	Allowance for choke station w REPLACEMENT	30	m
4000	4600	4640	Tailings Distribution and Water Reclaim	26" Steel Knife Gate Valve (Class 150) for Choking Station w/ hydraulic	Isolation valves for the choke station bypass w	2	ea
4000	4600	4640	Tailings Distribution and Water Reclaim	26" Steel Tees (Class 150) 1/2" Rubber Lined for choke station	Choke station bypass w REPLACEMENT	2	ea
4000	4600	4640	Tailings Distribution and Water Reclaim	26" Steel Elbows(Class 150) 90 Degree 1/2" Rubber Lined	Choke station bypass w REPLACEMENT	2	ea
4000	4600	4640	Tailings Distribution and Water Reclaim	26" to 16" Reducer Steel (Class 150) 1/2" Rubber Lined	Choke station bypass w REPLACEMENT	2	ea
4000	4600	4670	Mine Dewatering	8" STD Steel Pipe	PW22-17 riser pipeline	35	m
				Total Installed Cost Before Owners Cost			

TABLE F.21

NEW GOLD INC.
BLACKWATER GOLD PROJECT

MINE WASTE AND WATER MANAGEMENT DESIGN REPORT
MATERIAL TAKEOFF - SUSTAINING YEAR 13 - WBS TASK 4600

A	A	A	D	F	G	H	I
Mandatory	Mandatory	Mandatory	Mandatory	Mandatory	If Required	Mandatory	Mandatory
Blackwater WBS Level 1	**Blackwater WBS Level 2**	**Blackwater WBS Level 3**	**WBS Description**	**Primary Item Description**	**Secondary Item Description**	**Qty**	**Unit of Measure**
				YEAR 13			
4000	4600	4610	TSF Site Preparation	Sediment and Erosion Control BMPs	Allowance for on-going sediment and erosion control	1	L.S.
4000	4600	4610	TSF Site Preparation	Clear and Grub	Aggregate screening borrow area	1	ha
4000	4600	4610	TSF Site Preparation	Topsoil removal	Aggregate screening borrow area	5,000	m3
4000	4600	4630	TSF Site D	Clear and Grub Footprint		-	m2
4000	4600	4630	TSF Site D	Foundation Preparation	Assumes 1 m removal under footprint	-	m3
4000	4600	4630	TSF Site D	Excavate Cut-Off Trench (COT)		268,000	m3
4000	4600	4630	TSF Site D	Haul, Place, Compact - Zone C - U/S Zone C	From Cut-off Trench Excavation	201,000	m3
4000	4600	4630	TSF Site D	Haul and Dump Cut-Off Trench Waste	From Cut-off Trench Excavation	67,000	m3
4000	4600	4630	TSF Site D	COT Load, Haul, Dump - Zone S (mining)	Rehandle, Place, Compact - Zone S (contractor)	-	m3
4000	4600	4630	TSF Site D	COT Load, Haul, Place, Compact - Zone F (contractor)	From Aggregate Screening Area	4,000	m3
4000	4600	4630	TSF Site D	Load, Haul, Dump, Compact - Zone C (mining)	Mining load, haul, compact. Contractor spread.	795,000	m3
4000	4600	4630	TSF Site D	Load, Haul, Place - Zone S (mining)	Spread and Compact - Zone S (contractor)	437,500	m3
4000	4600	4630	TSF Site D	Load, Haul, Place, Compact - Zone F (contractor)		34,000	m3
4000	4600	4630	TSF Site D	Load, Haul, Place, Compact - Zone T (contractor)		34,000	m3
4000	4600	4630	TSF Site D	Allowance for Embankment Drains	Suggest $15,000 annual allowance	-	L.S.
4000	4600	4630	TSF Site D	Allowance for Foundation Drains	Suggest $15,000 annual allowance	-	L.S.
4000	4600	4630	TSF Site D	Allowance for Dam Instrumentation		-	L.S.
4000	4600	4670	Mine Dewatering	8" STD Steel Pipe	PW22-17 riser pipeline	60	m
				Total Installed Cost Before Owners Cost			

TABLE F.22

NEW GOLD INC.
BLACKWATER GOLD PROJECT

MINE WASTE AND WATER MANAGEMENT DESIGN REPORT
MATERIAL TAKEOFF - SUSTAINING YEAR 14 - WBS TASK 4600

A	A	A	D	F	G	H	I
Mandatory	Mandatory	Mandatory	Mandatory	Mandatory	If Required	Mandatory	Mandatory
Blackwater WBS Level 1	**Blackwater WBS Level 2**	**Blackwater WBS Level 3**	**WBS Description**	**Primary Item Description**	**Secondary Item Description**	**Qty**	**Unit of Measure**
				YEAR 14			
4000	4600	4610	TSF Site Preparation	Sediment and Erosion Control BMPs	Allowance for on-going sediment and erosion control	1	L.S.
4000	4600	4610	TSF Site Preparation	Clear and Grub	Aggregate screening borrow area	1	ha
4000	4600	4610	TSF Site Preparation	Topsoil removal	Aggregate screening borrow area	5,000	m3
4000	4600	4630	TSF Site D	Clear and Grub Footprint		-	m2
4000	4600	4630	TSF Site D	Foundation Preparation	Assumes 1 m removal under footprint	-	m3
4000	4600	4630	TSF Site D	Excavate Cut-Off Trench (COT)		140,000	m3
4000	4600	4630	TSF Site D	Haul, Place, Compact - Zone C - U/S Zone C	From Cut-off Trench Excavation	105,000	m3
4000	4600	4630	TSF Site D	Haul and Dump Cut-Off Trench Waste	From Cut-off Trench Excavation	35,000	m3
4000	4600	4630	TSF Site D	COT Load, Haul, Dump - Zone S (mining)	Rehandle, Place, Compact - Zone S (contractor)	-	m3
4000	4600	4630	TSF Site D	COT Load, Haul, Place, Compact - Zone F (contractor)	From Aggregate Screening Area	2,500	m3
4000	4600	4630	TSF Site D	Load, Haul, Dump, Compact - Zone C (mining)	Mining load, haul, compact. Contractor spread.	535,000	m3
4000	4600	4630	TSF Site D	Load, Haul, Place - Zone S (mining)	Spread and Compact - Zone S (contractor)	254,500	m3
4000	4600	4630	TSF Site D	Load, Haul, Place, Compact - Zone F (contractor)		23,000	m3
4000	4600	4630	TSF Site D	Load, Haul, Place, Compact - Zone T (contractor)		23,000	m3
4000	4600	4630	TSF Site D	Allowance for Embankment Drains	Suggest $15,000 annual allowance	-	L.S.
4000	4600	4630	TSF Site D	Allowance for Foundation Drains	Suggest $15,000 annual allowance	-	L.S.
4000	4600	4630	TSF Site D	Allowance for Dam Instrumentation		-	L.S.
4000	4600	4670	Mine Dewatering	Godwin HL160M Dri-Prime (CAT 3406C Diesel Engine)	No pump cost - installation only. Pumps reused from	2	ea
4000	4600	4670	Mine Dewatering	Pump Conversion (HL160M to HL250M)	Quote attached for conversion. Allow $22,000 per	2	ea
4000	4600	4670	Mine Dewatering	8" Suction Hose (7 m length)		1	ea
4000	4600	4670	Mine Dewatering	8" Suction Screen		1	ea
4000	4600	4670	Mine Dewatering	Flanged Reducer (16" x 8")		1	ea
4000	4600	4670	Mine Dewatering	Flanged Reducer (6" x 16")		3	ea
4000	4600	4670	Mine Dewatering	16" Check Valve (Class 150)		3	ea
4000	4600	4670	Mine Dewatering	16" HDPE DR17 Dewatering Pipeline		1,750	m
				Total Installed Cost Before Owners Cost			

TABLE F.23

NEW GOLD INC.
BLACKWATER GOLD PROJECT

MINE WASTE AND WATER MANAGEMENT DESIGN REPORT
MATERIAL TAKEOFF - SUSTAINING YEAR 15 - WBS TASK 4600

A	A	A	D	F	G	H	I
Mandatory	Mandatory	Mandatory	Mandatory	Mandatory	If Required	Mandatory	Mandatory
Blackwater WBS Level 1	**Blackwater WBS Level 2**	**Blackwater WBS Level 3**	**WBS Description**	**Primary Item Description**	**Secondary Item Description**	**Qty**	**Unit of Measure**
				YEAR 15			
4000	4600	4610	TSF Site Preparation	Sediment and Erosion Control BMPs	Allowance for on-going sediment and erosion control	1	L.S.
4000	4600	4610	TSF Site Preparation	Clear and Grub	Aggregate screening borrow area	1	ha
4000	4600	4610	TSF Site Preparation	Topsoil removal	Aggregate screening borrow area	5,000	m3
4000	4600	4630	TSF Site D	Clear and Grub Footprint		-	m2
4000	4600	4630	TSF Site D	Foundation Preparation	Assumes 1 m removal under footprint	-	m3
4000	4600	4630	TSF Site D	Excavate Cut-Off Trench (COT)		262,000	m3
4000	4600	4630	TSF Site D	Haul, Place, Compact - Zone C - U/S Zone C	From Cut-off Trench Excavation	197,000	m3
4000	4600	4630	TSF Site D	Haul and Dump Cut-Off Trench Waste	From Cut-off Trench Excavation	66,000	m3
4000	4600	4630	TSF Site D	COT Load, Haul, Dump - Zone S (mining)	Rehandle, Place, Compact - Zone S (contractor)	-	m3
4000	4600	4630	TSF Site D	COT Load, Haul, Place, Compact - Zone F (contractor)	From Aggregate Screening Area	4,500	m3
4000	4600	4630	TSF Site D	Load, Haul, Dump, Compact - Zone C (mining)	Mining load, haul, compact. Contractor spread.	-	m3
4000	4600	4630	TSF Site D	Load, Haul, Place - Zone S (mining)	Spread and Compact - Zone S (contractor)	380,000	m3
4000	4600	4630	TSF Site D	Load, Haul, Place, Compact - Zone F (contractor)		24,000	m3
4000	4600	4630	TSF Site D	Load, Haul, Place, Compact - Zone T (contractor)		24,000	m3
				Total Installed Cost Before Owners Cost			

APPENDIX G

TATELKUZ LAKE WATER SUPPLY STUDIES

(Pages G-1 to G-44)

August 2, 2012

File No.:VA101-457/4-A.01
Cont. No.:VA12-00758

ISO 9001 - FS 64925
ISO 14001 - EMS 550121
OHSAS 18001 - OHS 550122

Mr. Paul Hosford
New Gold Inc.
Park Place
3110 - 666 Burrard Street
Vancouver, BC V6C 2X8

Dear Paul,

Re: Blackwater Gold - Fresh Water Supply Options Trade-off Study

SUMMARY

New Gold Inc. (NGD) is evaluating water supply options for the Blackwater Gold Project and retained Knight Piésold Ltd. (KPL) to complete a preliminary assessment for fresh water supply options. KPL completed a trade-off study to identify potential long-term freshwater water sources for mining operations.

A preliminary water balance indicates that the site (including the TSF, open pit and contributing catchments) will likely be in deficit conditions starting in Year 4 of operations with the water shortfall ranging between 2 and 8 million cubic metres (Mm^3) annually. The deficit condition is the result of the pore volume losses into the tailings and waste rock voids being greater than the net precipitation and runoff directed to the facility. The water balance model developed for this trade-off study was based on preliminary estimates of hydrometeorological conditions at the project site and further refinement may be required when additional site specific data is available. The water balance is also sensitive to the quantities of PAG waste rock disposal as the water losses in the voids are significant. An average annual water supply rate of 6 Mm^3 per year was considered for the potential water supply options considered in this trade-off study.

Initial consideration was given to identifying surface water drainages and groundwater sources; however the large makeup water requirement could adversely impact surface waters and/or groundwater sources and could result in flow reductions in the local fish bearing streams. Construction of a large water storage reservoir or a large groundwater well field was considered impractical for the site conditions. Larger water body sites, such as natural lakes, were determined to be more practical for supplementing make-up water during the higher flow periods. Precedent exists in British Columbia for this type of system as it has been used successfully at the Mt. Polley Mine.

Potential make-up water sources were identified and short-listed based on terrain criteria, distance from the site, and availability of water as a percentage of lake inflow.
Three lakes were identified for consideration:

- Tatelkuz Lake
- Kuyakuz Lake, and
- Top Lake.

The focusing question of this letter report is:
Where should the water supply for the project be sourced?

At present, the answer to this question is **Tatelkuz Lake,** based on the following findings:

a) Tatelkuz Lake is the largest water body of the three, and the projected withdrawal rate would have the least amount of impact because of the expected small fluctuation in the lake level due to the rate and timing of water withdrawal.
b) Preliminary costs for water supply systems at Tatelkuz Lake and Kuyakuz Lake were found to be very similar. The economic assessment indicates the preferred water supply system at Tatelkuz lake is a steel pipe system with an initial capital cost of $19M, and an additional cost of $13M for mobilization/demobilization, indirects, EPCM and contingency. The operating cost is estimated to be in the order of $1.4 M per year.

DESIGN BASIS AND OPERATING CRITERIA

The factors considered for estimating average monthly water volumes reporting to each of the lakes were:

- Catchment Area
- Evaporation
- Precipitation
- Percentage of Snow as Precipitation
- Snowmelt Periods
- Temperature, and
- Maximum Lake Volume.

Precipitation and climate data were obtained from the KPL Hydrometeorology Report for the project (KPL Report VA101-457/4-1). The total make-up water requirement was distributed evenly over a 6 month period (April to September). Flows are typically highest in the drainages during this period due to the spring freshet, which occurs between April and June, and during the summer months, between July and September, due to the quantity of precipitation and runoff expected in the mine site area. Lake volumes were determined using bathymetry surveys obtained from the Government of British Columbia, Ministry of Environment website. The timing of the bathymetry surveys suggests that they were undertaken at the maximum lake level within the survey year. There is no known data on the minimum spill elevation and outflows from the three lakes. Consequently, no changes in storage of the lakes were considered as part of this trade-off study. Comparisons have been made between the fresh water extraction and net annual inflows to the lake.

Pipeline routes were developed using Google Earth, and where possible, the routes followed existing logging road alignments to minimize site disturbances and to minimize road building costs. The study considered a design water velocity range of between 1 and 3 m/s for the pipelines. Two pipeline materials, steel and HDPE, were considered in the assessment of water conveyance systems for the options because each provides unique advantages and disadvantages to cost, performance, and ease of construction. Ductile Iron was excluded due to the additional cost for trenching and burial of the pipe.

A passive intake screen was selected for use at the intake point as it admits water at a low, uniform velocity. The screen will be placed away from the shoreline to minimize disturbance to shore life. The screen type was selected based on the following:

- Reliable water delivery
- Simple intake and pumping station design
- Low maintenance cost
- Very low slot velocity and uniform flow
- Environmentally fish friendly, and
- Bio fouling resistant screen material.

Environmental considerations and constraints were not included in this trade-off study other than the size of the lake and annual inflow as it relates to potential fisheries impacts.

The lake volume was estimated for each lake using the government published bathymetry surveys. The lake bathymetry data and volume data is summarized in Tables 1 to 3 and the filling curves for each lake are shown in Figures 1 to 3. A summary of the lake capacity, surface area, estimated annual inflow, and fresh water demand as a percentage of net annual inflow to each lake is provided in the table below:

Lake	Capacity ($M m^3$)	Surface Area (km^2)	Estimated Annual Inflow ($M m^3$)	Percentage of Net Annual Inflow (%)
Tatelkuz Lake	172	9	79	8
Kuyakuz Lake	60	8	23	25
Top Lake	14	2	7	80

A smaller water extraction case was considered for Top Lake due to its lower supply capacity and smaller watershed. A design fresh water demand of 200,000 m^3 per month for 6 months (1.2 Mm^3 total demand) was considered reasonable for the Top Lake watershed, assuming the balance of 800,000 m^3 per month could be obtained from alternative sources, such as Tatelkuz Lake or Kuyakuz Lake. This reduced withdrawal rate into Top Lake would decrease the percentage of net annual inflow from 80% to 16%.

The distance from potential lake intake sites to the discharge location at the TSF ranged from approximately 11 to 17 km. The design flow rate was 385 litres/sec (1,000,000 m^3/month). A total of six pipeline options were considered. These options included a pipeline route from each lake intake site to the TSF and consideration of two material types per pipeline (HDPE or Steel). The pipeline lengths developed along the Tatelkuz and Kuyakuz Lake routes were 15.7 km and 17.0 km respectively. Pipeline sizing required a 30 inch diameter HDPE pipe or an 18 inch diameter steel pipe. The pipeline for the Top Lake system included a 10.7 km length of 16 inch diameter HDPE pipe or a 10 inch diameter steel pipe for the smaller extraction rate of 77 litres/sec (200,000 m^3/month). The pumping head requirements for each water supply option are summarized below:

Lake	Elevation (m)		
	Lake level Intake	TSF Discharge	Difference
Tatelkuz Lake	929	1345	+416
Kuyakuz Lake	1077	1345	+268
Top Lake	1095	1345	+250

Pump stations were added along the pipeline route to maintain pipe design pressures. The HDPE pipe was maintained below 200 psi using a pipe with a DR rating of 9. The steel pipe design assumed standard weight carbon steel pipe with a wall thickness of 0.25 inches and maintained pipe design pressures below 458 psi.

WATER SUPPLY OPTIONS

The advantages and disadvantages of each option are summarized in Table 4. Top Lake is relatively close to the mine site and the pipeline can generally follow existing road alignments, but its small storage capacity and watershed area will not be able to satisfy the entire projected demand without a significant reduction in lake discharge and the associated potential environmental effects. Kuyakuz Lake is a medium-sized watershed with a relatively large capacity and the pipeline is able to follow existing historic logging road alignments. However, the lake is not close to the mine site and there is variable gradient between the lake and mine site, which complicates the pipeline and pumping design and operation. Tatelkuz Lake has a large watershed area and capacity, a smooth gradient to the mine site, and pipelines would be able to follow existing road alignments. The distance from the lake to the mine site and the relatively large change in elevation (when compared to Top and Kuyakuz Lake) are the principle disadvantages of this option, which result in increased pipeline distances and higher pumping power requirements.

The proposed pipeline routes for each lake site are shown on Figure 4. The Top Lake pipeline flows into the northwest corner of the Tailings Storage Facility (TSF). The pipelines for the Tatelkuz and Kuyakuz Lake options flow into the southeast corner of the TSF. Simplified profiles along the proposed pipelines for each lake option along with estimated pump station locations are shown on Figures 5 to 7. Steel pipelines require fewer pump stations, but the pump stations required higher horsepower pumps. HDPE pipelines required more pump stations in series with lower pump horsepower requirements.

PRELIMINARY COST COMPARISON

Preliminary capital and operating cost estimates were developed with approximately ±50% accuracy for each water supply alternative to facilitate a comparative evaluation of the cost areas for the six alternatives. Cost estimates were prepared for the following items:

- Pipeline
- Logging for new ROW
- Pioneer Road
- Powerline
- Pumpstations
- Power Cost, and
- Allowance for Pipeline and Pumpstation Maintenance Cost (5% of pipeline and pumpstation CAPEX).

The Tatelkuz and Kuyakuz Lake water supply system capital cost estimates are summarized in Table 6 and the Top Lake capital cost estimate is summarized in Table 7. The capital cost for each configuration is summarized as follows:

Location	30 inch dia HDPE Pipeline	18 inch dia Steel Pipeline
Tatelkuz Lake	$ 24.9 M	$19.0 M
Kuyakuyz Lake	$ 24.3 M	$20.1 M

The smaller capacity Top Lake water supply system provides only one-fifth the projected water supply at an estimated cost of $11.6 M for the 16 inch diameter HDPE pipeline configuration and $7.5 M for the 10 inch diameter steel pipe system.

Percentage allowances for mobilization/demobilization, indirects, and contingency were applied as follows:

- Construction mobilization/demobilization – 4%
- Indirects and EPCM – 20%, and
- Contingency – 30%.

The Tatelkuz Lake and Kuyakuz Lake water supply systems cost an additional $13.1M to $13.5M for the HDPE configurations and $10M to $11M for the steel pipe configurations using the above percentage allowances for mobilization/demobilization, indirects, EPCM and contingency. The Top Lake water supply system costs an additional $6M for the HDPE Pipeline alternative and $4M for the steel pipe alternative when the percentage allowances for mobilization/demobilization, indirects, EPCM and contingency are factored into the costs.

The operating costs for the water supply systems were developed based on the following assumptions:

- Pump System Efficiency = 70%
- Electricity Cost = $ 40/MWh
- Pump operating cost based on 24 hours per day operation for 180 days per year, and
- Pipe and pumping maintenance costs were based on an allowance of 5% of the capital cost of the system, which included supply and installation of pipe, the lake intake structure and pump station.

