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December 21, 2011

Joint Review Panel
Enbridge Northern Gateway Project
444 - Seventh Avenue S.W.
Calgary, Alberta T2P 0X8

Attention: Anne-Marie Erickson

Dear Ms. Erickson:

Re: **Hearing Order OH-4-2011; File No. OF-Fac-Oil-N304-2010-01 01**

Please find enclosed the written evidence of Swan River First Nation in respect of the above-noted matter, including:

High Level Review of the Enbridge Northern Gateway Pipeline Environmental Impact Assessment - Whitecourt to Fox Creek Alberta (January 2011)

Aboriginal Traditional Knowledge Community Report (April 2010)

Effects of Industrial Disturbance on the Traditional Resources of the Swan River First Nation (December 2011)

Thank you for your attention to this matter. Should you have any questions regarding the above, please do not hesitate to contact me.

Yours truly,
WOODWARD & COMPANY

<original signed by>

Jay Nelson

Encl. as noted above

c.c. SRFN Chief and Council
D. Sowan
A. Dersch

Effects of Industrial Disturbance on the Traditional Resources of the Swan River First Nation

Prepared for

Swan River First Nation

December 2011

Prepared by

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Executive Summary

The Swan River First Nation (SRFN) has requested that Management and Solutions in Environmental Science (MSES) undertake a time-series disturbance analysis for parts of their traditional lands. This disturbance analysis is the first step in gaining an understanding of the regional environmental planning and protection requirements for key traditional resource areas as defined by SRFN. MSES was also requested to evaluate impacts of disturbance on the SRFN traditional resource use. MSES reviewed evidence about the availability of past and present key traditional resources and applied that evidence to a key traditional resource area (the study area), as defined by the SRFN, for vegetation and wildlife.

For the purpose of this report we have been asked to assume that the following traditional resources are of concern to the SRFN: remoteness, ecosystem process, moose, beaver, and waterfowl.

This report consists of the following three parts:

- industrial impacts on conditions supporting traditional resources;
- industrial impacts on traditional resources; and
- re-establishment of traditional resources.

To detect the progression of land cover disturbance we used both Landsat and SPOT satellite image analyses. SPOT images are fine resolution satellite imagery but are not readily available for the area of interest prior to 2006. Hence, we first used the Landsat imagery to gain an understanding of the relative change in land cover from 1998 to 2009, and then we used the SPOT imagery to gain an understanding of how much the Landsat imagery leaves undetected.

Our main findings are that, as of 2009, approximately 65% of the study area was disturbed by industrial developments. Over the past 20 years, land disturbance in the study area has increased by over 33%, although there has been a noticeable slowing of this rate over the past decade. Two future scenarios are presented in the report. If the rate of conversion of natural land cover to industrial surface remains constant at the predicted annual rate, then there will be 100% loss of undisturbed areas by as early as 2035. Alternatively, if the rate of conversion continues to slow, as is the case since 2001, it is possible that a plateau will be reached by approximately 2035, leaving about 4,000 to 6,000 km^2 (about 25%) of undisturbed area. This potential remaining area, however, will be left heavily fragmented resulting in altered ecosystems with human induced sets of controls. If the rate of moose, beaver, and waterfowl habitat loss remains constant, moose will likely cease to be viable by around 2040 and beaver and waterfowl will continue to experience the erosion of their habitats. To date, reclamation practices have not re-established vegetation and wildlife diversity similar to pre-disturbance conditions, and are unlikely to do so in the future.

The key findings of our analyses are:

Key Finding: The Landsat image analysis indicates that in the past 20 years, an average of 136 km^2 of undisturbed area has been removed each year from the SRFN study area. At this rate, using an approximation of total amount of land cover available in 1950 (16,694 km^2),

there will be no undisturbed area left for the effective practice of traditional resource use in the SRFN study area by the year 2035. If the rate of conversion of natural land cover slows down, 25% of the SRFN study area could remain by 2035 and be maintained thereafter. The fine resolution SPOT image analysis indicates that, as of 2009, 65% of land cover in the SRFN study area was disturbed as a result of the high density of linear industrial features and land clearing (1.11 km/km^2 linear disturbance).

Key Finding: The landscape disturbance process in the SRFN study area has reached an asymptote of maximum fragmentation. Further development is almost certain to push the ecosystem into a substantial and long-term reorganization which is understood as an ecosystem or regime shift.

Key Finding: Over the past 20 years, an average of 4.5 km^2 or 1.2% of moose habitat has been removed each year from the SRFN study area. At this rate, the population of moose will cease to be viable as early as in the 2030s, depending on the probability of natural extinction events.

Key Finding: Over the past 20 years, beaver habitat experienced an annual loss of 2.5 km^2 or 0.9% of the 261 km^2 originally available in 1988. Waterfowl habitat experienced an annual loss of 0.4 km^2 or 1.1 % of the 36 km^2 originally available in 1988.

Key Finding: Disturbed lands are unlikely to be reclaimed. There is very little similarity in terms of species composition between reclaimed sites and natural stands. Reclaimed sites show an unnaturally low diversity of species.

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ACRONYMS

C&R	Conservation & Reclamation
EA	Environmental Assessment
EIA	Environmental Impact Assessment
ERCB	Energy Resources Conservation Board
IA	Impact Assessments
LFH	Litter, Fermentation and Humus
MSES	Management and Solutions in Environmental Science
STUDY AREA	SRFN Study Area
RMWB	Regional Municipality of Wood Buffalo
SRFN	Swan River First Nation
TLU	Traditional Land Use
ToR	Terms of Reference
ZOI	Zone of Influence

1.0 Introduction

The Swan River First Nation (SRFN) has requested that Management and Solutions in Environmental Science (MSES) undertake a time-series disturbance analysis for parts of their traditional lands. This disturbance analysis is the first step in gaining an understanding of the regional environmental planning and protection requirements for key traditional resource areas as defined by SRFN. MSES was also requested to evaluate impacts of disturbance on SRFN traditional resource use. MSES reviewed evidence regarding the availability of past and present key traditional resources and applied that evidence to a key traditional resource area as defined by SRFN for vegetation and wildlife. Specifically, the SRFN have requested that MSES focus their analyses on an area that is about 16,000 km^2 and is centred on the town of Swan Hills, with Whitecourt as the southern boundary and Lesser Slave Lake as the northern boundary. MSES also specifically included sections in the southern portion of the study area that include segments of the proposed Northern Gateway Pipeline route (please see Supplement for figures with pipeline route). The region that was analyzed by MSES is hereafter referred to as the study area.

For the purpose of this report, we have been asked to assume that the following traditional resources are of concern to the SRFN: remoteness, ecosystem process, moose, beaver, and waterfowl.

This report consists of the following three parts:

- industrial impacts on conditions supporting traditional resources;
- industrial impacts on traditional resources; and
- re-establishment of traditional resources.

Our main findings are that, as of 2009, about 65% of the study area was disturbed by industrial developments. Over the past 20 years, land disturbance in the study area has increased by over 33%, although there has been a noticeable slowing of this rate over the past decade. Two future scenarios are presented. If the rate of conversion of natural land cover to industrial surface remains constant at the predicted annual rate, then there will be 100% loss of undisturbed areas by as early as 2035. Alternatively, if the rate of conversion continues to slow, as is the case since 2001, it is possible that a plateau will be reached by approximately 2035, leaving about 4,000 to 6,000 km^2 (about 25%) of undisturbed area. This potentially remaining area, however, will be left heavily fragmented resulting in altered ecosystems with human induced sets of controls. If the rate of moose, beaver, and waterfowl habitat loss remains constant, moose will likely cease to be viable in the study area by around 2040 and beaver and waterfowl will continue to experience the erosion of their habitats. To date, reclamation practices have not re-established vegetation and wildlife diversity similar to pre-disturbance conditions, and are unlikely to do so in the future.

2.0 Industry Impacts on Conditions Supporting Traditional Resources

2.1 Remoteness as an Ecosystem Service

Key Finding: The Landsat image analysis indicates that in the past 20 years, an average of 136 km^2 of undisturbed area has been removed each year from the SRFN study area as a result of industrial activity and development. At this rate and using an approximation of total amount of land cover available in 1950 (16,694 km^2), there will be no undisturbed area left for the effective practice of traditional resource use in the SRFN study area by the year 2035. Alternatively, if the rate of conversion of natural land cover slows down, about 25% of the SRFN study area could remain in 2035 and be maintained thereafter. The fine resolution SPOT image analysis indicates that the Landsat images underestimate the actual disturbance and that as of 2009, 65% of land cover in the SRFN study area was disturbed as a result of the high density of linear industrial features and land clearing (1.11 km/km^2 linear disturbance).

This section focuses on the "deprivation of traditional lands". "Traditional lands" refers to the natural land surfaces and resources, including the vegetation and the wildlife, required to exercise traditional resource use, as opposed to industrial surfaces which do not provide traditional resources. Here, we view the ability to use traditional resources as a service provided by the ecosystem to human society (see discussion by Schindler and Lee 2010).

2.1.1 Past and Current Disturbances

2.1.1.1 Identifying the Industrial Footprint

The rate of converting natural land surfaces to industrial/disturbed ones was calculated by means of satellite imagery. Using a series of satellite Landsat5 images we calculated the yearly rate of converting natural surfaces to industrial ones from 1988 to "present" (as captured in the satellite image of 2009). We applied a change analysis using data processing based on the image algebra method which allows one to compute the change in each pixel between two images of different dates (see Appendix A for detailed methods). For consistency, all Landsat images used for this analysis were from the month of September. Images were from 1988, 2001, and 2009. Both linear and non-linear disturbances were included in the disturbance analyses. The disturbance analysis does not include damage from natural disturbances such as fire or wind storms.

For linear disturbances that may not be detected by the 30 m resolution of Landsat images, we used cloud-free SPOT images of the same area from 2008 (http://www.geobase.ca/geobase/en/browse.do?produit=imr&decoupage=image&map=canada). SPOT images are fine resolution satellite imagery with a resolution of 10 m. However, SPOT imagery is not readily available for the area prior to 2006. Therefore, we first used the Landsat imagery to gain an overall understanding of the relative changes to the landscape from 1988 to 2009, and then we used the SPOT imagery to determine how much the Landsat imagery leaves undetected. Because SPOT image analysis is very time consuming and labour intensive, the budget for this project did not allow for SPOT-

analysis coverage of the entire SRFN study area. Instead, we randomly selected three townships in which to conduct SPOT image analysis from a September 2008 image. These were: TWP 67, 66 and 63 and Range 10, 6 and 12, respectively, all west of the 5th meridian. All visible linear disturbances were digitized and these were then compared with Landsat linear disturbances in the same townships. The difference between the SPOT analysis and Landsat analysis provided us with a correction ratio to be used to "correct" the Landsat data.

2.1.1.2 Identifying the Zone of Influence

In our ecological research and evaluations, we typically find that animals avoid the area near industrial activities. This area is typically called a "zone of influence" (ZOI). Based on our experience working with First Nations, we understand that local hunters and trappers also avoid the areas near industrial activities. Consequently, in addition to analyzing the effects of direct vegetation clearing and the simple length of linear corridors, we have applied a ZOI around each disturbance footprint and each linear industrial feature.

Both the Alberta and the British Columbia provincial resource management agencies have adopted a 250 m buffer (zone of influence) when developing land use plans relating to industrial activities (ASRD 2009a, Thiessen 2009).

The distance of 250 m was chosen for several reasons, including the following:

- hunting is not permitted within 183 m of any occupied building (ASRD 2008);
- moose presence near roads is reduced within 200 m (Rolley and Keith 1980) to 500 m (Laurian *et al.* 2008);
- moose suffer higher mortality from wolf predation near trails (median distance of kills was 209 m, compared to random sites at 470 m, Kunkel and Pletscher 2000);
- caribou avoid industrial features within about 250 m (Dyer *et al.* 2001);
- the viability of caribou populations could be compromised when more than 61% of the landscape is within 250 m of industrial features (Sorensen *et al.* 2008);
- other mammals avoid industrial features within about this distance (Forman *et al.* 2003);
- birds in woodlands avoid roads, power lines and seismic lines by up to about 300 m, depending on species and ecological context (Kroodsma 1982, Bayne *et al.* 2008, Machtans 2006); and
- comprehensive reviews of edge responses show that "abiotic and plant responses are generally reported to extend up to 50 m into patches, invertebrate responses up to 100 m, and bird responses 50–200" (Ries *et al.* 2004, p. 510).

Clearly, the ZOI differs widely between the species, the type of industrial features and related activities, and the ecological context (i.e., species, reproductive cycle, hunting or predation regimes, habitat structure and quality). However, it appears that, in absence of detailed information on any of the situations, the 250 m distance is a reasonable approximation for a zone within which the abundance of wildlife and the land use by humans may be altered.

2.1.1.3 Results

Assuming that the disturbance includes a ZOI of 250 m from any industrial feature, of the 16,694 km^2 in the SRFN study area, Figure 2.1-1 shows the progression of disturbance as follows:

- as of 1988, 44% was disturbed;
- as of 2001, 56% was disturbed; and
- as of 2009, 59% was disturbed.

This analysis indicates that currently, 59% of the land in the study area is either directly disturbed by industrial activities, or within 250 m of a disturbed site. Over the past 20 years, land disturbance in the study area has increased by over 33%, although there has been a noticeable slowing of this rate over the past decade. Between 2001 and 2009 there was only a 5% increase in land disturbance according to Landsat imagery.

SPOT Image Analysis

When using the more detailed SPOT image analysis, it appears that the results shown in the Landsat analysis underestimate the amount of disturbance in the study area by approximately 10%. Using the correction factor from the SPOT image analysis, the results show that in 2009, 65% of the land cover in the study was on or within 250 m of an industrial feature (as compared to 59% calculated from Landsat images). This SPOT correction factor was used in all predictions of future development scenarios (see Section 2.1.2.1 below).

In terms of linear disturbance, in 2009, there were 18,471 km of linear corridors in the study area, representing a linear disturbance density of 1.11 km/km^2. To put this density into perspective, density thresholds of seismic lines as low as 0.3 to 0.8 km/km^2, depending on the ecological context, have been shown to exclude moose populations from an area (Weclaw & Hudson 2004). Figure 2.1-2 shows how much disturbance is underestimated when linear features are omitted from the analysis.

Consequently, with 65% of land on or near industrial features and 1.11 km/km^2 linear disturbance, wildlife species, such as moose, can likely only persist at very low densities under these land disturbance conditions.

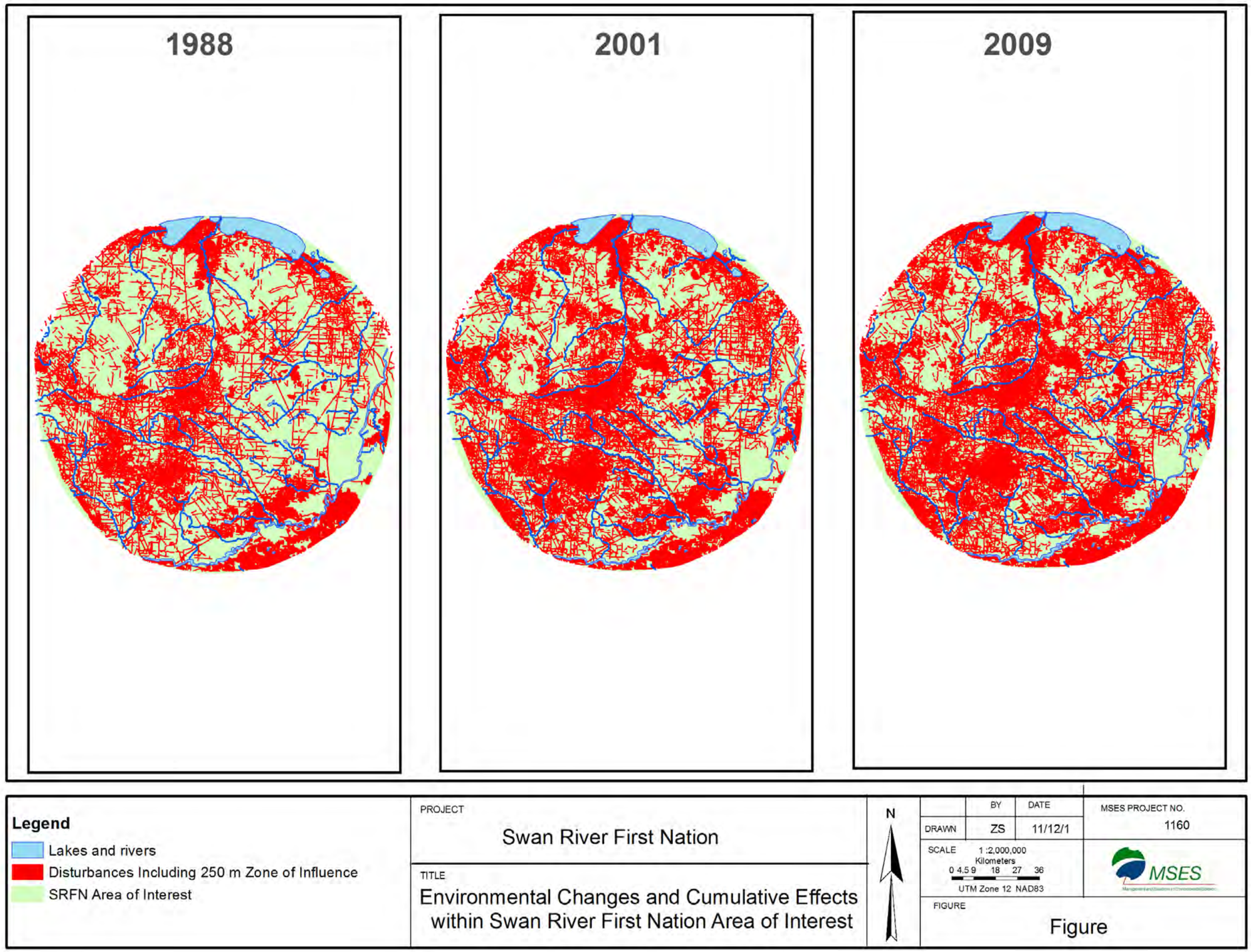

Figure 2.1-1: Increasing conversion of natural surfaces (green) to industrial ones (red) in SRFN study area. (Includes 250 m ZOI around all industrial features and is based on Landsat image analysis.)

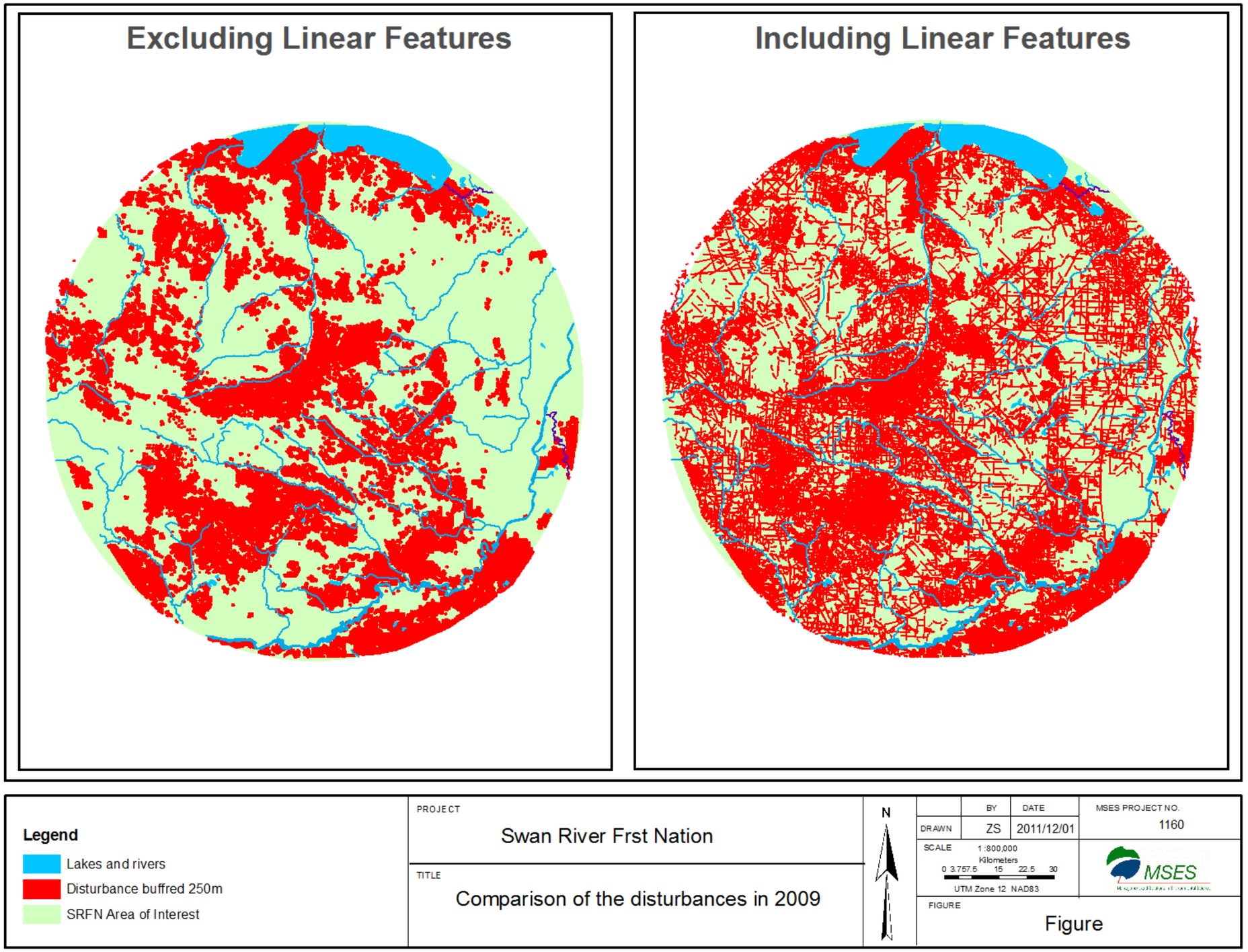

Figure 2.1-2: Comparison of the disturbances in the SRFN study area in 2009 showing all disturbances excluding linear features (left panel) and with the linear features (right panel).

2.1.2 Projected Decrease of Natural Surfaces

2.1.2.1 Rate of Disturbance and Future Projections

Landsat image analysis indicates that over the past 20 years, the study area saw an average annual addition of 124 km^2 of new disturbance. However, analysis of SPOT images shows that the Landsat images leave an approximate 10% of the disturbance undetected. We can therefore estimate (multiplying the Landsat results by a correction factor of 1.1) that the actual yearly disturbance was on average 136 km^2. It is important to note that the annual rate of land conversion has not remained constant over the past 20 years. Between 1988 and 2001 the annual rate of conversion was 186 km^2/year. It then slowed between 2001 and 2009 to 63 km^2/year.

Using the calculated rates of change, an assumption of complete landscape availability in 1950, and trend lines, we can project disturbance levels into the future. These projections are presented in Figure 2.1-3. Several different development scenarios have been plotted on this figure.

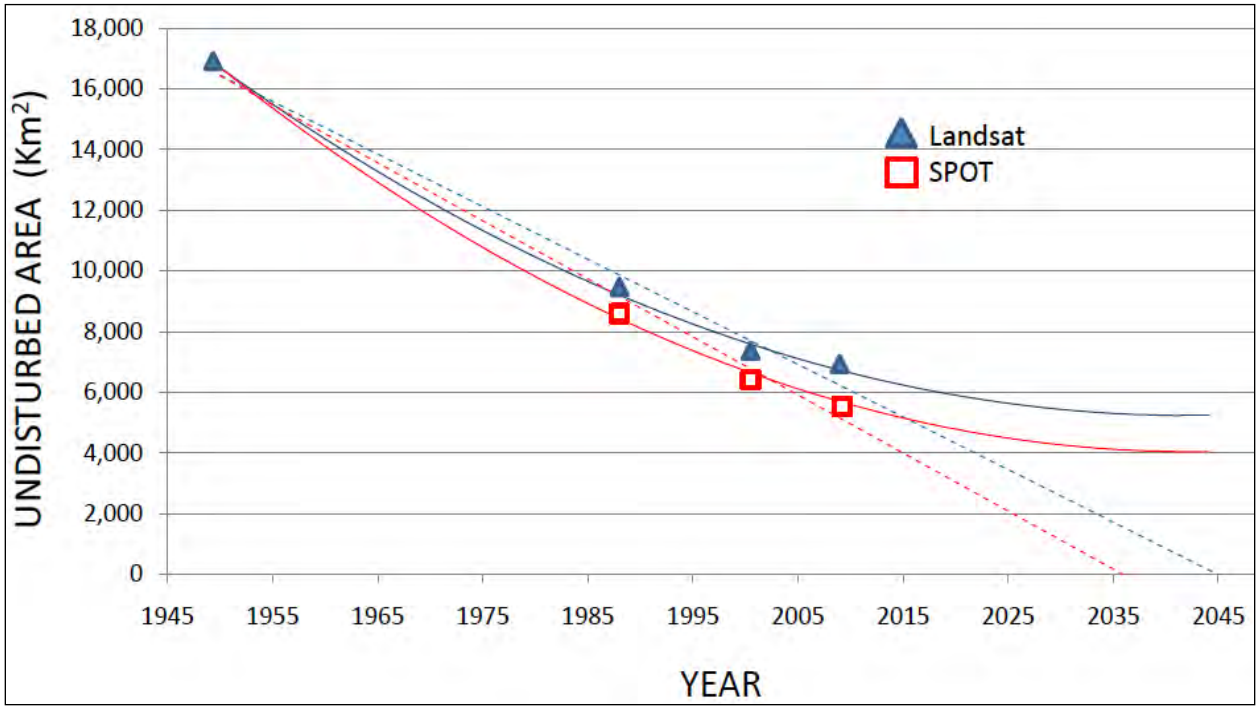

Figure 2.1-3: Projected disturbance in the SRFN study area, based on Landsat and SPOT image analysis, including ZOI. Second degree polynomial (solid lines) and linear (dashed lines) best fit trend lines were calculated. Solid symbols = measurements from Landsat imagery; Open symbols = derived from the ratio of Landsat:SPOT correction factor. The 1950 data point is an approximation of the total amount of the SRFN study area that was available for traditional resource prior to industrial development.

In the first scenario (see dashed lines in Figure 2.1-3), if the rate of conversion of natural land cover to industrial surface remains constant at the predicted annual rate then there will be 100% loss of undisturbed areas by as early as 2035 (Figure 2.1-3; red dashed lines). In other words, after 2035, there

will be no area left in the SRFN study area where a person could go to be farther than 250 m away from an industrial feature.

In the second scenario (see solid lines in Figure 2.1-3), if the rate of conversion of natural land cover to industrial surfaces continues to slow down, as it has since 2001, it is possible that a plateau will be reached by approximately 2035, leaving about 4,000 to 6,000 km^2 of undisturbed area. This would correspond to about 25% of the area being farther than 250 m from a disturbance feature.

The key to understanding these scenarios is that the analysis calculates a disturbance projection using the assumption that the actual disturbance rate measured in the past will continue into the future. Whether or not this will happen depends on all future land management decisions. We are aware that development in the Swan Hills region is growing again, including new oil and gas projects and supporting activities such as exploration and infrastructure. It has yet to be seen whether the rate of development will follow one of the two scenarios presented above.

The continued addition of new disturbance is not currently balanced by reclamation because not all vegetation types are targeted for reclamation and those that are show little similarity with pre-disturbance conditions (see Section 4.0 below, and Johnson and Miyanishi 2008).

2.1.2.2 Conservative Use of Data

A major challenge in obtaining data detailed enough to capture all disturbance data lies in the fact that Landsat images do not capture small human caused changes. While we were able to determine and apply a correction factor to the Landsat data based on the analysis of three townships on SPOT images for recent years, we were unable to apply SPOT level detail to the entire study area. Furthermore, while the analysis of SPOT images enables us to capture linear disturbance with high accuracy, we were unable to apply the same level of detail to the analysis of non-linear developments. For example, well pads are difficult to capture on satellite images and we believe that we may have omitted numerous well pads in the analysis of disturbance of the SRFN study area. Other small disturbances such as staging areas, sumps, or workers camps may not have been detected as a disturbance.

2.2 Ecosystem Process

Key Finding: The landscape disturbance process in the SRFN study area has reached an asymptote of maximum fragmentation. Further development is almost certain to push the ecosystem into a substantial and long-term reorganization which is understood as an ecosystem or regime shift.

Ecosystem shifts occur when external forces alter a system so that its organization shifts from one set of processes to another (Gordon *et al.* 2008). Folke *et al.* (2003, p.354) define ECOLOGICAL RESILIENCE as "the magnitude of disturbance that can be experienced before a system moves into a different state and different set of controls". These researchers argue that natural and human systems are combined as one social-ecological system and that ecosystems need to be managed to sustain the social systems. They define SOCIAL RESILIENCE as "the ability of human communities to withstand external shocks to their social infrastructure, such as environmental variability or social, economic, and political upheaval". If the environmental variability represents a great shock to the social infrastructure, then the social structure will break down. If the environmental variability moves the ecosystem to a different state then the First Nation traditional resource use will be unable to sustain that shock and will need to change.

The ecosystem in the SRFN study area may have already shifted to a different state: the landscape now exists of very many, very small and isolated patches of natural surfaces. To visualize the effect of vegetation clearing on natural surfaces in the SRFN study area, we calculated the number of patches of natural surfaces and the average patch size using the Patch Analyst of ArcGIS 9 for each of 20 townships in the SRFN study area representing the range of 0-100% of land cover disturbance. We also calculated the amount of natural surface disturbed in each township.

These calculations show that fragmentation of natural surfaces in the SRFN study area increases exponentially with the amount of natural surface conversion (Figures 2.2-1 to 2.2-2; Appendix B). This is consistent with theoretical predictions in landscape ecology (Andrén 1994, Hargis *et al.* 1998). Comparing these findings with snapshots of the entire SRFN study area in 1988, 2001, and 2009 (both Landsat and SPOT image corrected for 2009), the number of patches has surpassed a maximum (slope: m = -0.02; Figure 2.2-1) indicating that patches of undisturbed habitat are now being entirely removed from the landscape. Furthermore, the average size of patches is near a minimum (slope: m = -0.04, Figure 2.2-2). Therefore, the required travel distance from one patch to another is at a maximum and even if any patch is reached it is small and likely isolated.

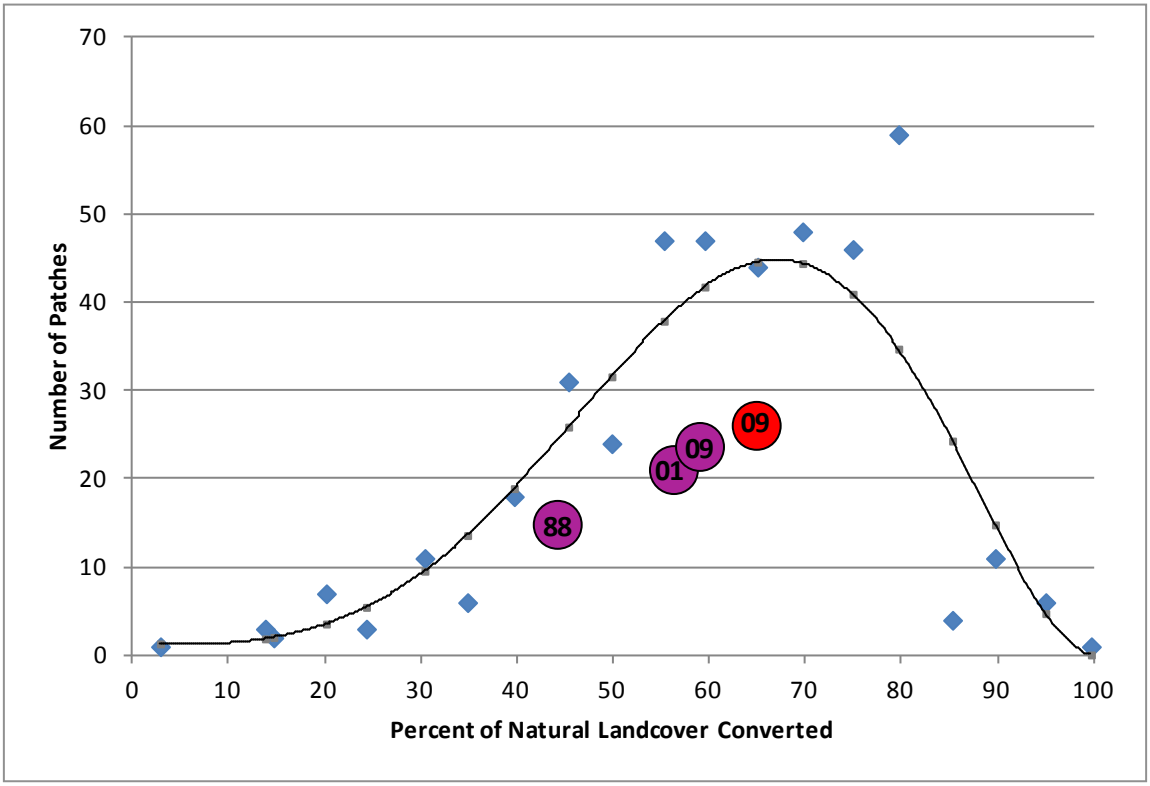

Figure 2.2-1: The number of patches of natural land cover related to the amount of land cover conversion in townships within SRFN study area.

The best fit regression model is a 3rd order polynomial (n=20, R^2=0.84, P<0.001) with a square root transformation. The R^2 value is 0.84, indicating that 84% of the variation in the data is represented by the regression line. The purple circles indicate the situation in the SRFN study area in 1988, 2001 and 2009, based on Landsat images, and the red circle indicates 2009 conditions based on SPOT image correction. The slope (m) of the regression line at 65% natural landcover converted (2009 conditions based on SPOT image correction) is -0.02.

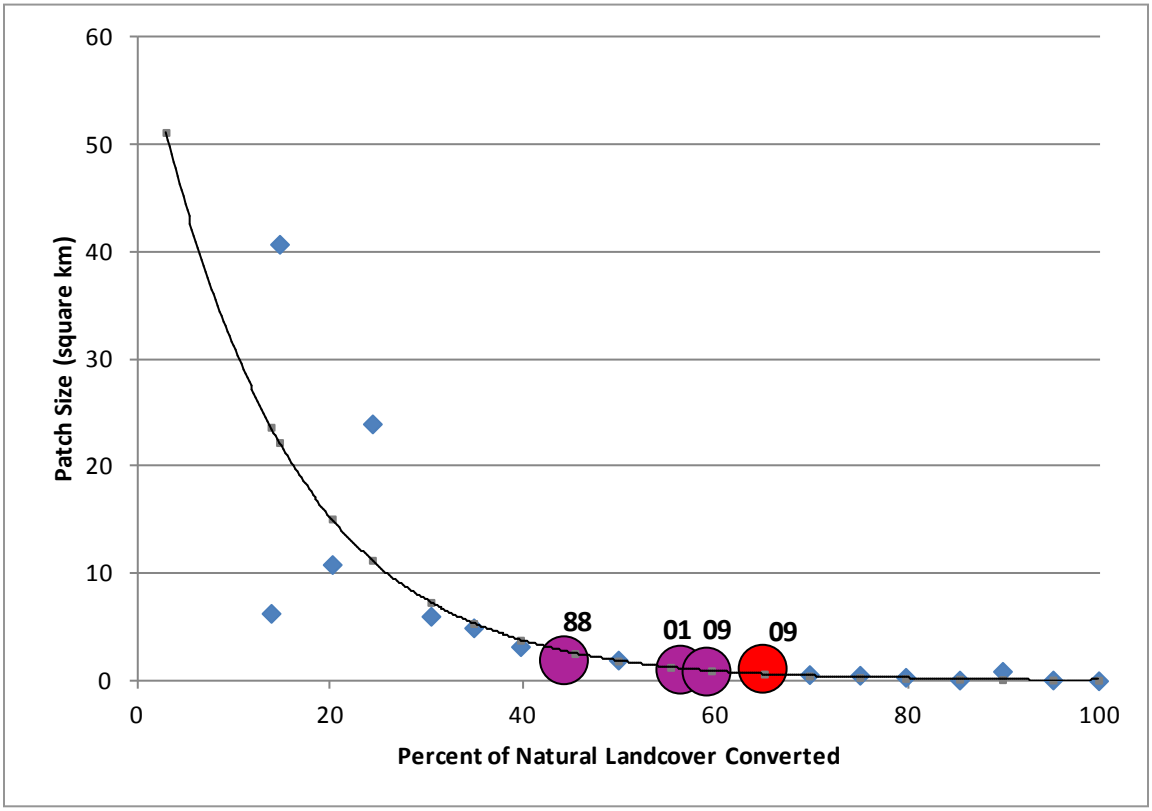

Figure 2.2-2: The average size of patches of natural land cover related to the amount of land cover conversion in townships within the SRFN study area.

The best fit regression model is a simple linear regression (n=20, R^2=0.87, P<0.001) with a natural log transformation. The R^2 value is 0.87, indicating that 87% of the variation in the data is represented by the regression line. The purple circles indicate the situation in the SRFN study area in 1988, 2001 and 2009, based on Landsat images, and the red circle indicates 2009 conditions based on SPOT image correction. The slope (m) of the regression line at 65% natural landcover converted (2009 conditions based on SPOT image correction) is -0.04.

If the original landscape is disturbed more than about 50%, it breaks up into small and isolated patches. The landscape in the SRFN study area is now dominated by disturbed surfaces and edges of the small patches with core wildlife habitat being rare. This may lead to the disappearance of wildlife species from the landscape, including moose (see Section 3.1 below), and to the invasion by other species, including deer and magpies (Dawe and Boutin 2009; ASRD 2009b). Invading deer change wolf-prey dynamics (Latham et al. 2011), and the invasion of natural vegetation communities by invasive plant species is believed to be a considerable impact caused by disturbance (White *et al.* 1993, ASRD 2004).

The landscape changes bring about many radical ecological changes, not only in wildlife and vegetation populations, but also in hydrological cycles (Gordon *et al.* 2008). The changed ecosystem structure and processes may lead to changes in the ecosystem services such as water retention and filtration, carbon storage, and resource use (Schindler and Lee 2010). Large changes in the landscape structure can increase the risk of ecological regime shifts (Gordon *et al.* 2008). In the early 1990s, aside from providing a comprehensive review of biophysical conditions and trends, the Northern River Basin Study used traditional knowledge of Aboriginal communities to illustrate the observations of people most familiar with the rivers. Traditional knowledge holders believed that changes in river conditions were not only caused by in-stream flow alterations, but also by activities on land such as mining, logging and other industrial disturbances. In support of these observations, western scientists and authors of the Northern River Basin Study agreed that land clearing includes some or all of these hydrologic impacts on rivers (Northern River Basin Study 1994, p. 29):

- changes to water tables and water retention capacity of soil;
- slow recovery of evapotranspiration processes;
- changes in the capacity of peat lands to store water;
- reduction in the size and number of wetlands;
- potential for increased flows causing degradation of rivers and streams at some locations and aggregation of rivers and stream beds at other locations;
- decreased stream gradients;
- low nutrient soil environments; and
- changes to sediment levels, water yield, water temperature, and aquatic biota.

Aside from the projected elimination of natural surfaces, it is likely that the landscape in the SRFN study area has already entered a new state of configuration of natural vegetation patches likely leading to a new scheme of ecological processes (Scheffer *et al.* 2001; Gordon *et al.* 2008). Open spaces and habitat edges or ecotones now dominate the landscape and areas large enough to be considered intact expanses of boreal forests no longer exist (Potapov *et al.* 2008 defined intact forests as areas of at least 500 km^2 without significant human activity). Concurrently with the advancement of disturbance, the spread of species such as deer, magpies, and invasive vegetation is observed as is the disappearance of others such as caribou. Early warning signals for ecological transition, such as increasing variance of environmental parameters (natural variability), may well be accessible and measurable (Landres *et al.* 1999; Carpenter and Brock 2006, Scheffer *et al.* 2009), but the system controls in the SRFN study area are not sufficiently known to quantify the change.

Oil and Gas development proponents often state that their disturbances (which in our view cause ecosystem shifts) can be reversed. However, as discussed below there is very little evidence of successful re-establishment of natural vegetation communities in Northeastern Alberta (Section 4.0). Further, there is no verifiable example where pre-disturbance conditions had been restored, which would allow for traditional land use to resume.

In fact, future development is almost certain to push the ecosystem into a substantial and long-term reorganization which is understood by many as an ecosystem or regime shift (Scheffer *et al.* 2001; Carpenter and Brock 2006; Gordon *et al*. 2008; Scheffer *et al.* 2009; Gamerstani *et al.* 2009).

3.0 Industry Impacts on Traditional Resources

3.1 Moose

Key Finding: Over the past 20 years, an average of 4.5 km² or 1.2% of moose habitat has been removed each year from the SRFN study area. At this rate, the population of moose will cease to be viable in possible as early as in the 2030s, depending on the probability of natural extinction events.

3.1.1 Moose Population Decline

Surveys in Northeastern Alberta indicate that moose have declined nearly fourfold since the 1960s. Figure 3.2-1 is based on the data provided in regulatory application documents (Suncor's Mine Dump 9 Application, Attachment 1 of the SIRs, Table 5-1, Suncor 2008). It demonstrates that moose density is declining in the region which overlaps with the SRFN study area. The declining trend is significant (Spearman rank order correlations r_s=-0.41, N=65, p<0.001) and consistent with the increasing conversion of natural land surfaces to industrial development.

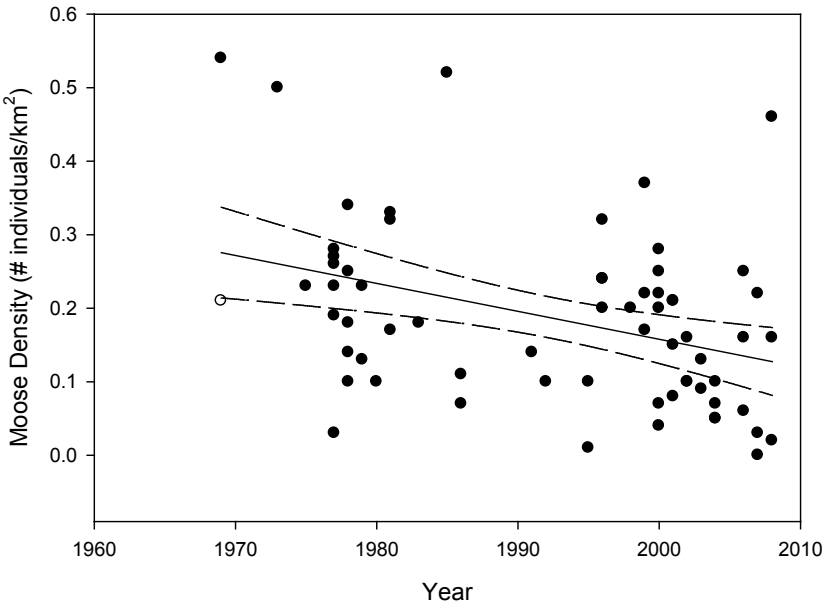

Figure 3.2-1: Moose densities (moose per km²) observed in various aerial surveys conducted by regulatory agencies or private industry between the years 1960 and 2008.

The data were obtained from Suncor (2008). Where a range of dates was given we plotted the most recent year, where multiple densities were given we plotted all indicated densities. The trend line is y=-0.0038x + 7.7525, ± 95% confidence limits indicated by the dashed lines above and below. The declining trend is statistically significant (Spearman rank order correlations r_s=-0.41, N=65, p<0.001).

3.1.2 Moose Habitat Use in Reclaimed Areas

Monitoring reports from proponents in the Alberta Oil Sands Region are required to produce evidence of wildlife re-establishment, for example Suncor's Approval No. 94-02-00:

6.1.73 The approval holder shall re-establish a diversity of wildlife and fish habitats similar to those that existed prior to disturbance, in proportions appropriate relative to the approved Life of Mine Closure Plan.

6.1.74 The approval holder shall demonstrate, through monitoring, progress in achieving a diversity of wildlife and fish habitats as outlined in subsection 6.1.73.

6.1.75 The approval holder shall document wildlife and fish habitat utilization on the reclaimed land by monitoring wildlife and fish species typically associated with and naturally occurring in the wildlife and fish habitat types present.

No moose sign on reclaimed or disturbed sites has been found by Suncor Energy Inc in either their *2007 Annual Conservation & Reclamation Report for the Millennium Mine* or their *Wildlife Monitoring Program March 2006 for the Firebag Project*. Similarly, no moose sign has been reported by either Shell (Shell Canada Energy Jackpine Mine Phase 1) or Albian Sands (Albian Sands Energy Inc Muskeg River Mine) on their reclaimed areas. Moreover, no empirical documentation of moose re-establishment has been provided by Syncrude in their 2006 Closure and Reclamation Plan.

These observations indicate that moose do not readily return to newly revegetated sites while oil sands operations are still ongoing.

3.1.3 Moose Use Habitat Less When Fragmented and in Low Supply

Increased fragmentation and decreased habitat availability result in higher isolation of moose habitat patches and smaller patch size of moose habitat. Moose are less likely to use small and isolated patches because it may not be worthwhile for moose to reach them. Evidence of moose reducing their use of habitat patches in highly fragmented areas was found in the Foothills Natural Region of Alberta (Figure 3.2-2, Stewart and Komers (in press)). The implication is that the number of moose in an area declines faster than expected from the decline in habitat availability alone because moose are unlikely to use habitat patches that are small and far apart.

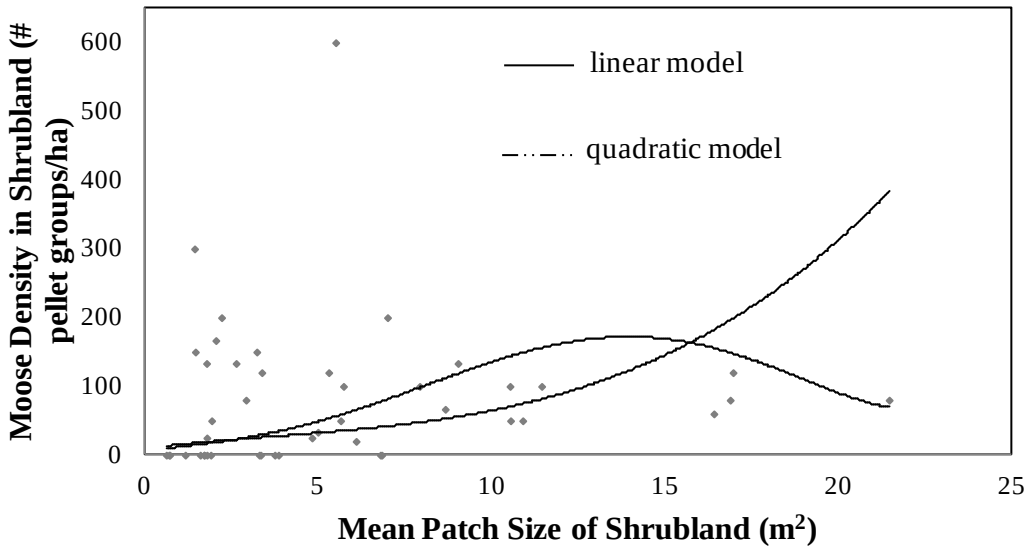

Figure 3.2-2: Moose pellet group density (indicating intensity of habitat use) in moose habitat increases as mean moose habitat patch size increases in the landscape (reprinted from Stewart and Komers 2011 (in press)).

There is a great deal of evidence from research in landscape ecology that fragmentation and isolation of habitat patches affects the ability of animals to use the patches (Collingham and Huntley 2000, Laurance *et al.* 2002). Research on moose in Alberta appears to support this evidence (Stewart *et al.* 2010, Stewart and Komers (in press)). We have used this information in our calculations of moose habitat availability in the SRFN study area. Given that fragmentation effects result in a decreasing probability of moose using small patches, we conclude that carrying capacity in highly fragmented landscapes is more variable than in contiguous landscapes.

3.1.4 Moose Habitat Decline in the SRFN Study Area

Moose habitat in the SRFN study area declined from 374 km^2 (in 1988) to 283 km^2 (in 2009). This represents a yearly loss of 4.5 km^2 (1.2%) of the moose habitat available in 1988. Moose habitat was determined by calculating an affinity index (see Appendix C for detailed methods). Affinity indices provided a quantitative evaluation of wildlife habitat preferences. These indices were designed to remove habitat availability biases from wildlife habitat use assessment (Cairns and Telfer 1980). Unlike traditional habitat modelling, which is based on literature and expert knowledge, affinity indices are based on empirical data from field measurements. Affinity indices provided a ranking of habitat preference and gave an indication of where individuals or populations of a species were likely to occur based on past observations.

We assumed that habitat normally preferred by moose that is within 250 m of industrial features is avoided by moose; therefore, we removed all habitat within 250 m of industrial features as having been disturbed. Our assumption is based on many ungulate studies in peer-reviewed literature (Rolley and Keith 1980, Dyer *et al.* 2001, Forman *et al.* 2003, Gavin and Komers 2006) as well as our own measurements in wildlife surveys and field courses with our students.

The rate of decline in habitat availability was calculated based on satellite imagery. Using a series of satellite Landsat5 images, we calculated the yearly rate of converting natural surfaces to industrial developments from 1988 to present. We applied a change analysis using data processing based on the image algebra method which allows one to compute the change in each pixel between two images of different dates (see Appendix A for detailed methods).

A map depicting the declining availability of moose habitat and increasing fragmentation between 1988 and 2009 in the SRFN study area is provided in Figure 3.2-3. Moose habitat availability prior to 1988 (i.e., pristine) is a best estimate of moose habitat before disturbance (i.e., based on vegetation data, non-moose habitat is not considered a disturbance and therefore no 250 m ZOI has been applied).

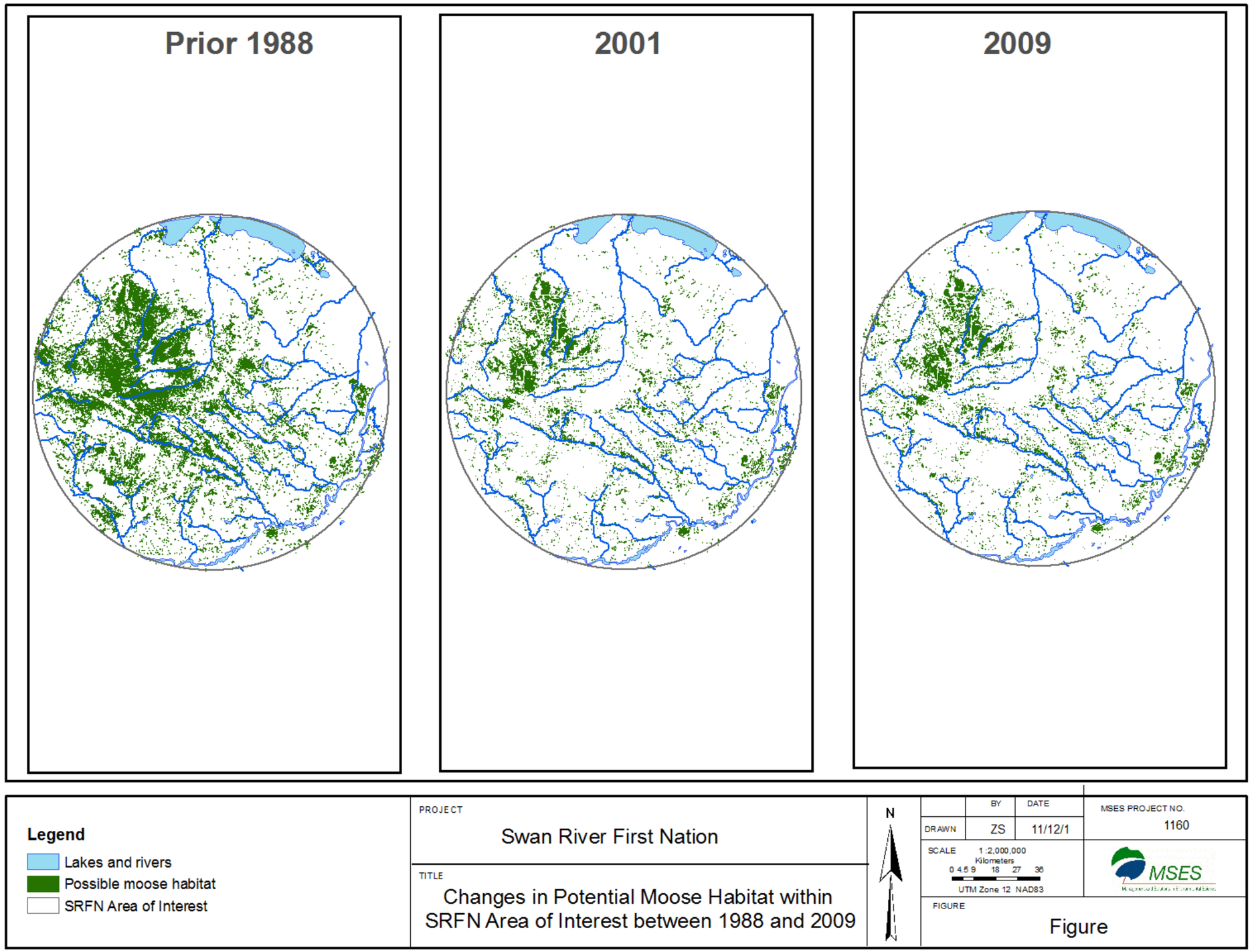

Figure 3.2-3: Moose habitat (green areas) decline in the SRFN study area between 1988 and 2009

Based on the rate of decline in the past 20 years, (undisturbed) moose habitat will disappear from the SRFN study area in about the year 2047 (Figure 3.2-4). There is currently 44% (283 km^2) of moose habitat remaining in the SRFN landscape based on the amount of pristine habitat estimated to occur pre-1988. Variability in moose density within any given habitat patch was significantly higher in landscapes with about 25-30% of undisturbed moose habitat remaining, indicating that moose may not reach some isolated patches while they may concentrate in other patches (Stewart and Komers, in press). From a land-user point of view, this means that in fragmented landscapes it is more difficult to predict which areas of habitat contain moose, and which do not.

Moose habitat in the SRFN study area has been decreasing steadily (Figure 3.2-4). At this current rate of moose habitat loss and assuming pristine moose habitat in 1950, we can expect to see significantly higher variability in moose density in remaining patches of moose habitat as early as 2018 (30% moose habitat remaining) in the SRFN study area (Figure 3.2-4). This variability in moose density will likely result in more variable hunting success and reflects a more variable carrying capacity of the landscape. Given the impacts of habitat decline and increasing fragmentation and if the decreasing trend in habitat availability continues as observed in the past, the population of moose will cease to be viable, possibly in the 1930s, a few years before all habitat disappears which will occur in the early to mid-2040s. In essence, the SRFN study area is approaching a state where habitat for moose may not be effective.

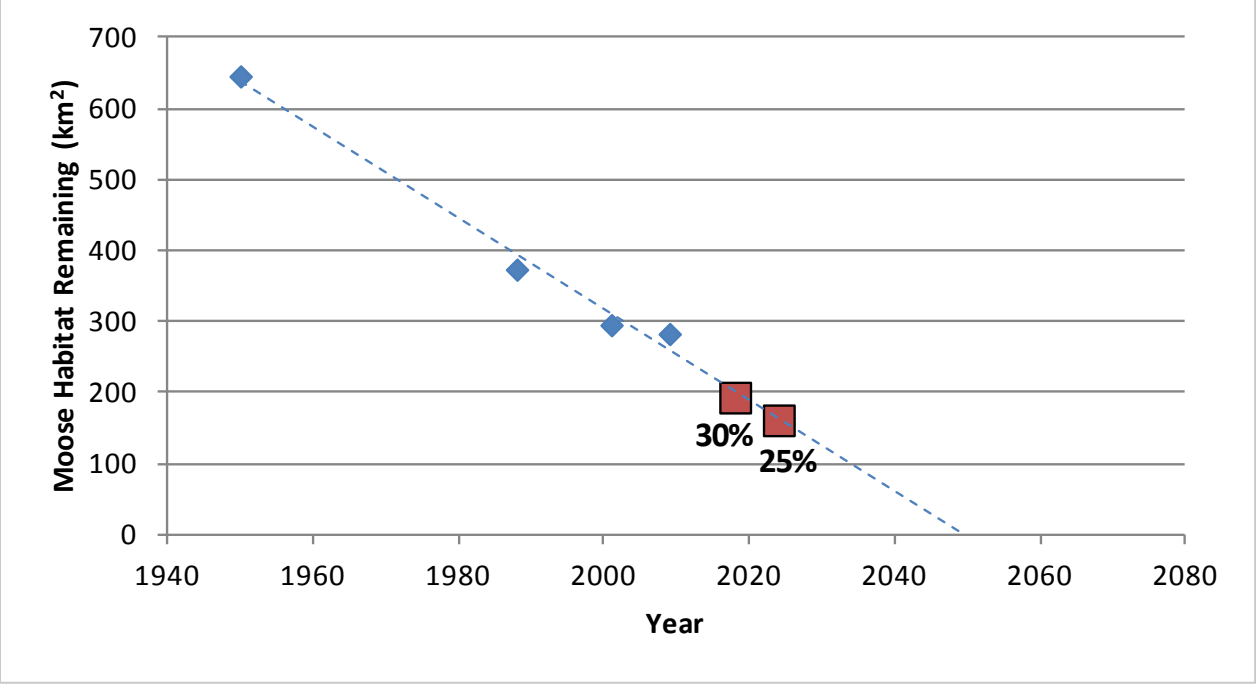

Figure 3.2-4: Projected disturbance to moose habitat in the SRFN study area based on Landsat image analysis. Blue diamonds = moose habitat remaining in the SFRN study area based on Landsat imagery (the 1950 data point is an estimation of the total amount of pristine moose habitat that was available in the SRFN study area). Red squares = 25 and 30% of moose habitat remaining in the SRFN study area, if the decreasing trend in habitat availability continues as observed in the past.

3.2 Beaver and Waterfowl Habitat Decline

Key Finding: Over the past 20 years, beaver habitat experienced a yearly loss of 2.5 km^2 or 0.9% of the 261 km^2 originally available in 1988. Waterfowl habitat experienced a yearly loss of 0.4 km^2 or 1.1 % of the 36 km^2 originally available in 1988.

Beaver habitat in the SRFN study area declined from 261 km^2 in 1988 to 212 km^2 in 2009. This represents a yearly loss of 2.5 km^2 or 0.9% of the beaver habitat that was available in1988 (Figure 3.2-5).

As for the habitat calculations for moose, we have used satellite imagery to map the distribution and availability of beaver habitat (see Appendix C for detailed methods), as well as the changes in habitat availability between 1988 and 2009. We included in our calculations the observations that beaver are disturbed from their preferred habitat within up to 50 m of human activities.

Waterfowl habitat in the SRFN study area declined from 36 km^2 in 1988 to 28 km^2 in 2009. This represents a yearly loss of 0.4 km^2 or 1.1 % of the waterfowl habitat available in 1988 (Figure 3.2-6).

We have used a model for the green winged teal as an indicator for waterfowl in general. As for the habitat calculations for moose, we have used satellite imagery to map the distribution and availability of waterfowl habitat (see Appendix C for detailed methods), as well as the changes in habitat availability between 1988 and 2009. There may be some variation between waterfowl species in their habitat requirements and their responses to disturbance, but the green winged teal model we used encompasses the general requirements of many waterfowl species in terms of their need for grassy or shrubby vegetation types in proximity to water. We included in our calculations the observations that waterfowl are disturbed from their preferred habitat within up to 100 m of human activities.