Lake Water Supply Location	Power Cost (per year)	Maintenance Cost (per year)	Total OPEX (per year)
Tatelkuz			
30 inch dia. HDPE pipeline	$0.45M	$1.20M	$1.65M
18 inch dia. Steel pipeline	$0.55M	$0.85M	$1.40M
Kuyakuz			
30 inch dia. HDPE pipeline	$0.33M	$1.10M	$1.43M
18 inch dia. Steel pipeline	$0.43M	$0.90M	$1.33M

Operating costs for the smaller Top Lake pipeline system (one-fifth capacity) were estimated as follows:

Lake Water Supply Location	Power Cost (per year)	Maintenance Cost (per year)	Total OPEX (per year)
Top Lake			
16 inch dia. HDPE pipeline	$0.05M	$0.5M	$0.55M
10 inch dia. Steel pipeline	$0.07M	$0.3M	$0.37M

The cost estimate indicates that steel pipe is the preferred material for each alternative. Steel pipe requires less pump high horsepower stations. The Tatelkuz Lake and Kuyakuz Lake water supply alternatives were found to have similar costs. Top Lake provides only one-fifth the design capacity at slightly less than half the cost and requires a second system that would be four-fifths the size of the current designed Tatelkuz and Kuyakuz water supply systems.

CONCLUSIONS AND RECOMMENDATIONS

Several alternatives have been evaluated for the fresh water supply at the Blackwater project; Top Lake, Tatelkuz Lake and Kuyakuz Lake. Tatelkuz Lake was determined to be the most practical fresh water supply option. While the pipeline system would have the largest head loss due to both friction and elevation, it presents the easiest route for construction. It would also have the lowest environmental impact and risk from a water supply standpoint. Lake area and volume data indicate that the removal of 1 Mm^3 per month during open water would have a negligible effect on lake levels. There is approximately 50 Mm^3 in the top 6 meters of the lake, indicating that water withdrawals would result in potentially 12 cm of total loss in lake level. This drawdown estimate is conservative as it assumes that there are no natural inflows to Tatelkuz Lake during the period of withdrawal, which is not the case. Water withdrawal could be restricted to higher inflow periods for the lake in order to reduce lake level fluctuations.

We trust that the above information meets your present needs. If you have any questions or comments please contact the undersigned.

Yours truly,
KNIGHT PIESOLD LTD.

Signed:
Brendan Worrall, E.I.T.
Staff Engineer

Reviewed:
Daniel Fontaine, P. Eng.
Project Engineer

Reviewed:
Bruno Borntraeger, P.Eng.
Specialist Engineer

Approved:
Ken Brouwer, P.Eng.
Managing Director

Attachments:

Table 1 Rev 1	Water Requirements – Summary of Inflows to Tatelkuz Lake
Table 2 Rev 0	Water Requirements – Summary of Inflows to Kuyakuz Lake
Table 3 Rev 1	Water Requirements – Summary of Inflows to Top Lake
Table 4 Rev 1	Fresh Water Supply Options – Advantages and Disadvantages
Table 5 Rev 0	Tatelkuz and Kuyakuz Lake Water Supply Capital Cost Estimate
Table 6 Rev 0	Top Lake Water Supply Capital Cost Estimate
Figure 1 Rev 1	Tatelkuz Lake Filling Curve
Figure 2 Rev 1	Kuyakuz Lake Filling Curve
Figure 3 Rev 1	Top Lake Filling Curve
Figure 4 Rev 0	Proposed Pipelines
Figure 5 Rev 1	Tatelkuz Lake Pipeline Elevation Profile
Figure 6 Rev 1	Kuyakuz Lake Pipeline Elevation Profile
Figure 7 Rev 1	Top Lake Pipeline Elevation Profile

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TABLE 1

NEW GOLD INC
BLACKWATER GOLD PROJECT

WATER REQUIREMENTS
SUMMARY OF INFLOWS TO TATELKUZ LAKE

Print Aug/02/12 16:29:59

Month	Net Precip and Runoff Reporting to Lake m^3	Makeup Water Requirement m^3	Balance Reporting to Lake m^3	Reduction to Lake Inflow %	Cumulative Balance Reporting to Lake m^3
January	623,544	0	623,544	0%	623,544
February	353,341	0	353,341	0%	976,885
March	488,528	0	488,528	0%	1,465,413
April	13,988,390	1,000,000	12,988,390	7%	14,453,803
May	22,712,730	1,000,000	21,712,730	4%	36,166,533
June	15,434,137	1,000,000	14,434,137	6%	50,600,670
July	8,269,720	1,000,000	7,269,720	12%	57,870,389
August	6,793,916	1,000,000	5,793,916	15%	63,664,305
September	6,011,910	1,000,000	5,011,910	17%	68,676,215
October	3,163,396	0	3,163,396	0%	71,839,611
November	850,984	0	850,984	0%	72,690,595
December	762,712	0	762,712	0%	73,453,307

LAKE AREA AND VOLUME

Elevation (m)	Area m^2	Volume m^3	Cumulative Volume m^3	Comments
916	0	0	0	Lowest elevation listed in Bathymetry
921	3,949,589	9,873,974	9,873,974	
927	5,868,886	29,455,427	39,329,401	
933	7,001,965	38,612,555	77,941,955	
939	7,741,935	44,231,702	122,173,657	
945	9,050,757	50,378,077	172,551,734	Lake surface (from Bathymetry)

M:\1\01\00457\04\A\Correspondence\VA12-00758 - Fresh Water Trade-Off Study\Rev B\Attachments\[Tables 1-4 and Figures 1-3 - rB.xlsx]TABLE 1 - TATELKUZ

NOTE:

1. CHANGE IN LAKE STORAGE WAS NOT CONSIDERED AS NO DATA CURRENTLY EXISTS ON RELATIONSHIP BETWEEN INFLOW, STORAGE, AND OUTFLOW RATE.

REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D
1	25MAY12	ISSUED WITH LETTER VA12-00758	BW	DDF	KJB

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TABLE 2

NEW GOLD INC
BLACKWATER GOLD PROJECT

WATER REQUIREMENTS
SUMMARY OF INFLOWS TO KUYAKUZ LAKE

Print Aug/02/12 16:29:59

Month	Net Precip and Runoff Reporting to Lake m^3	Makeup Water Requirement m^3	Balance Reporting to Lake m^3	Reduction to Lake Inflow %	Cumulative Balance Reporting to Lake m^3
January	503,565	0	503,565	0%	503,565
February	285,354	0	285,354	0%	788,919
March	306,551	0	306,551	0%	1,095,470
April	3,987,382	1,000,000	2,987,382	25%	4,082,851
May	6,221,561	1,000,000	5,221,561	16%	9,304,412
June	4,187,061	1,000,000	3,187,061	24%	12,491,473
July	2,112,944	1,000,000	1,112,944	47%	13,604,417
August	1,701,544	1,000,000	701,544	59%	14,305,961
September	1,653,917	1,000,000	653,917	60%	14,959,878
October	1,079,685	0	1,079,685	0%	16,039,563
November	533,993	0	533,993	0%	16,573,555
December	569,839	0	569,839	0%	17,143,394

LAKE AREA AND VOLUME

Elevation (m)	Area m^2	Volume m^3	Cumulative Volume m^3	Comments
1,076	0	0	0	Lowest elevation listed in Bathymetry
1,078	1,450,000	1,450,000	1,450,000	
1,081	3,612,500	7,593,750	9,043,750	
1,084	5,143,750	13,134,375	22,178,125	
1,087	6,043,750	16,781,250	38,959,375	
1,090	8,018,750	21,093,750	60,053,125	Lake surface (from Bathymetry)

M:\1\01\00457\04\A\Correspondence\VA12-00758 - Fresh Water Trade-Off Study\Rev B\Attachments\[Tables 1-4 and Figures 1-3 - rB.xlsx]TABLE 2 - KUYAKUZ

NOTE:

1. CHANGE IN LAKE STORAGE WAS NOT CONSIDERED AS NO DATA CURRENTLY EXISTS ON RELATIONSHIP BETWEEN INFLOW, STORAGE, AND OUTFLOW RATE.

REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D
0	20APR12	ISSUED WITH LETTER VA12-00758	BW	CMB	KJB

Knight Piésold CONSULTING

TABLE 3

NEW GOLD INC
BLACKWATER GOLD PROJECT

WATER REQUIREMENTS
SUMMARY OF INFLOWS TO TOP LAKE

Print Aug/02/12 16:29:59

Month	Net Precip and Runoff Reporting to Lake m^3	Makeup Water Requirement m^3	Balance Reporting to Lake m^3	Reduction to Lake Inflow %	Cumulative Balance Reporting to Lake m^3
January	91,324	0	91,324	0%	91,324
February	51,750	0	51,750	0%	143,074
March	62,307	0	62,307	0%	205,381
April	1,280,813	200,000	1,080,813	16%	1,286,194
May	2,053,089	200,000	1,853,089	10%	3,139,283
June	1,390,872	200,000	1,190,872	14%	4,330,155
July	731,528	200,000	531,528	27%	4,861,682
August	597,374	200,000	397,374	33%	5,259,056
September	544,186	200,000	344,186	37%	5,603,242
October	308,345	0	308,345	0%	5,911,587
November	108,534	0	108,534	0%	6,020,122
December	106,861	0	106,861	0%	6,126,983

LAKE AREA AND VOLUME

Elevation (m)	Area m^2	Volume m^3	Cumulative Volume m^3	Comments
1063	0	0	0	Lowest elevation listed in Bathymetry
1064	126,431	63,215	63,215	
1067	348,387	712,227	775,442	
1070	580,645	1,393,548	2,168,990	
1073	837,253	2,126,847	4,295,837	
1076	1,071,384	2,862,955	7,158,792	
1079	1,185,640	3,385,535	10,544,328	
1082	1,400,104	3,878,616	14,422,943	Lake surface (from Bathymetry)
1100	1,732,164	28,190,410	42,613,353	

M:\1\01\00457\04\A\Correspondence\VA12-00758 - Fresh Water Trade-Off Study\Rev B\Attachments\[Tables 1-4 and Figures 1-3 - rB.xlsx]TABLE 3 - TOP LAKE

NOTES:

1. CHANGE IN LAKE STORAGE WAS NOT CONSIDERED AS NO DATA CURRENTLY EXISTS ON RELATIONSHIP BETWEEN INFLOW, STORAGE, AND OUTFLOW RATE.
2. AS CAPACITY AND CATCHMENT AREA ARE SMALL, A SMALLER WATER REQUIREMENT WAS ANALYZED

REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D
1	25MAY2012	ISSUED WITH LETTER VA12-00758	BW	DDF	KJB

Knight Piésold CONSULTING

TABLE 4

NEW GOLD INC
BLACKWATER GOLD PROJECT

FRESH WATER SUPPLY OPTIONS
ADVANTAGES AND DISADVANTAGES

Print Aug/02/12 16:29:59

	Advantages	Disadvantages
Top Lake	-Distance to Mine -Pipeline can follow a portion of existing roads	-Smaller Watershed -Smaller Storage Capacity and an embankment may be required to increase storage -Does not satisfy water demand by itself
Tatelkuz Lake	-Large Watershed -Large Storage Capacity -Pipeline can follow existing roads -No embankment needed -Smooth Gradient	-Distance to Mine -Change in Elevation
Kuyakuz Lake	-Medium Watershed -Medium Storage Capacity -Pipeline can follow existing roads -No embankment needed	-Distance to Mine -Varied Gradient

M:\1\01\00457\04\A\Correspondence\VA12-00758 - Fresh Water Trade-Off Study\Rev B\Attachments\[Tables 1-4 and Figures 1-3 - rB.xlsx]TABLE 4 - Pros and Cons

REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D
1	25MAY'12	ISSUED WITH LETTER VA12-00758	BW	DDF	KJB

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TABLE 5

NEW GOLD INC
BLACKWATER GOLD PROJECT

TATELKUZ AND KUYAKUZ LAKE WATER SUPPLY CAPITAL COST ESTIMATE

Print Aug/02/12 16:31:57

Item	Units	Unit Cost	Tatelkuz Lake		Kuyakuz Lake	
			Quantity	Cost	Quantity	Cost
Supply and Install 30" dia DR9 HDPE Pipe	m	$900	15,700	$14,130,000	17,000	$15,300,000
Logging	ha	$2,050	2.4	$5,000	2.2	$5,000
Pioneer Road	km	$100,000	2.4	$238,000	3.4	$340,000
Power Lines	km	$100,000	15.7	$1,570,000	17.0	$1,700,000
Lake Intake Structure	LS	$1,000,000	1	$1,000,000	1	$1,000,000
Pump Station	LS	$2,000,000	4	$8,000,000	3	$6,000,000
	Sub Total			**$24,943,000**		**$24,345,000**

Item	Units	Unit Cost	Tatelkuz Lake		Kuyakuz Lake	
			Quantity	Cost	Quantity	Cost
Supply and Install 18" dia Std Carbon Steel Pipe	m	$650	15,700	$10,205,000	17,000	$11,050,000
Logging	ha	$2,050	2.4	$5,000	2.2	$5,000
Pioneer Road	km	$100,000	2.4	$238,000	3.4	$340,000
Power Lines	km	$100,000	15.7	$1,570,000	17.0	$1,700,000
Lake Intake Structure	LS	$1,000,000	1	$1,000,000	1	$1,000,000
Pump Station	LS	$3,000,000	2	$6,000,000	2	$6,000,000
	Sub Total			**$19,018,000**		**$20,095,000**

M:\1\01\00457\04\A\Correspondence\VA12-00758 - Fresh Water Trade-Off Study\Rev B\Attachments\[Tables 5-6 and Figures 4-7 - rB.xlsx]TABLE 5 - Cost

NOTES:

1. LOGGING ASSUMED A 10m WIDE Xsec FOR EVERY 1m OF UNBUILT ROAD
2. PIONEERING ROAD IS ASSUMED TO ONLY BE DONE WHERE AN EXISTING ROAD HAS NOT BEEN BUILT
3. UNIT COST OF PUMP STATIONS IS BASED OF REQUIRED HORSEPOWER PER STATION
4. UNIT COST OF PIPES BASED ON ESTIMATED COST PER POUND OF MATERIAL AND CONVERTED INTO A COST PER LENGTH

REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D
0	20APR12	ISSUED WITH LETTER VA12-00758	BW	HPD	KJB

Knight Piésold CONSULTING

TABLE 6

NEW GOLD INC
BLACKWATER GOLD PROJECT

TOP LAKE WATER SUPPLY CAPITAL COST ESTIMATE

Print Aug/02/12 16:31:57

Item	Units	Unit Cost	Top Lake	
			Quantity	Cost
Supply and Install 16" dia DR9 HDPE Pipe	m	$450	10700	$4,815,000
Logging	ha	$2,050	5.4	$11,000
Pioneer Road	km	$100,000	4.2	$417,000
Power Lines	km	$100,000	10.7	$1,070,000
Lake Intake Structure	LS	$750,000	1	$750,000
Pump Station	LS	$1,500,000	3	$4,500,000
	Sub Total			**$11,563,000**

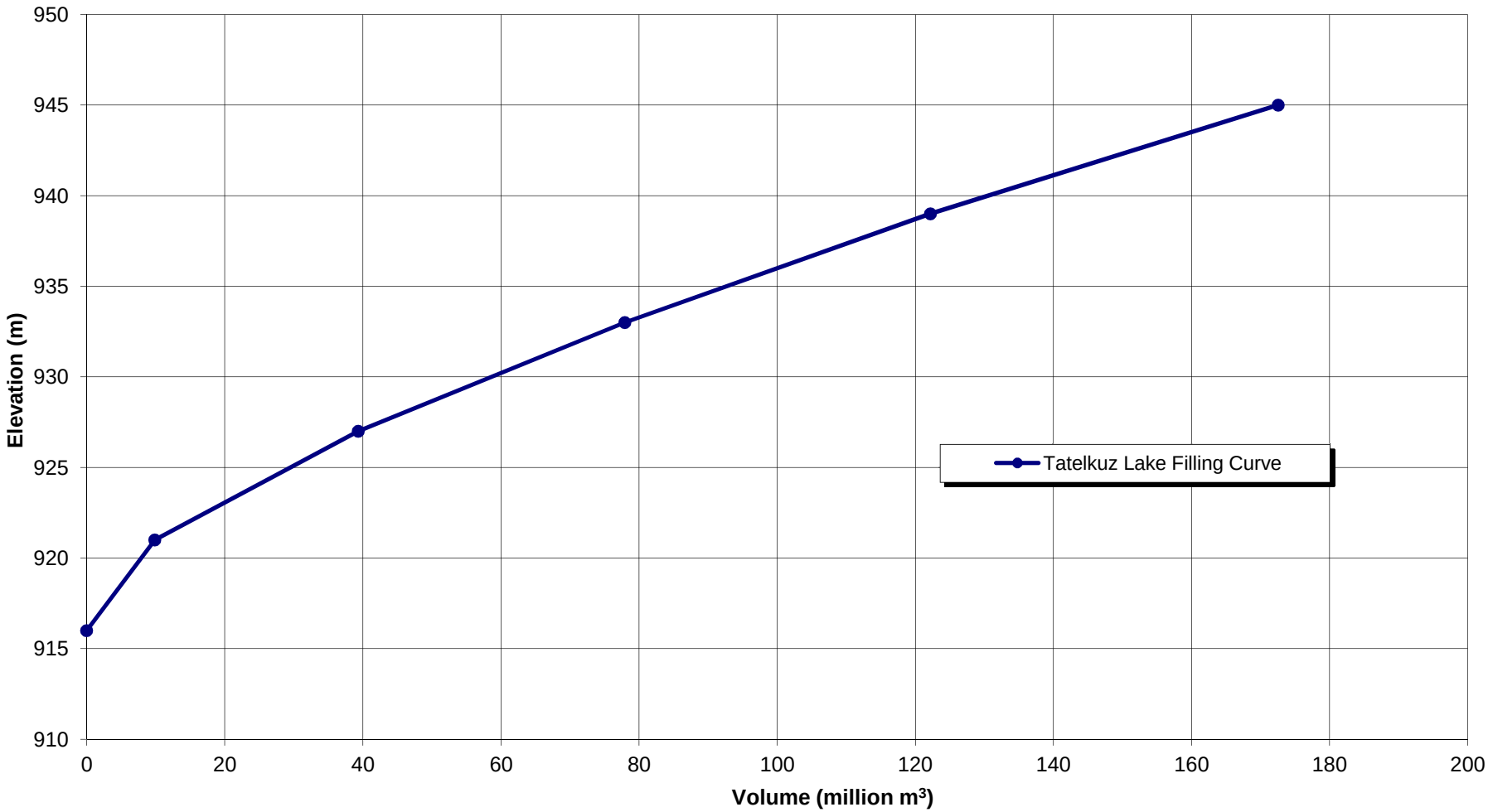
Supply and Install 10" dia STD Carbon Steel Pipe	m	$300	10700	$3,210,000
Logging	ha	$2,050	5.4	$11,000
Pioneer Road	km	$100,000	4.2	$417,000
Power Lines	km	$100,000	10.7	$1,070,000
Lake Intake Structure	LS	$750,000	1	$750,000
Pump Station	LS	$2,000,000	1	$2,000,000
	Sub Total			**$7,458,000**

M:\1\01\00457\04\A\Correspondence\VA12-00758 - Fresh Water Trade-Off Study\Rev B\Attachments\[Tables 5-6 and Figures 4-7 - rB.xlsx]TABLE 6 - Cost

NOTES:

1. LOGGING ASSUMED A 10m WIDE Xsec FOR EVERY 1m OF UNBUILT ROAD
2. PIONEERING ROAD IS ASSUMED TO ONLY BE DONE WHERE AN EXISTING ROAD HAS NOT BEEN BUILT
3. UNIT COST OF PUMP STATIONS IS BASED OF REQUIRED HORSEPOWER PER STATION
4. UNIT COST OF PIPES BASED ON ESTIMATED COST PER POUND OF MATERIAL AND CONVERTED INTO A COST PER LENGTH

REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D
0	20APR12	ISSUED WITH LETTER VA12-00758	BW	HPD	KJB



1	25MAY'12	ISSUED WITH LETTER	BW	DDF	KJB
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