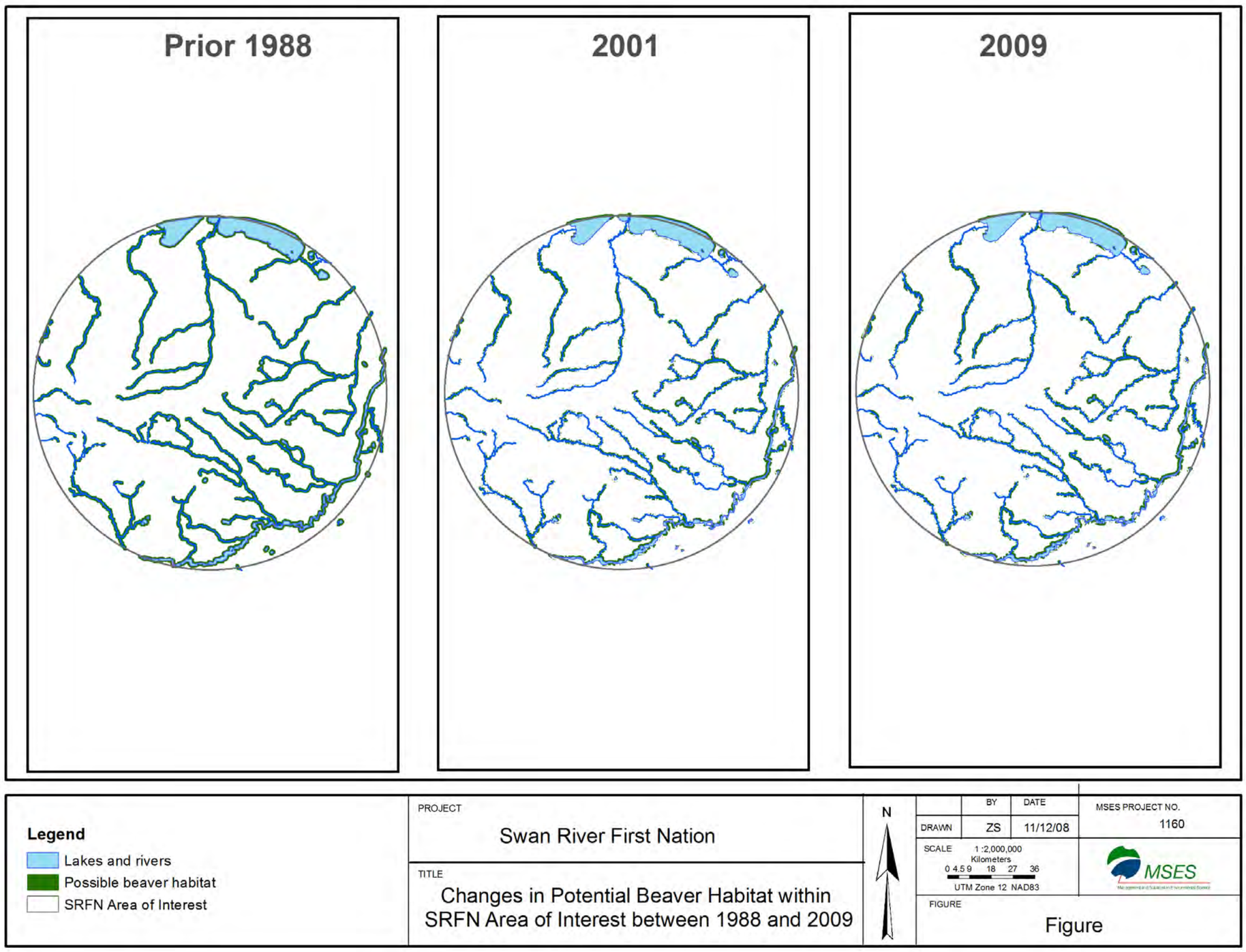

Figure 3.2-5: Beaver habitat (green areas) decline in the SRFN study area between 1988 and 2009

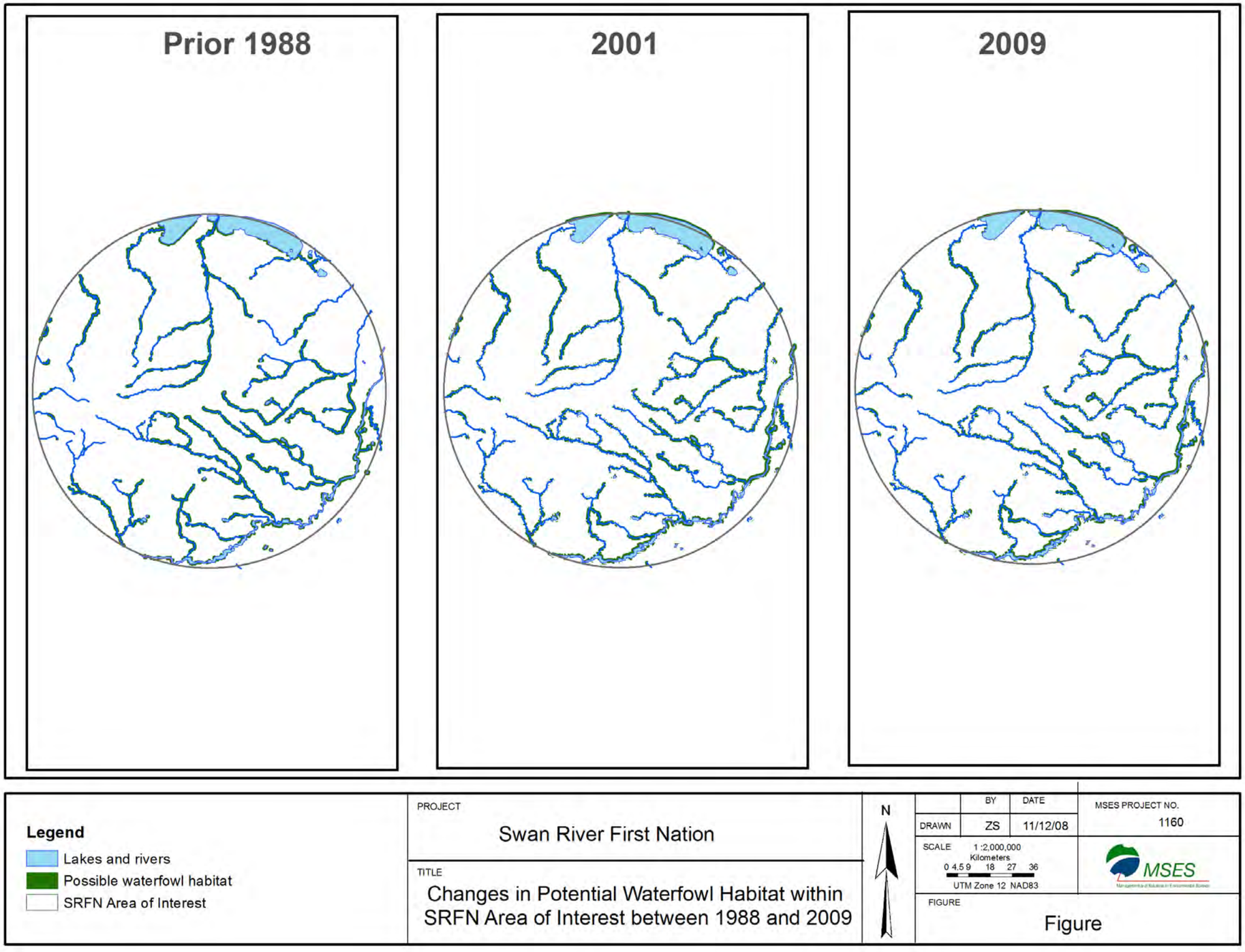

Figure 3.2-6: Waterfowl habitat (green areas) decline in the SRFN study area between 1988 and 2009

4.0 Re-establishing Traditional Resources

Key Finding: The disturbed areas are unlikely to be reclaimed. There is very little similarity in terms of species composition between reclaimed sites and natural stands. Reclaimed sites show an unnaturally low diversity of species.

4.1 Natural Forest Stands

Under natural conditions within the boreal forest, the plant species present within each stand (i.e., ecosite phase) is determined primarily by the soil moisture and nutrient regime of a site (e.g., Bridge and Johnson 2000) and by the availability of seeds or viable asexual stems/roots soon after wildfire (e.g., Greene *et al.* 2004). Most plant species in the boreal forest appear to establish within the first few years after forest fire (Chipman and Johnson 2002). The establishment of most sexually reproducing plant species occurs where the litter, fermentation and humus (LFH) layers have been consumed by fire, leaving either a very thin layer of humus or exposed mineral soil (e.g., Charron and Greene 2002, Hesketh *et al.* 2009). Where LFH is consumed by fire, conditions for establishment and growth are ideal: there is adequate moisture, space, and light, allowing plants to thrive. Soon after fire, these sites become covered with plants and as a result there is little or no further establishment. Thus, in contrast to what is often believed, a succession of plant species does not establish over long periods of time in these stands (see Appendix D for further detail). At least one study has shown that as boreal forest stand age increases, the number of vascular plant species actually decreases (Chipman and Johnson 2002).

4.2 Reclaimed Sites

In a reclaimed site, salvaged surface organic material (LFH) or a peat-mineral mix is put onto the site and a small number of tree and shrub species are planted. The presence of a relatively thick surface organic layer precludes most sexually reproducing species from successfully establishing. Therefore, these sites will consist of mainly planted species that survive and species that can sprout from underground stems or roots and spread from adjacent, intact forests. They may also contain species that have emerged from viable seeds or vegetative structures within the salvaged LFH layers replaced on a site. However, the emergence of species from the LFH appears to occur only if the LFH is replaced within 12 months of it being salvaged (MacKenzie and Naeth 2007). Unfortunately, such rapid replacement is rare in reclamation. Only a small number of species are planted in reclamation sites because it is believed that a succession of species will establish over time, eventually leading to high diversity sites similar to naturally occurring boreal forest stands. Unfortunately, this view is not supported by evidence in the scientific or gray literature.

Evidence for the above arguments of a lack of succession can be seen in peer-reviewed publications (e.g., Gutsell and Johnson 2002) and in Suncor and Syncrude's long-term reclamation data as seen in Appendix F of Guidelines to Reclaim Forest Vegetation in Alberta (OSVRC 1998). Notably, Syncrude and Suncor's results, after 40 or more years of reclamation, substantiate the arguments that there is a short establishment period in reclaimed sites and no succession thereafter (and contradict the Guidelines' own recommendations that revegetation of reclaimed sites will occur by natural successional processes). The relevant results from their reclaimed sites are detailed below (text in italics are quotes from page F-14, OSVRC 1998):

On the oldest reclaimed sites, where peat amendment was incorporated and a legume/grass mix applied, grass and legume cover ranged from 50-100%. These vegetation communities have *persisted for over 20 years* and have *resisted the establishment of native species either through natural invasion* or planting programs. Reclaimed sites that were not seeded or only seeded to annual barley have typically become dominated by a variety of herbaceous species that provide *close to 100% total cover within a few years after reclamation* (incidentally, none of these herbaceous species were present in natural stands). These herbaceous species *maintain their control in the following years*. Trembling aspen, balsam poplar and a variety of native shrubs *invade* the sites within *a few years* of reclamation.

4.3 Differences Between Natural Stands and Reclaimed Sites

The methods that are often proposed by oil sands operators to reclaim disturbed areas have been shown to result in reclaimed sites that have very low or no similarity, in terms of species composition, to natural stands, with a low diversity of species unlike any post-fire boreal forest stands. The reasons for this can be seen by examining what we know about the post-fire regeneration dynamics in the boreal forest and comparing it with the methods that are often proposed in oil sands reclamation plans.

Comparisons between reclaimed sites and natural stands show that there is very little similarity in terms of species composition between any of the reclaimed areas with natural stands. The oldest reclaimed sites seeded to grasses and legumes typically had ≤10% similar species. Sites seeded to native grasses and sites not seeded had similarity values between 0.1 and 0.29. In most cases, the *species that were common between the sites were the trees and shrubs planted as part of the reclamation program*. These results clearly show that it is incorrect to assume that re-vegetation will be augmented by natural vegetation species ingress and reclaimed areas will evolve into ecosystems similar to those found naturally. Clearly, if a particular set of plant species is desired within a reclaimed site then they will need to be planted within the first few years of reclamation. Within these reclaimed sites at least some patches of thin humus or exposed mineral soil will be needed to ensure early plant survival.

There is a relatively small number of plant species in the planting mix for reclaimed sites because it is also believed that shrubs, graminoids, and forbs will establish from seeds or propagules in the LFH layers that are placed back onto reclamation sites. However, as noted above, recent studies in the oil sands (MacKenzie 2006, MacKenzie and Naeth 2007, MacKenzie 2009) have found that when soils are stockpiled for more than one year, there are no viable seeds or root stocks remaining in the LFH. Furthermore, if the LFH was a productive source of seeds then one would expect to see the emergence of plant species found in natural stands from soils salvaged from natural areas (pre-disturbance stands). Instead, Suncor and Syncrude's reclaimed sites have plants that are "virtually absent" in natural stands (OSVRC 1998). Two of the plants found to be dominant in reclaimed sites, fireweed (a native species) and sow thistle (a non-native species), which are known to be good at dispersing quickly into disturbed areas, were not found in adjacent natural stands. Trembling aspen, balsam poplar, a variety of willows and other native shrubs *invaded* the sites (likely from asexual stems) within a few years of reclamation (OSVRC 1998). Given that none of the herbaceous species that dominated reclaimed sites were present in natural stands and that tree and shrub species apparently invaded the sites from adjacent intact stands, it does not appear that there has been emergence of individuals from the LFH.

The information presented above is important to understanding how successful reclamation might be achieved. Unfortunately, the belief that the emergence of plants from the LFH and "successional processes" will supplement any early reclamation efforts (i.e., planting/seeding) means that not enough will be done in the critical early period of reclamation to ensure that a variety of plant species will establish successfully and lead to the high diversity of forested stands seen in the pre-disturbance landscape.

To date there is no evidence that reclamation has been successful in the oil sands region of Alberta. That is, there are no reclaimed areas that are similar in species composition and contain a similar number of species as naturally occurring, boreal forest stands. Reclamation issues will be similar between the SRFN study area and the oil sands region in NE Alberta because vegetation communities are similar and the current reclamation practices (i.e. planting trees and shrubs, seeding with grasses, natural recovery) do not return the full suite of pre-disturbance plant species and vegetation types (i.e. ecosite phases and wetland types) to the reclaimed landscape.

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Appendix A

Change of Land Cover Analysis

A1.0 Change of Land Cover Analysis

We estimated the change in the landscape based on the:

1) digitized linear disturbances that are visible on the Landsat5 images at a 1:50,000 scale;
2) change analysis of the Landsat images which extracts areas that have been changed between two consecutive images.

Linear disturbances that were visible on the Landsat images were digitized and used as a separate layer of lines. We did not have any reliable information on the width of linear disturbances because they do not have a footprint per se, unless they were buffered by 250 m (see below), so as a result, the change analysis only addresses footprints of non-linear developments such as clearings, facilities, mining operations, etc.

The Landsat images used for the analysis of Swan River area of interest were taken in 1988 (September 2) and 1991 (July 25); 2001 (September 14); 2009 (September 12) and 2008 (August 8). The image resolution was 30 x 30 m and they were orthorectified using geodetic and elevation control data to correct for positional accuracy and relief displacement. Large blocks of Landsat data were adjusted through a patented procedure that uses pixel correlation to acquire tie-points within the overlap area between adjacent Landsat images (USGS 2008). Ground control points were fixed, and images were projected to the Universal Transverse Mercator map projection. All bands were individually re-sampled, using a nearest neighbour algorithm. The result is a final product with a Root Mean Square Error of better than 50 m in positional accuracy (USGS 2008). To estimate the disturbances other than linear, we performed a change analysis using data processing based on the image algebra method (Wickware and Howarth 1981, Singh 1989, Stanojevic *et al.* 2006).

The image algebra method is based on a mathematical manipulation of the values of two input images. Methods within the image algebra method include: simple differencing, image regression, and image rationing. Rationing and regression are useful when considering more than two dates because a common relationship is established between the images in an effort to normalize areas of non-change. We have used the simple differencing method, which employs a simple equation for the differencing of a common band of imagery for two image dates as shown below:

$$D_{ijk} = BV_{ijk}(1) - BV_{ijk}(2) + c$$

where: D_{ijk} = change in pixel value
$BV_{ijk}(1)$ = brightness value at time 1
$BV_{ijk}(2)$ = brightness value at time 2
c = constant
i = line number
j = column number
k = band number

The image algebra method allows the analysts to define the level of change that they are interested in describing. In our analysis, we specified that the change in pixel value had to be at least 10%. We compared the satellite image from 1988 to the images from 2001, and the image from 2001 to the image

from 2009, in order to detect changes caused by anthropogenic disturbances between these periods of time.

The 4th or 5th image bands were used for differencing within the image pairs. These were used to minimize the atmospheric effects on the spectral signature of any given land cover type. A raster file was created based on the output of this image differencing. The output raster file depicted all pixel changes greater than (approximately) 10% between the two dates. In some cases, the bands being compared were evaluated for minor differences in reflectance unrelated to changes in cover type. Discrepancies were treated by evaluating and matching the histograms of the bands used in the analysis. This process aided in the reduction of in-between scene variability as a result of potential differences in atmospheric conditions.

All of the raster files depicting change were compared with the image pairs to ensure that the appropriate data were captured. In order to reduce the data "noise" that resulted from the processing routine, the initial processed data set was re-processed using a filter to eliminate the smaller, scattered clusters of pixels that were less than 0.27 ha in size (3 pixels). Upon visual inspection of the image pairs, the vast majority of these small, scattered clusters of pixels appeared to indicate "natural" and/or phenological changes, such as varying water levels in wetlands and lakes, or varying leaf colour and cover. In some cases, the filter eliminated linear disturbances such as roads, seismic line, etc., but these were manually re-inserted into our "anthropogenically-disturbed" data layer during the visual checking stage.

An unsupervised isodata clustering process was also applied to the image files in order to provide an additional dataset to assist in determining whether specific identified changes were anthropogenically-caused disturbances. Clusters which fell into both classes were identified as "crossovers" and these pixels were subjected to another round of isodata clustering (with a greater number of specified classes) and then classified accordingly. This complementary data layer was especially useful in identifying areas affected by wildfire.

In addition to the classification of pixel clusters in the differencing output raster files, the analyst manually "cleaned" the borders of some of the detected changes. Some of the changes that were eliminated by the "noise" filter that was performed were manually recovered and added back into the data set of anthropogenically-disturbed clusters. The pixels classified as "anthropogenically-disturbed" were used to create a digital disturbance layer.

A1.1 Disturbance Buffer (Zone of Influence)

A disturbance buffer or zone of influence of 250 m around the footprints of developments and the centerlines of linear corridors was applied based on the potential for reduced animal activity and hunting and trapping activity near industrial features. The distance of 250 m was chosen for many reasons, for example, hunting is not permitted within 183 m (200 yards) of any occupied building (ASRD 2008). Other examples include: moose sign was found to be reduced within 200 m of roads (Rolley and Keith 1980); caribou avoid industrial features within about 250 m (but avoidance could be greater or smaller for some feature during some seasons, Dyer *et al.* 2001); and other mammals have been observed to avoid industrial features within this distance (Forman *et al.* 2003). Birds in woodlands have also been

observed to avoid roads, power lines and seismic lines by up to about 300 m depending on species and ecological context (Kroodsma 1982, Belisle *et al*. 2001, Machtans 2006).

Clearly, the zone of influence differs widely between the species, the type of industrial features and related activities, and the ecological context (reproductive cycle, hunting or predation regimes, habitat structure and quality). However, it appears that, in absence of detailed information on any of the situations, the 250 m distance is a reasonable approximation for a zone within which First Nations could not effectively exercise their rights.

A1.2 Atmospheric Correction

The solar spectrum electromagnetic radiation signals that satellites collect are affected by aerosols and gases in the atmosphere. Performing atmospheric correction on the satellite images can account for this modification and lead to improvements in classification and detection, and therefore, atmospheric correction problems have received considerable attention from researchers in remote sensing who have devised a number of solution approaches. Sophisticated approaches are computationally demanding and have only been validated on a very small scale (Tucker and Sellers 1986), and, in fact, some researchers have determined that atmospheric correction is unnecessary in many cases (Tucker *et al*. 2004).

We addressed the issue of atmospheric influence in our study by first creating a cloud-water mask and then performing differencing using only spectral band 4 or 5, because these are less influenced by atmospheric conditions. Other studies also dropped the bands most influenced by atmospheric effects from their analyses (Skole and Tucker1993, Collins and Woodcock 1994, Foody *et al*. 1996).

A1.3 Accuracy Analyses

Accuracy assessments determine the quality of the information derived from remotely sensed data (Congalton and Green 1999). Quantitative assessments attempt to identify and measure remote sensing-based error such as misclassification. There are two main types of common errors including omission (underestimation) and commission (overestimation). Processes that use medium and low resolution images produce larger errors than high resolution images. For the assessment, we compared data derived from Landsat images with reference data. For linear disturbances that may not be detected by the 30 m resolution of Landsat images, we used cloud-free SPOT images of the same area from 2008 (http://www.geobase.ca/geobase/en/browse.do?produit=imr&decoupage=image&map=canada). SPOT images are fine resolution satellite imagery with a resolution of 10 m. However, SPOT imagery is not readily available for the area prior to 2006. Therefore, we first used the Landsat imagery to gain an overall understanding of the relative changes to the landscape from 1988 to 2009, and then we used the SPOT imagery to determine of how much the Landsat imagery leaves undetected. Because SPOT image analysis is very time consuming and labour intensive, the budget for this project did not allow for SPOT-analysis coverage of the entire SRFN study area. Instead, three townships were randomly selected in which to conduct SPOT image analysis from a September 2008 image. These were: TWP 67, 66 and 63 and Range 10, 6 and 12, respectively, all west of the 5th meridian. All visible linear disturbances were digitized and these were then compared with Landsat linear disturbances. The difference between the SPOT analysis and Landsat analysis provided us with a "correction ratio" to be used to "correct" the Landsat data.

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Appendix B

Class Metric Regression Analysis

B1.0 Class Metric Regression Analysis

The two class-level metrics, number of patches (NUMP) and mean patch size (MPS), were regressed against the percent of natural landcover converted in each of the 20 townships analyzed in the SRFN study area to assess whether these metrics followed the expected patterns based on simulations (Gustafson and Parker 1992, Hargis et al. 1998). Simple linear, quadratic polynomial, and cubic polynomial regression models were fit to the data using Systat software (Systat Software Inc. 2004) and compared using AICc values (Burnham and Anderson 1998). The response variable NUMP was square root transformed and the response variable MPS was natural log transformed to satisfy assumptions of normality and heteroscedasticity. Estimated response variables were backtransformed for the purposes of presentation and calculation of slopes at 65% disturbance (corresponds to 2009 conditions based on SPOT image correction).

The cubic polynomial model was the best model for describing the relationship between NUMP of landcover and the percent of natural landcover converted. The linear model was the best model for describing the relationship between landcover MPS and the percent of natural landcover converted (Table B1-1).

Table B1-1: Regression results and AICc values for landcover class metrics versus the percent of natural landcover converted.

CLASS METRIC	TYPE	P VALUE	R2	AICC	Δ AICC (X – SMALLEST)
NUMP = % of natural landcover (n=20)	Linear	0.14	0.12	37.81	26.82
	Quadratic	<0.0001	0.66	21.66	10.67
	Cubic*	<0.0001	0.84	10.99	0
MPS = % of natural landcover (n=20)	Linear*	<0.0001	0.87	-3.04	0
	Quadratic	<0.0001	0.87	0.07	3.12
	Cubic	<0.0001	0.89	0.72	3.76

* best models describing relationship

B1.1 References

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Appendix C

Wildlife Habitat Models

C1.0 Affinity Index for Moose Habitat

Information on differential habitat use by wildlife species can be used to develop management tools for species potentially affected by human development (Harkonen and Heikkila 1999). Many methods provide general information on species habitat use, but often habitat availability is not taken into consideration when interpreting this information. Affinity indices provided a quantitative evaluation of wildlife habitat preferences. These indices were designed to remove habitat availability biases from wildlife habitat use assessment (Cairns and Telfer 1980).

Unlike traditional habitat modelling, which is based on literature and expert knowledge, affinity indices are based on empirical data. Affinity indices provided a ranking of habitat preference and gave an indication of where individuals or populations of a species were likely to occur. It should be noted that actual use of habitat by individuals may vary depending on the local (home range) availability of alternative habitat that may provide some resource value (Dunning *et al.* 1992; Estades and Temple 1999). There could be what is termed a neighbourhood effect, whereby abundance within preferred habitat may be positively or negatively influenced by adjacent vegetation, depending on the quality of the adjacent vegetation (Dunning *et al.* 1992). These relationships are difficult to assess; however, they may account for subtle differences in habitat use between different home ranges.

Habitat preference was determined using affinity indices for moose which were calculated based on reports that provided information on relative abundance, survey effort, and habitat availability for the Oil Sands Region. This information was obtained from several EIAs listed in Table C1-1.

Table C1-1: Datasets Used for Calculation of Affinity Indices

Valued Ecosystem Component	Data Type	Number of EIAs Used	EIAs Used
Moose (*Alces alces*)	Pellet Group Data	7	Husky Oil Operations Ltd. 2005 Imperial Oil Resources 2006 OPTI-Nexen 2006 Shell Canada Ltd. 2002 Shell Canada Ltd. 2005 Suncor Energy Inc. 2005a Suncor Energy Inc. 2005b
	Winter Track Count Data	4	Birch Mountain Resources Ltd. 2006 Shell Canada Ltd. 2002 Suncor Energy Inc. 2005a Suncor Energy Inc. 2005b

Affinity indices were calculated using methods outlined in Neu *et al.* (1974), Cairns and Telfer (1980), and Harkonen and Heikkila (1999). Affinity indices were calculated as: (proportion of total counts of species sign on plots in vegetation group x (p_i)) / (proportion of study plots in vegetation group x). Species sign refers to the data type available for moose, as indicated in Table C1-1. Affinity indices are positive values with no upper limit. The calculation of affinity indices takes sampling effort into consideration. An index <1.0 indicated that the vegetation group was used less than one would expect based on availability. An index equal to 1.0 indicated that the vegetation group was used in proportion to its availability. An index >1.0 indicated that the vegetation group was used more than one would expect based on availability (preferred). Bonferroni confidence intervals were calculated to determine which vegetation groups were used significantly more or less than would be expected based vegetation availability alone (Neu *et al.* 1974; Arthur *et al.* 1996). Affinity indices give an indication of habitat preference, while Bonferroni confidence intervals determine statistical significance of vegetation use. Bonferroni confidence intervals were constructed for each observed proportion of species sign (p_i) to identify whether the expected proportion of species sign (area of habitat x out of all habitat available) fell within the magnitude of the significant effects. Bonferroni confidence intervals use an adjusted z-statistic that widens the confidence intervals (to bound the probability error rate at α=0.05) and takes into consideration that multiple simultaneous estimates are being made. The form of the confidence interval is:

$$p_i - z_{(1-\alpha/2k)}\sqrt{(p_i(1-p_i)/n)} \leq p_i \geq p_i + z_{(1-\alpha/2k)}\sqrt{(p_i(1-p_i)/n)}$$

where: α = 0.05, k = number of simultaneous estimates (i.e., the number of vegetation groups with data), and n is the sample size (e.g., number of pellet groups). This method of habitat use assessment accounted for vegetation availability biases. The ability to detect significant differences, or the power of an analysis, increases with an increase in sample size due to a corresponding reduction in the standard error of the estimate (Peers 1996). Therefore, vegetation types with affinity indices closer to 1.0 may be found to be significant if there is a large sample size, while those with indices farther from 1.0 may not be found to be significant due to a smaller sample size.

Vegetation group rank was determined using results of the Bonferroni confidence intervals and data interpretation where needed. The ranking system used consisted of four classes: High (1), Moderate (2), Low (3), and Very Low (4). Most often, vegetation used significantly more than expected based on availability (according to Bonferroni confidence intervals) were categorized as Very Low or High, respectively. In some cases, ranks were assigned based on a combination of the affinity index, professional knowledge and data interpretation. Effective wildlife habitat was considered to be vegetation groups ranked as High and Moderate, while vegetation groups ranked as Low and Very Low were considered to be non-effective habitat. Effective habitat is where species abundance is likely to be highest and where the majority of resources are found in the landscape for a species. It is essential to understand the distribution of effective habitat in order to make predictions about the impact that changes to the landscape may have on a particular species. Habitat availability for the baseline scenario was presented using this binary classification of effective and non-effective habitat in the landscape.

A primary goal of habitat mapping was to be able to predict the distribution and abundance of species of interest by extrapolating from sampled to un-sampled areas. Vegetation group ranks were associated with a spatial vegetation component that was easily analyzed and integrated using a Geographic Information System (GIS). Ranks based on affinity indices, spatial vegetation information, and baseline zone of influence were integrated using a GIS to determine baseline habitat availability.

C2.0 Green-winged Teal Habitat Model

C2.1 Introduction

The group of waterfowl known as "dabbling" ducks are common in Alberta from March – October (Fisher and Acorn 1998). Dabbling describes the feeding behaviour whereby invertebrates, seeds, and other plant materials are filtered from or near the surface of the water. Dabbling duck nesting sites generally occur where graminoid, herbaceous, and low shrub cover (<1 m tall) occur adjacent to water (Bent 1987). The waterfowl habitat model is based on the Green-winged Teal (*Anas crecca*), a typical dabbling duck species that is representative of ducks and waterfowl occurring in the study area. This species-habitat model was developed using published literature and adapted from a Blue-winged Teal model developed by OPTI-Nexen (2006).

C2.1.1 Status

The status of the Green-winged Teal is determined by federal and provincial agencies. As of August 2007, the Green-winged teal in Canada was not listed on any of the Schedules of the *Species At Risk Act* (SARA). The Committee on the Status of Endangered Wildlife in Canada has not classified the Green-winged teal (COSEWIC 2008). The Green-winged teal is listed as *Sensitive* in Alberta (AENV 2005).

C2.1.2 Distribution

The breeding habitat of the Green-winged Teal spans most of Canada and Alaska, and spreads south into states of North Dakota, Minnesota, Northern Michigan, and Maine. They do not winter in Alberta, but rather migrate south to the western and southern United States and Mexico (Roof 1999).

C2.1.3 Habitat Preferences

The Green-winged Teal is typical of dabbling duck species occurring within Alberta. Their primary habitat requisites are aquatic habitat for rearing young and feeding with adjacent suitable nesting habitat. Green-winged Teal feed in shallow water with abundant aquatic vegetation. The Green-winged Teal will most often be found feeding in shallow waters near the shoreline, where they feed on aquatic invertebrates, seeds of aquatic vegetation, and directly on aquatic vegetation (Roof 1999). Any open waterbody, including rivers, creeks, ponds, marshes, and lakes, was considered as potentially suitable habitat for the Green-winged teal. Suitable nesting habitat consists of graminoid, herbaceous and low shrub habitat within 100 m of open water (Hickie 1985).

High quality habitat for the Green-winged Teal was determined by the close proximity (<100 m) of feeding and nesting habitat. Forage was considered to be limiting during the summer season before they migrate south. Reproductive habitat was considered to be a critical factor for green-winged teal during the spring season.

The key habitat components for this species were:

- open water (feeding; summer); and
- graminoid, herbaceous, and low shrub habitat (nesting; spring).

C2.2 Development of Ratings Table

Ratings are listed for each landcover class occurring in the study area (Table C2-1) for each of the life requisites of the Green-winged Teal.

Table C2-1: Vegetation Group Ratings for the Green-winged Teal Life Requisites in the study area (Rating: 4= best, 1=poorest)

Vegetation Group	Nesting: ≤100 m to Water (Spring)	>100 m apart (both requisites)
Bog / fen	4	1
Coniferous	1	1
Deciduous	1	1
Disturbed	1	1
Mixed wood	1	1
Shrub	4	1
Water	n/a	n/a

C2.2.1 Development of Ratings Table

Green-winged Teal ratings tables were developed for suitability of vegetation groups for the spring and summer seasons. The following list of assumptions was applied to the model:

- any permanent water bodies such as ponds and lakes were suitable as foraging habitat (excluding tailings ponds, streams and Athabasca River); and
- suitable nesting sites were limited to graminoid, herbaceous and low shrub habitat within 100 m of foraging habitat.

The suitability of a habitat type providing resources for one life requisite depended on its proximity to another habitat type providing for another life requisite (Dunning *et al.* 1992). This attribute of Green-winged Teal habitat requirements (i.e., proximity of nesting and food resources) was incorporated into the model (Table C2-2).

Table C2-2: Adjustments for Green-winged Teal Habitat in the Wildlife Study Area

Needs	Variable	Parameter	Details	Rating	Comments
Spring and Summer: Nesting and Feeding (March – October)	Vegetation and Water	Proximity	Both nesting and food habitat within 100 m	No change to rating.	Habitat requirements met.
			All area >100 m from water's edge	Rating 1-4=1	Proximity requirement not met.
		Human Activity (roads, RoW, facilities, developments)	0-50 m	Rating down by 2	≤50 m waterfowl vigorously swim or fly.
			50-100 m	Rank down by 1	>50 m waterfowl response less vigorous (Pease *et al.* 2005).

C2.3 Development of Ratings Table

The Green-winged Teal model was evaluated using Green-winged Teal observations from waterfowl surveys conducted in various surveys in the oil sands. Green-winged Teal locations were overlaid on maps showing the distribution of Green-winged Teal effective habitat.

C3.0 Beaver Habitat Model

C3.1 Introduction

Beaver (*Castor canadensis*) are specialized aquatic rodents that are active year-round and range throughout the North America (Allen 1982). Beavers inhabit permanent waterbodies, such as streams, ponds, and lakes, with forested and shrubby margins for forage and building materials. Beavers build lodges on waterbody shorelines or directly within waterbodies, and also build dams to regulate water levels (Fisher and Acorn 1998). This species-habitat model was developed using published literature and adapted from Allen (1982).

C3.1.1 Status

As of August 2007, the beaver was not listed on any of the Federal Schedules of the *Species At Risk Act*. The Committee on the Status of Endangered Wildlife in Canada has not classified the beaver (COSEWIC 2008). The beaver is listed as *Secure* in Alberta (AENV 2005).

C3.1.2 Distribution

Beaver range throughout Canada, though they are infrequent in the prairie regions and not present north of the treeline (Rezendes 1999). In their 2nd spring, subadult beavers will migrate to alternate waterbodies, while adult beavers are non-migratory. Migrations typically cover a distance of approximately 8 to 16 stream km (Allen 1982).

C3.1.3 Habitat Preferences

Beaver inhabit permanent freshwater environments, including lakes, ponds, and low-gradient streams, where suitable woody vegetation is in close proximity. Beavers gather food from around a pond and return it to a central location for consumption. Beaver have been known to forage at distances up to 200 m from the water's edge, but typically remain within 100 m of the shoreline (Boyle and Owens 2007). The effort associated with transportation of trees increases as distance from the pond increases. Gallant *et al.* (2004) found that as distance from water increases, tree selection became more selective with fewer, larger trees being cut. This decrease in the number of trees being cut as distance increases suggests an incremental decrease in habitat suitability and no suitability beyond a distance of 200 m. Suitable vegetation consists of tree and/or shrub cover adjacent to the waterbody. Beaver have been noted to prefer aspen and willow species, but will also utilize coniferous species if needed (Allen 1982). Suitable beaver habitat must include a permanent and stable waterbody with a gradient of less than 15%, and the presence of year-round woody food sources (Williams 1965).

High quality beaver habitat was determined by the close proximity (<200 m) of feeding and low-gradient aquatic habitat (ponds and lakes). High quality habitat occurred within 20 m of streams, as streams were likely to be used in search of forage or building materials, but not directly inhabited. Forage was considered to be limiting during the winter season when beavers rely solely on woody vegetation. Reproductive habitat was considered to be a critical factor for beaver during the spring season.

The key habitat components for this species were:

- adjacent tree and shrub habitat (forage; winter);
- permanent water (reproduction; spring); and
- low gradient of water body (reproduction; spring).

C3.2 Development of Ratings Table

Ranks are listed for each vegetation type occurring in the study area (Table C3-1) for each of the life requisites of the Beaver.

Table C3-1: Vegetation Group Ratings for the Beaver Life Requisites in the Study Area (Rating: 4= best, 1=poorest)

Vegetation Group	Distance to Stream: 0-20 m (Spring)	Distance to Pond/Lake: 0-100 m (Spring)	Distance to Pond/Lake: 100-150 m (Spring)	Distance to Pond/Lake: 150-200 m (Spring)	Distance to Pond/Lake: >200 m (Spring)
Bog / fen	1	1	1	1	1
Coniferous	3	3	2	1	1
Deciduous	4	4	3	2	1
Disturbed	1	1	1	1	1
Mixed wood	4	4	3	2	1
Shrub	4	4	3	2	1
Water	n/a	n/a	n/a	n/a	n/a

C3.2.1 Assumptions and Adjustments

Beaver ratings tables were developed for suitability of habitat types for the spring and winter seasons. The following list of assumptions and limitations applied to the Project area:

- suitable foraging habitat was limited to woody tree and shrub habitat within 200 m of a permanent waterbodies such as lakes and ponds and within 20 m of streams;
- any permanent water bodies such as ponds, lakes, and streams were suitable as habitat for reproduction (excluding tailings ponds, streams and Athabasca River); and
- the most suitable waterbodies had a gradient of less than 6%. Permanent ponds, lakes, and most streams meet this criterion.

The suitability of a habitat type providing resources for one life requisite was dependent on its proximity to another habitat type providing for another life requisite (Dunning *et al.* 1992). This attribute of beaver habitat requirements was incorporated into the model (Table C3-2). The presence of either water or forage was insufficient for supporting beavers in the study area. Both habitat requirements occurred within 200 m of each other (20 m for streams) in order to be given a habitat suitability ranking, otherwise the habitat was considered unsuitable.

Table C3-2: Adjustments for Beaver Habitat in the Wildlife Study Area

Needs	Variable	Parameter	Details	Rating	Comments
Winter and Spring: Food and Reproduction	Vegetation and Water	Proximity of food and residence to ponds and lakes	0-100 m	No change in rating.	Proximity requirement met.
			100-150 m	Rating down by 1.	Most trees are cut within 100 m. More selective tree cutting occurs beyond 100 m (Boyle and Owens 2007).
			150-200 m	Rating down by 2.	
			>200 m	Rating 1-4=1	Maximum distance recorded for trees cut (Allen 1982a).
		Proximity of food to streams	0-20 m	No change in rating	Proximity requirement met.
			>20 m	Rating 1-4=1	Unlikely to travel beyond 20 m of streams.
		Human Activity (roads, RoW, facilities, developments)	0-50 m	Rating down by 1	Disturbance adjacent to waterbodies may remove or adversely affect resources (Slough and Sadleir 1977)

C3.3 Model Evaluation

The beaver model was evaluated using Beaver and Beaver sign observations from field surveys conducted in the oil sands region. Beaver locations were overlaid on maps showing the distribution of Beaver effective habitat.

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Appendix D

Background on Forest Succession and Reclamation through Natural Succession

D1.0 Reclamation in Environmental Impact Assessments

The reclamation process is typically based on CEMA's guidance and the general belief described in EIAs of the Oil Sands Region:

> "Successful reclamation requires the reestablishment of ecosystem functions based on natural successional processes."
>
> "While specific ecosite phases will be targeted within various landscapes, natural processes will ultimately determine the progression and eventual ecosite phase. Revegetation will be augmented by natural vegetation species ingress and successional processes, providing an opportunity for reclaimed areas to evolve into ecosystems similar to those found naturally in the region under similar environmental conditions."

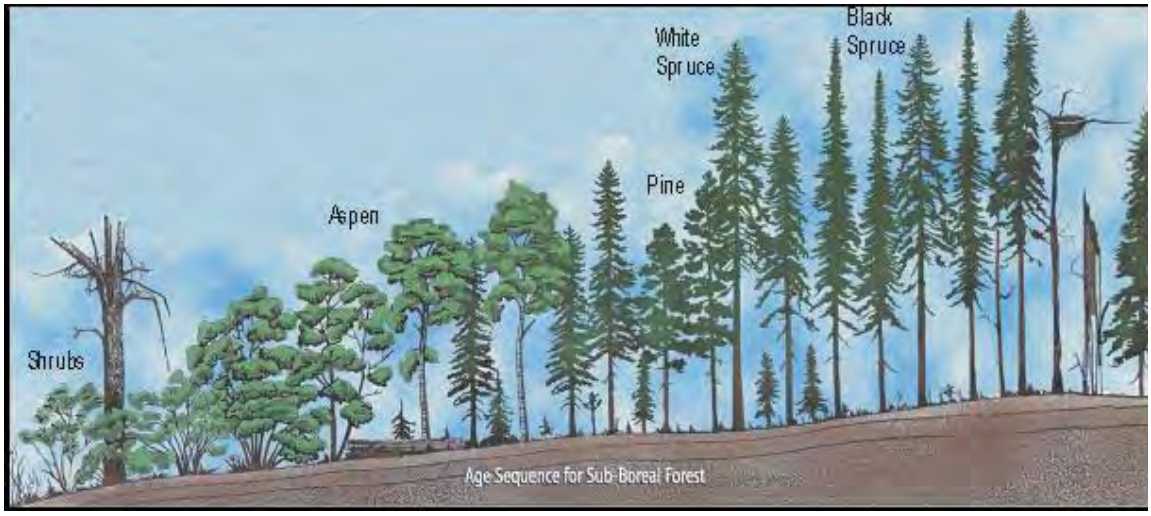
As the above and similar such statements from EIAs indicate, an important part of any reclamation plan involves believing that "a succession of species" will become established on their own within reclaimed sites. This means that only a few species may be planted/seeded initially in the reclamation site with the expectation that a series of plant species will become established on their own over time. However, *direct* evidence from both Suncor and Syncrude data and scientific studies shows that in the boreal forest most plant species become established within the first few (~five) years of reclamation or after forest fires. The only species that we are aware of that can establish after this initial period are trembling aspen (*Populus tremuloides*), which can sprout from underground stems, and white birch (*Betula papyrifera*) which can sprout asexually from the base of the tree, usually after the tree is damaged or dies. However, both species have high mortality rates.

D1.1 Background about Forest Succession

Definitions of forest succession may include only tree species or all plant species that exist in a forest. The concept of succession with only trees or all plants came about using what is called a chronosequence approach. This approach is described below for only tree species, but the same approach has been used to develop successional arguments for all plant species.

Forest succession is hypothesized to be a result of differences among tree populations in establishment time and growth and death rates. Some populations establish, mature, and decline when a community is young, while others do so when the community is middle aged, or older. Hence, there is a succession of tree species replacing each other. It is often believed that the early successional species make the environment unsuitable for recruitment of their own species such that as they die, space is made available for the next species in the successional sequence.

For example, Figure D1-1 below shows a *hypothesized* pattern of forest succession in the boreal forest, with different tree populations establishing and dominating at different times. In early succession, aspen (*Populus tremuloides*) establishes and dominates the community. In mid-succession, as aspen dies, white spruce (*Picea glauca*) and pine (*Pinus banksiana*) establish and dominate the community. Finally, in late succession, when aspen and pine have died, black spruce (*Picea mariana*) establishes and dominates the community (with some white spruce).



Aspen dominates	White Spruce/Pine dominate	Black Spruce dominates
Early Succession	→Mid-Succession →	Late-Succession (Old-growth)

Figure D1-1: Hypothesized pattern of forest succession in the boreal forest

The theory of forest succession is widely accepted as an accurate description of nature, but there is actually little *direct evidence* that tree populations succeed each other. Direct evidence is lacking because the long life span of trees (>100 years) makes it impossible to follow several generations of tree species populations long enough to see the replacement of tree species in the canopy.

Because showing forest succession directly is difficult, ecologists have tried to document succession indirectly (e.g., Cowles 1899 and Cooper 1923 are examples of two classic studies). They have attempted this by finding a series of forest sites that are believed to be similar in all respects except age. This series of sites is called a chronosequence. For example, Figure D1-2 below shows the same diagram as above but it is divided into a chronosequence of sites, separated by vertical black lines. On the left is a young site dominated by aspen, in the middle is a middle-aged site dominated by white spruce and pine, and on the right is an old site dominated by black spruce.

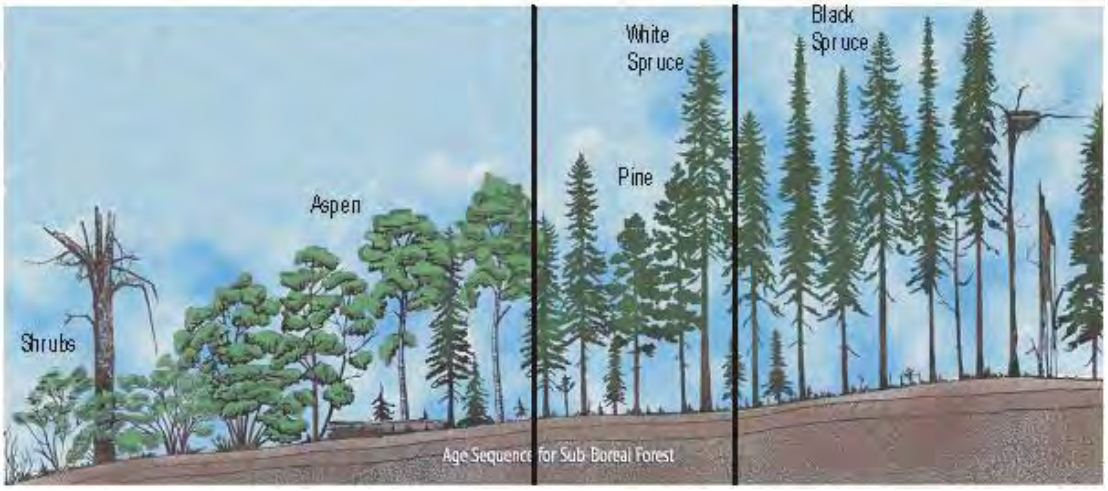


Figure D1-2: Chronosequence for sub-boreal forest

It is *assumed* that the different tree populations dominating the different-aged sites represent a sequence over time that occurred (and is occurring) at each site. Unfortunately, studies advocating succession seldom test the assumption that different aged sites experience the same developmental sequence. In fact, the few studies that have examined this assumption have found that plant populations do not succeed each other over time (e.g., Jackson *et al.* 1988; Fastie 1995).

Succession, as described above (or some form of the above) is a widely-believed concept. Therefore, it is surprising to most people that there is actually no *direct* evidence of succession in the boreal forest, or in other forests. More recent studies have shown that forest dynamics are actually much simpler than succession theory suggests. The recruitment of plant species after forest fires or during initial reclamation of oil sands sites is rapid and occurs until all available sites are occupied by plants (e.g., Gutsell and Johnson 2002, OSVRC 1998). After this initial period, the number of species within sites actually decreases such that older stands are less diverse than younger stands (Chipman and Johnson 2002).

D1.2 References

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Supplement

Gateway Pipeline Figures

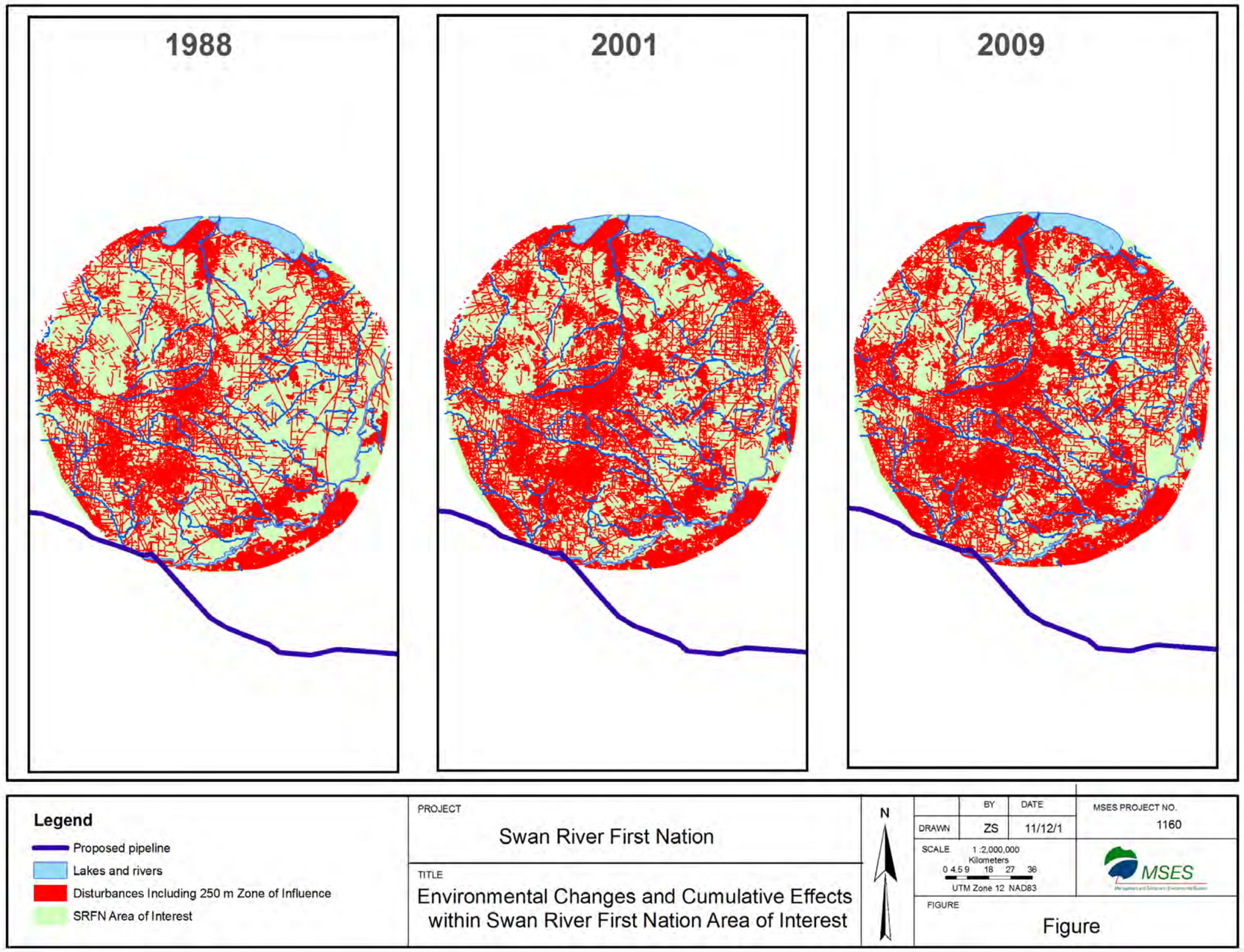

Figure E-1: Increasing conversion of natural surfaces (green) to industrial ones (red) in SRFN study area with inclusion of the proposed Gateway Pipeline route.

(Includes 250 m ZOI around all industrial features and is based on Landsat image analysis.)

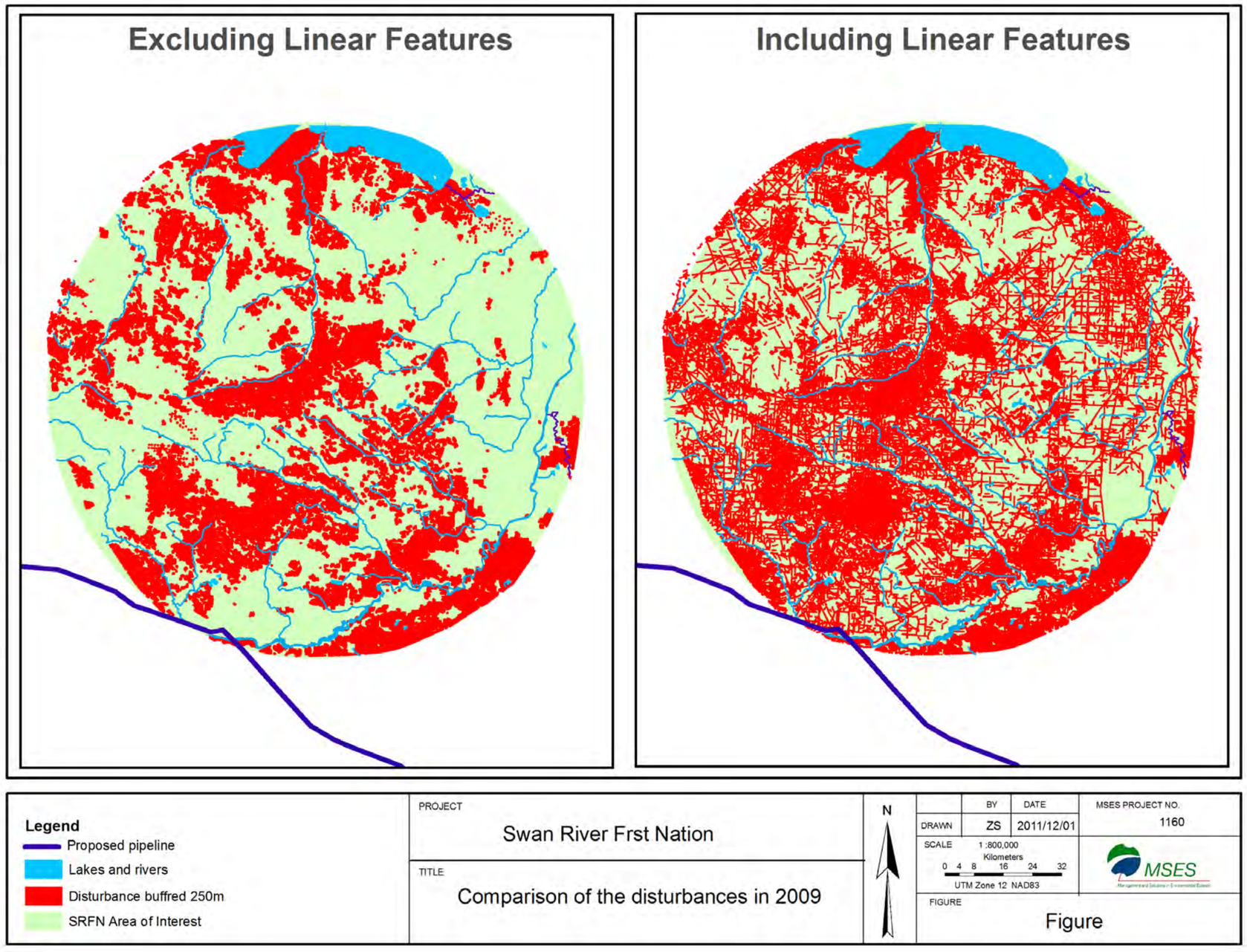

Figure E-2: Comparison of the disturbances in the SRFN study area in 2009 showing all disturbances excluding linear features (left panel) and with the linear features (right panel) with inclusion of the proposed Gateway Pipeline route.

Aboriginal Traditional Knowledge Community Report

Swan River First Nation

ENBRIDGE NORTHERN GATEWAY PROJECT

FMA Heritage Inc.
Calgary, Alberta

April 2010

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This report belongs to Swan River First Nation and its members. The completion of this study and report would not have been possible without commitments of time and energy of the following members of Swan River First Nation: Charlie Chalifoux, Dinah Chalifoux, Angela Courterellie, Fred Chalifoux, Patrick Chalifoux, Doris Courterellie, Gordon Courterellie, James (Harry) Courterellie, Jamie Courterellie, Randy Courterellie, Robert Courterellie, Eugene Cyre, Anne Davis, Edith Davis, James Davis (Twin), Maureen (Ellie) Davis, Ralph Davis, Ryan Davis, Virginia Davis, Yvonne Davis, Elsie Dumont, Ben Giroux, Billy Giroux, Clayton (Brian) Giroux, Delphine Giroux, Diane Giroux, Esther Giroux, Gerald Giroux Jr., Gerald Giroux Sr., Helen Giroux, John Giroux, Jonah Giroux, Margaret Jacknife, Evelyn Mckenzie, Susan Moyan, Carol Nome, Tracy Penner, Bernice Smith, Brent Smith, Clarence Sound, Florence Sound, Louis Sound, Penny Sound, Robert (Steve) Sound, Eleanor Sawan, Darryel Sowan, Leroy Sowan, Roberta Sowan, Rose Sowan, Duff Twin, Josephine Twin, Kyle Twin, Linda Twin, Roderick Twin, Wade (Rory) Twin, Tammy Watt and Richard Woodman.

Executive Summary

A summary of potential project effects related to the Enbridge Northern Gateway Project, as identified by Swan River First Nation (SRFN), appears in Table ES-1. Please note that this table is organized according to the Environmental and Socio-economic Assessment (ESA) disciplines, project and engineering processes, and regulatory and ESA processes.

Table ES-1 Summary of Potential Project Effects

Summary Category	Effects Anticipated by SRFN	Mitigation Recommendations Proposed by SRFN
Assessment Disciplines		
Surface Water	Potential adverse effects to waterways during construction.	• Avoid waterways when possible. • First Nations monitors to observe construction of watercourse crossings. • Directional drill large rivers and creeks. • See also Construction in this table for proposed mitigation related to surface water.
Water Quality	Effects on water from spills will adversely affect SRFN's ability to exercise Treaty Rights.	• See also Construction and Accidents & Malfunctions in this table for proposed mitigation related to water quality.
Vegetation		• Do not use herbicides or pesticides in RoW maintenance.
	Potential destruction of rare medicinal plants during construction of the RoW. Medicinal plant locations and rare medicinal plant locations were identified during fieldwork (see Section 7.2.3: Plant Gathering).	• Avoid areas identified as containing rare medicinal plants by SRFN Traditional Knowledge Holders; where avoidance is not possible, support SRFN in harvesting these areas prior to construction.
Wildlife	General habitat destruction from construction of the pipeline.	• SRFN members to monitor the construction of the RoW.
	Potential effects to beavers encountered along the proposed RoW.	• Trap and relocate beavers prior to pipeline construction.
Archaeological Resources		• Provide a presentation of the archaeological baseline results to SRFN members.

Table ES-1 Summary of Potential Project Effects (cont'd)

Summary Category	Effects Anticipated by SRFN	Mitigation Recommendations Proposed by SRFN
Assessment Disciplines (cont'd)		
Socio-economics		• SRFN recommends that First Nations persons have access to employment and training associated with the Project; proponent should commit to employing a certain percentage of SRFN members.
		• Pipeline shares should be made available to First Nations people.
		• Provide funding for housing, an Elder's lodge, an apartment for single people, and a new school with a gym.
Aboriginal Traditional Knowledge	RoW will serve to further reduce areas in SRFN Traditional Territories; areas in which traditional activities can be performed will be further limited.	• Compensation for environmental destruction associated with the construction of the pipeline.
Cumulative Effects	Future proponents may blame environmental contamination on the SHWTC and not accept responsibility for contributing to declining environmental conditions.	• Funding for independent SRFN or Treaty 8 study of water, air and traditional food quality. • Information should be used as baseline against which future levels are evaluated to help determine contamination sources and accountability. • Keep Northern Gateway a Canadian-owned company.
	Construction of the Project will lead to increased oil sands production in the Lesser Slave Lake area.	

Table ES-1 Summary of Potential Project Effects (cont'd)

Summary Category	Effects Anticipated by SRFN	Mitigation Recommendations Proposed by SRFN
Project and Engineering Process		
Access Management	Inability to access RoW after construction.	• Ensure that SRFN members have continued access to the RoW post-construction.
	Potential for Project to restrict access to hunting areas.	• Roads used to access hunting areas should not be cut off; no roadblock or gates installed.
Conservation & Reclamation	How area will be reclaimed after RoW construction.	• Reclaim with native vegetation. • Contract SRFN for reclamation work.
Construction	See also Surface Water in this table for anticipated effects related to construction.	• Provide more details on watercourse crossings. • See also Surface Water in this table for proposed mitigation related to construction.
	SRFN Traditional Knowledge Holders are concerned about wastage of traditional resources during construction of the RoW.	• Would like timber taken off RoW salvaged for use by SRFN members.
	Potential for Project to diverge from existing RoWs into undisturbed areas.	• Construct RoW between Fox Creek and Whitecourt parallel to the existing Alliance RoW.
	Potential effects from the construction of work camp (near Whitecourt) in an undisturbed area.	• Relocate proposed camp to a previously disturbed area.
		• See also Conservation and Reclamation in this table for proposed mitigation related to construction.

Table ES-1 Summary of Potential Project Effects (cont'd)

Summary Category	Effects Anticipated by SRFN	Mitigation Recommendations Proposed by SRFN
Project and Engineering Process (cont'd)		
Accidents and Malfunctions	Effects on water from spills will adversely affect SRFN's ability to exercise Treaty Rights.	• Adequate measures need to be taken to prevent spills. • Notify SRFN immediately if there is a spill or accidental discharge. • Disclose emergency planning to SRFN. • Ensure that monetary compensation measures for SRFN members are in place in the event that a spill occurs.
	Concerns over likelihood of a spill/accidental discharge and measures in place to prevent such an occurrence.	• In the event of an accident, proper cleanup procedures must be initiated immediately.
Regulatory and ESA Process		
Environmental and Socio-economic Assessment	ATK studies are not meaningful if issues are not taken into account in decision-making and there is no follow-up with communities.	• Involve First Nations in biophysical baseline studies. • Present biophysical baseline (wildlife, vegetation, and water) and archaeological assessment results to SRFN members and Elders. • Conduct further field studies with SRFN Traditional Knowledge Holders once the RoW is finalized and staked. • Develop a strategy to overcome the disconnect between engineering in the city and work in the field to ensure that areas identified in ATK studies are appropriately mitigated. • Continue relationship with SRFN after the approval process (i.e., come back to community to explain how SRFN issues, concerns and recommendations results were considered)

Table ES-1 Summary of Potential Project Effects (cont'd)

Summary Category	Effects Anticipated by SRFN	Mitigation Recommendations Proposed by SRFN
Regulatory and ESA Process (cont'd)		
Environmental and Socio-economic Assessment (cont'd)		• SRFN Study coordinator inquired about funding for third-party review of assessment.
Consultation	Project has the potential to affect SRFN Treaty Rights.	• Provide monetary compensation for effects to the environment and Treaty Rights. • See also Socio-economics in this table for proposed mitigation related to consultation.
		• Hold open house with higher-level representatives from Northern Gateway with knowledge of project engineering (e.g., watercourse crossings sand spill prevention) present. • Provide confirmation that the SRFN ATK study was reviewed by Northern Gateway and the government.
Monitoring & Follow-up Programs	Potential effects of chemicals used in maintenance of RoW after construction.	• Monitoring required to ensure no herbicides or pesticides are used. • Hire SRFN members to control vegetation and provide security.

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Abbreviations and Acronyms

ATK	Aboriginal Traditional Knowledge
ESA	Environmental and Socio-economic Assessment
GEM	Gateway Environmental Management
KP	kilometre post
Northern Gateway	Northern Gateway Pipelines Limited Partnership
PDA	project development area
Project	Enbridge Northern Gateway Project
REAA	regional effects assessment area
RoW	right-of-way
SHWTC	Swan Hills Waste Treatment Centre
SRFN	Swan River First Nation
TEK	traditional environmental knowledge
TU	traditional use

1 Introduction

FMA Heritage Inc. (FMA Heritage), as part of the Gateway Environmental Management team (GEM), has been contracted by Northern Gateway Pipelines Limited Partnership (Northern Gateway) to coordinate Aboriginal Traditional Knowledge (ATK) studies for the Enbridge Northern Gateway Project (the Project). Swan River First Nation (SRFN) elected to work collaboratively with FMA Heritage to complete the ATK study for the Project regarding SRFN traditional use and traditional lands. FMA Heritage facilitators working with SRFN on this ATK study are referred to in this report as the GEM ATK study team. This community report presents the traditional environmental knowledge (TEK) and traditional use (TU) information shared by SRFN study participants relative to the Project, as well as project-specific and cumulative effects anticipated by SRFN.