NEW GOLD INC

BLACKWATER GOLD PROJECT

TATELKUZ LAKE FILLING CURVE

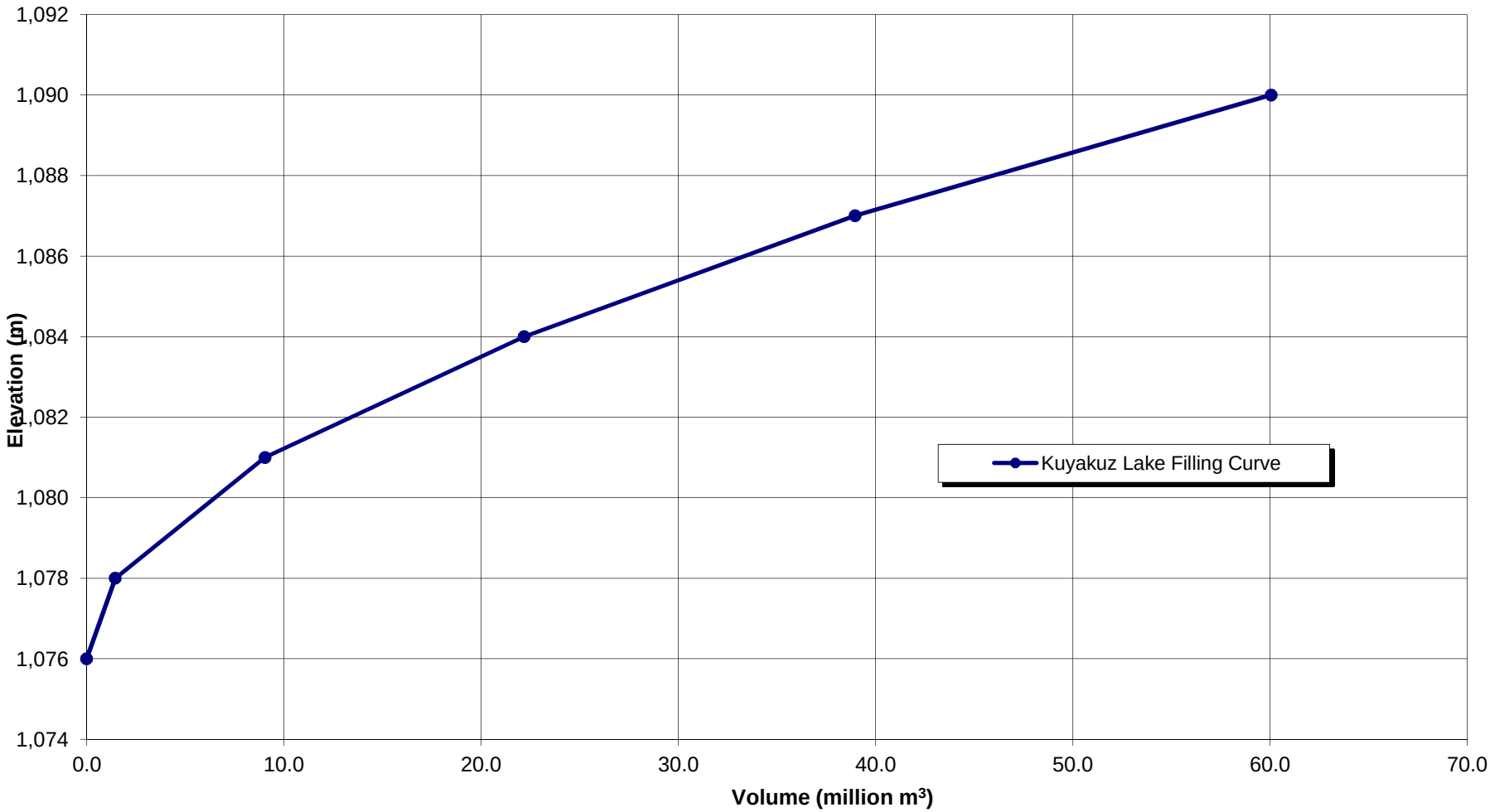
Knight Piésold CONSULTING

P/A NO. VA101-457/4

REF. NO. VA12-00758

FIGURE 1

REV 1



REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D
1	25MAY'12	ISSUED WITH LETTER	BW	DDF	KJB

NEW GOLD INC

BLACKWATER GOLD PROJECT

KUYAKUZ LAKE FILLING CURVE

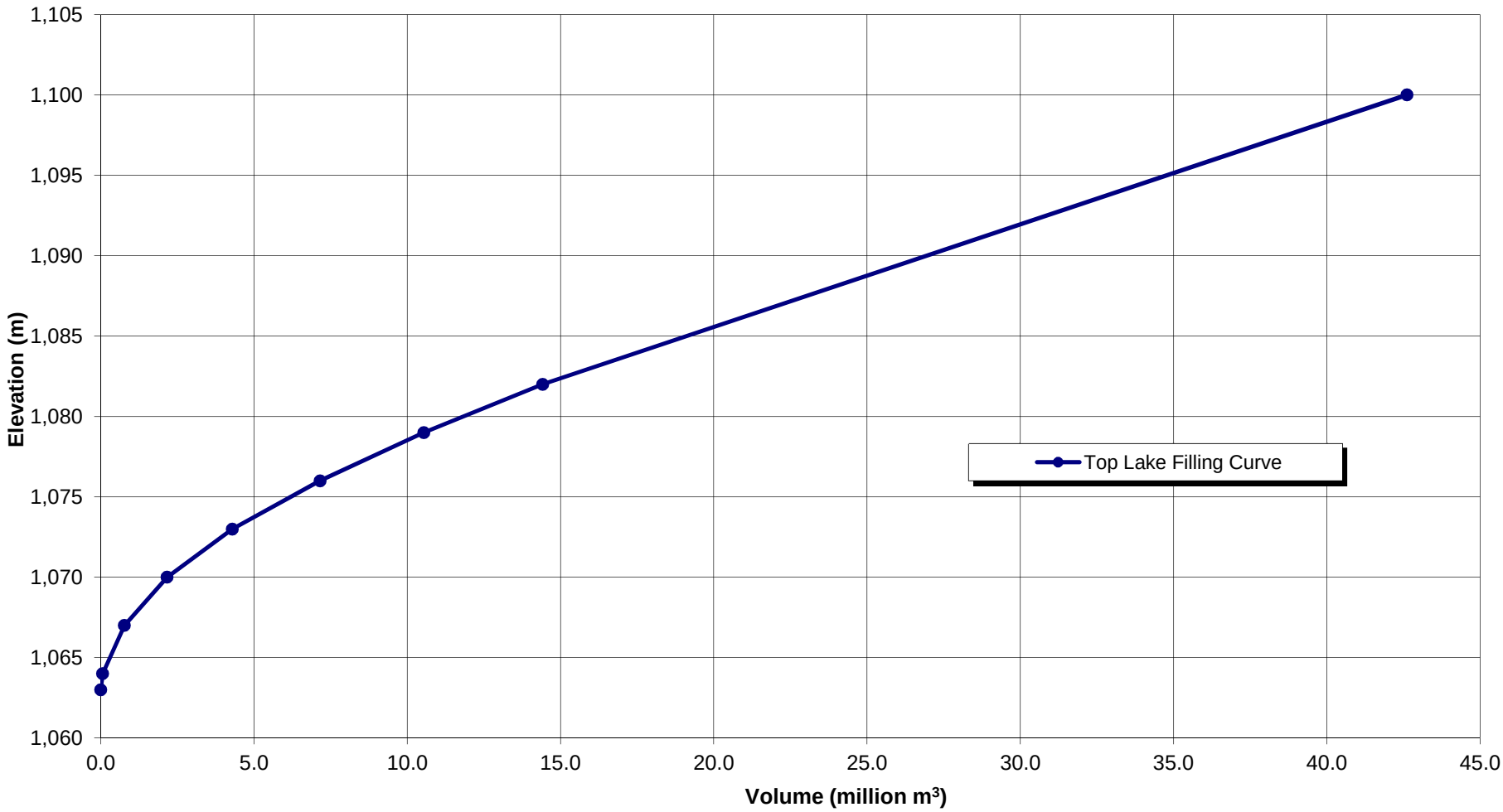
Knight Piésold CONSULTING

P/A NO. VA101-457/4

REF. NO. VA12-00758

FIGURE 2

REV 1



NOTE:
1. UPPER LIMIT OF CURVE DETERMINED BY PLACING AN EMBANKMENT AT 1,100m

REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D
1	25MAY'12	ISSUED WITH LETTER	BW	DDF	KJB

NEW GOLD INC

BLACKWATER GOLD PROJECT

TOP LAKE FILLING CURVE

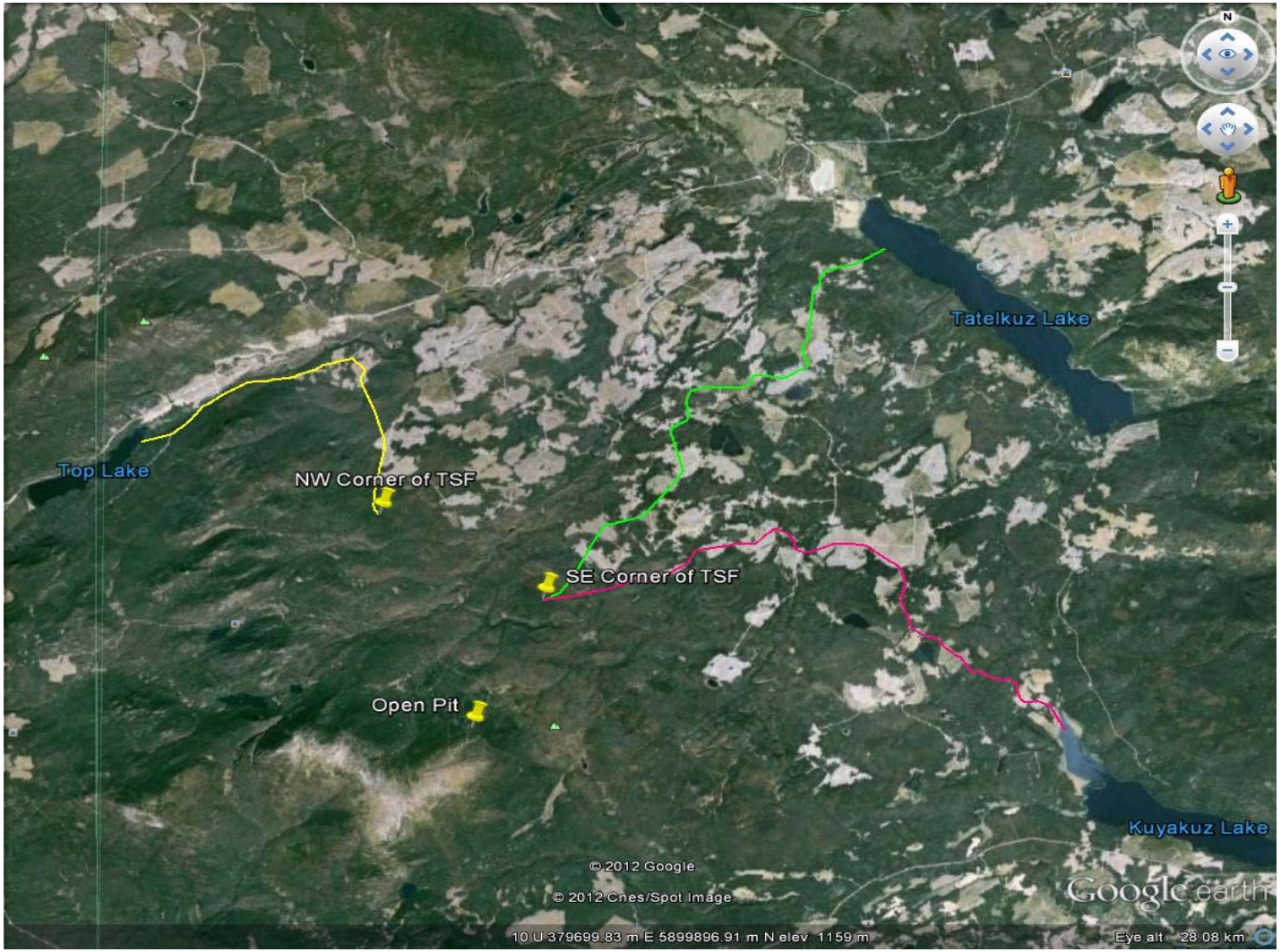
Knight Piésold CONSULTING

P/A NO. VA101-457/4

REF. NO. VA12-00758

FIGURE 3

REV 1



NOTES:
1. TOP LAKE PIPE ENTERING TSF FROM THE NORTHWEST SIDE
2. TATELKUZ AND KUYAKUZ PIPES ENTERING TSF FROM SOUTHEAST SIDE

REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D
0	20APR'12	ISSUED WITH LETTER	BW	HPD	KJB

NEW GOLD INC

BLACKWATER GOLD PROJECT

PROPOSED PIPELINES

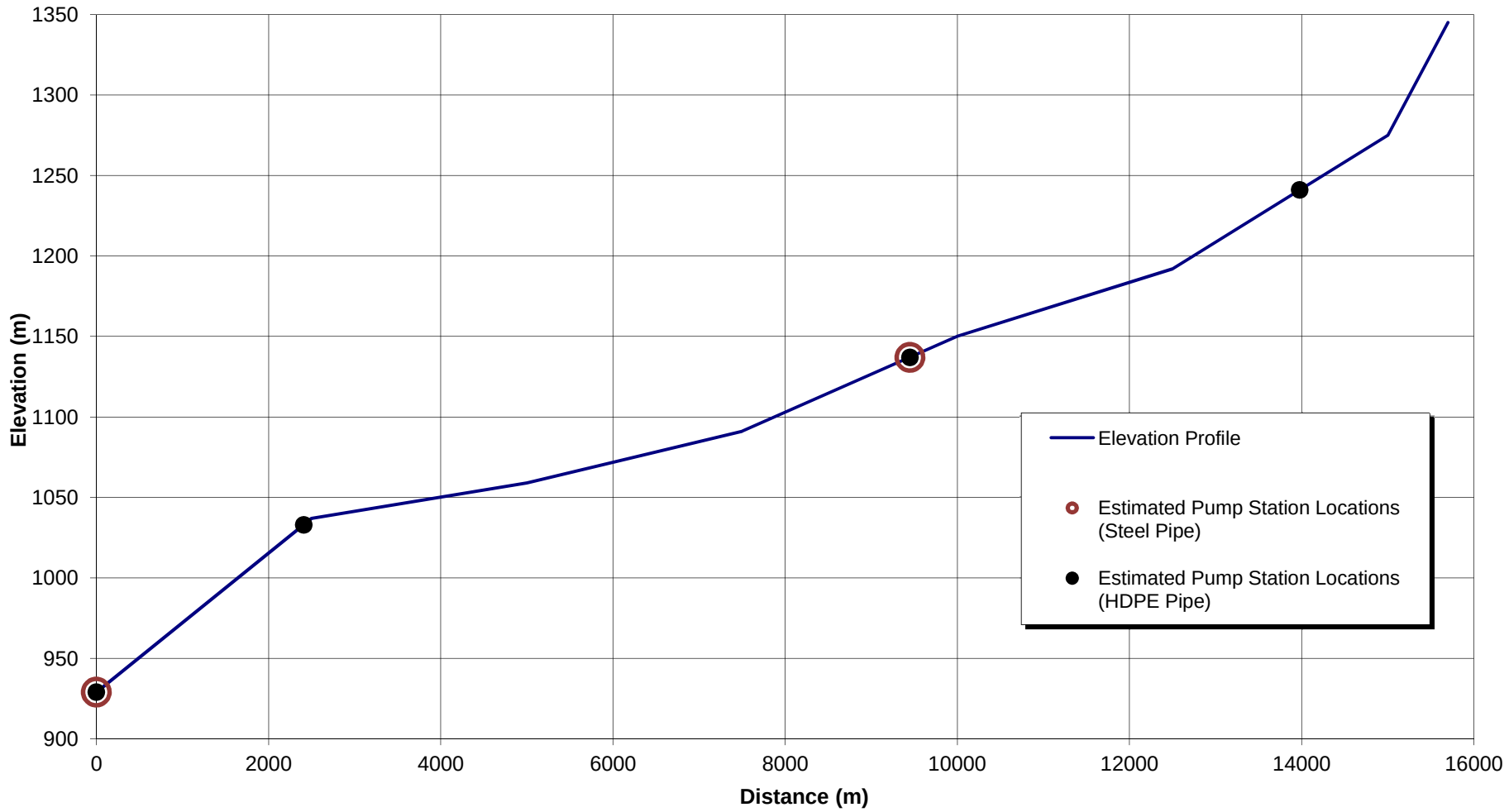
Knight Piésold CONSULTING

P/A NO. VA101-457/4

REF. NO. VA12-00758

FIGURE 4

REV 0



NOTES:
1. ABOVE IS A ROUGH SIMPLIFIED ELEVATION VIEW OF THE PIPELINE
2. ELEVATIONS TAKEN FROM GOOGLE EARTH

NEW GOLD INC

BLACKWATER GOLD PROJECT

TATELKUZ LAKE PIPELINE ELEVATION PROFILE

Knight Piésold CONSULTING

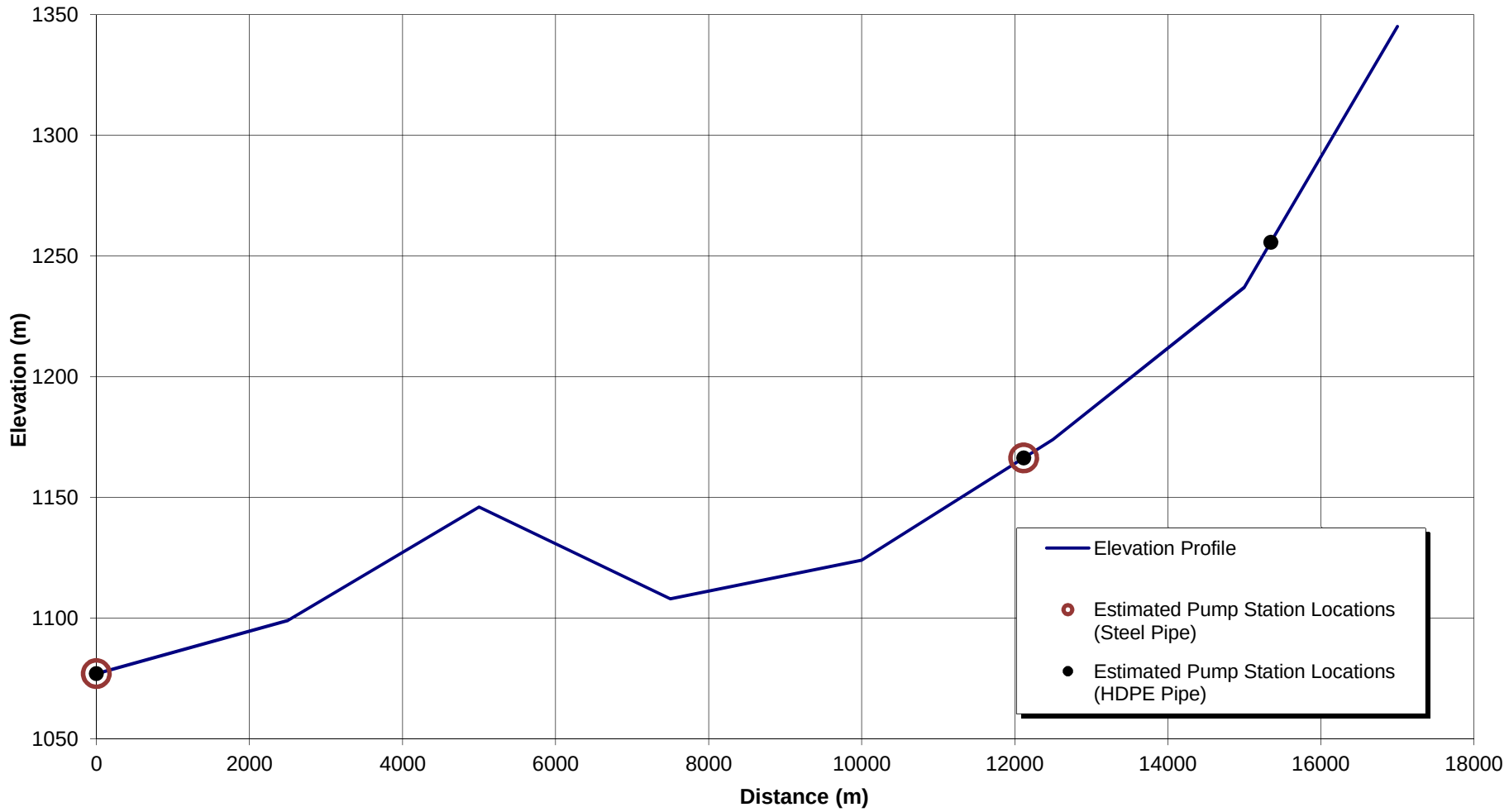
P/A NO. VA101-457/4

REF. NO. VA12-00758

FIGURE 5

REV 1

REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D
1	25MAY'12	ISSUED WITH LETTER	BW	HPD	KJB



NOTES:
1. ABOVE IS A ROUGH SIMPLIFIED ELEVATION VIEW OF THE PIPELINE
2. ELEVATIONS TAKEN FROM GOOGLE EARTH

REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D
1	25MAY'12	ISSUED WITH LETTER	BW	HPD	KJB