2 Enbridge Northern Gateway Project

Northern Gateway proposes to construct and operate:

- An oil export pipeline
- A condensate import pipeline
- A tank terminal and marine terminal near Kitimat, British Columbia

The pipeline route is approximately 1170 km in length, running from Bruderheim, Alberta to Kitimat, British Columbia. The oil and condensate pipelines will be buried for most of the length of the route in a common right-of-way (RoW). The permanent RoW will be 25 m wide with up to an additional 25 m of temporary workspace. In addition, the temporary use of land for construction camps, stockpile sites and staging areas will be required. The pipeline route will include two tunnels and several aerial crossings of rivers.

Ten electric-powered pump stations will be needed to operate the pipelines, including the initiating stations at Bruderheim (for oil) and the Kitimat Terminal (for condensate). Permanent roads and powerlines will be required for the construction and operations of the pump stations.

The oil pipeline is designed for an average annual throughput capacity of 525,000 barrels per day, and will have an outside diameter of 914 mm (NPS 36). The condensate pipeline is designed with an average annual throughput capacity of 193,000 barrels per day and will have an outside diameter of 508 mm (NPS 20).

Pipeline installation will require 12 spreads and construction will span two winter and two summer seasons (i.e., over two years). The construction will require 11 construction camps, 28 stockpile sites and staging areas of various sizes, primarily at spread breaks.

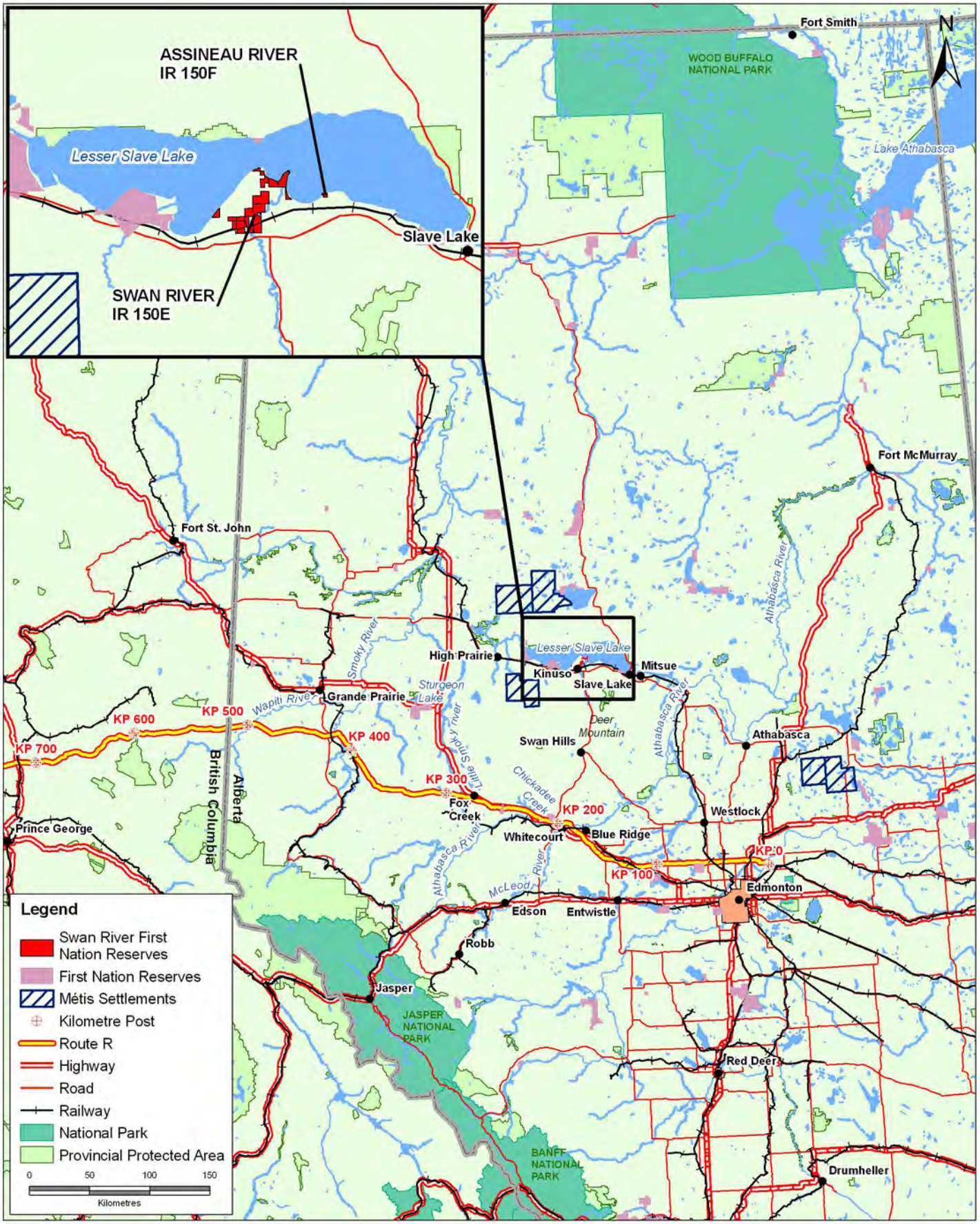
The marine terminal will accommodate transfer of oil into, and condensate out of, tankers. The Kitimat Terminal is on the west side of Kitimat Arm and includes the tank terminal and the marine terminal. The tank terminal will include 14 hydrocarbon tanks, each with a capacity of 78,800 m^3 (496,000 barrels), pump facilities and other associated facilities. The marine terminal will consist of two tanker berths and one utility berth. Both tanker berths will be equipped for loading oil tankers and unloading condensate tankers. The utility berth will have facilities that can accommodate the mooring of harbour tugs and two utility work boats.[1]

[1] This project description is effective as of September 2009.

3 Swan River First Nation

Swan River First Nation (SRFN) is a Woodland Cree nation. The registered population of SRFN as of January 2009 was 1,101 individuals (INAC 2009). Swan River No. 150E Reserve is located on the south-central shore of Lesser Slave Lake, approximately 50 km west of the town of Slave Lake, Alberta (Figure 3-1). This reserve is home to 346 SRFN members and is the location of SRFN administrative offices (INAC 2009).

Members of SRFN speak the Woodland and Plains Cree dialects and are called *Ne-hi-ya-wak*, or "the Cree People." Current prominent family names within SRFN include: Chalifoux, Courterellie, Davis, Giroux, Sawan/Sowan/Sound and Twin.



CONTRACTOR: FMA Heritage Inc.

PREPARED BY: gem

PREPARED FOR: ENBRIDGE NORTHERN GATEWAY PROJECT

ENBRIDGE NORTHERN GATEWAY PROJECT

Community Location

FIGURE NUMBER:	DATE:
3-1	20100310
SCALE: 1:4,350,000	AUTHOR: ML / APPROVED BY: NBS
PROJECTION: UTM11	DATUM: NAD 83

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3.1 Traditional Territory

SRFN, as one of the original negotiators and signatories to Treaty 8, has stated that the entire area encompassed by Treaty 8 is SRFN Traditional Territory. As explained by the SRFN Chief, this Traditional Territory is for the use and benefit of Treaty 8 members to continue to provide their livelihood, free from the interference of the newcomers, as long as the sun shines, the rivers flow and the grass grows (Chalifoux 2007).

3.2 Reserve Lands

Treaty 8 was signed at Lesser Slave Lake on June 21, 1899. This Treaty was prompted by a government desire to "extinguish the Indian title prior to the development of mineral resources, the construction of railways and the preparation for settlement" (Madill 1986). Acting as chief to the Cree people in the Lesser Slave Lake area, Kinosayoo was the first to sign the Treaty followed by: Moostoos, Felix Giroux (Astatchikun), Weecheewayis, Charles Neesuetasis, and the Captain. Felix Giroux, the third signatory of Treaty 8, was SRFN's first Chief.

SRFN has two reserves: Swan River No. 150E (4253.2 ha) and Assineau River No. 150F (71.6 ha). Both of these reserves were surveyed in 1902 (Madill 1986). SRFN Reserves 150E and 150F are located approximately 50 km and 15 km west of Slave Lake, respectively (Figure 3-1). Assineau River No. 150F was named after the Cree word for "place to sleep" as it used to be a stopping place between Slave Lake and Kinuso (SRFN20)[2].

3.3 Claims

In 1918, the Edmonton, Dunvegan and British Columbia Railroads Company constructed a railroad through Swan River No. 150E and purchased land from the reserve to build a station. The village of Kinuso grew around the railway station on reserve lands. In 1923, government officials began attempts to relocate SRFN members to Driftpile (Driftpile River No. 150 Reserve) and purchase Swan River No. 150E because of the agricultural potential of the lands, but SRFN members were able to resist the sale of the reserve (Wetherell 1999).

Swan River No. 150E was reduced from 11,500 ha in 1923 to 4253.2 ha today. Participants explained that some land was lost through illegal surrenders: "The land was sold…but not in the proper way, without the people's consent" (SRFN18). Reserve land was also lost through the allotment of quarter sections to Veterans to be used as homesteads (SRFN18). SRFN is actively pursuing several specific claims related to loss of land and other grievances.

[2] Numeric codes have been assigned to study participants to maintain confidentiality. These codes appear in brackets (SRFN#) following quotes, and are used throughout the text.

4 Aboriginal Traditional Knowledge Study Description

Aboriginal people in Canada have a connection to the natural environments that sustained preceding generations and continue to sustain a current way of life. These environments support personal and collective histories and identities, and are frequently the foundation for spiritual practices. Aboriginal peoples who have lived on the land have vivid and detailed memories and sensory perceptions, and this information constitutes the basis for traditional knowledge. This knowledge "is generally grounded in specific uses of particular ecosystems. It is inseparable from landforms, environmental quality, survival of particular species, and subsistence activities. Knowledge is taught, learned, tested and expanded through traveling and using a specific territory. Modifying the landscape, biodiversity or human ecology jeopardizes knowledge" (Battiste and Youngblood Henderson 2000).

ATK studies broaden the information base considered in environmental assessments and provide understanding about the potential effects of a proposed development on Aboriginal peoples' traditional lands, waters, resources and activities[3]. The consideration of potential effects of a proposed project on traditional lands and activities is of cultural, environmental, and, ultimately, socio-economic relevance, because it pertains to the social and physical well-being of affected Aboriginal communities.

4.1 Types of Aboriginal Traditional Knowledge

Traditional knowledge is passed on orally, from generation to generation, and current observations often have great depths in time. Information shared by Aboriginal participants is primarily qualitative and is based on sensory experience, oral traditions, and cultural norms and values.

This ATK study considers of two types of information: traditional use (TU) information and traditional environmental knowledge (TEK).

In this study, TU information focuses on activities as well as sites, areas and locales of cultural significance within traditional lands and territories. The types of activities or sites that may be identified can be classified under four broad categories:

- travel (e.g., trail systems, waterways, landmarks)
- harvesting (e.g., registered traplines, resource use and harvesting areas, special use sites such as fish camps, berry-picking areas, medicinal plant collection areas)
- habitation areas (e.g., occupation areas, meeting areas, gathering places, cabins, campsites)
- spiritual sites and sacred landscapes (e.g., burial sites, sacred sites, spiritual sites, sacred geography)

[3] Recognizing the inextricable link between the environment that supports traditional activities, the activities themselves, and culture and community well-being, "traditional lands, waters, resources and activities" will be referred to subsequently in this document as "traditional lands and activities." In this usage and wherever the term "traditional lands" is used in this document, "lands" are conceived broadly, and with respect to Aboriginal worldviews, to include all aspects of terrestrial and marine environments.

TEK is the wisdom and understanding of a particular natural and cultural environment that has accumulated over countless generations. Ideally, TEK is shared with practitioners of technical scientific disciplines to provide an alternative perspective for establishing baseline conditions and assessing project effects in the ESA for the Project (see Volume 5B). TEK is relevant to various project components (e.g., design, safety, aesthetic considerations, reclamation and abandonment), the biophysical environment (e.g., wildlife, vegetation, fisheries and aquatic resources, hydrogeology, geology and terrain, climate, soils, palaeontology, noise and air), and the human or socio-cultural environment (Aboriginal culture, health, socio-economics, TU, archaeology and heritage). TEK also relates to the cumulative effects of past and existing activities on both culture and the environment. The sharing of TU and TEK can lead to the development of strategies to avoid, reduce or mitigate potential effects of the Project on sensitive cultural areas.

4.2 Project Effects

Project effects are anticipated changes associated with project development areas and activities. These could include anticipated changes to the environment and TU sites, areas and locales, as well as shifts in traditional use and practices that arise from changing social and economic conditions. Project effects can also include anticipated effects such as demographic shifts, land use restrictions, increased outsider access, and changes to the local and regional economy.

4.3 Mitigation

Mitigation measures for affected sites, areas and locales, for example, may include avoidance, buffering, further studies, monitoring or co-management programs, restoration or conservation measures, or compensatory action. However, irreversible changes to cultural traditions necessitated by changing environmental and economic circumstances over time (cumulative effects) may require long-term mitigation measures to assist in the development of alternative livelihoods (economic systems) congruent with the values and world view of the Aboriginal group. The mitigation of cumulative effects can serve to sustain the identity, heritage and well-being of the group.

As part of the ATK study process, recommendations for mitigation of project and cumulative effects were recorded as provided by study participants. When provided, mitigation recommendations were communicated to Northern Gateway.

5 Spatial and Temporal Boundaries

Spatial and temporal boundaries were established in collaboration with study participants to provide a framework within which to assess potential project effects on the community and traditional lands and activities.

5.1 Spatial Parameters

Spatial boundaries for this study are based on input from SRFN study participants as to the extent of SRFN Traditional Territory and the extent of the area in which there is potential for project effects to occur. This study focuses on areas of direct effects, including the pipeline RoW and ancillary infrastructure, but also includes areas within SRFN Traditional Territory deemed by study participants to be of interest in relation to the Project.

A regional effects assessment area (REAA) and a limited linear extent of the project development area (PDA) are used for the ATK assessment areas. The boundaries of the REAA and the extent of the PDA to be assessed are established through collaborative discussions with each community (i.e., community study coordinators and study participants).

5.1.1 Project Development Area

The PDA corresponds to the area within which surface and subsurface ground disturbance will occur (see Figure 5-1). For the SRFN ATK study, the PDA includes those portions of the pipeline route that fall between KP 136 and KP 603 on Route R, current in July 2009. Although interviews may focus more broadly on the regional effects assessment area (see Section 5.1.2: Regional Effects Assessment Area), field visits are conducted with each group primarily within the PDA to record sites and areas potentially affected by the Project. In planning the study, the ATK Study Coordinator and GEM team members discussed maps and the spatial boundaries that would be appropriate to use as the basis for interviews and fieldwork.

During ATK meetings and interviews with SRFN study participants, TU sites, areas and locales potentially affected by the Project were identified. Sites, areas and locales located within the PDA formed the basis of the field survey for the study. Therefore, only a portion of the PDA within SRFN Traditional Territory (and Primary Livelihood Area [see Section 5.1.2: Regional Effects Assessment Area]) has been assessed through field survey. Additional portions of the PDA within SRFN Traditional Territory have not been assessed in the field due to project design changes and lack of access. When participants identified areas of interest outside of the PDA accessible through public roads, these areas were assessed in the field along with the important areas identified within the PDA.

The PDA within SRFN Traditional Territory is shown in Figures 3-1 and 5-1. Route revisions occurred after the SRFN scoping meeting, interviews and field visits were completed in 2007 (these 2007 activities were based on Route J, current in August 2006); one revised route (Route P, current in July 2008) was assessed through an update meeting and interviews in the fall of 2008, while another revised route (Route Q, current in May 2009) was assessed through field visits during the summer of 2009 (see Section 6.2: Aboriginal Traditional Knowledge Study Phases).

Lesser Slave Lake

Swan River
IR 150E

Assineau River
IR 150F

N

Grande Prairie

Wapiti River

KP 600

KP 550

KP 500

KP 450

KP 400

KP 350

KP 300

Fox Creek

KP 250

KP 200

Whitecourt

KP 150

Athabasca River

ROCKY MOUNTAINS

FOOTHILLS

RANGES

ROCHEUSES

WILLMORE WILDERNESS

PROVINCIAL PARKS

Legend

- Kilometre Post (Route R)
- Route R (not assessed)
- Route Q (assessed) (Coincides with Route R where not visible)
- Route P (assessed) (Coincides with Route R where not visible)
- Route J (assessed) (Coincides with Route R where not visible)
- Pump Station Location
- Camp Location
- Stockpile Location
- Staging Laydown Location
- Powerline

0 10 20 30

Kilometres

PREPARED BY:	PREPARED FOR:	CONTRACTOR:		ENBRIDGE NORTHERN GATEWAY PROJECT	FIGURE NUMBER:	
gem Gateway Environmental Management Team	ENBRIDGE NORTHERN GATEWAY PIPELINES	FMA Heritage Inc.			5-1	
		DATE: 20100310			SCALE: 1:1,100,000	
		AUTHOR: ML	APPROVED BY: NBS	Project Development Area and Pipeline Routes	PROJECTION: UTM11	DATUM: NAD 83

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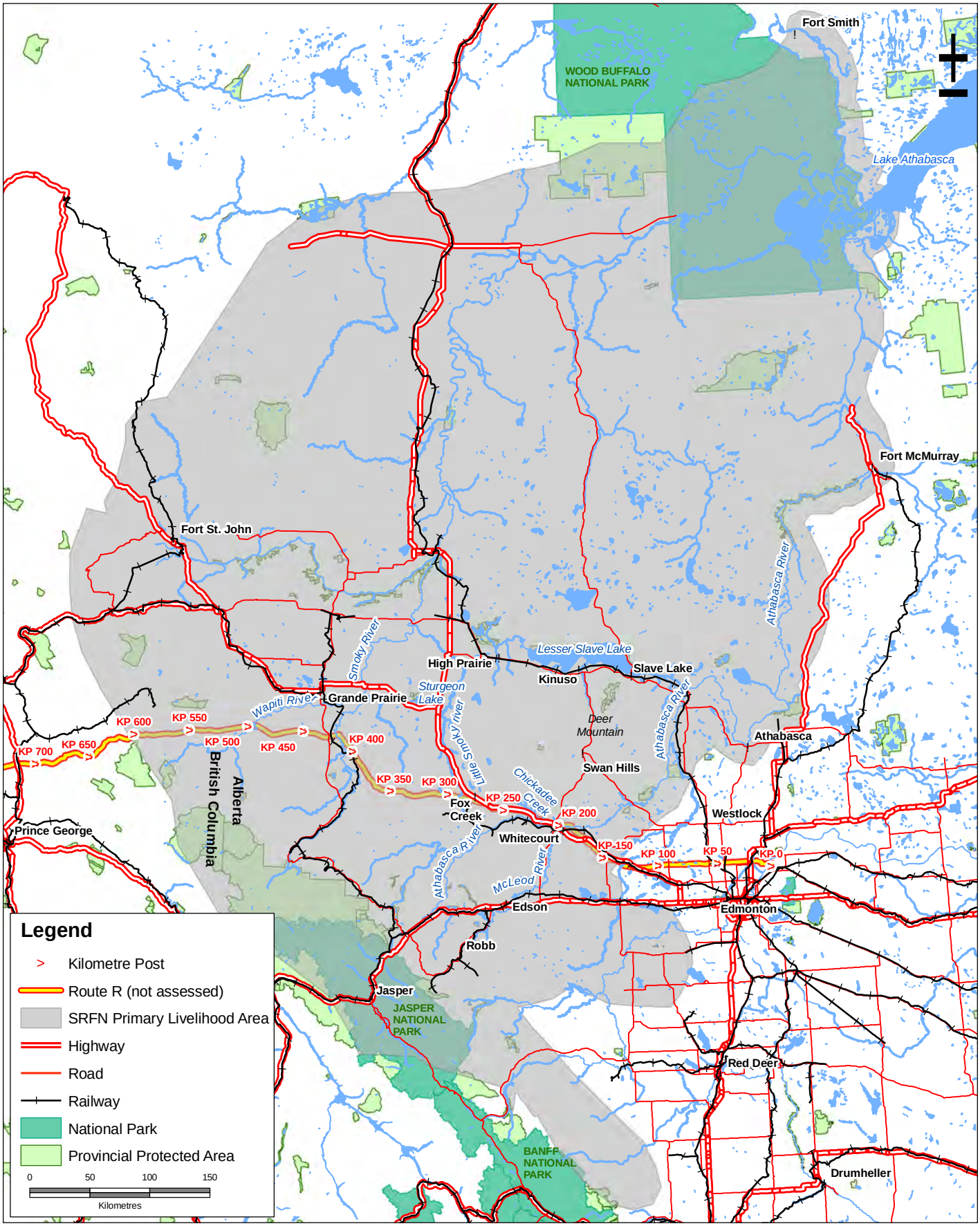
5.1.2 Regional Effects Assessment Area

An REAA was determined in the course of the study and reflects a portion of the community's traditional lands. Geographic reference points discussed during the ATK study are used as markers for an REAA (but are not intended to represent the community's Traditional Territory). This area was also used as reference by ATK study participants when discussing cumulative effects.

For the SRFN ATK study, the REAA includes the PDA and surrounding lands discussed by SRFN study participants in reference to the Project. The REAA extends from approximately KP 136 to KP 515 for Route R, current in July 2009 (Figure 5-2). From north to south, the REAA spans approximately 1000 km. SRFN uses the term "Primary Livelihood Area" rather than "REAA" when referring to this area. The Primary Livelihood Area, which is neither the full extent of SRFN traditional use areas nor SRFN Traditional Territory, is used by the community for the purposes of consultation and ATK work with industry.



* The depiction of the Primary Livelihood Area represented by the coloured area is neither fixed nor intended to be definitive.

CONTRACTOR: FMA Heritage Inc.

PREPARED BY: gem

PREPARED FOR: ENBRIDGE NORTHERN GATEWAY PIPELINES

ENBRIDGE NORTHERN GATEWAY PROJECT

Regional Effects Assessment Area

FIGURE NUMBER:	DATE:
5-2	20100310
SCALE: 1:4,350,000	AUTHOR: ML / APPROVED BY: NBS
PROJECTION: UTM11	DATUM: NAD 83

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5.2 Temporal Parameters

Temporal boundaries were identified by study participants as the dates at which major changes in traditional land use or surrounding environmental conditions began to be noticed. This timeframe provides a baseline against which incremental changes can be evaluated.

This study considered SRFN's current use of traditional lands and resources, use in the past (since time immemorial) as well as future use. Future use pertains to the opportunities for generations of SRFN descendants to practice traditional ways (in modern form) and maintain traditional cultural and spiritual values.

In this study, the temporal boundary against which incremental changes are being compared is the 1950s. This date was a common point of reference used by the Traditional Knowledge Holders who participated in the study. A timeline of important events as identified by SRFN members is listed below.

- *Natural Resources Transfer Act (NRTA)—1930*: When the federal government transferred control and ownership of Crown lands and natural resources to the three prairie provinces. It was a "real change because it was all traditional prior to that, but then it started to change" (SRFN8).
- "Before the [NRTA] people were not confined to their traplines. After the [NRTA] the provincial government said that all First Nations would get traplines and the federal government would pay the $10 per year fee for the trapline. That didn't happen—some people missed the boat and the federal government quit paying for the traplines and the province took over and gave them to other people" (SRFN8 and SRFN20).
- "The [NRTA] changed everything. People used to share what was obtained from the land. The trapline system had quotas attached to it; less to share" (SRFN20).
- *Amendment of the Indian Act—1951*: One of the most significant changes resulting from the 1951 amendment was the creation of section 87 (now section 88). This section "incorporated provincial laws of a general nature and made them part of the Indian Act legal regime. Thus, whenever a provincial law dealt with a subject not covered by the Indian Act… Parliament would allow the provincial law to apply to Indians on-reserve" (INAC 2006). One study participant explained how major changes occurred "when people accepted the Indian Act" with regard to land use (SRFN20).
- *Oil and Gas Activity in the Swan Hills—1950s*: The start of oil and gas activity in the Swan Hills marked an increase in transportation routes and oil and gas employees in the Kinuso area. "Before oil and gas activity started in the Swan Hills there was only one trail, a forestry road. After that there were more trails and forestry. That is when it started to flood down here [Kinuso]" (SRFN18).
- "Before that, the community was really isolated so people would watch for the train because it was a chance to see people. All the people on the train would wave when they were going by" (SRFN34).
- *Oil and Gas Boom in Slave Lake—late 1960s and early 1970s:* The oil and gas boom in Slave Lake led to the growth of the town of Slave Lake, which was favoured over Kinuso, despite the opportunity for growth in the latter centre: "Didn't accept the proposal to have Kinuso a major centre. Chamber of Commerce didn't want oil and gas here because of social impacts and because reserve lands are all around. Didn't want people moving in, so Slave Lake boomed" (SRFN34).

6 Study Methodology

6.1 Intellectual Property

The information provided during this ATK study constitutes the intellectual property of study participants and, collectively, Swan River First Nation (SRFN). As such, the study has been designed in collaboration with and was subject to the approval of participants and SRFN. Any recorded information, including notes, GPS readings and photographs, whether on tape, transcribed or in electronic form, is considered the property of SRFN and will be returned to SRFN upon completion of the regulatory application process. Information has been provided by SRFN with the understanding that the ATK study for the Project is intended only for the one-time use of the ESA for the Project and the Project described therein.

In order to obtain prior informed consent of ATK study participants, the purpose and goals of the study as well as the nature of the Project were explained to participants during the first meeting with ATK study facilitators. The discussion also included options and implications for sharing confidential information (e.g., presenting information to the appropriate level of detail to protect the information and implications for not sharing the information at all). Participants have also been advised that information provided will be summarized in a report and presented to SRFN for review of accuracy and suitability for release as a public document unless otherwise specified by SRFN.

As of March 2010, SRFN was considering signing an Information Sharing Agreement with Northern Gateway that would outline the parameters under which information would be shared. SRFN consented to the release of the ATK study report in the interim.

6.2 Aboriginal Traditional Knowledge Study Phases

SRFN representatives and the GEM team carried out an eight-phase ATK study program for the Project. In its entirety, the study consisted of a literature review, an initial scoping process, group interviews, field visits and an initial report review, followed by a study update that included interviews, field visits, and a report review. The literature review, scoping process, interviews, field visits and initial report review were conducted prior to a slowing of the assessment portion of the Project (resulting in a slowdown in ATK programs) in 2007. Further interviews and field visits were conducted in December 2008 and August 2009 to address project design revisions, including updated pipeline routes (Route P, current in July 2008 and Route Q, current in May 2009, respectively) (Figure 5-1). The resulting report was reviewed by study participants prior to its release to Northern Gateway.

6.2.1 Literature Review

The review of background literature included general historical and ethnographic literature, as well as relevant Internet resources, such as the Department of Indian and Northern Affairs, public land claims documents, the Energy Resources and Conservation Board, Alberta Environment, the National Energy Board, academic libraries and databases.

6.2.2 Initial Scoping Process

The initial scoping process commenced in May 2007 with an in-person discussion between the SRFN ATK Study Coordinator and GEM ATK study team representatives. Phone and email discussions followed between these individuals in order to determine the specifics of the study that would be carried out with SRFN (for a list of individuals involved in the scoping process, see Appendix A, Section A.1). The community ATK Study Coordinator, together with Chief and Council, identified members of the community knowledgeable of either, or both, current and historic community practices that might be affected by the Project. In this report, study participants selected by SRFN are referred to as Traditional Knowledge Holders and study participants.

6.2.3 Interviews

Group interviews with SRFN Traditional Knowledge Holders and the SRFN ATK Study Coordinator were conducted on September 4 and 5, 2007 (Appendix A, Section A.2). Interviews created an opportunity for SRFN Traditional Knowledge Holders to share TU information and TEK relevant to the Project and to explore and clarify potential project effects on SRFN traditional lands and activities. In the course of these discussions, recommendations for mitigation measures made by SRFN were also recorded. Group interviews were aided by reference to maps depicting the REAA and PDA for Route J, current in August 2006. GEM ATK study team members facilitated the interviews. Cree interpreters were not required. Field visit plans were finalized with participants during the group interviews.

6.2.4 Field Visits

Field visits were conducted on September 6 and 7, 2007. Field study participants included SRFN Traditional Knowledge Holders, the SRFN ATK Study Coordinator and the GEM ATK study team (Appendix A, Section A.3). The areas visited were selected by SRFN Traditional Knowledge Holders during the group interviews and included lands between KP 200 and KP 250 on Route J, current in August 2006 (Figure 5-1).

The field visits consisted of a reconnaissance by vehicle during which SRFN Traditional Knowledge Holders were able to view the general terrain and area of the proposed RoW. SRFN Traditional Knowledge Holders conducted limited pedestrian surveys of the proposed RoW near KP 250 where direct road access to the proposed RoW was possible (Figure 5-1). The field visits provided an opportunity for SRFN Traditional Knowledge Holders to assess the relationship between the proposed RoW and areas important to the community.

6.2.5 Analysis and Reporting

Information from interviews and field visits has been compiled in this report. This includes baseline information, potential project effects and cumulative effects within SRFN Traditional Territory identified by study participants, and mitigation measures recommended by study participants.

6.2.6 Community Review

On December 5 and 6, 2007, a community meeting was held with SRFN Traditional Knowledge Holders (Appendix A, Section A.4) to review the draft report for accuracy and suitability for release as a public document. Prior to the meeting, the draft report was reviewed by SRFN's Chief and his comments were incorporated. At the report review meeting, a copy of the draft report was provided to each Traditional Knowledge Holder for their consideration.

6.2.7 Update Meeting

On October 10, 2008 an ATK update meeting was held in SRFN to notify members about minor re-routes of the pipeline and to collect any new traditional knowledge or issues and concerns (Appendix A, Section A.5). At the meeting, Route P, current in July 2008, was used as the basis for discussion.

6.2.8 Update Interviews

Interviews were held with five additional SRFN members on December 6, 14 and 15, 2008 (Appendix A, Section A.6).

6.2.9 Update Field Visits

Additional field visits were held August 24 to 27, 2009. Field study participants included SRFN Traditional Knowledge Holders, the SRFN Field Director and the GEM ATK study team (Appendix A, Section A.7). The areas visited were selected by SRFN Traditional Knowledge Holders during the update group interviews, including lands between KP 186 and KP 280 on the Route Q, current in May 2009 (Figure 5-1).

These field visits consisted of a survey conducted on all-terrain vehicles during which SRFN Traditional Knowledge Holders were able to view the proposed RoW.

6.2.10 Update Community Review

On September 18, 2009, an additional community meeting was held with SRFN Traditional Knowledge Holders (Appendix A, Section A.8) to ensure that information added to the report from the December 2008 interviews and August 2009 field visits was accurate and suitable for release as a public document, unless otherwise specified by SRFN.

6.2.11 Report Finalization

Following the September 18, 2009 meeting, additional information shared by study participants at the community review was incorporated. The report was returned to the SRFN ATK Study Coordinator for final review and approval. Copies of the report were then distributed to study participants upon completion of the final document.

7 Baseline

7.1 Environmental Observations

SRFN members have experienced serious effects from polychlorinated biphenyls (PCBs) and other chemical contamination from the Swan Hills Waste Treatment Centre (SHWTC) (SRFN2, SRFN5, SRFN7, SRFN8, SRFN9, SRFN13, SRFN14, SRFN16, SRFN18, SRFN19, SRFN21, SRFN22, SRFN28, SRFN29, SRFN30, SRFN32 and SRFN46). The SHWTC is a disposal facility located approximately 80 km south of Swan River No. 150E (see also Section 9: Cumulative Effects). On October 16, 1996, a malfunction of the SHWTC transformer furnace resulted in the flow of gases containing PCBs, dioxins and furans (PCDD/Fs) into the ambient air. In 1997, Alberta Health and Wellness conducted a human health risk assessment to estimate human exposure and as a result issued advisories for consumption of wild game and fish taken within a 30-km radius of the facility (Alberta Health and Wellness 2004). Contamination from the SHWTC is viewed by SRFN members as causing serious negative effects to the environment and human health. “That plant contains all the toxins and chemicals from the whole world” (SRFN34). SRFN members describe traditional foods as having high levels of PCBs and related that some SRFN members themselves have high levels of PCBs in their bodies (SRFN7, SRFN13, SRFN14, SRFN19 and SRFN32).

7.1.1 Water Quality

“The water was beautiful, clear, like melting ice; now the rivers and creeks look like hard boiled tea. You could drink from rivers and creeks…now you can’t because they are all polluted” (SRFN50).

Water quality in Slave Lake and other water bodies around Kinuso is declining because of boating (SRFN16), forestry (SRFN34) and the SHWTC (SRFN5 and SRFN9): “Everything from the SHWTC comes down in our lake and fish are contaminated” (SRFN8).The water is also a health risk: “The lake is contaminated, people break out in blisters … it smells now and it never used to” (SRFN14 and SRFN28). SRFN51 agreed: “Can’t even swim in the lake, get rashes.” Elders described how in the last 50 years the lake has begun to have algae blooms (SRFN7, SRFN47 andSRFN48) and the community no longer drinks from natural sources: “People have to buy water even though water is all over” (SRFN14). SRFN28 highlighted the centrality of concerns related to declining water quality: “My biggest concern is the water, you can’t even bathe in this water and go swimming. There is almost like a scum on the creeks, we can’t drink the water no more. On the news you hear how the water is being contaminated but the government is allowing it to happen, they don’t take into consideration people’s health. I don’t even want my face in the water…the main concern is the water; the main, main topic is the water situation.”

7.1.2 Air Quality

Study participants said that contamination from the SHWTC is particularly prevalent in Kinuso because the community is downstream (SRFN5 and SRFN9) and downwind of SHWTC (SRFN8, SRFN16 and SRFN32). As a result, “the pollution drifts north” (SRFN16 and SRFN46). Ash carrying contaminants

from the SHWTC is said to "fly around and come to Kinuso" (SRFN5) and "the wind blows all the ashes—where the wind blows it gets contaminated" (SRFN8).

7.1.3 Wildlife

SRFN study participants have observed considerable changes in wildlife populations, but in particular wildlife health.

SRFN members described a number of instances when animals harvested for community consumption were found to have lumps and deformities. Participants attribute these abnormalities to sickness in the animals resulting from SHWTC contamination. Three years ago, one youth was hunting and shot an animal with "lumps the size of a fist on its back" (SRFN40). Another youth explained how "everybody tells stories about [animals] being sick. They find lumps on the outside and sickness on the inside" (SRFN39). One Elder recalled finding a "deformed [animal] fetus from near the SHWTC" (SRFN29) while another described how the "liver and heart [of animals] are now green because of the SHWTC" (SRFN30). SRFN48 recalled snaring a small rabbit (*Lepus sp.*) about four years ago that had large growths: "If it has a growth we leave it, we still hunt in the Swan Hills but we are pickier about what we eat" (SRFN48).

Elders described warnings from Alberta Health and Wellness not to hunt animals within a 30 to 40 km radius of SHWTC. Elders describe this warning as useless "because wildlife can travel over 100 km…wildlife travel, they roam" (SRFN9, SRFN14 and SRFN16). Elders also described how "birds get contaminated and fly all over" (SRFN18). Contamination can travel great distances, affecting animals far from the SHWTC: "Wind blows from the SHWTC and pollution affects animals because they eat what falls on the ground" (SRFN8). SRFN32 also explained that "cattle are dying off all over here [Valleyview area] downwind of SHWTC. Are the cattle being poisoned by pollution from SHWTC? They say it's BSE [bovine spongiform encephalopathy], but maybe there is a connection to contamination from SHWTC."

Furthermore, animals are unable to tell the difference between good and contaminated water sources: "Animals don't know the difference between clean and dirty water, they drink it" (SRFN46). One community member killed a moose (*Alces alces*) in the Swan Hills in 1989 and found the meat was oily and full of worms. The meat was sent to Fish and Wildlife for analysis and the results showed that the moose had been drinking water from near a sump pump (SRFN50). Old wells are also a source of contaminated water for animals as they are not properly reclaimed; one Elder explained that he has seen moose licking the old well installations and noted, "It is hard to shoot a moose after you see them lick poison" (SRFN46). The same Elder explained how companies keep their leases that are closest to roads tidy, while leases further back in the bush, not readily observable by the public, are not well maintained (SRFN46).

7.1.3.1 Ungulates

Moose populations in particular are suffering from both poor health and diminished numbers. SRFN46 attributes the decline in the moose population in the Swan Hills to warmer weather and overhunting as a result of the province's Métis Harvesting Agreement. SRFN47 also noted that moose numbers are low in both the Mitsue and Swan Hills area: "In the past used to be some [in Swan Hills], almost guaranteed to

see a moose. None in south Mitsue either, hardly any sign." Another SRFN Traditional Knowledge Holder described moose as "scarce and far between" in the Swan Hills, Deer Mountain, House Mountain, and Grizzly Mountain areas, but generally still healthy (SRFN48); the Elder, however, has also observed moose in the same areas "with growths, big growths with sacs" (SRFN48). SRFN47 has likewise "seen moose with cysts around south Mitsue," where there is a concentration of oil and gas activity. SRFN50 explained how "moose meat used to smell good and now it stinks, now there are always things wrong with them." Another study participant recalled killing a moose recently in the Swan Hills: "it was a two-year-old bull with brown teeth" (SRFN47). The colour of the teeth was deemed a sign of contamination or disease.

A younger but very experienced SRFN hunter provided a detailed description of the types of abnormalities encountered while harvesting moose and deer (species unidentified) in SRFN Traditional Territory. One bull moose killed near Driftpile had "10 to11 potato-like growths on the outside" (SRFN46); however, the meat, liver, kidneys and heart of this moose looked healthy. The hunter refused to eat a moose shot on the SRFN Reserve because it had a "blue tumour," but clarified that a moose with tumours was still considered edible as long as the tumours were on the outside of the skin and not in the meat (SRFN46). This hunter no longer hunts in Swan Hills because "the population is low and most of the moose I've gotten with tumours are from there" (SRFN46). However, this hunter had also heard that "some people this year are forced to hunt close to the SHWTC, because they are so hard up [for moose]" (SRFN46).

SRFN46 explained that "a bad [moose] liver is spotty, not colourful, it doesn't shimmer, but sometimes the liver gets blown up and you can't tell" (SRFN46). SRFN46 has also observed "white moles" on livers and evidence of lung cancer in moose and deer, which appears as "dead, black lungs, not right, one lung smaller than the other" (SRFN46). This lung condition has been observed more in deer than moose, but SRFN46 noted that this observation may be biased because more deer are harvested than moose. An animal's health can be determined by observing the amount of fat around the kidneys (SRFN46).

SRFN Traditional Knowledge Holders have also noticed changes in ungulate behaviour. One Elder described how "in the past you break a twig and the moose ran, now honk your horn and they just stand there, now they're tame" (SRFN50). Similarly, Elders described an increase in animals killed on highways. "Lots of animals on the highway now, getting killed. Start going close to the highway when it's cold" (SRFN11).

7.1.3.2 Birds

Elders noted a decrease in migratory birds in the Slave Lake area (SRFN10) but did not attribute this decrease to anything specific.

7.1.4 Fish

Fish health is deteriorating as a result of water contamination and populations have declined over the past 50 years (SRFN51). One Elder explained how "a lot of fishermen say there are lumps on the fish" (SRFN18); others say the fish have cysts and growths on them (SRFN47 and SRFN48). Another described how "there are tumours in fish because of the SHWTC. Scientists from the waste treatment centre say the lumps are from spawning but they aren't" (SRFN14). About five years ago, one per cent of

pickerel (species unidentified) in Lesser Slave Lake had a small bump on it. Today about 60 to 70 per cent of pickerel have two to three small bumps on them (SRFN46).

One Elder recalled a trip to Snipe Lake in July 2007 where a large quantity of dead fish was observed. The Elder was told that this was due to a lack of oxygen in the lake, but the lake was not shallow, people fished there, and the Elder could not recall seeing a fish kill like this in the past (SRFN9).

Another Elder described how there used to be grayling (species unidentified) in the streams around Kinuso: “Can’t eat them anymore; used to be able to drink from the creeks, can’t do that anymore” (SRFN8). “Fish are no good now, whitefish in Lesser Slave Lake used to be good and now they have meat black on both sides and the meat tastes like gas and oil because of too much boats” (SRFN50).

7.1.5 Vegetation

The Swan Hills provided an abundance of berries and, prior to the SHWTC, were an important berry-picking area for SRFN.

One Elder described how there are “less blueberries now because the bush has grown up” (SRFN50).

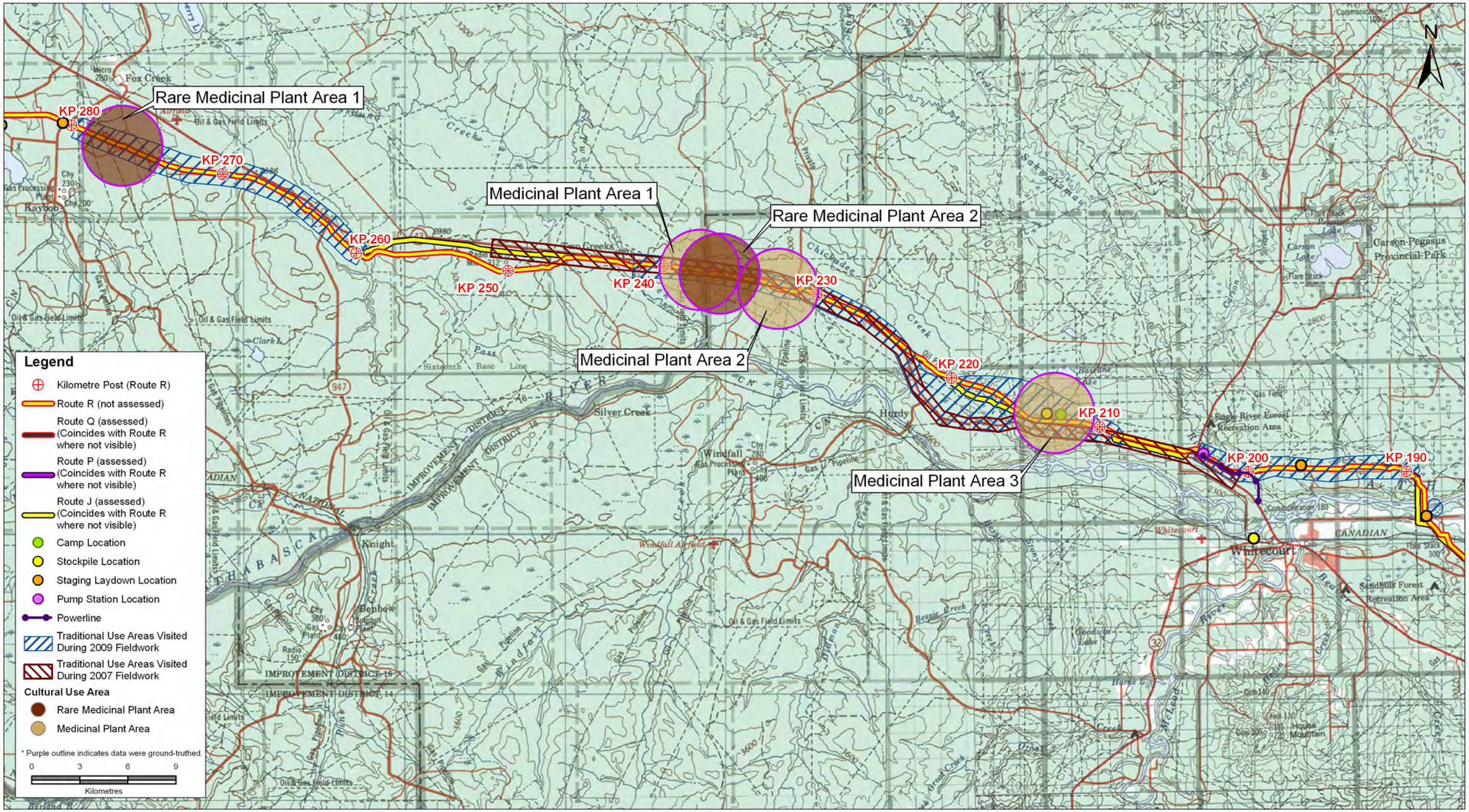
In addition to oil and gas, forestry, agriculture and the SHWTC, Elders explained how power companies and highway services are affecting environmental conditions in SRFN Traditional Territory: “[They] spray along RoWs and roadsides, [it] affects berries, plants, and animals eat that. This affects our territory as well” (SRFN5 and SRFN6). Recently, trees have been observed as brown rather than green in the Swan Hills (SRFN47). The Swan Hills have also been described as being so overlogged that logging companies have been forced to log right next to the road (SRFN46).

7.2 Traditional Use and Cultural Lifeways

SRFN Traditional Knowledge Holders were reluctant to discuss specific traditional sites, because the Primary Livelihood Area in its entirety is important for traditional use and the locations of resources change over time. SRFN11 explained that “there are not necessarily specific places for resources,” while SRFN8 stated, “It’s all a hunting area, we can’t pinpoint sites,” and SRFN16 noted that “there is no specific berry or hunting sites; you have to go looking for berries and moose.” “To tell you the truth it is all our traditional hunting area…our ancestors were all through this area. Wherever there are trails, creeks, rivers, lakes, those are camping grounds for everyone” (SRFN8, SRFN20 and SRFN27).

Accordingly, SRFN does not agree with the practice of graphically delineating discrete points of traditional land use. The community feels that this non-holistic approach serves to create small pockets of traditional use areas that do not reflect how the area is actually used nor its importance as a whole. As a result, SRFN has chosen to not disclose specific traditional-use locations in this study, with the exception of medicinal and rare medicinal plant areas.

As a result, Figure 7-1 depicts areas surveyed during the two stages of fieldwork as well as medicinal plant areas identified by SRFN.



REFERENCES: NTDB Topographic Mapsheets provided by the Majesty the Queen in Right of Canada, Department of Natural Resources. All rights reserved.

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gem Gateway Environmental Management Team	ENBRIDGE NORTHERN GATEWAY PIPELINES	FMA Heritage Inc.		7-1
		DATE: 20100310	Traditional Use Areas Visited by Swan River First Nation During Field Visits	SCALE: 1:235,000
		AUTHOR: ML / APPROVED BY: NBS		PROJECTION: UTM11 / DATUM: NAD 83

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7.2.1 Hunting and Trapping

Although SRFN uses the entire Primary Livelihood Area (see Figure 5-2) for harvesting, a few study participants did identify some specific areas used for hunting and trapping, including the Whitecourt, Mitsue, Swan Hills, Deer Mountain, House Mountain, and Grizzly Mountain areas (SRFN47 and SRFN48). The community is now having to hunt farther south (close to the project area) because of the pollution levels closer to the community reserves; SRFN21 noted, "We are now hunting in the Whitecourt area because the Swan Hills are contaminated." Other SRFN study participants also mentioned the following traditional use areas and sites: "Hunting up to Entwhistle, hunting as far as Robb, Edson, Jasper… used to pick medicine at Berland River and hunt lots in that area… Blueridge area used for camping…used to trap from here to Grande Prairie, fishing [on the] Little Smoky River" (SRFN8, SRFN20 and SRFN27).

A number of factors now restrict SRFN harvesting activities. The current poor health observed in many animals in the area, attributed in part to the SHWTC, and the alteration of hunting areas because of development activities, were two examples given. One Elder has "never hunted since that time [when the SHWTC opened]" (SRFN2) and another explained how the family hunting area at south Mitsue used to be just an ATV trail and now it is a logging road surrounded by intensive oil and gas activity (SRFN47).

Study participants have also noticed that access has become increasingly restricted in the Swan Hills (SRFN11) and that there are often "lots of gates" (SRFN27) around development areas. "Oil and gas figures they own the roads" (SRFN5 and SRFN6). SRFN20 explained that oil and gas "block things off, forestry does the same thing." Even if community members no longer actively trap on traplines, continued access to them is important for maintaining a connection to the land. Access to at least one Elder's trapline is severely compromised because industry is blocking the trails and roads into it: "They're plugging up the roads, that's what I don't like" (SRFN20).

7.2.2 Fishing

Many community members continue to fish for a variety of species in Lesser Slave Lake as well as in other creeks, rivers and lakes in SRFN Traditional Territory. Fish continue to be an important traditional food to the community (see also Section 7.2.4: Traditional Foods).

7.2.3 Plant Gathering

As with hunting and trapping, study participants were reluctant to name any one area as important for plant gathering, as harvesting locations are, by their nature, not static. SRFN16 explained, "There are medicines that don't grow in the same place every year, they move around."

Many SRFN members use traditional medicines. These medicines are to be collected from non-contaminated locations. SRFN members are having to travel farther to collect medicine and, because of the time, distance and expense involved, some SRFN members may be collecting fewer medicines than they would if they had secure sources nearby (SRFN28).

An SRFN member described how it is now necessary to travel far to the south (Red Deer and Drumheller areas) to pick medicinal herbs due to the contamination in the Swan Hills (SRFN28). SRFN11 explained that "some of the medicines aren't around here [Kinuso] anymore, you have to go a long ways to find it." Another SRFN member explained how a common medicinal plant in a popular collection site just outside of Kinuso is now less abundant and doesn't grow as tall (SRFN47).

One Elder discussed the importance of wetlands as habitat for medicinal plants: "Regardless of where these pipelines are, if they are in swamps, they are in our medicines" (SRFN34). Another participant explained how white people are being affected more by cancer than Aboriginal people. Some traditional medicines are used to treat cancer; "That's why it's so important to save those medicines" (SRFN32).

In the search for non-contaminated traditional foods, SRFN members make use of traditional lands in the Whitecourt area for hunting, berry picking and the collection of medicines (SRFN8, SRFN20 and SRFN21). "We pick medicines down in the Whitecourt area" (SRFN8) (Figure 7-1: see Medicinal Plant Areas 1-3, and Rare Medicinal Plant Areas 1-2). The specific names of medicinal plants used are not included in this report at the request of SRFN.

Berries are an important traditional food for SRFN members, who discussed recent berry-picking forays and expressed interest in picking berries during the field visits.

7.2.4 Traditional Foods

Prior to the SHWTC, the Swan Hills were "the best grocery store for medicine, plants, hunting and trapping" (SRFN19). Now people are afraid to consume traditional foods obtained in the Swan Hills because these foods are understood to be contaminated from the SHWTC (SRFN18, SRFN22, SRFN28 and SRFN32). One Elder explained, "Contamination affects plants like willows, moose eat willows, we eat moose" (SRFN28).

As a result of fears about contamination, SRFN members have experienced a drastic reduction in traditional food security, leading to decreased consumption of traditional foods. For example, SRFN members are eating less moose meat: "When offered moose meat our first response is: 'Where did you get it?'" (SRFN14). Elders used to eat organ meat, but have been warned not to by Alberta Health and Wellness (Alberta Health and Wellness 2004) (SRFN14). As a result of decreased consumption of traditional foods, there is an increased reliance on store-bought foods (SRFN7, SRFN8, SRFN14 and SRFN19). Some SRFN members continue to eat moose meat despite the dangers of contamination because they "love it" (SRFN7, SRFN13 and SRFN19). (See also Sections 7.1.1: Water Quality, 7.1.3: Wildlife, 7.1.4: Fish, 7.1.5: Vegetation, 7.2.1: Hunting and Trapping, 7.2.2: Fishing, 7.2.3: Plant Gathering and 7.2.6: Health and Well-Being.)

7.2.5 Spirituality

Information on SRFN spirituality was not included in this report at the community's request.

7.2.6 Health and Well-Being

SRFN members report negative effects to health and well-being resulting from changes in the consumption of traditional foods and medicines due to fears about the contamination of plants, animals

and water. SRFN members clearly linked the decreased consumption of traditional food with declining health. (See also Sections 7.1.1: Water Quality, 7.1.3: Wildlife, 7.1.4: Fish, 7.1.5: Vegetation, 7.2.1: Hunting and Trapping, 7.2.2: Fishing, 7.2.3: Plant Gathering and 7.2.4: Traditional Foods.)

With the increased consumption of "store food," SRFN members have seen an increase in diabetes (SRFN8). "There is more diabetes because more people have to eat store food—and more heart attacks too" (SRFN8). "A lot of diabetes because less moose, [we have] no choice but to eat beef" (SRFN7).

The very act of being out on the land to obtain traditional foods is perceived as risky to one's health because of possible contamination. For example, an SRFN member recalled getting dizzy while picking berries with a friend about 15 km from the SHWTC, forcing them to get back into the car and go home (SRFN16).

SRFN members described the fear people have felt since the inception of the SHWTC. Around 1997 some SRFN members had their hair and blood tested to measure PCB levels. Results showed high PCB levels, which in turn caused SRFN members to consume less or even no traditional foods and medicines. The community feels that at least one community member's sickness is related to contaminants (SRFN7, SRFN13 and SRFN19). To make matters worse, the community feels that "[SRFN members] are not being properly informed about [the] condition of resources" (SRFN32). SRFN16 explained that "lab results are always hidden," and SRFN2 noted, "We should get results from government studies."

SRFN members also describe an increase in cancer in the community. "More cases of cancer appear all the time, more than there used to be" (SRFN22). SRFN32 explained, and two other Elders agreed, "There is a lot of cancer in the Swan Valley because of the SHWTC, lots of abdominal cancer in all ages." SRFN46 also noted that "there are four people in Kinuso with brain tumours, some young." The increased rates of cancer in the community are attributed to contamination from the SHWTC, but also linked to increased industrial and agricultural development (SRFN22 and SRFN32). "Oil and gas, farm chemicals all contribute to cancer in the community" (SRFN34). The rise in asthma cases is also attributed to increased pollution in the area (SRFN7).

8 Potential Project Effects

8.1 Environmental Observations

8.1.1 Water Quality

Participants (SRFN8, SRFN11, SRFN16, SRFN47 and SRFN49) expressed concern over effects to waterways and wildlife habitat near lakes, rivers and creeks during pipeline construction.

SRFN Recommendation: Avoid waterways when possible during construction.

SRFN Recommendation: Provide more information to communities regarding how waterways are crossed (i.e., a watercourse crossing seminar).

SRFN Recommendation: Use directional drilling under larger rivers and streams to completely avoid effects to riparian zones (including the Athabasca and Sakwatamau rivers and Chickadee Creek).

8.1.2 Wildlife

SRFN is also worried about general habitat disturbance resulting from the proposed RoW. “What happens to animals’ homes [e.g., beaver (*Castor canadensis*)] that are destroyed during construction of the RoW?” (SRFN1).

SRFN Recommendation: SRFN members to monitor the construction of the RoW.

SRFN Recommendation: SRFN members would like beavers whose lodges will be affected by the intended RoW to be trapped and relocated elsewhere. Relocation needs to occur at the appropriate time of year (before lodges are built for the winter).

8.2 Traditional Use and Cultural Lifeways

The intended RoW will further limit areas within SRFN Traditional Territory where traditional activities can be performed, already reduced through existing development activities. SRFN Traditional Knowledge Holders expect compensation for damages associated with project-related activities. SRFN25 noted that “the only point [of the project] is to make money,” while SRFN16 explained, “They are damaging our medicines, our berry-picking places, our hunting places, so they should compensate us…. I’d like to see that guy who owns that pipeline so he can pay us some money!”

SRFN Recommendations: Northern Gateway to provide monetary compensation to SRFN for damages resulting from project-specific activities.

8.2.1 Hunting and Trapping

SRFN Traditional Knowledge Holders are concerned about effects to all harvesting areas, not only the traplines registered with the provincial government: “There should not be compensation only for trappers, there are hunters as well. Hunters, fishermen or anyone who hunts wildlife for traditional purposes should be compensated” (SRFN32). SRFN are also concerned that the targeted field visits conducted for this

ATK study could be insufficient for assessing effects on hunting, trapping and other harvesting activities: "People hunt in the whole area, our field visit [for the study] is only scratching the surface, we need to walk it all to know for sure" (SRFN8). SRFN6 agreed that "unless you do a field visit of the whole line, how will you know what is there?" SRFN11 also explained that "if a person is going to look for something, you have to go to many places. The only way to tell is to walk along the line" (SRFN11). SRFN hunters are now hunting close to the RoW, near Whitecourt, because of the effects of the SHWTC, as well as increasingly restricted access due to development (see Sections 7.2.1: Hunting and Trapping and 8.3.1.1: Access).

SRFN Recommendation: Consider means of providing compensation to registered trapline holders and other harvesters. See also recommendation in Section 8.2: Traditional Use and Cultural Lifeways.

SRFN Recommendations: Elders requested that further field studies be conducted by SRFN members on the RoW between approximately KP 200 and KP 250 once the route is finalized.

8.2.2 Plant Gathering

SRFN Traditional Knowledge Holders are concerned about the destruction of traditional resources during construction of the RoW (including two medicinal plants considered to be rare by SRFN). Elders discussed a number of medicinal plants found along the proposed RoW and asked that the names of the plants not be included in this report.

SRFN Recommendation: Avoid areas identified as containing rare medicinal plants by SRFN Traditional Knowledge Holders; where avoidance is not possible, support SRFN in harvesting these areas prior to construction.

8.2.3 Ancestral Sites (Archaeology)

SRFN Traditional Knowledge Holders are interested in hearing the results of the archaeological baseline assessment. "What if our grandmothers and grandfathers knew something about the area but they are gone and we do not know where cabins were, where people were buried? What then?" (SRFN16).

SRFN Recommendation: Present results of the archaeological baseline assessment for SRFN community members.

8.2.4 Community Well-Being

Elders also discussed compensation for the younger generation who will not be able to make a living off of the land as their ancestors once did (SRFN9): "Some money for the young people so they can have an education" (SRFN16). Elders are concerned about the low standard of living on the reserve evidenced by inadequate housing and recreation facilities.

SRFN Recommendation: Provide funding for housing, an Elder's lodge, an apartment for single people, and a new school with a gym.

8.2.5 Health and Well-Being

SRFN28 outlined the relationship between industrial development and health and well-being, as well as the long-term effects perceived by SRFN members: "Ever since 1945/55 when they started drilling, this is when the sickness came…in the last 30 years there are more and more diabetics and abdominal cancers; what is that caused by?… It's scary, very, very scary. It's dangerous to live here…Do little kids here ever get a chance to live up to the age of twenty?...Nobody can compensate for life lost—you can't compensate…We have no choice—my biggest frustration is how come we can't say 'yes' or 'no' to this for the reasons of our lives, our future, our children's lives…I want to live, clean air to breathe, our atmosphere to be clean—they can take their billions. What is this pipeline going to do that's good? What benefit is it to us as an Aboriginal community? Is there any benefit to us? I'm not talking about 'compensation,' but about 'benefit'. Is it going to benefit us or is it going to do us more harm than good? In case something happens and we start dying off, I want the public to know I asked this question."

SRFN Recommendation: No recommendation to date.

8.2.6 Livelihood and Economic Benefits

SRFN Traditional Knowledge Holders are interested in employment and training opportunities related to the Project, as well as in the possibility of owning shares in the Project.

SRFN Recommendation: Give priority to First Nations with regards to employment related to pipeline construction and commit to employing a certain percentage of SRFN members.

SRFN Recommendation: Offer training opportunities to community members, as well as onsite training for youth to increase employability.

SRFN Recommendation: SRFN Elders expressed interest in acquiring shares in the proposed pipeline.

8.3 Engineering

8.3.1 Design

SRFN Traditional Knowledge Holders are concerned about areas along the proposed RoW between Whitecourt and Fox Creek (KP 197 to KP 276 on Route R, current in July 2009) that diverge from the existing Alliance Pipeline RoW, as this will result in effects to previously undisturbed areas. The community is particularly concerned about the divergence across Alexander First Nation Indian Reserve No. 134A because SRFN feel that this re-route is purely for commercial gain at the expense of the environment (SRFN52). SRFN Traditional Knowledge Holders are also concerned about effects of ancillary facilities (e.g., pump stations, campsites, staging areas, stockpiles) on undisturbed areas (SRFN22 and SRFN28).

SRFN Recommendation: Where possible, do not diverge from the existing Alliance Pipeline RoW between Fox Creek and Whitecourt.

SRFN Recommendation: Relocate the proposed campsite (located at KP 213 on Route R) to a previously disturbed area.

8.3.1.1 Access

SRFN Traditional Knowledge Holders are concerned that the Project will restrict access to hunting areas (SRFN8, SRFN11 andSRFN27). SRFN is having to hunt more frequently in the Whitecourt area due to contamination in Swan Hills and increasingly restricted access closer to the community (see Section 7.2.1: Hunting and Trapping).

SRFN Recommendation: Do not cut off, use roadblocks or gates on access roads used for hunting.

SRFN Recommendation: Provide continued access to the project area to hunt and permit travel to the RoW using quads.

8.3.2 Safety

Study participants expressed concern that effects on water from spills will adversely affect SRFN's ability to exercise Treaty rights. SRFN8 stated, "If anything gets in the water, it will affect traditional use," and SRFN16 explained, "That's why it is important for [Northern Gateway] to consult with us when they cross rivers." SRFN16 noted, "Our focus is on the water because it flows to us." "Spills spoil everything, plants, animals, trees, people" (SRFN50). SRFN is also concerned that construction workers may not respect the land, particularly at watercourse crossings.

SRFN members had many questions regarding the likelihood of a spill and the measures taken to ensure that a spill does not occur. There is a heightened concern over contamination of water from spills due to the breakage of a number of old pipelines in the Slave Lake area and the spill at Burnaby, British Columbia that occurred around the time of study. "They say if [oil] flows into a creek or river it can go a long way before they catch it" (SRFN25). SRFN members have experienced environmental contamination from the SHWTC and have seen the effect this has had on traditional food.

Compensation for water contamination resulting from pipeline spills is of crucial importance to SRFN members. "What compensation is available if the pipeline breaks and contaminates the water?" (SRFN5, SRFN32 and SRFN34). Another member explained that "if they [Northern Gateway] guarantee a big number [in case of a spill], they will be more careful" (SRFN32).