NEW GOLD INC

BLACKWATER GOLD PROJECT

KUYAKUZ LAKE PIPELINE ELEVATION PROFILE

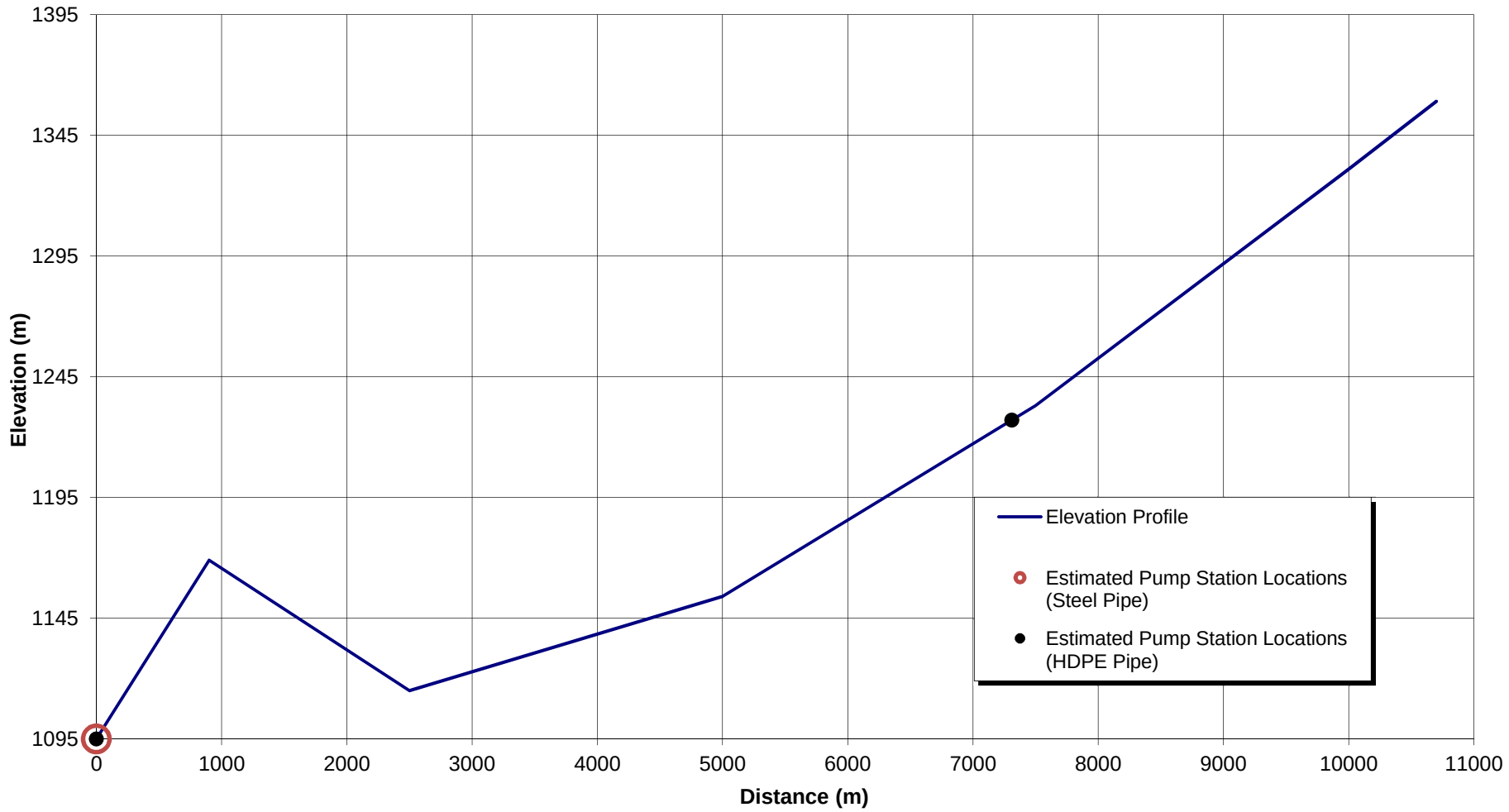
Knight Piésold CONSULTING

P/A NO. VA101-457/4

REF. NO. VA12-00758

FIGURE 6

REV 1



NOTES:
1. ABOVE IS A ROUGH SIMPLIFIED ELEVATION VIEW OF THE PIPELINE
2. ELEVATIONS TAKEN FROM GOOGLE EARTH

REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D
1	25MAY'12	ISSUED WITH LETTER	BW	HPD	KJB

NEW GOLD INC

BLACKWATER GOLD PROJECT

TOP LAKE PIPELINE ELEVATION PROFILE

Knight Piésold CONSULTING

P/A NO. VA101-457/4

REF. NO. VA12-00758

FIGURE 7

REV 1

July 22, 2013

File No.:VA101-457/6-A.01
Cont. No.:VA13-01604

Mr. Ryan Todd
Manager, Environment
New Gold Inc.
Suite 1800, Two Bentall Centre
555 Burrard Street
Vancouver, British Columbia
Canada, V7X 1M9

Dear Ryan,

Re: Revised Baseline Tatelkuz Lake Levels

INTRODUCTION

Knight Piesold LTD. (KPL) has completed an analysis of the lake level changes at Tatelkuz Lake during Baseline conditions in the Project Area and presented it in a KPL letter VA13-01528 issued on July 11, 2013. In that letter, the stage measurements in the lake and the lake bathymetry were presented in two different coordinate systems, where the lake levels were presented in a local coordinate system, while the bathymetry was presented in the absolute coordinate system relative to sea level. In this revised letter, the same information is presented again, but with all the data shown in the same coordinate system equivalent to absolute elevations in meters above sea level (masl).

The estimated lake levels are based on measured lake levels and estimated discharges at the outlet to Chedakuz Creek. The following outlines the methodology and the results of the analysis.

METHODOLGY

Baseline outflows from Tatelkuz Lake are based on a long term synthetic discharge series developed at the hydrology station H5 on Chedakuz Creek (KPL, 101-457/4-1, Rev 1 issued Feb. 2013). The values at H5 were then pro-rated by catchment area to the outlet of the lake. The synthetic discharge series is 40 years long. A short period of stage record also exists for Tatelkuz Lake at Station L1, which was installed by Avison Management Services (AMS) and KPL on October 16, 2012. The station was removed on December 10, 2012 for the winter and then re-installed on May 6, 2013.

An empirical and a theoretical method were used in order to develop a relationship between discharge and lake levels. The empirical method involved relating the discharge estimated at the lake outlet to the measured lake stage at L1. The theoretical method involved using Manning's equation and an assumed channel geometry to relate lake levels to the outlet channel hydraulics and discharge.

Method 1

A stage/discharge relationship was developed using the daily average stage measured at L1 and the daily average discharge estimated at the outlet. The results of this analysis are shown on Figure 1, where the scatter in the measured lake levels is due to lake storage and attenuation effects. The resulting best fit equation is of the form:

$$\boldsymbol{Q = C(Stage - a)^n}$$

Where:
Q is the discharge (m^3/s);
C is a constant describing the channel geometry equal to 5.6;
a is a point of zero flow (PZF) equal to 926.483 m; and
n is an exponent describing the channel roughness equal to 2.19.

Method 2

Manning's equation was used to estimate the flow depth in the outlet channel based on the estimated outlet discharge. The flow depth in the channel was then used to calculate the long term lake levels. Manning's equation is typically presented in the following form:

$$\boldsymbol{Q = \left(\frac{1}{n}\right) A(R_h)^{\frac{2}{3}}(S_0)^{\frac{1}{2}}}$$

Where:
Q is the channel discharge (m^3/s);
n is the Manning's roughness coefficient equivalent to 0.045 for the Chedakuz Creek downstream of the lake outlet;
A is the channel area (m^2);
R_h is the hydraulic radius (m); and
S_o is the channel slope.

The channel geometry was based on a measured cross-section at the lake outlet that was surveyed on October 16, 2012 by Avison Management Services (AMS) and KPL and is shown on Figure 2 and a point of zero flow (PZF) was established to be equivalent to 926.483 masl. The measured cross-section was simplified in our numerical model and represented by a trapezoidal cross-section. A relationship was developed between the discharge at the outlet and the lake stage that was calculated based on the flow depth in the channel downstream of the lake outlet.

The developed relationship using Manning's equation is also shown on Figure 1. As expected, the estimated lake level is somewhat lower for the Manning's equation approach compared to the empirical approach that is based on measured lake levels (Figure 1), where the difference increases with increasing flow. This is due to the fact that no storage or attenuation is considered in this theoretical analysis and the changes in the channel are assumed to occur concurrently with the changes in the lake, which would not be the case.

RESULTS

Both the empirical and the numerical methods resulted in a similar relationship between the lake level and the outlet discharge (as shown on Figure 1). The two methods were used to develop a long term synthetic lake level series based on the 40 year long synthetic discharge series and provided reasonable estimates of the lake level fluctuations (Figure 3). The empirical method, however, is based on measured data and inherently incorporates lake storage and attenuation effects. Consequently, the estimated lake levels are somewhat higher based on this method resulting in larger annual fluctuations, and will be therefore used as a basis for further analysis. For the 40 year period, the estimated average annual lake level fluctuation was determined to be 0.8 m with the maximum fluctuation between the historic minimum and maximum levels of 2.0 m.

Figure 4 presents the long term synthetic stage series as a scatter plot of daily lake levels in order to better illustrate how the average stage relates to both peak and low events. On average, the lake levels are at their lowest elevations between August and April. The highest lake levels are experienced during the freshet period between April and August, with occasional high levels in the summer or fall that are driven by rainfall events.

A frequency duration curve for the lake levels was also developed to better understand the frequency and magnitude of lake elevations as shown on Figure 5. As can be seen, for the majority of the time the changes to the natural lake levels are small. For example, 80% of the time, the lake level elevations are within 0.3 m and they exceed 1.0 m only about 3% of the time.

LAKE BATHYMETRY

A bathymetric survey was performed on Tatelkuz Lake by AMEC on June 9, 2013, at which time the lake level was at elevation 927.6 masl. The results of this survey yielded a Depth Area Capacity (DAC) curve as shown on Figure 6. The survey was undertaken during a period of typically high water surface elevations (Figure 4) that occurs approximately 2% of the time (Figure 5), and for the majority of the time the lake elevation would fluctuate below the water surface observed at the time of the survey. Based on the estimated PZF of 926.483 masl, the water depth at the lake outlet was approximately 1.12 m and the outflow to Chedakuz Creek was about 7.13 m^3/s. The difference between the lake level at the time of the bathymetric survey and the PZF is equivalent to nearly 11 million m^3 of water (5.6% of the total lake volume) and the lake surface area for this is equivalent to 0.24 km^2 (2.6% of the total lake surface area), as shown on Figure 6.

Linear relationships were developed from the DAC curves for the lake surface area and volume based on the lake elevations above 920 masl.

The lake surface area can be calculated using the following equation:

$$\boldsymbol{A = \frac{y - y_0}{m} + A_0 = \frac{y - 920}{5.94} + 7.87}$$

Where:
A is the lake surface area (km^2);
y is the lake elevation (m);
m is the slope of the depth to area relationship equivalent to 5.94;
y_0 is the lake elevation at A_0 equivalent to 920 masl; and
A_0 is the lake surface area at elevation y_0 equivalent to 7.87 km^2.

The lake volume can be calculated using the following equation:

$$\boldsymbol{V = \frac{y - y_0}{m_1} + V_0 = \frac{y - 920}{0.118} + 131.99}$$

Where:
V is the lake volume (million m^3);
y is the lake elevation (m);
m_1 is the slope of the depth to volume relationship equivalent to 0.118;
y_0 is the lake elevation at V_0 equivalent to 920 masl; and
V_0 is the lake volume at elevation y_0 equivalent to 131.99 million m^3.

CONCLUSIONS

A stage/discharge relationship was developed for the Tatelkuz Lake that was based on measured lake elevations and estimated outlet discharges. This relationship was used to develop a long term synthetic stage series for the period January 1973 to May 2013, which represents our estimate of historic lake surface elevations. The results of this analysis indicate that the maximum lake level fluctuation was on the order of 2 m during this period, while on average the lake level fluctuates within 0.8 m annually. The lake levels are the highest during the freshet period from April to August, while they vary within a relatively narrow margin during the rest of the year.

We trust that the information provided in this letter is sufficient for you needs at this time. If you have any questions or comments please contact the undersigned.

Yours truly,
KNIGHT PIESOLD LTD.



Signed:
Brendan Worrall, E.I.T.
Staff Engineer

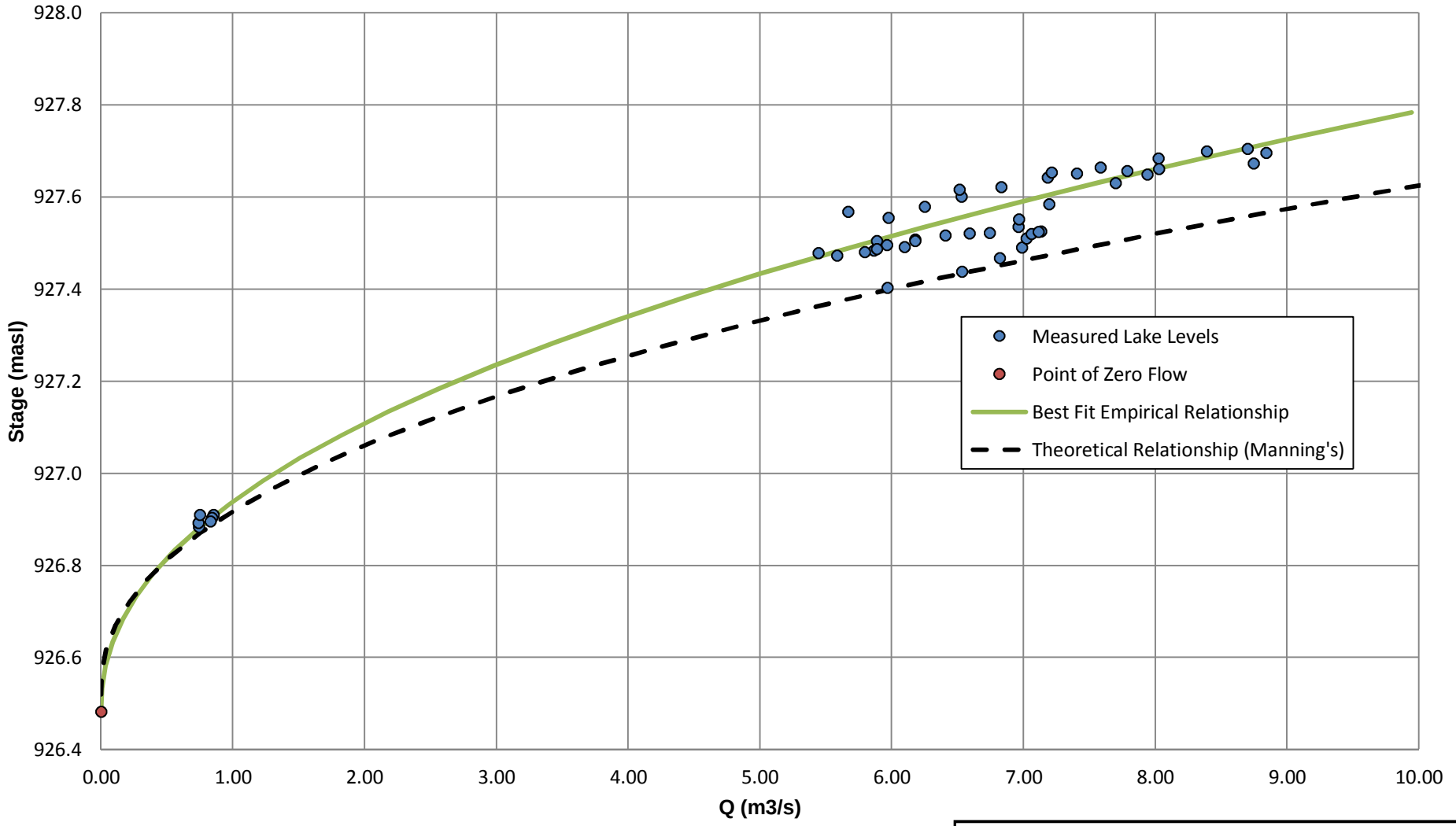
Reviewed:
Violeta Martin, Ph.D., P.Eng.
Senior Hydrotechnical Engineer

Approved:
Ken Brouwer, P.Eng.
President

Attachments:

Figure 1 Rev 0	Tatelkuz Lake Level vs. Discharge Relationship
Figure 2 Rev 0	Tatelkuz Lake Outlet Channel Geometry
Figure 3 Rev 0	Tatelkuz Lake Long Term Synthetic Stage Series
Figure 4 Rev 0	Tatelkuz Lake Synthetic Stage Series Scatter Plot
Figure 5 Rev 0	Tatelkuz Lake Level Frequency Duration Curve
Figure 6 Rev 0	Tatelkuz Lake Depth Area Capacity Curve

/vm



REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D
0	19JUL'13	ISSUED WITH LETTER	BW	VM	SRM

NEW GOLD INC.

BLACKWATER GOLD PROJECT

TATELKUZ LAKE LEVEL VS. DISCHARGE RELATIONSHIP

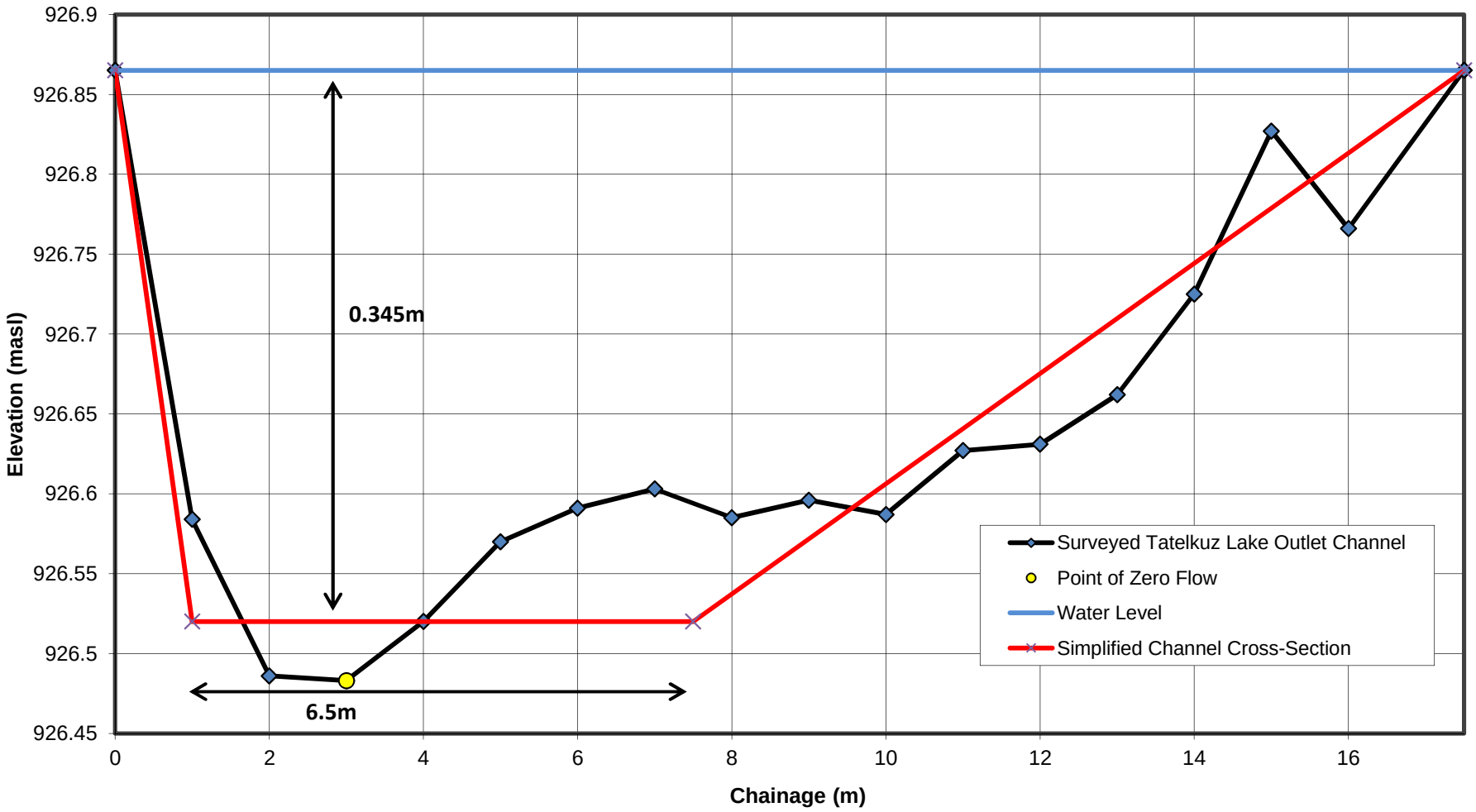
Knight Piésold CONSULTING

P/A NO. VA101-457/6

REF. NO. VA13-01604

FIGURE 1

REV 0



NOTES:
1. CROSS SECTION SURVEYED BY KPL AND AMS ON OCTOBER 16, 2012.

0	19JUL'13	ISSUED WITH LETTER	BW	VM	SRM
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

NEW GOLD LTD.

BLACKWATER GOLD

TATELKUZ LAKE OUTLET CHANNEL GEOMETRY

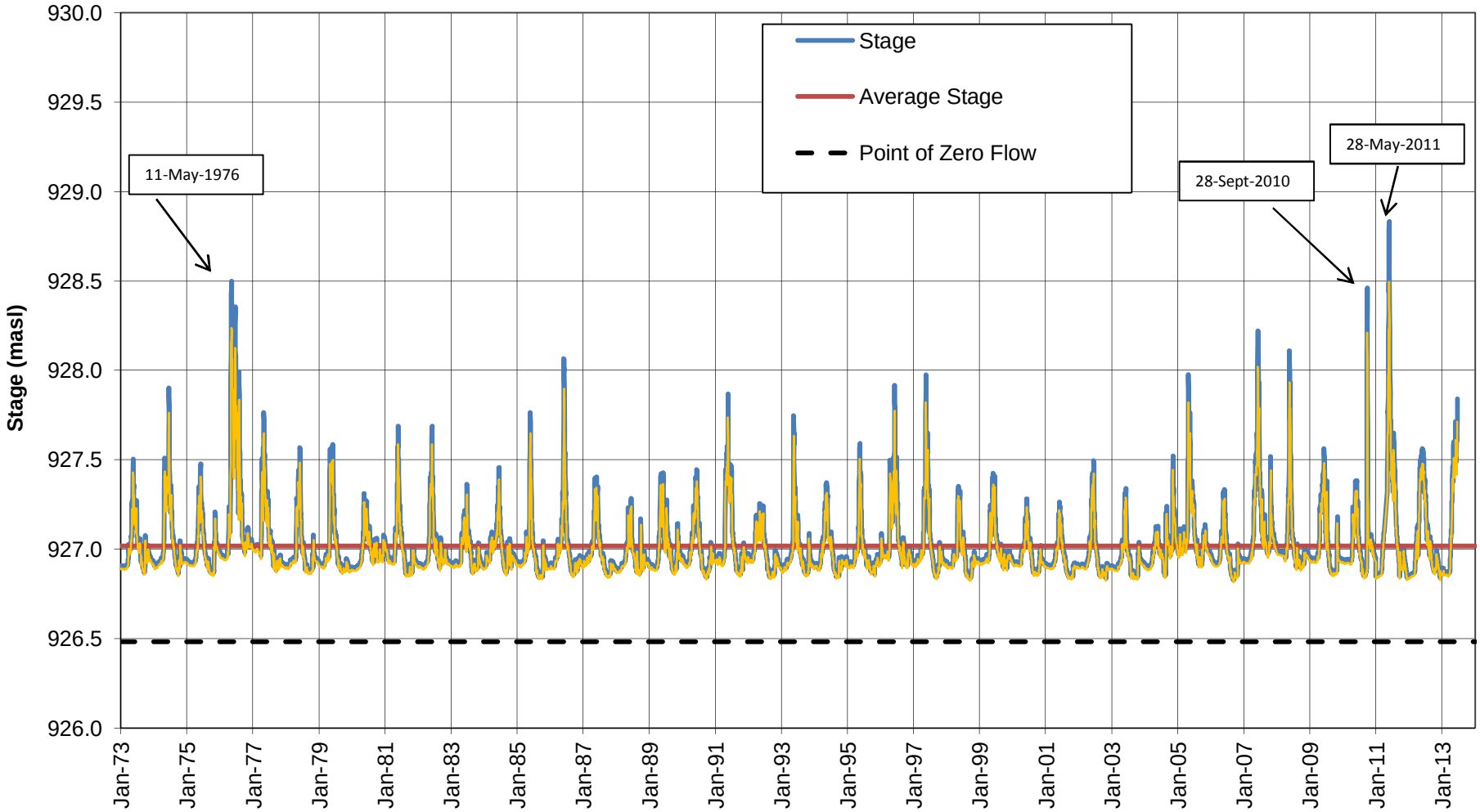
Knight Piésold CONSULTING

P/A NO. VA101-457/6

REF. NO. VA13-01604

FIGURE 2

REV 0



NOTES:

1. LONG TERM SYNTHETIC STAGE SERIES IS BASED ON THE COMBINED LONG TERM SYNTHETIC AND MEASURED DISCHARGE SERIES DEVELOPED FOR THE LAKE OUTLET FOR THE PERIOD JAN 1973 - MAY 2013.
2. AVERAGE STAGE IS THE AVERAGE DAILY STAGE OVER THE ENTIRE PERIOD OF RECORD.

REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D
0	19JUL'13	ISSUED WITH LETTER	BW	VM	SRM

NEW GOLD INC.

BLACKWATER GOLD PROJECT

TATELKUZ LAKE
LONG TERM SYNTHETIC STAGE SERIES

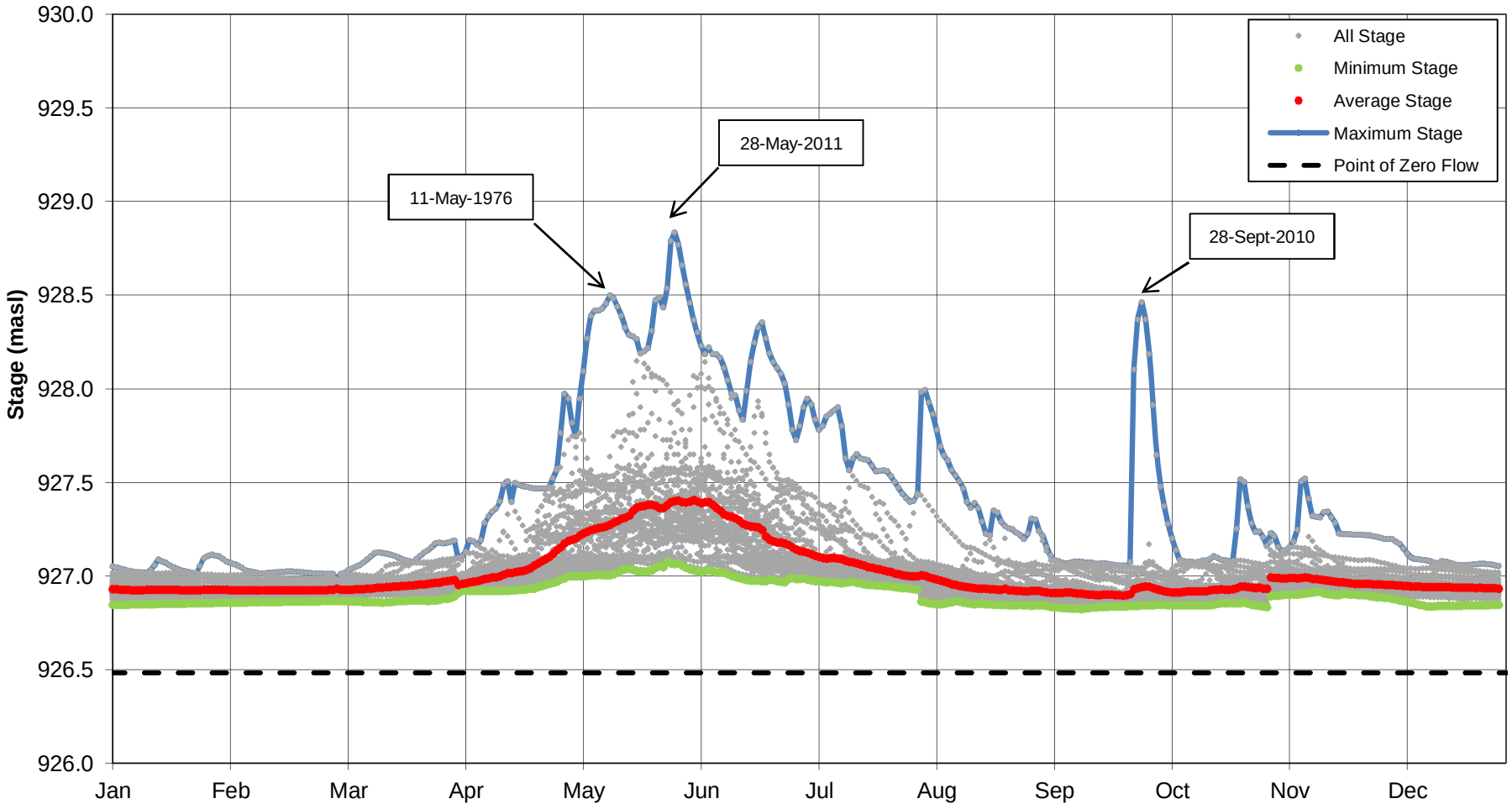
Knight Piésold CONSULTING

P/A NO. VA101-457/6

REF. NO. VA13-01604

FIGURE 3

REV 0



NOTES:

1. SYNTHETIC STAGE SERIES IS BASED ON THE COMBINED MEASURED AND SYNTHETIC DISCHARGE SERIES FOR THE LAKE OUTLET DEVELOPED FOR THE PERIOD JAN 1973 - MAY 2013.

REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D
0	19JUL'13	ISSUED WITH LETTER	BW	VM	SRM

NEW GOLD INC.

BLACKWATER GOLD PROJECT

TATELKUZ LAKE
SYNTHETIC STAGE SERIES SCATTER PLOT

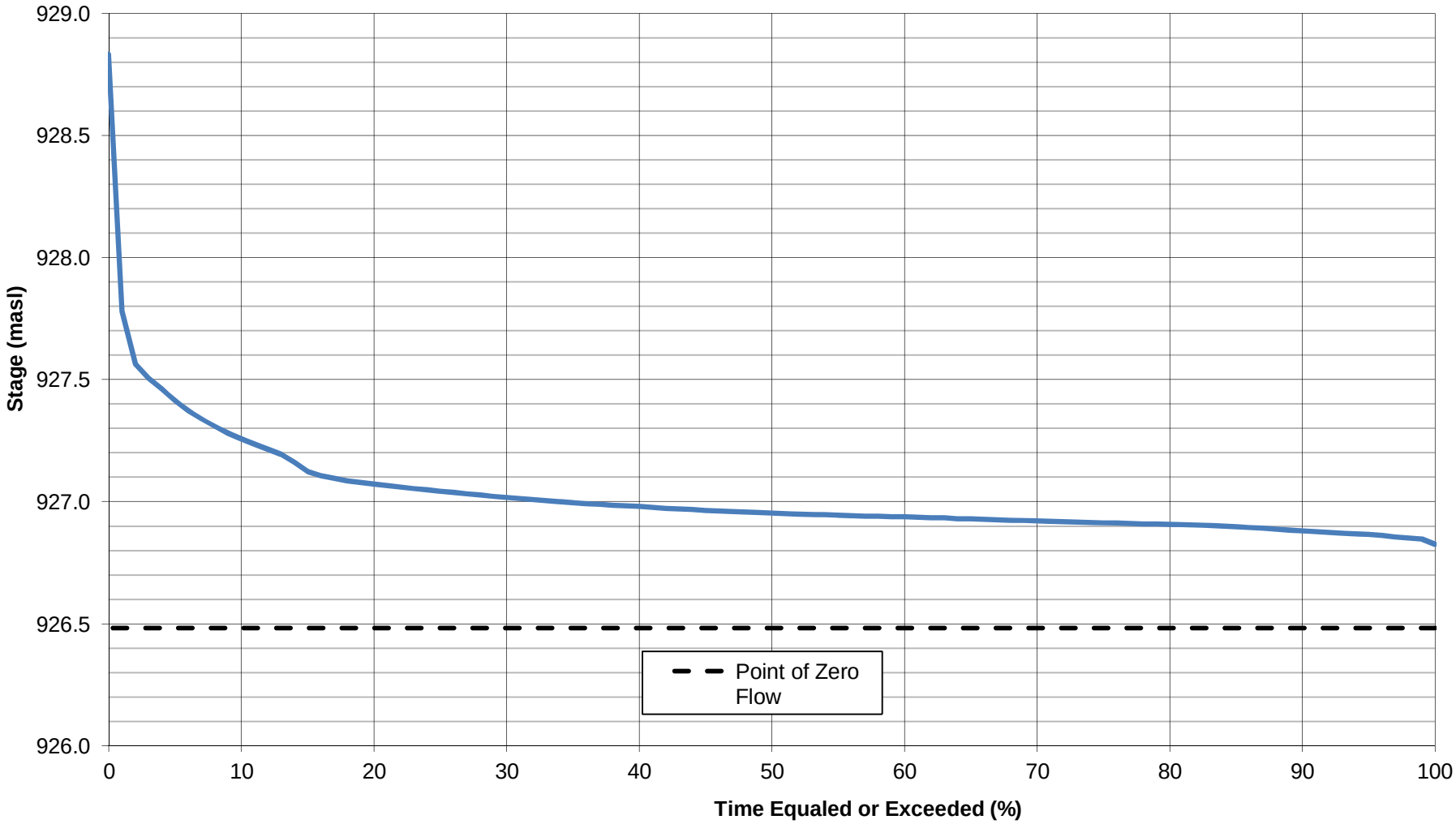
Knight Piésold CONSULTING

P/A NO. VA101-457/6

REF. NO. VA13-01604

FIGURE 4

REV 0



NOTES:

1. FREQUENCY DURATION CURVE IS BASED ON THE LONG TERM SYNTHETIC STAGE SERIES DEVELOPED FROM JAN 1973 - MAY 2013.

REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D
0	19JUL'13	ISSUED WITH LETTER	BW	VM	SRM

NEW GOLD INC.

BLACKWATER GOLD PROJECT

TATELKUZ LAKE LEVEL FREQUENCY DURATION CURVE

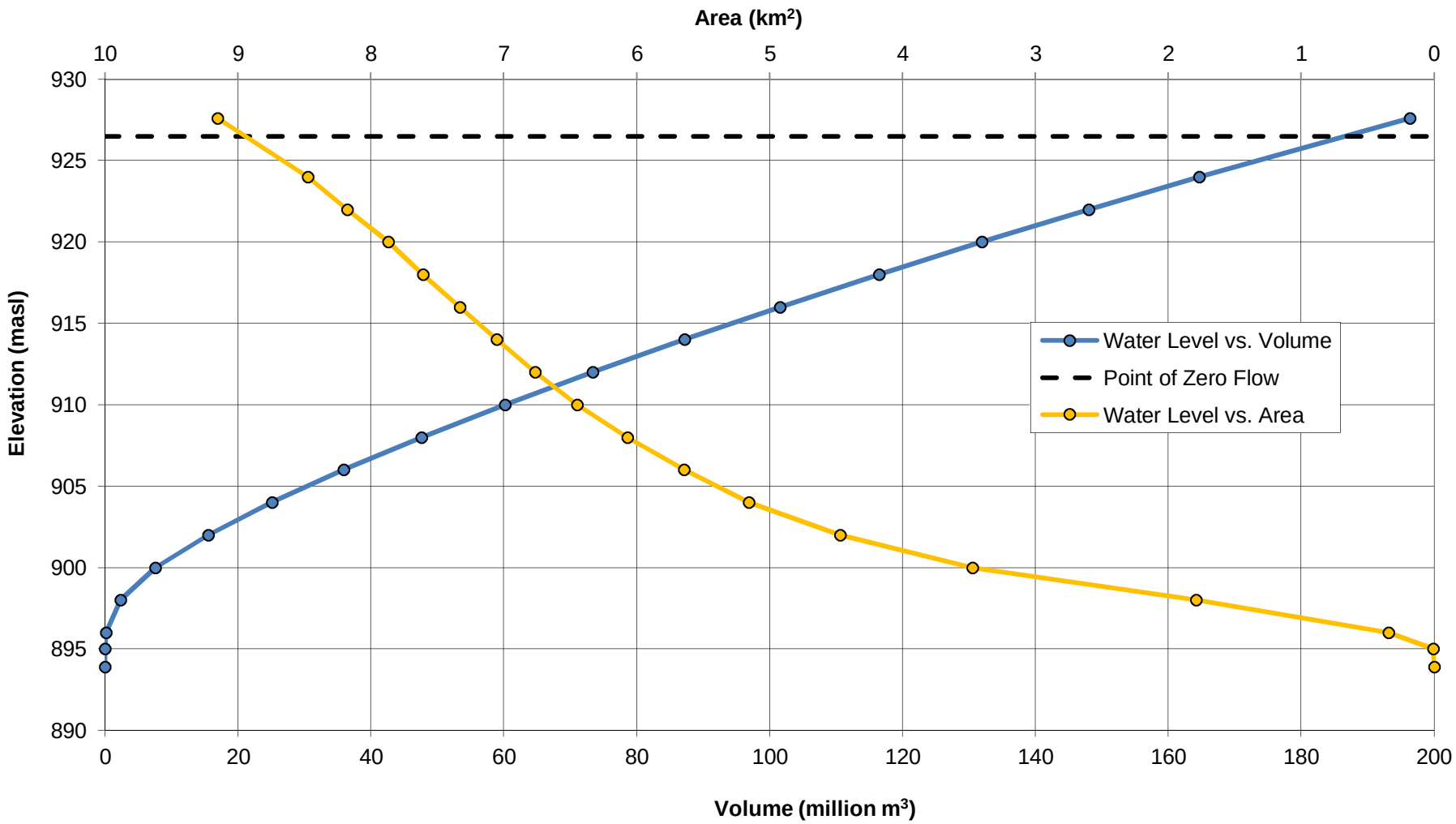
Knight Piésold CONSULTING

P/A NO. VA101-457/6

REF. NO. VA13-01604

FIGURE 5

REV 0



NOTES:

1. DAC CURVE IS BASED ON BATHYMETRIC SURVEY PERFORMED BY AMEC ON JUNE 9, 2013.
2. WATER SURFACE ELEVATION AT THE TIME OF SURVEY WAS 927.6 m.
3. VOLUME IS CUMMULATIVE VOLUME.
4. AREA IS NOT CUMMULATIVE (i.e. AREA AT 910 m IS THE AREA OF THAT CONTOUR).

REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D
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NEW GOLD INC.

BLACKWATER GOLD PROJECT

TATELKUZ LAKE DEPTH AREA CAPACITY CURVE

Knight Piésold CONSULTING

P/A NO. VA101-457/6

REF. NO. VA13-01604

FIGURE 6

REV 0

November 22, 2013

File No.:VA101-457/6-A.01
Cont. No.:VA13-02066

Mr. Ryan Todd
Manager, Environment
New Gold Inc.
Suite 1800, Two Bentall Centre
555 Burrard Street
Vancouver, British Columbia
Canada, V7X 1M9

Dear Ryan,

Re: Tatelkuz Lake IFN Withdrawal Model

Introduction

The Blackwater Gold Project is a prospective mining project located southwest of Vanderhoof, in central BC. The project design proposes a requirement for mill make-up water (during operations), as well as supplementary flows to Davison Creek downstream of the proposed TSF (during operations and closure). It is proposed that required flows be pumped from Tatelkuz Lake, located approximately 20 km northeast of the Project site.

AMEC performed a habitat assessment on Davidson Creek to determine the seasonal in stream flow needs (IFNs) that would be required to maintain fish habitat. Knight Piésold Ltd. (KP) was then retained by New Gold Inc. (New Gold) to develop a lake withdrawal model in order to estimate the impact of withdrawal on stage and discharge at the Tatelkuz Lake outlet. Two hydrometric monitoring station locations will be discussed in this letter, and will be referred to as the H2 node and the H5 node.

Model Objectives

The proposed Fresh Water Supply System, shown on Figure 1, implies that a reach of Chedakuz Creek, approximately 1 km long and located immediately downstream of the Tatelkuz Lake outlet, will likely be the area most impacted by the proposed system. Water required for the mill and IFN needs in Davidson Creek will be pumped from the lake to the H2 node on Davidson Creek during operations and closure. These flows will then return to Chedakuz Creek at the Davidson Creek confluence approximately 1 km downstream of Tatelkuz Lake outlet and 2.5 km upstream of the H5 node on Chedakuz Creek. The objective of the IFN withdrawal model was to assess the impact of water withdrawal on this 1 km reach of Chedakuz Creek based on the assessment of Tatelkuz Lake levels and outlet discharges.

Model Development

The primary input to the model was a 40 year synthetic discharge series for Chedakuz Creek at the H5 node. This series was prorated to the Tatelkuz Lake outlet and then analysed in conjunction with detailed outlet surveys and continuous but short-term measured lake level and outlet discharge data, in order to develop a 40 year long synthetic daily series of Tatelkuz Lake levels. The methodology is described in detail in KP letter VA13-01604 (KP, 2013).

The simplest approach to modelling the impact of withdrawal is to subtract the withdrawal rate from the continuous discharge series at the outlet of the lake. This approach, however, ignores the lake attenuating effects and assumes that alternating pumping rates have an immediate response at the lake outlet. Tatelkuz Lake has a surface area of over 8 km^2, which allows for temporary storage and attenuation. A better approach is to model the impacts of withdrawal by accounting for the attenuating effects of the lake by using a reservoir routing model.

The reservoir routing model balances the lake inflows and outflows through changes in lake storage. The following inputs were used in calculations:

- Depth-Area-Capacity (DAC) relationship for Tatelkuz Lake.
  - The depth area capacity (DAC) relationship was developed from a real-time bathymetric survey undertaken by AMEC on June 9, 2013. The DAC curve is shown on Figure 2.
- Hydraulic geometry of the outlet (rating curve).
  - Surveys of the Tatelkuz Lake outlet were used in conjunction with hydraulic theory to develop a reliable relationship between lake levels and lake outflows (i.e. a rating curve for the lake outlet). The rating curve development was described in KP letter VA13-01604 (KP, 2013). Measured discharge at the outlet suggests that the rating curve has a good fit to measured data, as shown on Figure 3.
- Inflow Hydrograph (daily resolution)
  - Daily inflow data are not available and hence the inflow hydrograph was developed using the reservoir routing model, which incorporated the 40 year long synthetic outlet discharge, the DAC relationship, and the rating curve for the lake outlet.
  - The modelled inflows were then verified by re-running the reservoir routing model and comparing the modelled lake outflows with the 40 year long synthetic Tatelkuz Lake outlet discharge series.

The inflow hydrograph developed for baseline conditions was used as an input for modelling Tatelkuz Lake levels and outflows for operational conditions. Operational withdrawal rates, consisting of two main components, were incorporated into the reservoir routing model as follows:

1. Mill makeup water supplied at a constant rate of 0.033 m3/s (33 L/s) annually, and
2. Supplementary flows, or IFN requirements, for Davidson Creek, which were determined through fish habitat studies performed by AMEC. The Davidson Creek IFNs are as follows (AMEC, 2013a):
   - Winter Stanza (December – March): 0.125 m3/s (125 L/s).
   - Freshet Stanza (May – June): 0.56 m3/s (560 L/s).
   - Rainbow Incubation Stanza (July – August): 0.15 m3/s (150 L/s).
   - Kokanee Incubation Stanza (September – November): 0.115 m3/s (115 L/s).