There is also a concern that companies owned by foreigners are more likely to have an accidental release as they "have no ownership over the environment…they don't care if they spill" (SRNF46). SRFN study participants felt that companies operating in Alberta should be owned by the Government of Alberta (SRFN46).

SRFN Recommendation: Adequate measures need to be taken to prevent spills.

SRFN Recommendation: Provide information to SRFN on Northern Gateway's plans for watercourse crossings.

SRFN Recommendation: Provide a copy of Northern Gateway's emergency response plan for the Project and information regarding the potential for spills.

SRFN Recommendation: In the event of a spill, notify SRFN immediately and ensure proper cleanup procedures are initiated.

SRFN Recommendation: Ensure that monetary compensation measures for SRFN members are in place in the event that a spill occurs.

SRFN Recommendation: Keep Northern Gateway a Canadian-owned company.

8.3.3 Construction

SRFN Traditional Knowledge Holders are concerned about the destruction of traditional resources such as the trees cleared during construction of the RoW (see also Section 8.2.2: Plant Gathering).

There were also concerns regarding how SRFN recommendations would be communicated to work crews. One participant explained how "there is a big difference between the head guys [lead engineers] and the actual worker. This guy has pressure to get the job done on a timeline. He focuses on getting the job done and will run over what he has to" (SRFN49). Although "top dogs come to open houses and say everything will be okay," it is a different scenario on the ground and in the field (SRFN49). As a result, areas identified in ATK studies (e.g., mineral licks) are not always avoided.

SRFN Recommendation: Salvage timber from clearing the RoW for use by SRFN members for cabins and firewood.

SRFN Recommendation: Employ First Nations monitors at watercourse crossings during construction to ensure construction workers are respectful of the land.

SRFN Recommendation: Northern Gateway to develop a strategy to overcome the common disconnect between engineer leads in the city and construction crews in the field to ensure that areas identified in ATK studies are mitigated appropriately.

8.3.4 Operations

SRFN Traditional Knowledge Holders are worried about chemicals used in the maintenance of the RoW after construction: "After they put the pipeline in, it has to be monitored [so] that there are no chemicals put on to kill vegetation on that line. If [they] use herbicides, animals eat it." Instead, "hire people from the band to keep vegetation down" (SRFN8) and "to provide security" (SRFN18). There are also concerns about the potential effects of sabotage on the pipeline.

SRFN Recommendation: Do not use herbicides or pesticides to maintain the RoW.

SRFN Recommendation: Employ members of SRFN to maintain the RoW and provide security.

8.3.5 Reclamation

SRFN Traditional Knowledge Holders are concerned about how the area will be reclaimed after the construction of the RoW. "[Northern Gateway should use] what was there before and what is on either side" (SRFN25).

SRFN Recommendation: Use native plant species in reclamation.

SRFN Recommendation: SRFN would like an opportunity to bid on reclamation and maintenance contracts for the proposed RoW.

8.4 Regulatory Process

SRFN members are concerned that ATK studies are not meaningful and that such studies are shelved after regulatory approval with no subsequent follow-up. “They might do these meetings, but the reports are always shelved” (SRFN5 and SRFN11). SRFN34 asked, “What is the use of the study?” One SRFN member “want[s] to know that the report is, in fact, reviewed by Northern Gateway and the government” (SRFN11) and others stated, “We want follow-up” (SRFN8 andSRFN32). SRFN Traditional Knowledge Holders suggested that another way of making ATK studies more meaningful would be to involve First Nations communities earlier in the process: “Ideally [Aboriginal community representatives] should have been out with the scientists because [the scientists] don’t even really know what is important to Aboriginal people, for example, medicines” (SRFN5, SRFN8, SRFN11 and SRFN16).

SRFN study participants are also interested in hearing more information, in more detail, about the Project, project-related activities, and environmental assessment results regarding effects to wildlife and water, for example.

SRFN Recommendation: Provide confirmation that the SRFN ATK study was reviewed by Northern Gateway and the government.

SRFN Recommendation: Involve First Nations in the biophysical baseline studies.

SRFN Recommendation: Host an open house that includes higher-level representatives from Northern Gateway and the various specialists with knowledge about engineering aspects of the Project (for example: watercourse crossings and spill prevention).

SRFN Recommendation: Provide responses to the questions recorded during the SRFN ATK study.

SRFN Recommendation: Present the results of the ESA pertaining to wildlife, vegetation and water to SRFN Elders.

SRFN Recommendation: Provide information on available funding from Northern Gateway for SRFN to hire a consultant to conduct an independent review of the ESA on behalf of SRFN.

SRFN Recommendation: Continue relationship with SRFN after the approval process (i.e., come back to community to explain how SRFN issues, concerns and recommendations results were considered).

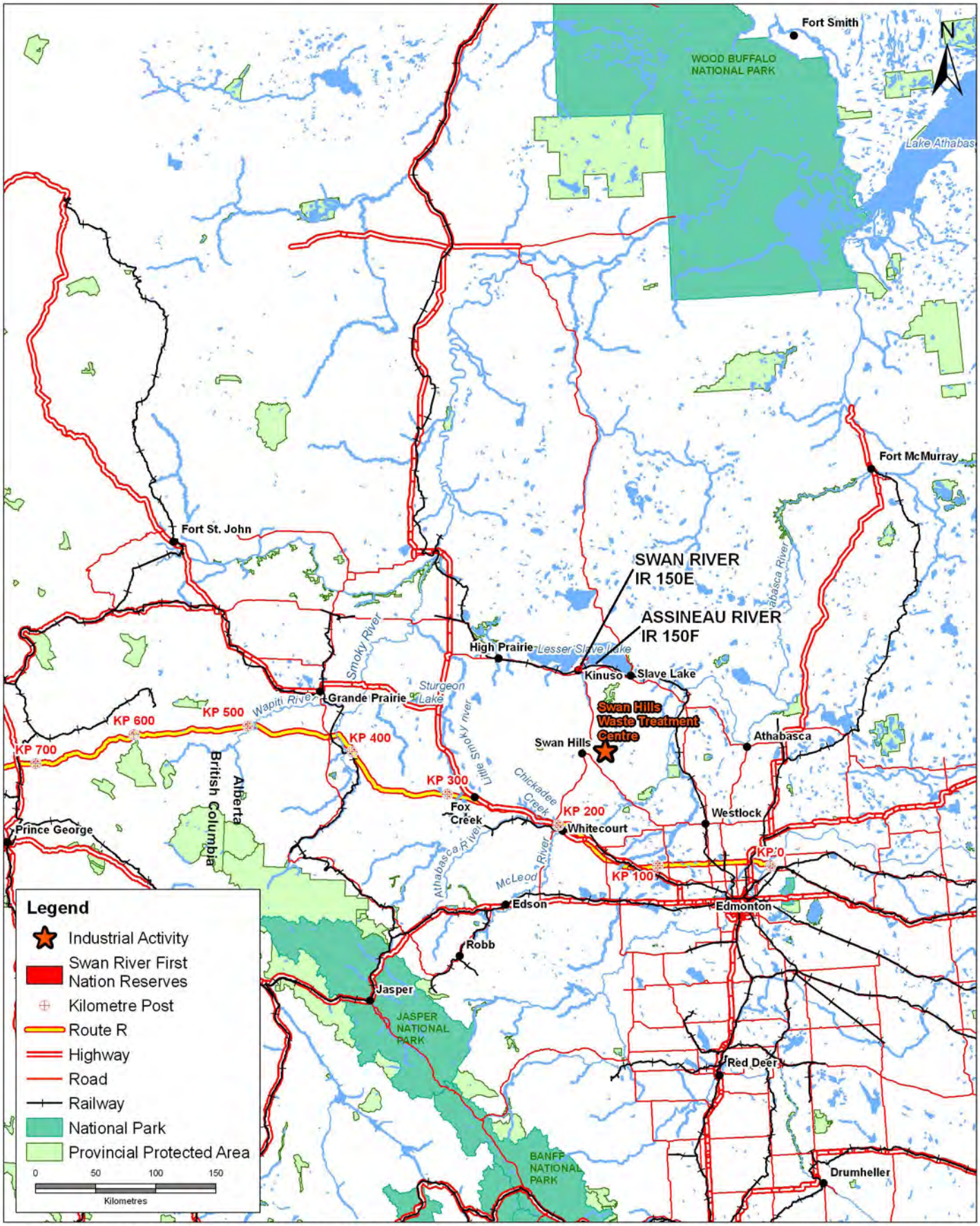
9 Cumulative Effects

SRFN members are concerned that future proponents undertaking development projects in the area will blame any environmental contamination on the SHWTC (see Figure 9-1) and not accept responsibility for their contributions to declining environmental conditions: “No one takes responsibility, Northern Gateway will try to blame problems on SHWTC” (SRFN16). “Who is responsible for impacts if you can’t tell who caused them?” (SRFN32).

SRFN associates oil producers conducting large-scale oil sands development in northeastern Alberta with companies investing in Northern Gateway and providing commercial support to the Project. When this association is made, the Project appears as more of a threat to continued land use by SRFN, as large-scale oil sands development is believed to soon be moving into the Lesser Slave Lake area (SRFN49).

SRFN Recommendation: Contribute funding for an independent SRFN or Treaty 8 laboratory to assess water, air and traditional food quality on an ongoing basis. This monitoring should consider contamination from a variety of sources, including oil and gas, agriculture, forestry and the SHWTC. SRFN also suggests that three independent blood tests be done to determine PCB levels when a community member dies.

SRFN Recommendation: SRFN members recommend that existing levels of contamination be used as a baseline against which future levels are evaluated to help determine who is responsible.



Due to the lack of publicly available or easily accessible data, this map does not include forestry, existing oil and gas activity, agriculture, powerlines or highway services, all of which were cited by SRFN as contributing to the cumulative effects experienced by the community.

CONTRACTOR: FMA Heritage Inc.

PREPARED BY: gem

PREPARED FOR: ENBRIDGE NORTHERN GATEWAY PIPELINES

ENBRIDGE NORTHERN GATEWAY PROJECT

Industrial Activity Discussed by Swan River First Nation ATK Study Participants

FIGURE NUMBER:	DATE:
9-1	20100421
SCALE: 1:4,350,000	AUTHOR: ML / APPROVED BY: NBS
PROJECTION: UTM11	DATUM: NAD 83

G:\CA\projects\1566_North\Swan_River\map\Report_Maps

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Appendix A Participant List

A.1 Initial Scoping Process

May 2007

SRFN ATK Study Coordinator

- Darryel Sowan (SRFN consultation unit manager)

GEM ATK Study Team

- Keely Winnitoy
- Ave Dersch

A.2 Interviews

September 4 and 5, 2007

SRFN Traditional Knowledge Holders:

- Robert Courterellie
- Louis Sound
- Evelyn Mckenzie
- Josephine Twin
- Charlie Chalifoux
- John Giroux
- Doris Courterellie
- Gordon Courterellie
- Delphine Giroux
- Helen Giroux
- Fred Chalifoux
- Yvonne Davis
- Anne Davis
- Bernice Smith
- Dinah Chalifoux
- R. Sowan
- Edith Davis
- Ralph Davis
- Virginia Davis
- Gerald Giroux Sr.
- Esther Giroux
- Eleanor Sawan
- Carol Nome
- Florence Sound
- Clarence Sound
- Robert (Steve) Sound
- Roderick Twin

- Elsie Dumont
- Susan Moyan
- Linda Twin
- Eugene Cyre
- Maureen (Ellie) Davis
- Billy Giroux
- Dianne Giroux
- James (Harry) Courterellie
- Tammy Watt
- Jonah Giroux
- Leroy Sowan
- Kyle Twin
- James Davis (Twin)
- Brent Smith
- Angela Courterellie
- Ben Giroux
- Randy Courterellie
- Wade (Rory) Twin

SRFN ATK Study Coordinator:

- Darryel Sowan

GEM ATK Study Team

- Ave Dersch
- Nicole Nicholls

A.3 Field Visits

September 6 and 7, 2007

SRFN Traditional Knowledge Holders

- Robert Courterellie
- Louis Sound
- Evelyn Mckenzie
- Josephine Twin
- Charlie Chalifoux
- John Giroux
- Doris Courterellie
- Gordon Courterellie
- Delphine Giroux
- Helen Giroux
- Fred Chalifoux
- Yvonne Davis

- Anne Davis
- Bernice Smith
- Dinah Chalifoux
- R. Sowan
- Edith Davis
- Ralph Davis
- Virginia Davis
- Gerald Giroux Sr.
- Esther Giroux
- Eleanor Sawan
- Carol Nome
- Florence Sound
- Clarence Sound
- Robert (Steve) Sound
- Roderick Twin
- Elsie Dumont
- Susan Moyan
- Linda Twin
- Eugene Cyre
- Maureen (Ellie) Davis
- Billy Giroux
- Dianne Giroux
- James (Harry) Courterellie
- Tammy Watt
- Leroy Sowan
- Kyle Twin
- James Davis (Twin)
- Brent Smith

SRFN ATK Study Coordinator

- Darryel Sowan

GEM ATK Study Team

- Ave Dersch
- Nicole Nicholls

A.4 Community Review

December 5 and 6, 2007

SRFN Traditional Knowledge Holders

- Robert Courterellie
- Louis Sound
- Evelyn Mckenzie
- Josephine Twin
- Charlie Chalifoux
- John Giroux
- Doris Courterellie
- Gordon Courterellie
- Delphine Giroux
- Helen Giroux
- Fred Chalifoux
- Yvonne Davis
- Anne Davis
- Bernice Smith
- Dinah Chalifoux
- R. Sowan
- Edith Davis
- Ralph Davis
- Virginia Davis
- Gerald Giroux Sr.
- Esther Giroux
- Eleanor Sawan
- Carol Nome
- Florence Sound
- Clarence Sound
- Robert (Steve) Sound
- Roderick Twin
- Elsie Dumont
- Linda Twin
- Eugene Cyre
- Maureen (Ellie) Davis
- Dianne Giroux
- Leroy Sowan
- James (Harry) Courterellie
- Kyle Twin
- James Davis (Twin)
- Angela Courterellie

- Ben Giroux
- Randy Courterellie

SRFN ATK Study Coordinator

- Darryel Sowan

GEM ATK Study Team

- Ave Dersch
- Nicole Nicholls

A.5 Update Meeting

October 10, 2008

- Evelyn McKenzie
- Yvonne Davis
- Virginia Davis
- Doris Courterellie
- Charlie Chalifoux
- Louis Sound
- Randy Courterellie
- Delphine Giroux
- Diane Giroux
- Esther Giroux
- Fred Chalifoux
- Anne Davis
- Gordon Courterellie
- Robert Sound
- Clarence Sound
- Elsie Dumont
- Bernice Smith
- Eleanor Sawan
- Ralph Davis
- Dinah Chalifoux
- Wade Twin
- Gerald Giroux
- Maureen Davis
- Eugene Cyre
- Roderick Twin
- Robert Courterellie
- Rose Sawan

GEM ATK Study Team

- Ave Dersch
- Rosalind Goldsmith
- GEM Team Member
- Stephen McCarthy (AMEC)

A.6 Update Interviews

December 6, 14 and 15, 2008

SRFN Traditional Knowledge Holders:

- Gerald Giroux Jr.
- Penny Sound
- Roberta Sowan
- Duff Twin
- Margaret Jackknife

GEM TK Study Team Members:

- Ave Dersch

A.7 Update Field Visits

August 24 to 27, 2009

SRFN Traditional Knowledge Holders

- Elsie Dumont
- Eleanor Sawan
- Roderick Twin
- Ralph Davis
- Clayton Giroux
- Richard Woodman
- Patrick Chalifoux
- Jamie Courterellie

SRFN Field Director

- Ryan Davis

GEM ATK Study Team

- Ave Dersch
- Kate McAnally

A.8 Update Community Review

September 18, 2009

SRFN Traditional Knowledge Holders

- Louis Sound
- Carol Nome
- Evelyn Mckenzie
- Josephine Twin
- Charlie Chalifoux
- Roderick Twin
- Clarence Sound
- Robert Sound
- Dwain Davis
- Elsie Dumont
- Doris Courterellie
- Linda Twin
- Gordon Courterellie
- Eugene Cyre
- Delphine Giroux
- Dorothy Baker
- Robert Courterellie
- Billy Giroux
- Yvonne Davis
- Robert Willier
- Anne Davis
- Bernice Smith
- Dinah Chalifoux
- R. Sowan
- Yvonne Sound
- Ralph Davis
- Virginia Davis
- Gerald Giroux
- Eleanor Sawan
- Dianne Giroux
- Clayton (Brian) Giroux
- Angela Courterellie
- Richard Woodman
- Maureen Davis
- Jamie Courterellie
- Randy Courterellie

SRFN Field Director

- Ryan Davis

GEM ATK Study Team

- Ave Dersch
- Kate McAnally

High Level Review of the Enbridge Northern Gateway Pipeline Environmental Impact Assessment - Whitecourt to Fox Creek Alberta

Prepared for

Swan River First Nation

January 2011

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Wildlife	Ms. Abbie Stewart, M.Sc., P. Biol.
Vegetation and Reclamation	Dr. Sheri Gutsell
Aquatic Resources	Ms. Sarah Hechtenthal, M.Sc., P.Biol.

Acronyms/Abbreviations

AENV	Alberta Environment
ASRD	Alberta Sustainable Resource Department
ATK	Aboriginal Traditional Knowledge
AVI	Alberta Vegetation Inventory
BACI	Before-after-control-impact
BMA	Bear Management Area
BMU	Bear Management Unit
CEAA	Canadian Environmental Assessment Agency
CEA	Cumulative Effects Assessment
CI	Control-Impact
EPMP	Construction Environmental Protection and Management Plan
ESA	Environmental and Socio-Economic Assessment
GBPU	Grizzly bear population unit
GOA	Government of Alberta
HADD	Harmful Alteration, Disruption or Destruction of fish habitat
KI	Key Indicator
MSES	Management and Solutions in Environmental Science
NEB	National Energy Board
PDA	Project Development Area
PEAA	Project Effects Assessment Area
REAA	Regional Effects Assessment Area
RoW	Right of Way
SRFN	Swan River First Nation
TDR	Technical Data Report
TEK	Traditional Ecological Knowledge
TLU	Traditional Land Use
TR	Traditional Resource
TSS	Total suspended solids
VEC	Valued environmental component
ZOI	Zone of Influence

Executive Summary

The Swan River First Nation (SRFN) requested that Management and Solutions in Environmental Science (MSES) complete a high-level review of the Application for the proposed Enbridge Northern Gateway Pipelines Project (the Project) which was submitted to the National Energy Board and Canadian Environmental Assessment Agency in May 2010. Specifically, the SRFN have requested that MSES focus their review efforts on the section of the proposed pipeline that may impact parts of their traditional territory, namely between Whitecourt and Fox Creek, Alberta. The proposed Project is a 1,172 km dual pipeline that will transport light and heavy oil, synthetic oil, and bitumen blends from Bruderheim, Alberta to a new marine terminal in Kitimat, British Columbia, and will transport condensate in the opposite direction. The oil pipeline is designed for an average capacity of 525,000 barrels per day, and will have an outside diameter of 36 inches (914mm). The condensate pipeline is designed with an average capacity of 193,000 barrels per day and will have an outside diameter of 20 inches (508mm). The pipelines will have an average permanent right-of-way (ROW) width of 25m, although a 55m width is planned for ROW clearing during construction. Associated infrastructure such as pump stations, power lines, access roads, work camps, etc. will also be built as part of the Project.

The review is largely focused on the section of the proposed pipeline between Whitecourt and Fox Creek, Alberta. MSES evaluated the Application material to assess how and to what extent Enbridge has addressed the concerns of the SRFN surrounding environmental stewardship, impacts to traditional resource use, and potential residual impacts on the environment. MSES understands that it is important to First Nations that regional landscapes maintain functional ecosystems and that reclamation for planned Projects, and other forms of mitigation, will successfully return the regional landscape as closely to its original capacity as possible in order to minimize effects on traditional resource use. Although the budget did not permit a comprehensive review of the Application material or the supplemental Technical Data Reports, key sections were consulted where necessary. A high-level review of the wildlife, vegetation, reclamation, and aquatic components in the Environmental and Socio-economic Assessment (ESA) was completed to evaluate the potential Project-related effects on the environment, in general, and the effects on traditional resource use, in particular. Key overarching concerns regarding the potential impacts to traditional resource use and availability, and regarding the information required to better understand the potential impacts have been summarized and are provided below within this executive summary. These concerns are discussed in further detail with other discipline-specific issues of concern in respective report sections.

Key Concerns with the Enbridge Northern Gateway Pipeline Project

1. We found little evidence in Enbridge's Application that information provided by the SRFN on traditional land and resource use has been considered in a concrete manner in the impact

assessment process and that the overarching concerns voiced by the SRFN have been addressed, let alone resolved. It remains unclear how First Nations will be involved in the development and implementation of monitoring plans and follow-up programs. Presently the ATK studies appear to have been undertaken as a demonstration of consultation and not so much as an effort to gain meaningful management information.

2. Enbridge uses various methods of determination for the significance of Project-related effects, but they do not appear to have used any definition of significance that would be recognized by SRFN. The loss of traditional resources and opportunities to practice traditional activities in large areas of their traditional territory during multiple human generations may well be deemed significant.
3. To date Enbridge has only presented conceptual monitoring and follow-up programs. These programs should be designed to test predictions, verify the effectiveness of proposed mitigation measures, and assure the SRFN that impacts on their traditional resource use would be at or below predicted levels. The current plans lack the credibility needed to assure the SRFN that monitoring would be carried out with the rigor required to test Enbridge's predictions.
4. The SRFN are concerned about the rapid pace of development in their traditional territory, which includes segments of the Northern Gateway Project. Enbridge identifies the amount of current land disturbance in their PDA (28% disturbed) and current linear disturbance in their REAA (1.66 km/km^2). Given Enbridge's stated understanding of the impact of increased disturbance on habitat and landscape fragmentation, and given that current levels of linear disturbance are already above the threshold for maintaining viable populations of large mammals that is suggested in peer reviewed literature (most thresholds are at less than $1km/km^2$), it is unclear how Enbridge determined that adding to an already high level of disturbance is insignificant.
5. The effect of the Project is not assessed in relation to SRFN's traditional land use. Development in the region may well have already taken up more traditional lands than Enbridge is prepared to show. In order to fully understand the impacts of the Project on traditional resource use and how much the practice of traditional activities has already been curtailed or deprived to date, it is imperative to understand how much of the SRFN's traditional resources have been impacted to date, and how additional impacts will act in a cumulative fashion. As presented, the cumulative effects assessment is not credible in light of the pace of development in the Swan Hills region over the past several decades.
6. The main goal of reclamation should be to reclaim sites such that they are as similar as possible to the pre-disturbance landscape. Enbridge has committed to the goal of achieving equivalent land capability, which may or may not include pre-disturbance community types. Unfortunately, equivalent land capability simply means that some boreal plant species will be present on the reclaimed site. Enbridge also proposes to use "*natural recovery*" in their reclamation plans. There is no recent and

direct evidence that natural recovery results in the establishment of a wide variety of native plant species such that reclaimed ecosites are similar in species composition to pre-disturbance ecosites.

7. Enbridge has identified several sensitive areas for wildlife in Alberta which may be impacted by the Project including the Little Smoky woodland caribou herd, several ungulate winter ranges, the Swan Hills Bear Management Area, the Grande Cache Bear Management Area, and Trumpeter Swan nesting areas. Significant impacts are predicted for some wildlife species. However, the mitigation measures and conceptual compensation plans that are presented to offset these impacts offer little confidence that Enbridge is prepared, capable and willing to resolve complex wildlife-related issues associated with Project development.

8. The proposed Northern Gateway pipeline route crosses 195 fish-bearing watercourses in Alberta. Watercourse crossing techniques are largely open cut and isolation methods resulting in13 high risk crossings, which are expected to result in temporary or permanent reductions of fish habitat productive capacity. Some of the high risk crossings are within the SRFN traditional territory, yet there are no specific references to the presence or location of any traditional fisheries used by the SRFN and no discussion of the possible effects of the Project on any such fisheries. Given the conclusion of no significant impacts on aquatic ecology, there may be unspoken assumptions that SRFN fisheries would be similarly unaffected**.** Impact predictions are completely reliant on successful mitigation and conceptual compensation plans, however, at present these are merely unsubstantiated promises of success and need to be supported with concrete examples and peer-reviewed literature.

9. There is the potential for environmental contamination associated with all phases of the proposed Project and concerns about these risks are justified given Enbridge's poor track record of pipeline spills and incidents. The SRFN were not provided with adequate funding to complete a comprehensive technical review of the Application or supplemental materials; an evaluation of the risks assessment and response plans was outside of the scope of this review. Given the risks and concerns associated with the Project, Enbridge should provide appropriate funding to First Nations to complete comprehensive third-party technical reviews.

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1.0 INTRODUCTION

The Swan River First Nation (SRFN) requested that Management and Solutions in Environmental Science (MSES) complete a high-level review of components of the Application for the proposed Enbridge Northern Gateway Pipelines Project (the Project) which was submitted to the National Energy Board (NEB) and Canadian Environmental Assessment Agency (CEAA) in May 2010. The SRFN were not provided with adequate funding to complete a comprehensive technical review of the Application or supplemental materials. Therefore, MSES has completed a high-level review of the wildlife, vegetation, reclamation, and aquatic components in the Environmental and Socio-economic Assessment (ESA).

The SRFN have requested that MSES focus their review efforts on the section of the proposed pipeline that may impact their traditional territory, namely between Whitecourt and Fox Creek, Alberta. MSES understands that it is important to First Nations that regional landscapes maintain functional ecosystems and that reclamation, and other forms of mitigation, will successfully return the regional landscape as closely to its original capacity as possible so as to minimize the effects on traditional resource use. MSES evaluated the Application material with that concern in mind and assessed how and to what extent Enbridge has addressed the concerns of the SRFN surrounding environmental stewardship, impacts to traditional resource use, and potential residual impacts on the environment. Moreover, MSES assessed whether the effectiveness of the proposed mitigation can be measured or quantified to demonstrate success. In its evaluative approach, MSES maintains that it is essential that scientific rigor be employed when considering the potential impacts of various projects on the environment. In turn, such rigorous analysis could assist in determining impacts to traditional resource use and in measuring the success of mitigating such impacts. Below, we comment on project design, and evaluate the proposed predicted impacts of the project in light of the plausible environmental management and restoration plans.

1.1 Project Description

The proposed Project is a 1,172 km dual pipeline that would transport light and heavy oil, synthetic oil, and bitumen blends from Alberta near Bruderheim (NE-4-56-21 W4M) to a new marine terminal in Kitimat, British Columbia (UTM Zone 9 Easting 518436, Northing 5977709), and would transport condensate (a diluent for heavy oil and bitumen) in the opposite direction. The oil pipeline is designed for an average capacity of 525,000 barrels per day, and would have an outside diameter of 36 inches (914mm). The condensate pipeline is designed with an average capacity of 193,000 barrels per day and would have an outside diameter of 20 inches (508mm). The pipeline route follows existing RoWs to some extent in Alberta, but only minimally in British Columbia. The pipelines would be buried at a depth of 1m with an average permanent right-of-way (ROW) width of 25m, although a 55m width is planned for ROW clearing during construction. Associated infrastructure such as pump stations, power

lines, access roads, work camps, etc. would also be built as part of the Project. The purpose of the Project is to facilitate increased marine shipping access for oil from the Alberta oil sands to world markets.

The SRFN have requested that MSES focus their review efforts between Whitecourt and Fox Creek, Alberta. This section of the pipeline runs entirely through the Green Area of Alberta which refers primarily to the forested public lands that are managed by Alberta Sustainable Resource Development (ASRD) located in northern and western Alberta.

In the ESA, Enbridge uses three scales to define the geographic scope of the Project: 1) the physical footprint of the Project known as the Project Development Area (PDA) which includes powerline easements (40 to 60 m wide) and 25 m permanent RoW for the pipeline, up to 25 m of temporary workspace and up to 10% of extra workspace, 2) the Project Effects Assessment Area (PEAA) which is a total of a 1km wide buffer – 500m on either side of the alignment and includes the PDA, and 3) the Regional Effects Assessment Area (REAA) used in assessing cumulative effects which varies in size depending on what is being assessed (e.g., for wildlife it is a total of 30 km wide buffer – with 15km on either side of the pipeline alignment). The impacts of the Project were also assessed using three development cases: The Base Case, the Project Case, and the Future Case. The Base Case addresses the existing environmental conditions within the Project area. The Project Case includes both the Baseline Case plus the proposed Project, and the Future Case includes the first two cases plus any future projects, according to Enbridge, that are expected to occur in the area.

1.2 Scope of the Review

When undertaking this work, we were mindful that a significant concern of the SRFN is the impact of development (existing and future) upon traditional land and resource use within their traditional territory, such as hunting, trapping, fishing and gathering. Given these concerns of the First Nations in Northern Alberta, the questions posed to environmental mangers and policy makers are unequivocal: **How much will the deprivation of traditional land and resource use by First Nations escalate and intensify in the future? How and when will this deprivation be mitigated?** The questions seem simple, but the devil lies in the detail. In order to fully answer this question, measurements are needed to provide quantifiable information on how much of the original traditional resource is available to date, and how much will be left once planned developments go ahead from construction to operation and decommissioning. These measurements must be the foundation of testable questions, much like in the process of environmental monitoring described by Burns and Wiersma (2004). In that process, testable questions are developed, seeking measurable parameters that are subjected to rigorous statistical analyses.

Working within the tight budget constraints, MSES completed a high-level review of the Enbridge Northern Gateway ESA (Volume 6A). Based upon our conversations with First Nations and our previous reviews associated with linear development projects and their impact on First Nation communities, we largely focused our review on the potential residual effects of the Project on the environment and the potential impact to traditional land and resource use. We have organized our concerns under 5 main sections: Current and Cumulative Disturbance, Addressing SRFN Concerns, Monitoring and Follow-Up, Terrestrial Resources, and Aquatic Resources. The final section of the review briefly summarizes the key information gaps that were noted in the Application materials and should be addressed by Enbridge in order to evaluate the impacts of the Project on the environment and traditional resource use.

2.0 OVERARCHING ISSUES

Enbridge has compiled a more comprehensive environmental impact assessment than most pipeline projects in Alberta. However, several overarching issues were pervasive in all sections of the Application that were subject to review.

1. Cumulative Disturbance and Impact Significance: Although Enbridge identifies the amount of current industrial development in their PDA and current linear disturbance in their REAA, the effect of this development is not assessed in relation to SRFN's traditional land use. In order to fully understand the impacts of the Project, it is imperative to assess how much of the SRFN's traditional resources have been impacted to date, and how additional impacts will act in a cumulative fashion. According to current research, it appears that the threshold for maintaining viable populations of wildlife in relation to linear disturbance has already been exceeded in Enbridge's REAA. Such high levels of disturbance in the landscape affect almost all aspects of an ecosystem and the SRFN are concerned about the rapid pace of development on their traditional lands. Accordingly, it is necessary to consult the SRFN for their views on what significance of an impact means; that is, definitions of impact significance should be provided by the SRFN.