In conjunction with AMEC, KP determined that baseflow during the month of April would not be considered when developing IFNs due to the high variability in the synthetic series set resulting from variability in the timing of spring freshet between years. Consequently, Winter IFNs were assumed to apply in April as well. The withdrawal hydrograph is given on Figure 4, and shows the IFN and the mill requirements across the various stanzas.

Impact assessments of operational withdrawals are required for the Tatelkuz Lake outlet and the first kilometer of Chedakuz Creek. AMEC (2013 b) determined that fish habitat stanzas were different in Chedakuz Creek compared to Davidson Creek. The Chedakuz Creek stanzas are as follows:

- Winter (December – March).
- Freshet (May – June).
- Rainbow Incubation (July).
- Kokanee Spawning (August – September).
- Rainbow Rearing (October – November).

Figure 5 shows the baseline and operational hydrographs for the Tatelkuz Lake outlet developed for the 40 year long synthetic series, where both mill and IFN requirements were taken into consideration for operations. The operational lake outflow series was then converted to stage using the outlet rating curve to investigate the withdrawal impacts on stage. Stage and discharge are not linearly related and the reduction in both is important when considering impacts to fish habitat.

Model Results

The results of the analysis are summarized in Table 1. The average discharge and stage for each Chedakuz Creek stanza during baseline and operations were calculated for average conditions and for the 1 in 10 year low flow conditions. The lowest daily flow for each stanza in each year were calculated and then run through the statistical modeling software, LFA, to produce the 1 in 10 year daily low flows. The impact on the 1 km long Chedakuz Creek reach just downstream of the lake outlet, based on this analysis, is as follows:

- The average change in the average case is -15% for discharge and -7% for stage.
- The average change in the 1 in 10 year low flow case is -28% for discharge and -14% for stage.
- The largest change in flow occurs in the average case during freshet and equates to an approximate flow reduction of 0.51 m3/s (or -13%).
- The largest percent change in flow occurs in the 1 in 10 year low flow case during freshet and equates to a flow reduction of 0.48 m3/s (or -39%).
- The largest change in stage also corresponds to the largest percent change in stage, and occurs during the 1 in 10 year low flow case during freshet. The change equates to -10 cm (or -20%).

Figures 6 through 10 show the withdrawal impacts with regards to the expected change in stage for both the average and the 1 in 10 year low flow conditions. Each figure contains a surveyed control cross-section, as well as a lake outlet photograph that was taken during the particular stanza (no photo is available for the Rainbow rearing stanza). The figures also show the main channel is largely trapezoidal, with steep banks and well developed levees leading into the floodplain, which is several hundred meters in width. The average condition for each stanza indicates that flows do not breach the levee banks of the main channel. However, it should be noted that higher flows within the synthetic record for the freshet stanza in particular do breach the banks and inundate the floodplain, as shown on Figure 3. The attenuating impact of the lake is such that the overall drawdown due to lake withdrawal is low in many of the stanzas. The Freshet 1 in 10 year flow and stage are an exception to this general trend, where the impact of drawdown is more substantial than in other stanzas.

Model Limitations

While the lake withdrawal model is designed to quantify the impacts at the outlet of Tatelkuz Lake, there are several assumptions and limitations relevant for its application:

- The primary discharge series is based on node H5 on Chedakuz Creek, pro-rated to the lake outlet. H5 is located approximately 3.5 km downstream of the outlet. While the catchment proration of these data is considered reasonable, there are inherent uncertainties when scaling a discharge series by drainage area, such as the assumption of proportionality of inflows from tributaries which flow into Chedakuz Creek between the lake outlet and node H5. No gauges exist along this reach of Chedakuz Creek, and consequently, assumptions of hydrologic behaviour were necessary.
- The bathymetric survey was completed during a peak flow period. However, it is still limited to the maximum water depth on that particular day, while higher water levels had to be extrapolated.
- The model is not deterministic and is not designed to state whether the impacts are acceptable or not from the perspective of fish and fish habitat.
- The model is not designed to be used for operations. It is possible to convert this model to one capable of functioning during operations; however, it does not have that capacity and was not intended for that purpose. The model may be used to assist in informing operations about the types of real-time data inputs that would be required to develop an operational model.
- Comparisons to channel cross-sections given on Figures 6 through 10 are provided as examples of channel sections, but may not necessarily represent the entire impacted reach of Chedakuz Creek.

Closing Remarks

The results of this analysis indicate that using Tatelkuz Lake as a fresh water source, for the purpose of supplementing mill and IFN requirements during mining operations, will result in reduced flow and stage along

the 1 km reach downstream of Tatelkuz Lake and upstream of the Chedakuz/Davidson confluence. As shown in Table 1:

- The average reduction to flows is predicted to be approximately 15%.
- The average reduction to stage is estimated to be 7%.
- The average reduction in 1:10 daily low flows is predicted to be approximately 28%.
- The average reduction in 1:10 daily low stage is estimated to be 14%.

Yours truly,

KNIGHT PIÉSOLD LTD.

Signed:
Brendan Worrall, E.I.T.
Staff Engineer

Reviewed:
Cameron McCarthy, P.Eng., PGeo.
Senior Engineer

Reviewed:
Violeta Martin, Ph.D., P.Eng.
Senior Hydrotechnical Engineer

Approved:
Ken Brouwer, P.Eng.
President

Attachments:

Table 1	Rev 0	Model Results
Figure 1	Rev 0	Fresh Water Supply Pipeline Layout
Figure 2	Rev 0	Tatelkuz Lake Depth Area Capacity Curve
Figure 3	Rev 0	Tatelkuz Lake Outlet Rating Curve and Cross Section
Figure 4	Rev 0	Withdrawal Hydrograph
Figure 5	Rev 0	Outflow Discharge Series
Figure 6	Rev 0	Winter Stage Impact
Figure 7	Rev 0	Freshet Stage Impact
Figure 8	Rev 0	Rainbow Incubation Stage Impact
Figure 9	Rev 0	Kokanee Spawning Stage Impact
Figure 10	Rev 0	Rainbow Rearing Stage Impact

References:

AMEC 2013 a	Recommended Flushing Flows, transitional Flows, and Ramping Rates for Davidson Creek., AMEC file ref. VA52277.4430, October 2013
AMEC 2013 b	Instream Flow – Chedakuz Switching Evaluation. AMEC File Ref. VE52277. September , 2013, issued in draft
KP 2013	Revised Baseline Tatelkuz Lake Levels, KP Cont. Number VA13-01604. July 2013

/bw

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TABLE 1

NEW GOLD INC.
BLACKWATER GOLD PROJECT

TATELKUZ IFN MODEL
BASELINE VS. OPERATIONS

Print Nov/19/13 12:19:35

Average Case						
Stanza	Baseline		Operations		Change	
	Discharge (m^3/s)	Stage (m)	Discharge (m^3/s)	Stage (m)	Discharge (%)	Stage (%)
Winter	1.14	0.48	0.97	0.45	-15%	-7%
Freshet	3.87	0.84	3.36	0.79	-13%	-6%
Rainbow Incubation	1.87	0.61	1.60	0.56	-14%	-7%
Kokanee Spawning	1.01	0.46	0.85	0.42	-16%	-8%
Rainbow Rearing	1.09	0.47	0.93	0.44	-15%	-7%
Average	1.80	0.57	1.54	0.53	-15%	-7%
1:10 Daily Low Flow Case						
Stanza	Baseline		Operations		Change	
	Discharge (m^3/s)	Stage (m)	Discharge (m^3/s)	Stage (m)	Discharge (%)	Stage (%)
Winter	0.72	0.39	0.58	0.35	-20%	-10%
Freshet	1.23	0.50	0.75	0.40	-39%	-20%
Rainbow Incubation	0.75	0.40	0.54	0.34	-28%	-14%
Kokanee Spawning	0.60	0.36	0.44	0.31	-26%	-13%
Rainbow Rearing	0.65	0.37	0.49	0.33	-24%	-12%
Average	0.79	0.41	0.56	0.35	-28%	-14%

M:\1\01\00457\06\A\Data\Task 903 - Hydrometric Monitoring\Tatelkuz Lake Level Models\Lake Level Effects Assessment\[Lake Model - DAILY - 20130918.xlsm]Stats Table

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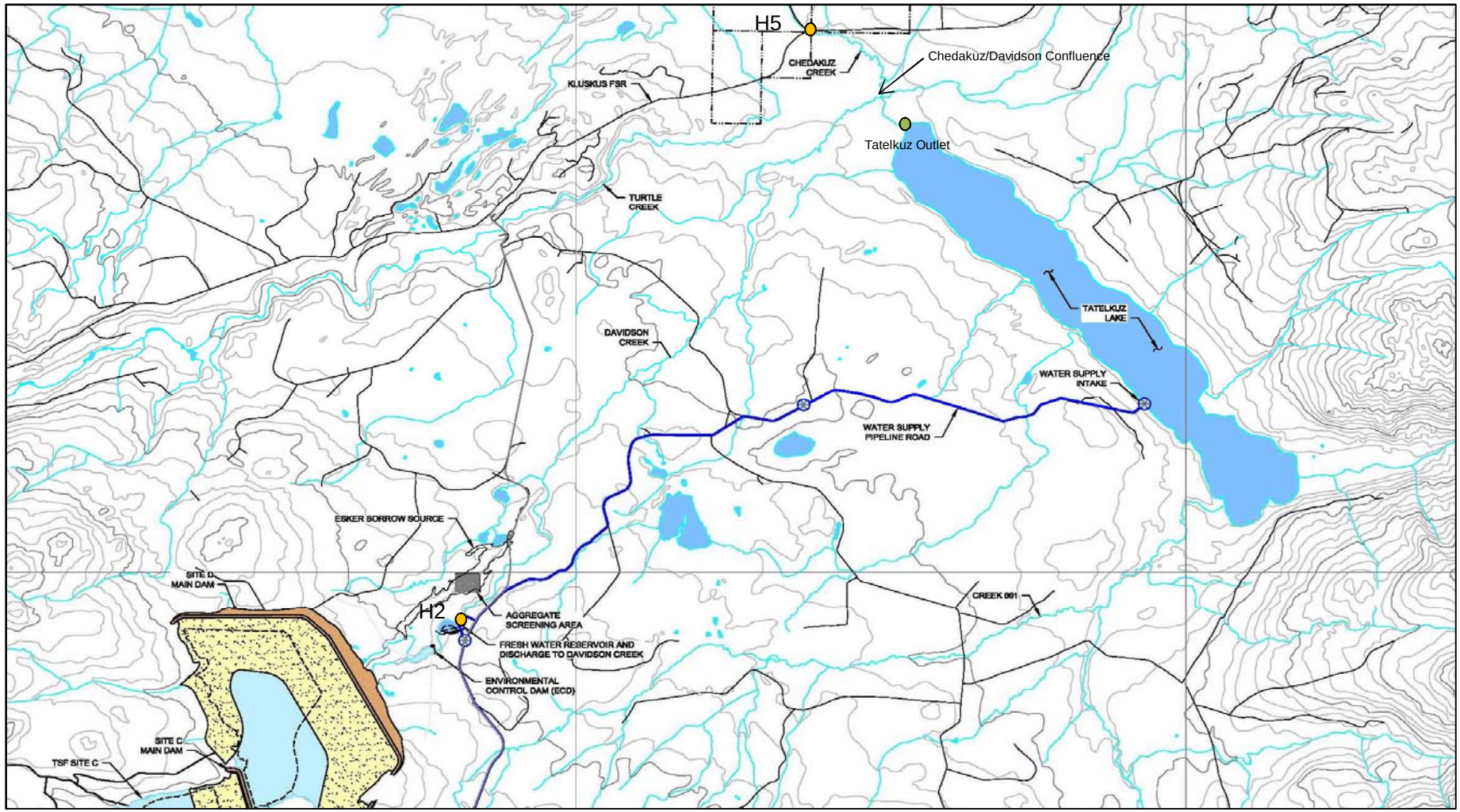

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NEW GOLD INC.

BLACKWATER GOLD PROJECT

FRESH WATER SUPPLY SYSTEM GENERAL ARRANGEMENT

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P/A NO. VA101-457/6

REF. NO. VA13-02066

FIGURE 1

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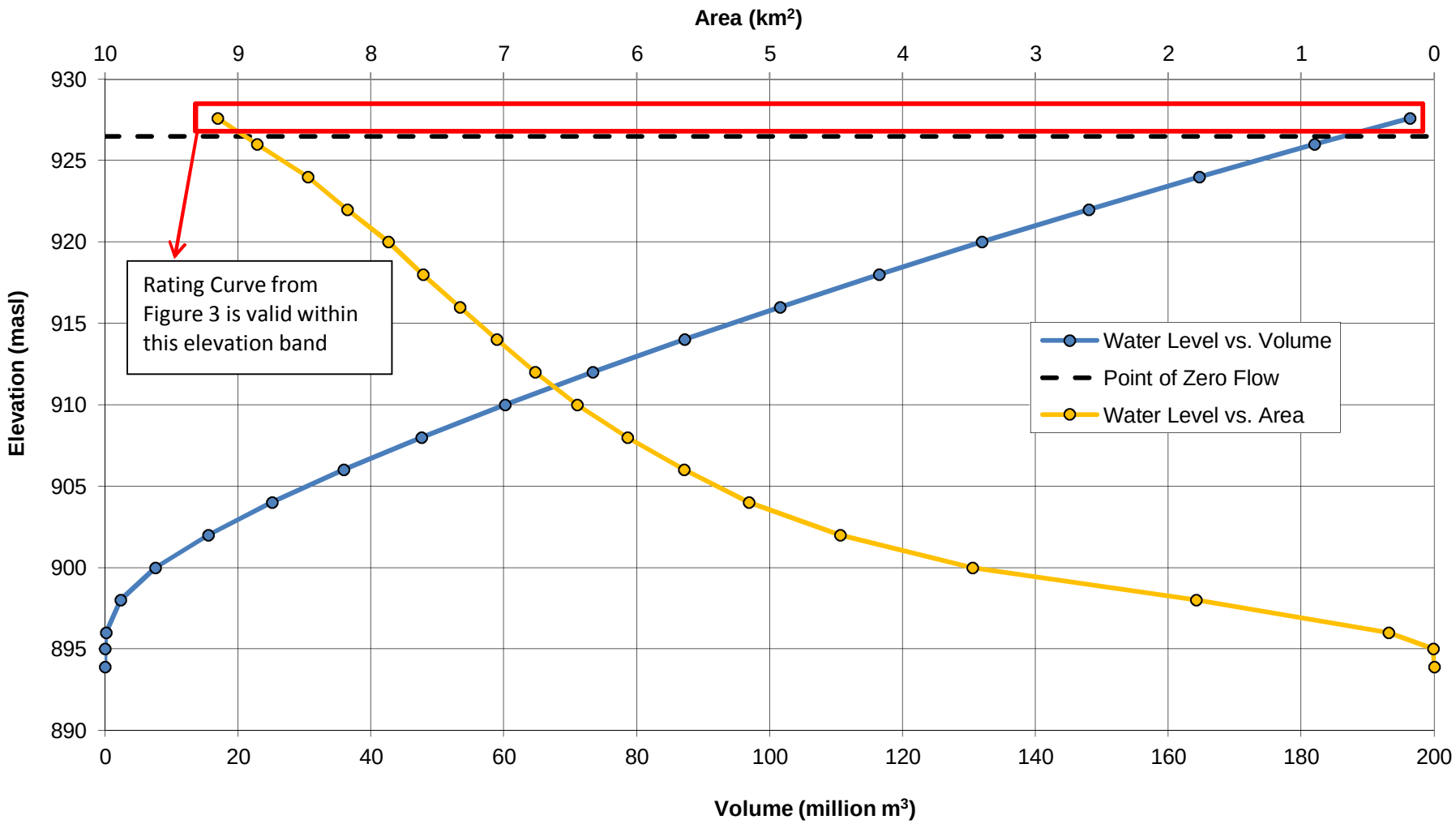

NOTES:

1. DAC CURVE IS BASED ON BATHYMETRIC SURVEY PERFORMED BY AMEC ON JUNE 9, 2013.
2. WATER SURFACE ELEVATION AT THE TIME OF SURVEY WAS 927.6 m.
3. VOLUME IS CUMMULATIVE VOLUME.
4. AREA IS NOT CUMMULATIVE (i.e. AREA AT 910 m IS THE AREA OF THAT CONTOUR).

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BLACKWATER GOLD PROJECT

TATELKUZ LAKE DEPTH AREA CAPACITY CURVE

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P/A NO. VA101-457/6

REF. NO. VA13-02066

FIGURE 2

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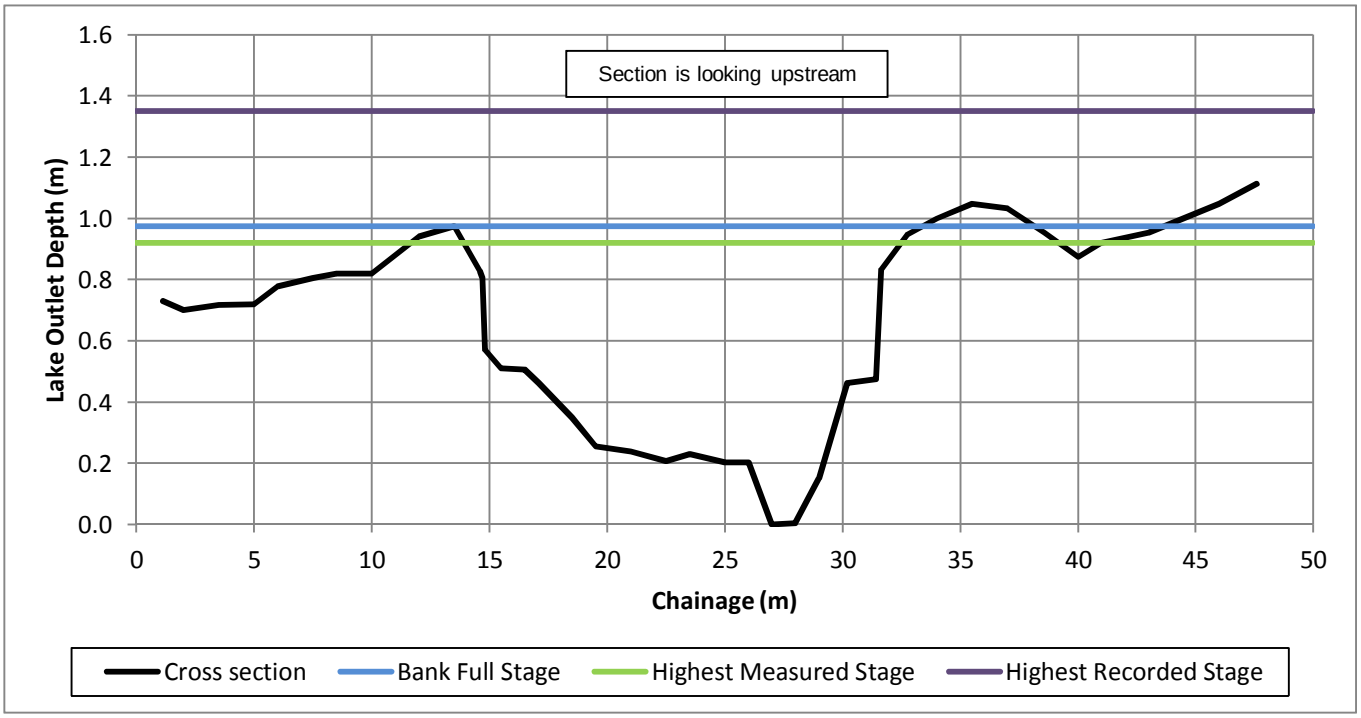

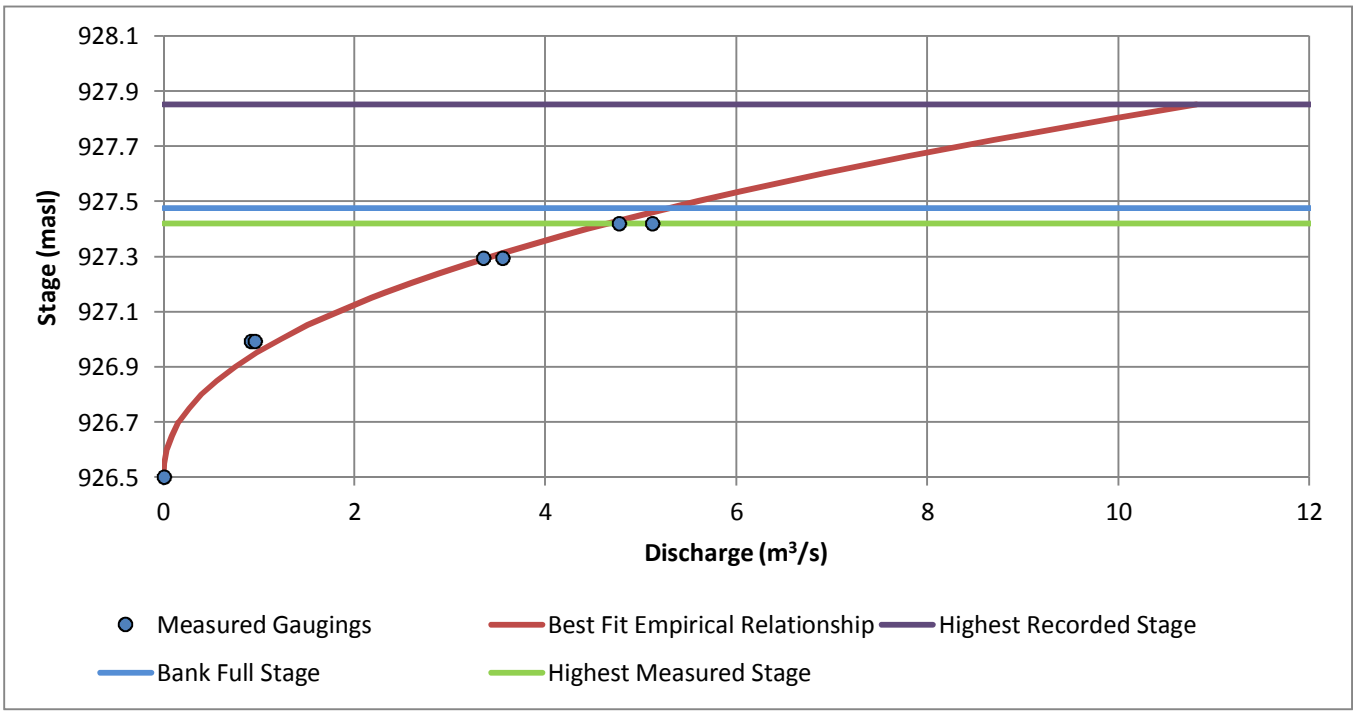

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BLACKWATER GOLD PROJECT

TATELKUZ LAKE OUTLET
RATING CURVE AND CROSS SECTION

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REF. NO. VA13-02066

FIGURE 3

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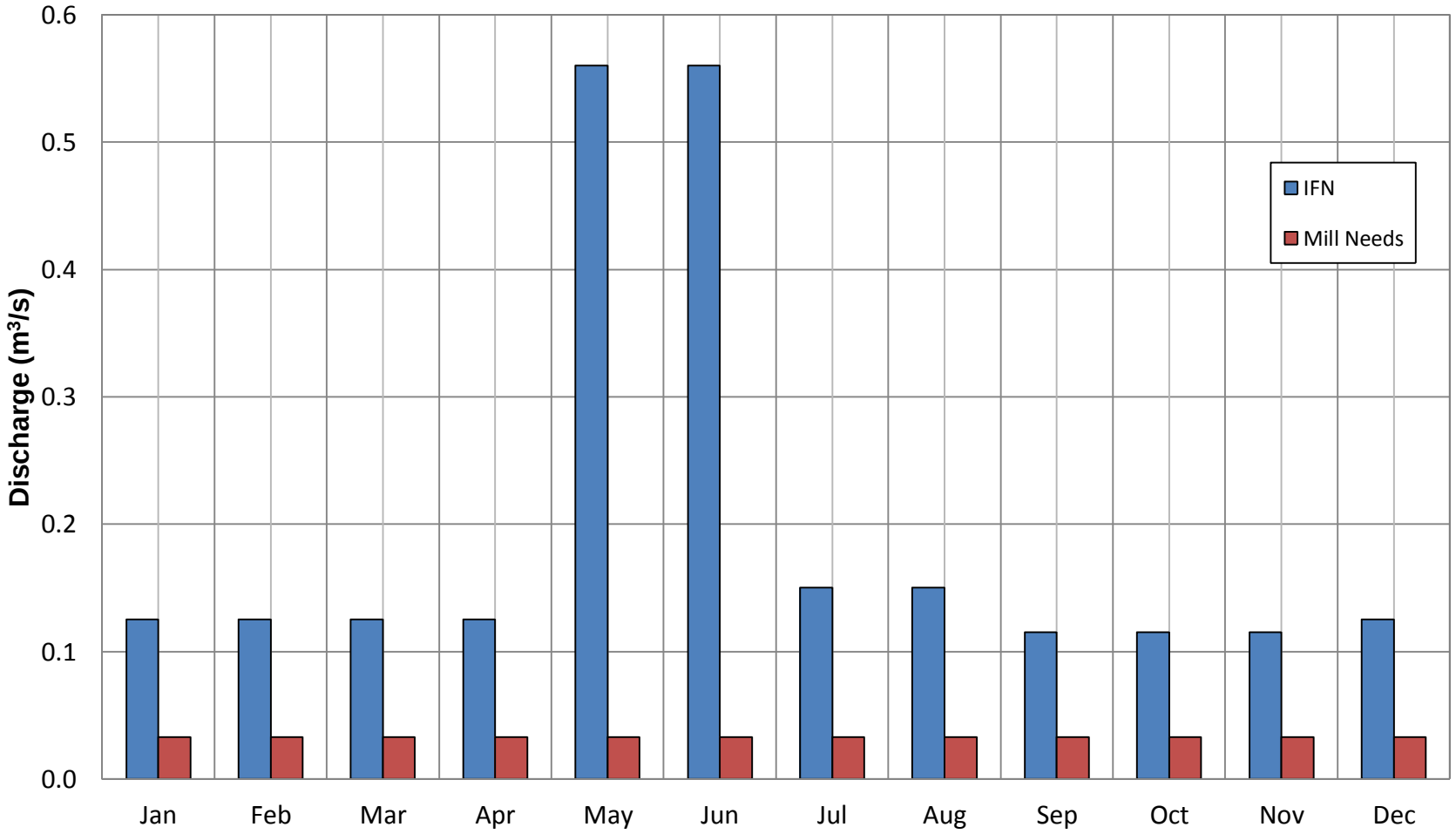

NOTES:
1. MILL WATER SUPPLY IS CONSTANT AT 0.033 m³/s.
2. IFN WATER REQUIREMENTS ARE BASED ON FISH HABITAT STUDIES (AMEC 2013a).

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BLACKWATER GOLD PROJECT

REQUIRED WITHDRAWAL FROM TATELKUZ LAKE

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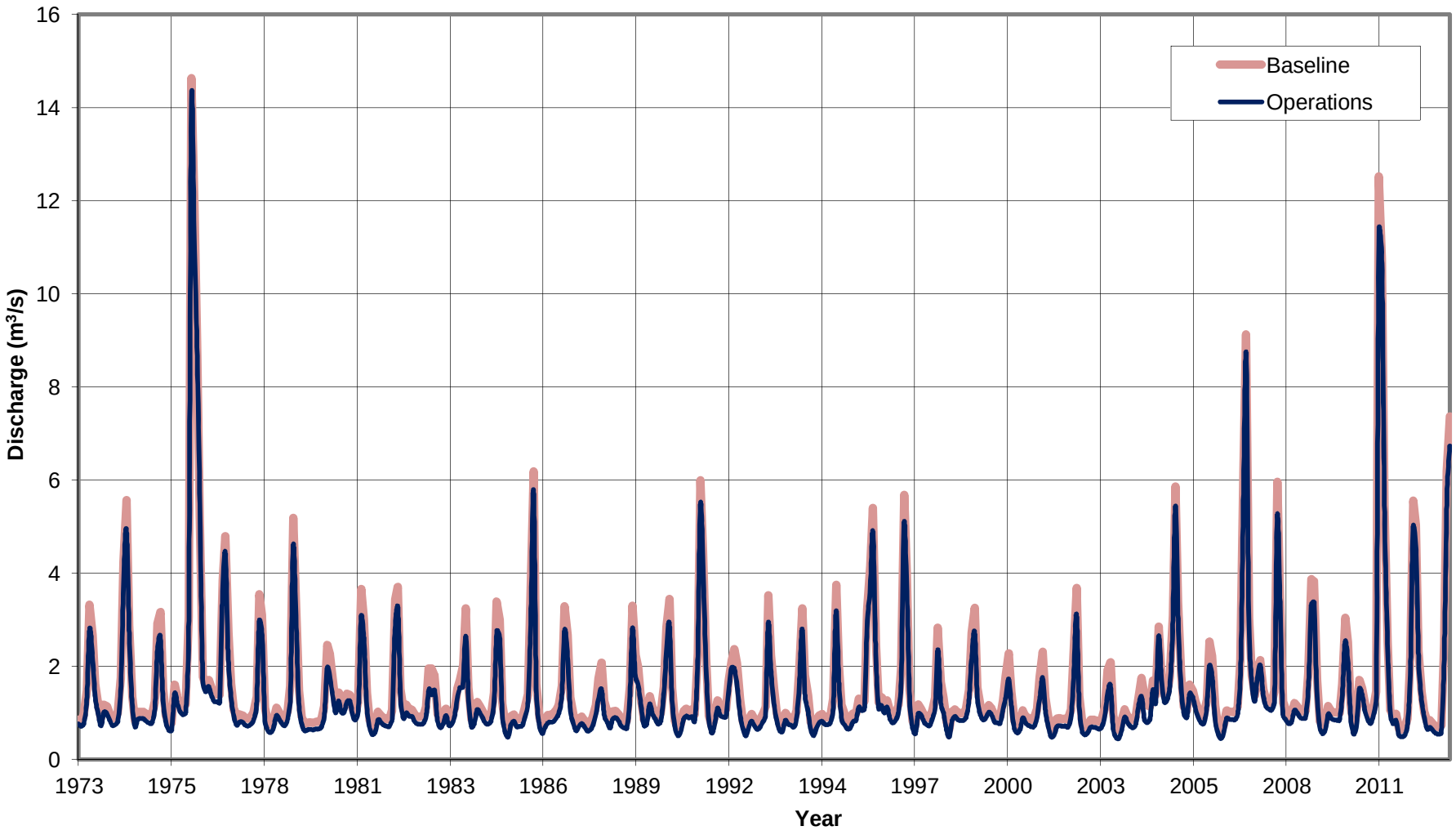
P/A NO. VA101-457/6

REF. NO. VA13-02066

FIGURE 4

REV 0



NOTES:
1. MILL WATER SUPPLY IS CONSTANT AT 0.033 m³/s.
2. IFN WATER REQUIREMENTS ARE BASED ON FISH HABITAT STUDIES (AMEC 2013a).

REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D
0	18NOV'13	ISSUED WITH LETTER	CJM	VM	KJB

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BLACKWATER GOLD PROJECT

MODELLED TATELKUZ LAKE OUTFLOW BASELINE AND OPERATIONS

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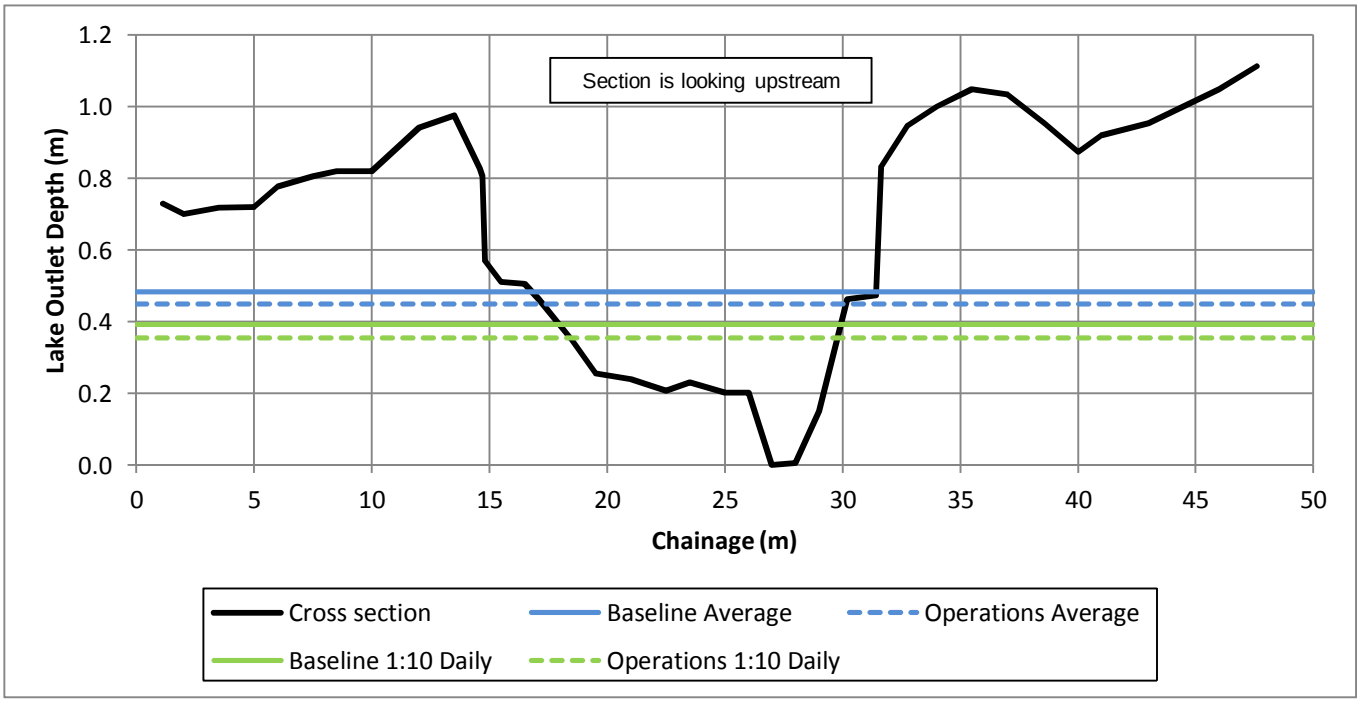
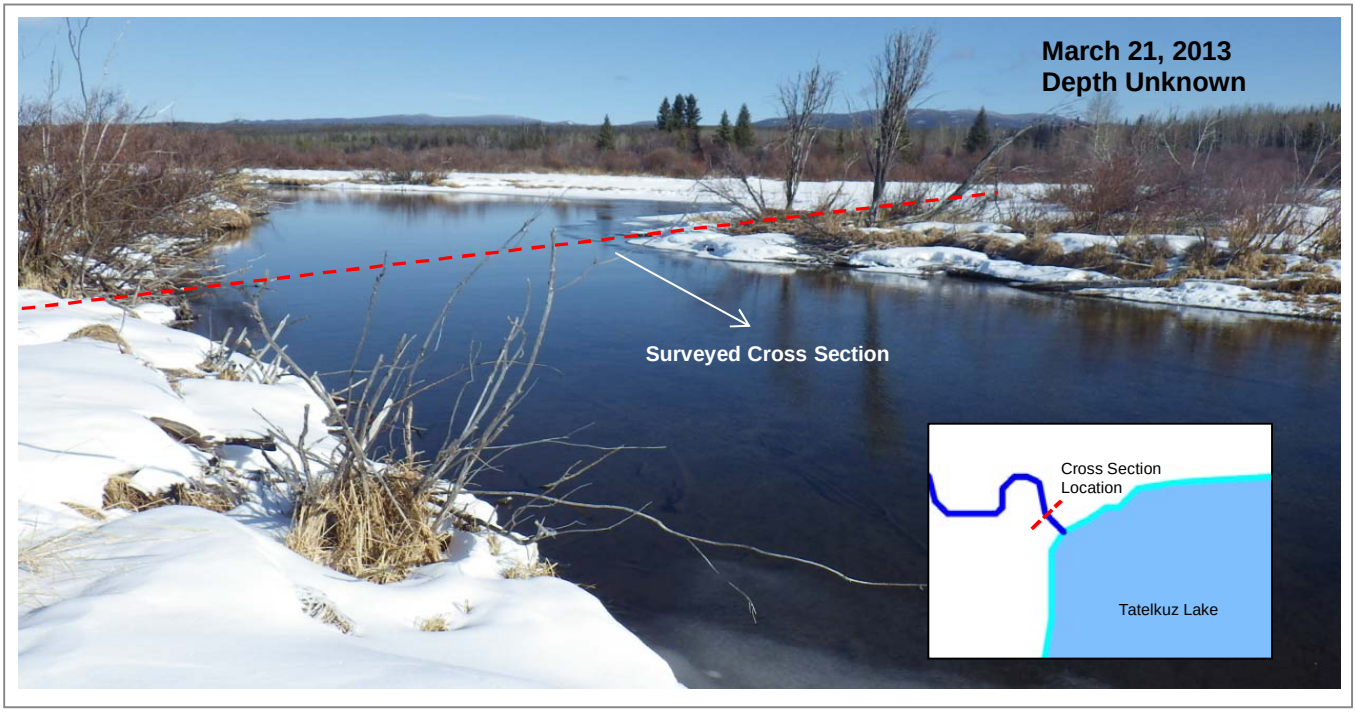
REF. NO. VA13-02066

FIGURE 5

REV 0





NOTES:

1. WINTER STANZA IS FROM DECEMBER TO APRIL.
2. "AVERAGE" IS THE AVERAGE DEPTH OF WATER AT THE LAKE OUTLET THAT OCCURS WITHIN THE GIVEN STANZA, ACROSS THE ENTIRE PERIOD OF RECORD.
3 "1:10 DAILY LOW" IS THE 1:10 DAILY LOW FLOW CONVERTED TO DEPTH AT THE LAKE OUTLET THAT OCCURS WITHIN THE GIVEN STANZA, ACROSS THE ENTIRE PERIOD OF RECORD.

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BLACKWATER GOLD PROJECT

TATELKUZ LAKE OUTLET
IMPACT OF PROJECT ON STAGE
WINTER STANZA

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REF. NO. VA13-02066

FIGURE 6

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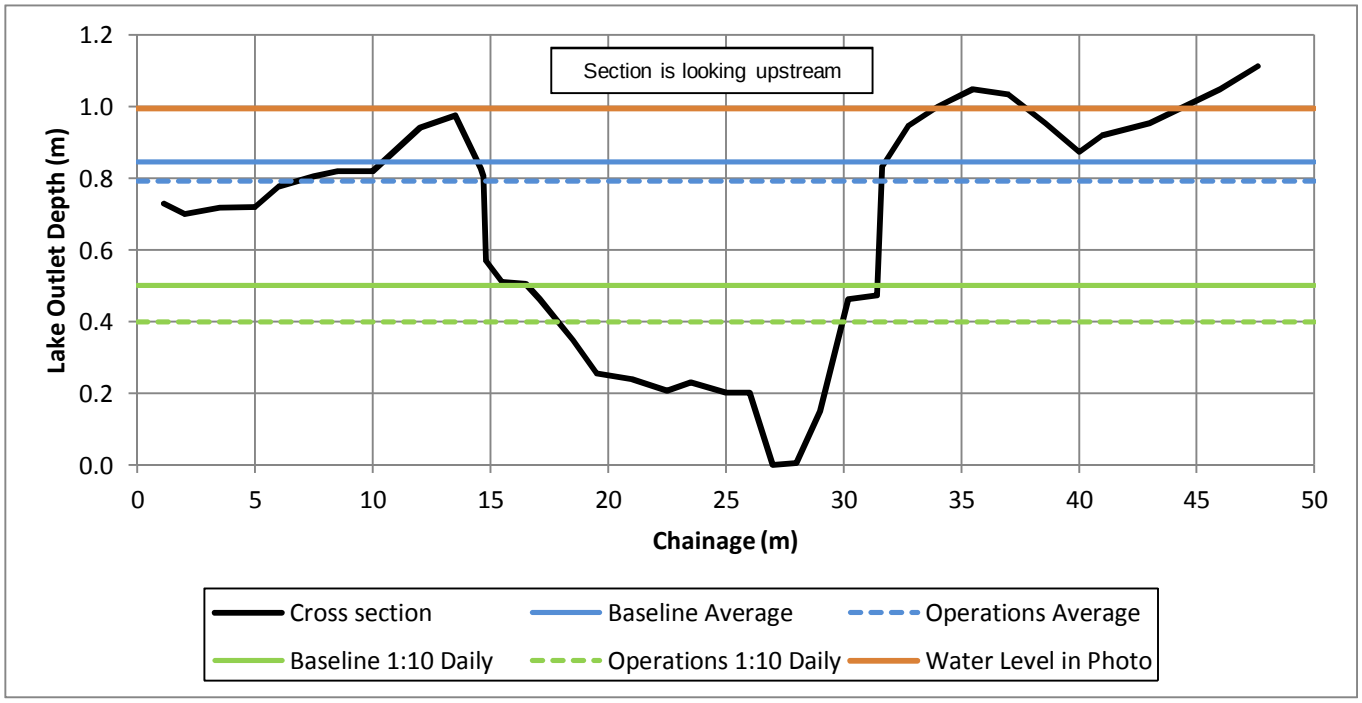

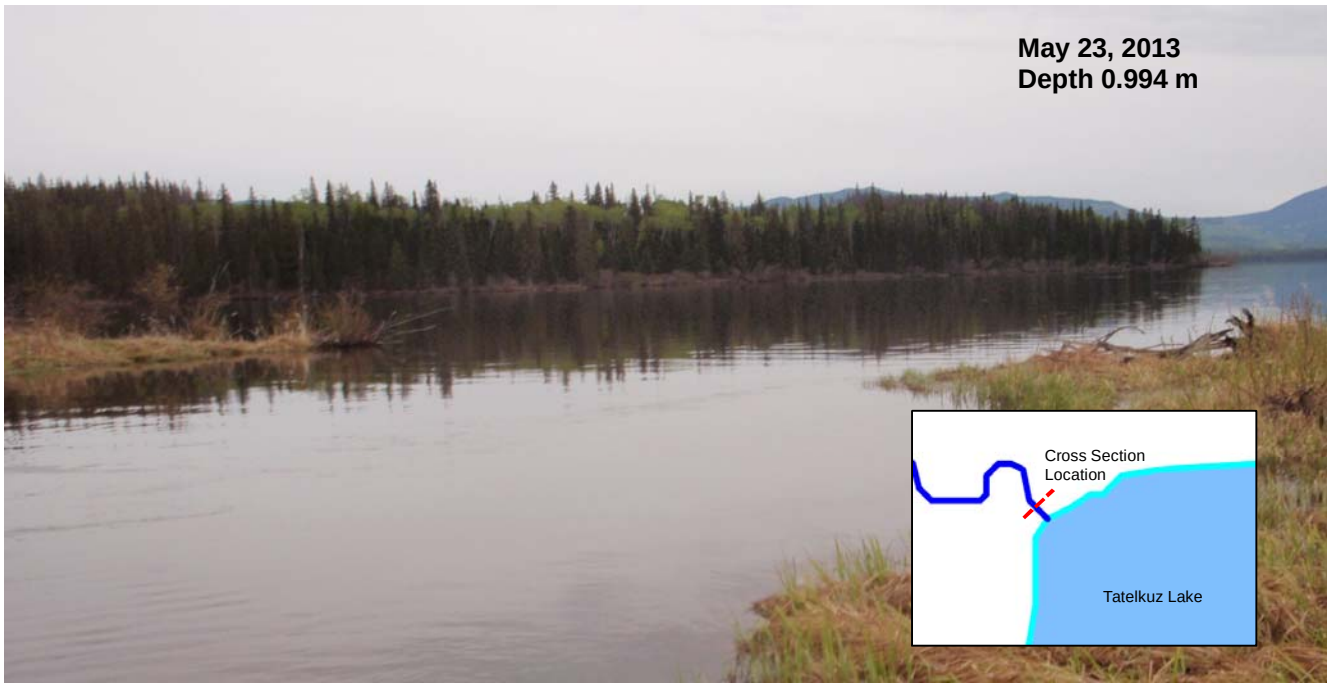

NOTES:

1. FRESHET STANZA IS FROM MAY TO JUNE.
2. "AVERAGE" IS THE AVERAGE DEPTH OF WATER AT THE LAKE OUTLET THAT OCCURS WITHIN THE GIVEN STANZA, ACROSS THE ENTIRE PERIOD OF RECORD.
3 "1:10 DAILY LOW" IS THE 1:10 DAILY LOW FLOW CONVERTED TO DEPTH AT THE LAKE OUTLET THAT OCCURS WITHIN THE GIVEN STANZA, ACROSS THE ENTIRE PERIOD OF RECORD.

NEW GOLD INC.

BLACKWATER GOLD PROJECT

TATELKUZ LAKE OUTLET
IMPACT OF PROJECT ON STAGE
FRESHET STANZA

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FIGURE 7

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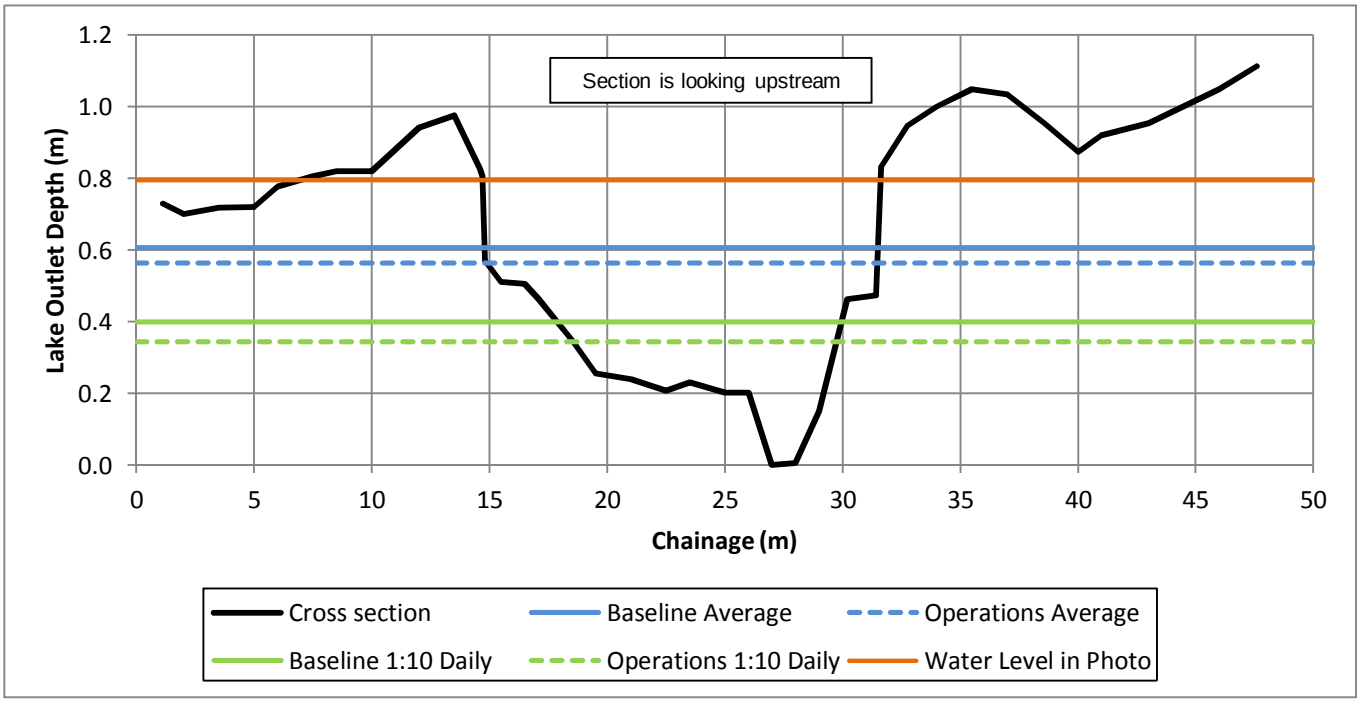

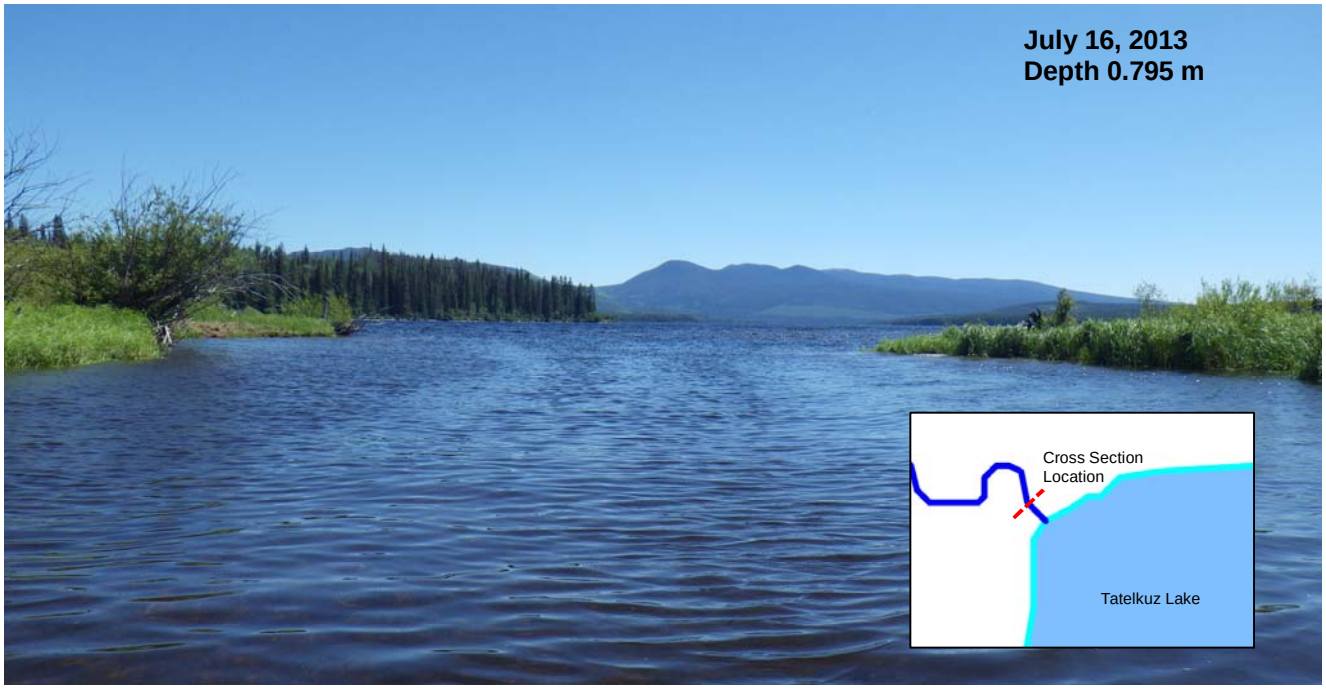

NOTES:

1. RAINBOW INCUBATION STANZA IS JULY.
2. "AVERAGE" IS THE AVERAGE DEPTH OF WATER AT THE LAKE OUTLET THAT OCCURS WITHIN THE GIVEN STANZA, ACROSS THE ENTIRE PERIOD OF RECORD.
3 "1:10 DAILY LOW" IS THE 1:10 DAILY LOW FLOW CONVERTED TO DEPTH AT THE LAKE OUTLET THAT OCCURS WITHIN THE GIVEN STANZA, ACROSS THE ENTIRE PERIOD OF RECORD.

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BLACKWATER GOLD PROJECT

TATELKUZ LAKE OUTLET
IMPACT OF PROJECT ON STAGE
RAINBOW INCUBATION STANZA

Knight Piésold CONSULTING

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FIGURE 8

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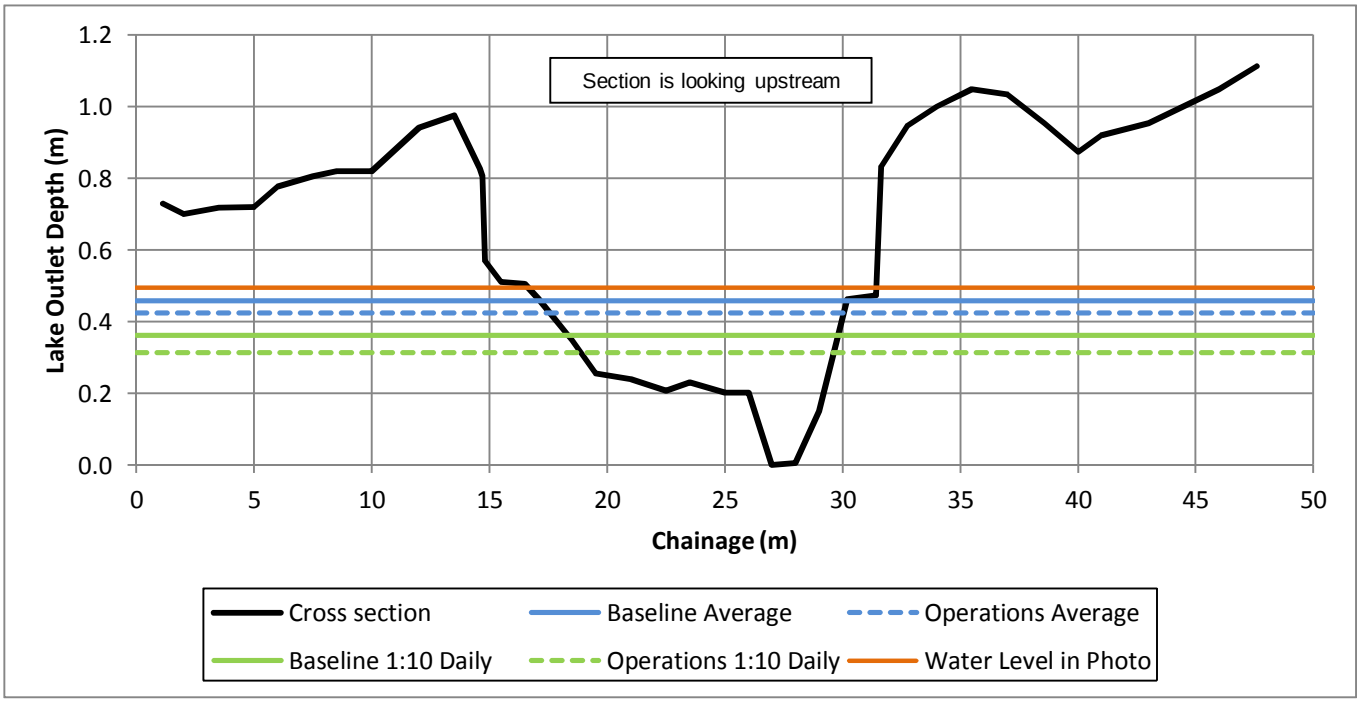

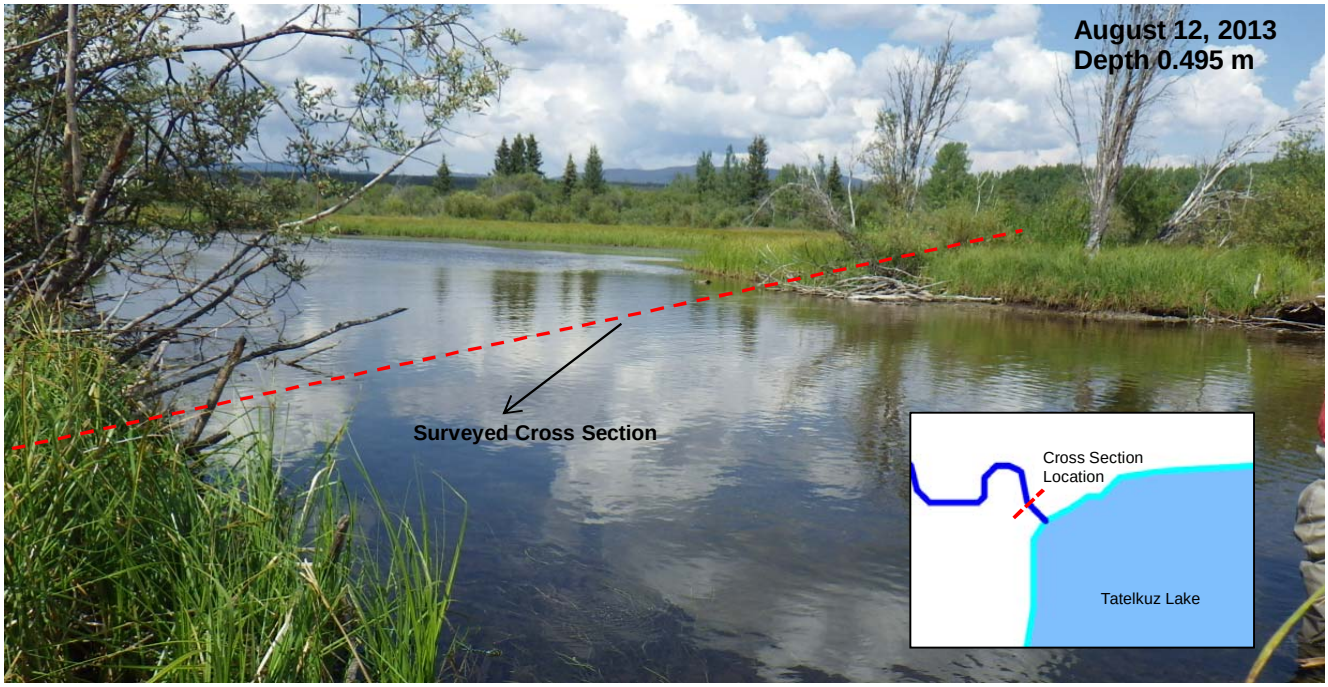

NOTES:

1. KOKANEE SPAWNING STANZA IS FROM AUGUST TO SEPTEMBER.
2. "AVERAGE" IS THE AVERAGE DEPTH OF WATER AT THE LAKE OUTLET THAT OCCURS WITHIN THE GIVEN STANZA, ACROSS THE ENTIRE PERIOD OF RECORD.
3 "1:10 DAILY LOW" IS THE 1:10 DAILY LOW FLOW CONVERTED TO DEPTH AT THE LAKE OUTLET THAT OCCURS WITHIN THE GIVEN STANZA, ACROSS THE ENTIRE PERIOD OF RECORD.

NEW GOLD INC.

BLACKWATER GOLD PROJECT

TATELKUZ LAKE OUTLET
IMPACT OF PROJECT ON STAGE
KOKANEE SPAWNING STANZA

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REF. NO. VA13-02066

FIGURE 9

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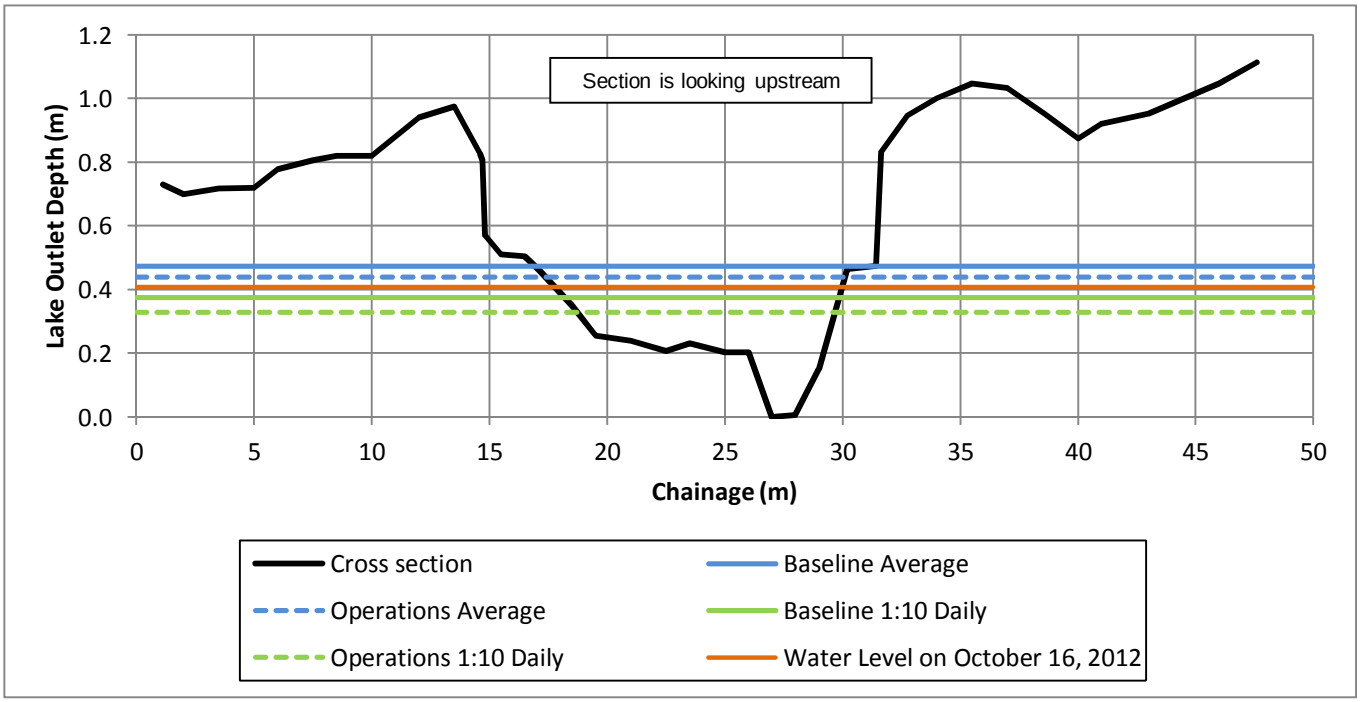
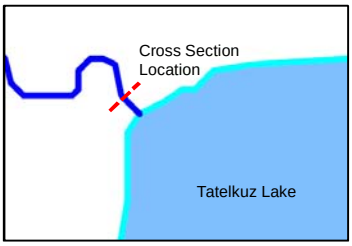


October 16, 2012
Depth 0.408 m

Cross Sectional Photo Not Available



NOTES:
1. RAINBOW REARING STANZA IS FROM OCTOBER TO NOVEMBER.
2. "AVERAGE" IS THE AVERAGE DEPTH OF WATER AT THE LAKE OUTLET THAT OCCURS WITHIN THE GIVEN STANZA, ACROSS THE ENTIRE PERIOD OF RECORD.
3 "1:10 DAILY LOW" IS THE 1:10 DAILY LOW FLOW CONVERTED TO DEPTH AT THE LAKE OUTLET THAT OCCURS WITHIN THE GIVEN STANZA, ACROSS THE ENTIRE PERIOD OF RECORD.

NEW GOLD INC.

BLACKWATER GOLD PROJECT

TATELKUZ LAKE OUTLET
IMPACT OF PROJECT ON STAGE
RAINBOW REARING STANZA

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REF. NO. VA13-02066

FIGURE 10

REV 0

REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D
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