2. Addressing SRFN Concerns: we found little evidence in Enbridge's Application that information provided by the SRFN on traditional land and resource use has been considered in a concrete manner in the impact assessment process and that the overarching concerns voiced by the SRFN have been addressed, let alone resolved.

3. Monitoring and Follow-up: monitoring must be in place to determine whether any effects have materialized, regardless of any conclusions from the impact analyses. Having a proper monitoring program in place may help hedge against incorrect assumptions. To date Enbridge has only presented conceptual monitoring and follow-up programs. These programs should be designed to test predictions, verify the effectiveness of proposed mitigation measures, and assure the SRFN that impacts on their traditional resource use would be at or below predicted levels. The current plans lack the credibility needed to assure the SRFN that monitoring would be carried out with the rigor required to test Enbridge's predictions.

2.1 Cumulative Disturbance and Impact Significance

Enbridge has completed a more comprehensive assessment of regional land disturbance than most pipeline regulatory applications in Alberta. Enbridge calculates the extent of the PDA in the Green Area

of Alberta that is already disturbed (Base Case) to be 541 ha or 28% if the PDA (Table 9-1, Volume 6A, Section 9, page 9-4). However, Enbridge states that this does not include forestry cutblocks, and "*the extent of the PDA that is already disturbed at baseline is higher.*" Also, methods used for these analyses were not readily apparent. **Enbridge should provide details on how the disturbed areas were calculated and provide updated calculations of disturbance including *all* linear disturbances in the PDA.**

From an ecosystem perspective, the process of landscape disturbance i.e., fragmenting vegetation communities and wildlife habitat into ever smaller and more isolated patches, results in numerous changes to ecosystem functionality at both the small patch scale and the landscape or regional scale. It is understood that the environment varies naturally and that ecosystems, and societies that depend on these ecosystems, are able to withstand the challenges of this natural variability within certain limits (Folke *et al.* 2003). Folke *et al.* defined ecological resilience as "*the magnitude of disturbance that can be experienced before a system moves into a different state and different set of controls*". If the magnitude of disturbance pushes an ecological system beyond its natural variability into a different state, then ecosystems and societies, such as First Nations, may be unable to withstand the resulting shift in ecosystem functionality. For ecologists, the task is to provide information on the amount of environmental variability, including the degree of ecological disturbance, which may lead to the system shifting into a different state of functionality (Gordon *et al.* 2008).
Please discuss the landscape scale changes in the REAA in light of ecosystem shifts. Please provide a rationale for why or why not ecosystems have shifted or will soon shift into a different state of functionality.

2.1.1.1 Fragmentation

The conversion from natural land surfaces to industrial ones between 1988 and 2009 in a section of SRFN traditional territory can be visualized by means of Landsat5 satellite imagery (Figure 1). The degree of change in landscape disturbance that can be observed in these aerial snapshots is alarming. According to Enbridge over ¼ of the land in the PDA is already disturbed; as a result, the local ecosystem may have already shifted to a different state. Enbridge indicates that the density of linear disturbances in the REAA is currently 1.66 km/km^2 and will increase to 1.70 km/km^2 with the addition of the Project (Volume 6A, Section 9, Table 9-73). The landscape in the REAA is now largely dominated by disturbed surfaces, edges, and numerous, very small, isolated patches of natural surfaces. This may lead to the disappearance of wildlife species from the landscape, including grizzly bears, moose and caribou and to the invasion of species, including deer and magpies (Weclaw and Hudson 2004, Dawe and Boutin 2009), the invasion of natural vegetation communities by invasive plant species (White *et al.* 1993), and changes in the ecosystem services such as water retention and filtration, and carbon storage (Schindler and Lee 2010). These in turn have a strong influence on traditional land use.

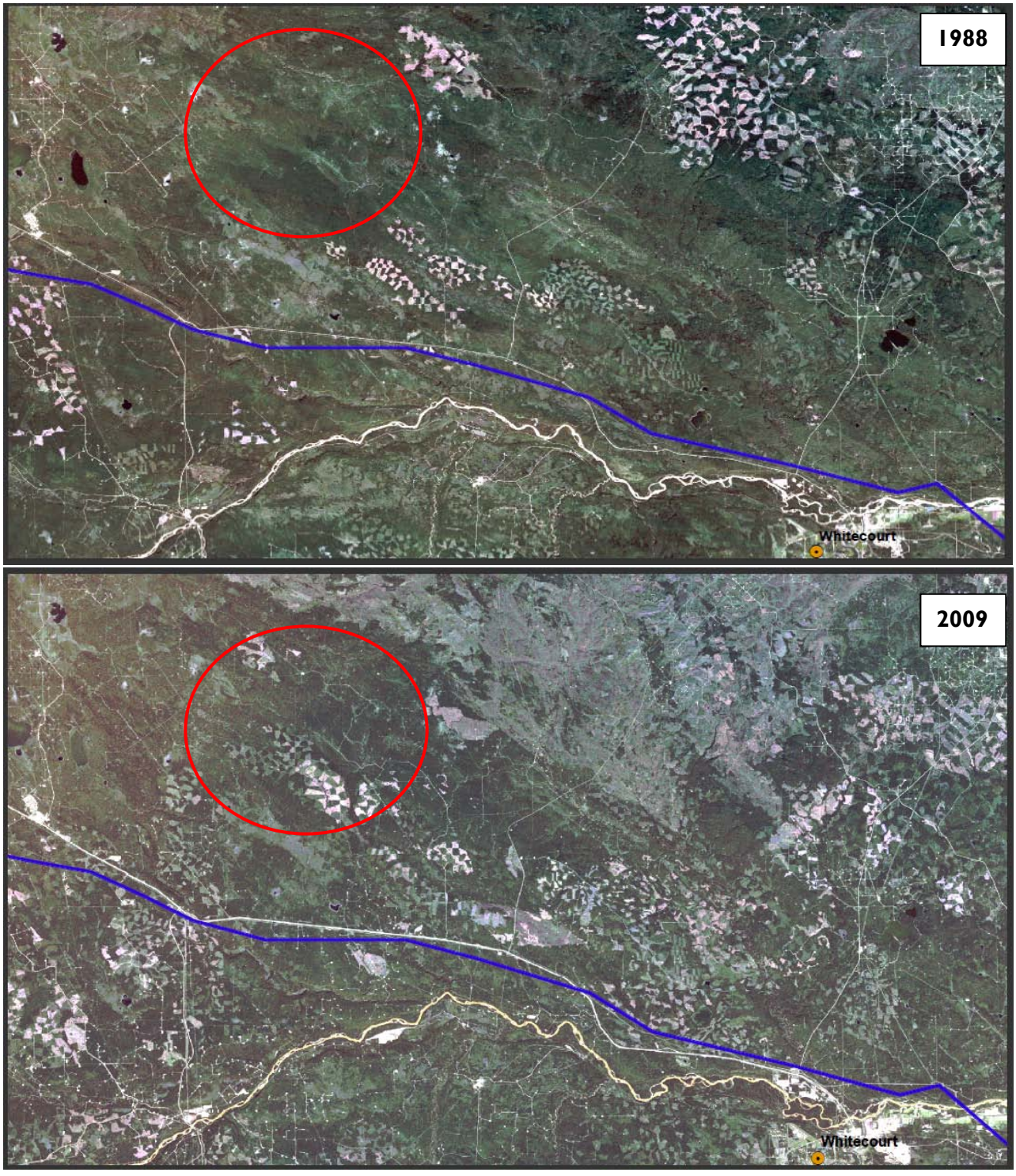

Figure 1- Landsat images showing increasing land disturbance in SRFN traditional territory along the proposed pipeline alignment (blue line) between 1988 (top) and 2009 (bottom). Red circle is an example of an area that has changed dramatically over time.

Current levels of linear disturbance in the Northern Gateway REAA are already above the threshold for maintaining viable populations of large mammals that is suggested in peer reviewed literature (most thresholds are at less than 1km/km^2). The density threshold of seismic lines at which caribou and moose populations (both species traditionally used by the SRFN) may be excluded from an area is as low as 0.8 km/km^2 (Weclaw and Hudson 2004). For moose, at a linear disturbance density of 0.16 km/km^2 the population may already be reduced (Laurian *et al.* 2008). Studies conducted in Alberta by Sorensen *et al.* (2008) and in British Columbia by Thiessen (2009) on the effect of land disturbance on caribou suggested that a sustainable caribou population can only exist when less than 61% of the resource area is within 250 m of industrial development. This finding is corroborated by the steadily declining caribou populations (McLoughlin et al. 2003). It appears that the REAA has already exceeded these levels of disturbance. **Please provide an analysis of the degree of existing disturbance and the likely future cumulative disturbance in light of the thresholds and populations declines discussed in the above cited literature.**

Enbridge correctly and repeatedly states in their ESA that the combination of increased density of linear development along with other types of development results in fragmentation of the landscape and wildlife habitat. Enbridge also appears to be aware of the current density of linear disturbance and the risk it poses to the sensitive wildlife in the region of their proposed pipeline. And yet, Enbridge states that an additional 0.04km/km^2 of linear disturbance resulting from the Project in the Green Area of Alberta, will have a negligible impact.

By what rationale did Enbridge determine that adding to an already high level of disturbance (which already exceeds some viability and management thresholds) is still insignificant and deemed "*acceptable*"?

Given Enbridge's stated understanding of the impact of increased disturbance on habitat and landscape fragmentation, and given that a density of 1.66 km/km^2 or more currently exists in the REAA, can Enbridge comment on how much more disturbance would need to occur to reach an "unacceptable" level of fragmentation? Please discuss the threshold between acceptable and unacceptable fragmentation regarding, at a minimum, vegetation communities, wildlife habitat, biodiversity, and traditional land use; provide refereed publications, data and testable predictions (please note that professional opinions unsupported by peer reviewed research are not useful responses to the SRFN requests).

Our experience and research from other regions in Alberta have shown that at 1.5 km/km^2 of linear development, various fragmentation parameters such as patch size and patch isolation approach an asymptote of maximum fragmentation. In other words, a linear density of 1.5 km/km^2 already represents the maximum impact that can be achieved as far as habitat fragmentation is concerned. In Enbridge's Application the baseline density of linear disturbance in the REAA, is greater than 1.5 km/km^2 indicating that maximum fragmentation may have already been reached.

Enbridge should conduct a patch analysis. This includes landscape metrics such as the number of patches of natural surfaces, the average patch size, and the index for the proximity of patches to each other.
Enbridge's proposal of offsetting some of its proposed disturbances by re-establishing pre-disturbance conditions on currently existing disturbed areas should be seriously considered. There is merit to this idea, but concrete plans are needed and it remains unclear how input from the SRFN will be used.

2.1.1.2 Adding to existing disturbance

Cumulatively, multiple, pipeline ROWs and existing transportation corridors can have numerous impacts on ecosystems. Pipeline construction activities create a large amount of temporary disturbance through the volume of people and equipment that become concentrated along a construction corridor. Combined, these activities create a large Zone of Influence (ZOI) around pipeline construction zones. During the operational life of the pipelines, ROWs are never fully allowed to revegetate to a forested condition for safety reason.
Although it is understood that much of proposed Project between Whitecourt and Fox Creek will run parallel to existing linear developments for a large portion of the route, the proposed Project will a) widen the existing linear features, b) introduce new construction activities, c) add additional project components/infrastructure (powerlines, pump stations, access roads, etc), and d) disturb segments of previously undisturbed land for new RoW. **It is assumed that the existing RoW will be expanded to accommodate the new pipelines - i.e., increase the footprint of the existing linear disturbance? If the Project is built, what will be the TOTAL width and area of the shared linear corridors? In the existing RoW, how much re-disturbance will occur? Some of these areas may have been reclaimed or become naturalized over years of non-use – was this examined? Enbridge should discuss the expansion of the already existing ZOI for the proposed Project.**

2.2 Addressing Swan River First Nation Concerns

Conducting a detailed evaluation of the Aboriginal Engagement and Aboriginal Traditional Knowledge (ATK) components of the Application (Volume 5) was outside the scope of our review. However, in our assessment of the Application materials we were mindful that a significant concern of the SRFN is the impact of development (existing and future) upon traditional resource and land use within their traditional territory, such as hunting, trapping, fishing and gathering. We noted that Enbridge has completed ATK reports for numerous Aboriginal groups, including the SRFN. This is an improvement

over most pipeline projects in Alberta. However, we found little evidence throughout the ESA that the overarching concerns presented in these reports have been addressed, let alone resolved. Traditional Resources (TR) and Traditional Ecological Knowledge (TEK) for the SRFN are not discussed in the ESA and no explicit connection between impacts of the proposed pipeline and traditional land use was evident. Presently the ATK study appears to have been undertaken as a demonstration of consultation and not so much as an effort to gain meaningful management information.

SRFN specific concerns regarding anticipated effects of the Project are summarized along with a list of recommended mitigation measures proposed by the SRFN (Volume 5B, Appendix C, Table C-15). Enbridge states that "*Aboriginal input is incorporated into the project design and ESA studies. Information received is reviewed by discipline experts for consideration of refinements or modifications to the Project, while balancing factors related to community and landowners, environmental, engineering, integrity, cost and constructability issues.*" (Volume 1, Section 11, page 11-10). **Enbridge is requested to provide concrete examples of how and where SRFN concerns and proposed mitigation measures were incorporated into the Project planning and design. How will local Aboriginal communities and TK be involved in the development and implementation of monitoring plans? Enbridge should explain how the ESA and proposed follow-up programs resolve SRFN community concerns.**
Enbridge should provide additional columns in Table C-15 to show: 1) where they have incorporated the gathered information into their planning and Project design and 2) concrete targets for monitoring to ensure success of mitigation (somewhat like a concordance table).

2.2.1.1 Determination of Significance for Project Effects

Enbridge uses various methods to determination the significance of a Project-related effect, but they do not appear to have used any definition of significance that would be recognized by First Nations. They state that an effect may become significant when it passes a key threshold which could be ecological, physical, political or social. In the wildlife section "*An effect is significant when a resource undergoes an unacceptable change or reaches an unacceptable level...*" (Volume 6A, Section 9, page 9-38)
Enbridge should make use of the comments received from the SRFN community to determine what an "*unacceptable*" effect is and what the key thresholds are for a significant social or ecological effect.
Were SRFN members consulted on these thresholds? Please clarify when well-defined thresholds for impacts to traditional resource use will be put in place in order to properly assess the impacts of the proposed Project.

Enbridge has not demonstrated an understanding of what the SRFN require in order to exercise their traditional activities now and in the future. **On what basis does Enbridge believe that it would**

be "acceptable" for SRFN members to suspend their traditional land use activities in parts of their traditional territory for many decades (and multiple generations) until the effects of disturbance are reversed? The loss of the opportunity to practice traditional resource use in the large areas of their traditional territories during multiple human generations may well be deemed significant.

2.2.1.2 Environmental Contamination

Some of the key concerns raised by the SRFN are related to environmental contamination issues through spills from the pipelines or through release of chemicals into the environment through operations and construction activities. Concerns about environmental contamination are justified given Enbridge's poor track record of pipeline spills. In 2009, Enbridge's self-reported total for Canada and the USA was 89 spills. In 2010, three large spills from Enbridge pipelines were publicly detected and reported, and have resulted in significant environmental damage. Given these cases, where, despite the apparent use of best management practices, process chemical and/or hydrocarbon spills occur intermittently over the lifetime of pipeline projects, the same risks can be expected for the Northern Gateway Project. **What will Enbridge do to deal with the negative perceptions of First Nations regarding their ability to prevent spills?** Unfortunately, given the budget restrictions, a third-party review of the documents relating to Risk Assessments and Management of Spills is not possible. **MSES strongly urges the SRFN to seek funding for a full review of these documents and plans. Given the high level of concern regarding this issue and the risks, Enbridge should provide funding to complete comprehensive third-party reviews.**

Enbridge does state that *"Northern Gateway is responsible as the operator of the pipeline for compensation to address property loss and personal injury as a result of an incident." (*Vol 1, Section 11, page 11-28*).* However, it appears that only financial compensation will be considered as mitigation for a contamination event**. Enbridge should consider compensation for cultural impacts and ecosystem restoration and off-sets. Enbridge is requested to clarify its responsibility, if any, for compensation for cultural and environmental losses as a result of an incident.**

2.2.1.3 Calculating the Rate of Change

The SRFN are concerned about the rapid pace of development in their traditional territory, which includes segments of the Northern Gateway REAA. Although current (baseline) conditions are described in Enbridge's Application, there is no apparent attempt to document how these conditions have changed and developed over time. In order to fully understand the impacts of the Project on traditional resource use and how much the practice of traditional activities has already been curtailed or deprived to date, it is imperative to understand how much of the SRFN's traditional resources have been impacted to date, and how additional impacts will act in a cumulative fashion. Development in the region may well have already taken up more traditional lands than Enbridge is prepared to show. In

other words, the SRFN need to understand what Enbridge is prepared to do if the current disturbances have already surpassed a threshold at which the SRFN culture ceases to be viable. It is therefore necessary to determine landscape level disturbances and their effects on TLU at several points in time when modeling cumulative effects.

Enbridge does not present either the pre-disturbance conditions (i.e. the conditions before industrial developments occurred in the region) or the rate at which the region is being impacted. Without calculating the rate of change it is impossible to determine if disturbance in the REAA has reached an asymptote of maximum fragmentation (discussed in Section 2.1.1.1 above) which can lead to ecosystem or regime shifts. These in turn can have impacts on traditional resources and their availability to the SRFN. The rate of conversion from natural land surfaces to industrial ones can be calculated by means of satellite imagery and, assuming that the rate of change remains constant, Enbridge could project disturbance levels into the future much more accurately than by simply adding some anticipated developments. This would be a critical piece of information that would help in gaining an understanding of the impacts to SRFN's traditional resource use to date. The requirement for conducting a pre-disturbance analysis now has precedence in the Alberta oil sands region, as Joint Review Panels (Joslyn North Mine Project, Application No. 1445535) have requested that such an analysis be completed.
Enbridge should conduct an analysis of pre-industrial conditions to show how much land and natural resources have been disturbed to-date. Enbridge should use this information to quantify the incremental yearly disturbance of the traditional resources that are of concern to the SRFN.

2.2.1.4 Loss of Remoteness

As discussed above, a high degree of landscape fragmentation currently exists in the REAA. Remote places are beginning to exist only in small and isolated patches, and are an ever–decreasing resource. The loss of remoteness is a recurring theme in the concerns voiced by First Nations. The ability to have solitude, connect with nature and pursue traditional activities is believed to be diminishing. Many First Nation community members state that the remoteness they once felt is threatened by the increase of non-traditional land uses that gain easier access to these areas through linear developments. Increasing fragmentation also reduces habitat that can sustain some wildlife populations. The reduction in wildlife abundance on traditional lands can affect the ability of community members sharing traditional knowledge with future generations. Teaching the practice of traditional activities to younger generations requires that the traditional resources to be available. **Enbridge should provide detailed measures for how additional linear disturbance and its subsequent impact on landscape fragmentation and loss of remoteness will be mitigated, and how the success of that mitigation will be measured.**

2.2.1.5 Access Management

Linear developments typically increase the accessibility of previously remote areas and this raises several issues about access to traditional resources. First, increased access to traditional land for non-aboriginal recreational users may impact First Nations by restricting where and how traditional land and resource use activities occur. Second, remoteness itself is a traditional resource and increased accessibility reduces the availability of remote areas. Third, as mentioned previously, from an ecological point of view, reduced remoteness alters ecosystem functionality in many ways. Therefore, traditional resource availability may be altered and traditional users may need to travel further or perhaps elsewhere, to access their traditional resources. Lastly, the proposed Project could alter or remove traditional travel corridors and trails or possibly restrict access to traditional resources via Project facilities, camps, or roads being fenced and gated. There is no apparent assessment of effects for access restrictions and no indication of mitigating the effects of increased access for non-traditional land users.

Enbridge should provide specific details regarding the ongoing ability of Aboriginal groups to access traditional land use areas. Enbridge is requested to provide an impact assessment regarding access to traditional resources and propose a set of mitigation measures followed by a monitoring program that would ensure that these measures are effective.

2.3 Monitoring and Follow-up Programs

Plans to monitor and manage any possible residual impacts resulting from construction, operations or decommissioning are not explicitly described for the Project. No testable predictions or hypotheses that could be confirmed or rejected by a monitoring program are provided, and no targets are set for this program. The absence of milestones and targets leads to monitoring reports which do not test either the validity of predictions of ESA or the effectiveness of mitigation measures. Concrete monitoring programs are not presented in the Application; therefore, it was impossible to evaluate the ability of the programs to detect whether or not the predicted success of the mitigation measures will be achieved. This is a problem that cuts across disciplines. Monitoring must be in place to determine whether any effects have materialized, regardless of any conclusions from the impact analyses. Having a proper monitoring program in place may help hedge against incorrect assumptions. Given that Enbridge's Application makes many assumptions regarding effectiveness of mitigation and reclamation, which are often poorly supported, this should be of concern to the SRFN. **Enbridge should monitor all possible areas of impact, even if the predicted impacts are *not significant*. A predicted result is not the same as an actual result: without an appropriate monitoring strategy, the actual impacts cannot be known.**

Enbridge needs to provide assurance that, where impacts have been deemed negligible, unexpected results could be revealed by adequate monitoring programs. These results would then need to be communicated to both the regulators and communities, including the First Nations.

2.3.1.1 Evidence of Reversible Effects

Many of the residual or cumulative impact significance ratings are *not significant* partly based on the assumption that effects will be fully reversible. For example, in the assessment of direct habitat loss for grizzly bears, although Enbridge states bears will be affected over the long term, the effects are deemed to be fully reversible and therefore not significant. Another example from the assessment of overall cumulative impacts on wildlife "*Mitigation measures for the Project, including access management, may help to neutralize the additive effect of the Project... As a result, the project contribution to cumulative habitat loss is considered to be not significant.*" (Vol 6A, Section 9, page 9-189, emphasis added) **What is not clear from these statements is how these conclusions will be tested? Enbridge should discuss how they will ensure that the success of the proposed mitigation can be measured. As it stands, the success of mitigation is a mere promise, without any methods to measure mitigation success.**

These types of statements are ubiquitous in the ESA, but no concrete monitoring plans are presented to test these predictions. Pipeline proponents often state that the land disturbance as a result of their Project is fully reversible. However, there are no examples from pipeline projects in this region where pre-disturbance conditions have been restored, which would allow for traditional land use to resume.
Given these statements, Enbridge should be able to demonstrate the reversibility of any effects. For example, Enbridge is requested to provide evidence for the re-establishment of wildlife and vegetation diversity along the pipeline RoW both after construction and decommissioning. Please clarify how the success of re-establishing ecological diversity and the supporting ecological processes that would be at least similar to pre-disturbance conditions will be demonstrated.

2.3.1.2 Adaptive management approach

In the Application, Enbridge states that *"Where follow-up is required, Northern Gateway has committed to using an adaptive management approach, where additional mitigation would be used if effects were greater than expected, or if mitigation results were not as planned."* (Vol 1, Section 6, page 6-8).
Enbridge should list the adaptive management options that are available to them in the case that monitoring shows higher than expected effects, to ensure the success of mitigation and reclamation. Enbridge should discuss how First Nations will be involved in the adaptive management planning and provide concrete examples.

2.3.1.3 Concrete Regional Targets

We could not find any evidence in the Application of regional targets being used in mitigation and reclamation planning, nor could we find reference to regional monitoring programs. Enbridge does appear to recognize the inherent importance of the regional perspective and of setting management goals (presumably via the establishment of targets, benchmarks or thresholds to assist in measuring the "success" of mitigation). Yet they have failed to generate any specific targets for wildlife, vegetation communities (wildlife habitat), and fish and fish habitats. Despite acknowledging the existence of various threshold levels for stressors of ecosystems, such as linear disturbance limits, there are no tangible thresholds or targets presented by Enbridge for the monitoring of environmental parameters. For example, Enbridge has concluded that "*there will be a significant residual cumulative effect on Grizzly bear mortality in Alberta without effective mitigation and compensation*." Therefore, it appears there is a great amount of liability in relying on successful mitigation. Enbridge states that although *"there is low confidence in the effectiveness of mitigation measures to reduce grizzly bear mortality....confidence will improve with the development of the Access Management Plan and a detailed monitoring program to gauge the effectiveness of the mitigation measures." (*Volume 6A, Section 9, Pages 9-243-244). Currently, the Access Management Plan and detailed monitoring program are only conceptual and thus impossible to evaluate. The understanding of "success" of any of the follow-up programs must be clearly defined and transparent.

Because of the critical role these programs are playing in mitigating a potential significant impact, it is not clear why they are not included as part of the Application.

Enbridge should explain what this monitoring program will use to "*gauge the effectiveness*" of mitigation and discuss targets for this program. How will achievement of no-net increase in linear features be measured? Firm commitments from Enbridge to answer these questions and creation of concrete targets should be in place prior to approvals.

2.3.1.4 Monitoring Programs for Traditional Resources

The conceptual level of follow-up commitment presented by Enbridge does very little to provide assurances to the SRFN that the monitoring programs will be developed with definitions and targets for successful mitigation that would be acceptable for the SRFN. Enbridge reports that they have received input from numerous Aboriginal groups. However, to date there appears to be no implementation of such information in the follow-up programs. Enbridge should develop monitoring and follow-up programs which specifically address and alleviate the concerns of the SRFN. To do so, workshops should be held in which SRFN members provide their input in monitoring and follow-up. Also, Enbridge should consider community-based monitoring which would enable First Nations to see the progress in achieving mitigation effectiveness and report back to their communities.

Enbridge should explain how the issues of concern that have been raised by the SRFN in the past and in our review will be addressed in any follow-up or monitoring programs. Enbridge needs to commit to using the input by SRFN to design its monitoring and follow-up programs.
How will results of the monitoring programs be made available to the First Nations community for review and how often will this occur?

2.3.1.5 Alberta-focused research initiatives

Although Enbridge purports that they are *"prepared to fund a series of initiatives aimed at improving knowledge and research on the marine and terrestrial environment…and has initiated discussions with several coastal Aboriginal organizations to undertake cooperative marine research"* (Vol 1, Section 1, page 1-6) all of the research initiatives that are listed relate to coastal and marine ecosystems and communities.
Why is there no mention of terrestrial and aquatic research projects in Alberta? Enbridge should clearly outline discussions that have been initiated with any Alberta Aboriginal groups regarding cooperative ecosystem research. If there have been no discussions, why has this not been considered in the Application?

3.0 Terrestrial Resources

3.1 Vegetation and Conservation & Reclamation

Issue: Use of Natural Recovery in Reclamation
Reference: Vol 6A, Sec 8.3, Table 8-7, pg 8-18
Concern: In a table called "*Best Management Practises to Reduce Potential Impacts to Vegetation*" Enbridge states that during decommissioning and abandonment they will "*use natural recovery of vegetation from seeds, roots and other propagules in the soil as the primary vegetation strategy in areas where surface vegetation has not been removed or grading has not occurred*."
In situations where surface vegetation has not been removed, to what extent will the ground be disturbed? For example, will there be small areas where soil is exposed? What proportion of the area to be disturbed by the Project will there be areas where surface vegetation will not be removed? Where grading has not occurred, will there be any ground disturbance and soil exposed? It is well known that when soil is exposed, the plants that invade and dominate are typically non-native weedy species, particularly if no native plant species are seeded or planted. **How will Enbridge ensure that where soil is exposed, these areas are not dominated by non-native weedy species?**
Using "*natural recovery*" simply means that there will be no active management after the ground is disturbed, i.e. no planting or seeding will be done. **Enbridge should provide recent and direct evidence that natural recovery results in the establishment of a wide variety of native plant species such that reclaimed ecosites are similar in species composition to pre-disturbance ecosites.**

Issue: Insufficient details regarding the results of field work to verify mapping and classification
Reference: Vol 6A, Sec 8.4.2.1, pg 8-22
Concern: The steps used to classify and map ecosystem units in the project area included the "*collection of field data to verify mapping and describe ecosystem units (preliminary fieldwork to verify the vegetation classes in the REAA)".* The description of field work in the Methods was adequate. However, when presenting the results of the data there were no figures or tables indicating the number and location of sample sites within ecosite phases and wetlands. This information is important for assessing the accuracy of the baseline data.
Questions: **What sampling regime was used? Were all ecosites phases and wetland types sampled? How many samples were taken from within each ecosite phase or wetland type?**

Issue: Classification of some stands as "Regenerating" and "Severely Affected by Mountain Pine Beetle"
Reference: Vol 6A, Sec 8.4.2.2., pg 8-27
Concern: "*Regenerating stands (shrub stage, structural stage 3) for all ecosystem units are calculated together. The stands are represented by the term "Regen" in the baseline condition tables*."

The grouping of different ecosite phases and wetland types based on age, i.e. young regenerating stands, makes it impossible to fully assess the effects of the project on native ecosite phases and wetland types. It is unclear why such a grouping was made when there are a wide variety of stand ages for each stand type at any given time.

Up to what age is a stand considered regenerating? Are regenerating stands considered of lower value compared to older stands such that project effects are considered less significant than effects to older stands? This might be the case if one was simply considering the value of timber on any particular site. However, for an assessment of the effects of a project on the baseline vegetation data, **all native stand types and ages are of equal importance and thus should be included together.** An assessment of project effects requires a good understanding of the baseline ecosite phases and wetland types. **Enbridge is requested to comment on this issue.**

In a similar manner, forests affected by or with the potential to be affected by mountain pine beetle are separated from the ecosite phase and wetland type data.

Are stands affected or potentially affected by mountain pine beetle considered of lower value compared to unaffected stands such that project effects are considered less significant?

For an assessment of the effects of a project on the baseline vegetation data, it is important to have a clear understanding of what vegetation types present at baseline will be affected. For both regenerating and mountain pine beetle-affected (or potentially affected) forests this is an important point because in some regions these forests occupy a significant part of the landscape. For example, within the Alberta Plateau, the area classified as Regeneration occupies 61 ha, or 19% of PDA. **Please provide the rationale for separating young regenerating and pine-beetle affected forest stands from the baseline ecosite phase and wetland data**.

Issue: Calculation of percent cover of each ecosite phase in PDA
Reference: Vol 6a, Table 8-13, pg 8-39
Concern: Typically, the percent cover of forest types are calculated as a function of total area within the PDA. However, for the Gateway project the percent cover of each ecosite phase and wetland type in the PDA is given as a proportion of the area within the PEAA. This makes it difficult to determine the significance of and relative effects on different stand types within the PDA.
Enbridge should explain their rationale for the calculations of percent cover of each ecosite phase in the PDA based on the area within the REAA.

Issue: Verification of Old-growth forest
Reference: Vol 6A, ESA, pg 8-102
Concern: "*Before construction, all mapped old growth stands within the PDA will be verified.*"
Were old-growth stands sampled as part of the fieldwork for the Project? Please explain why old-growth stands were not verified as part of the mapping classification phase of field surveys.

Issue: Inadequate Reclamation Goals
Reference: Vol 7A, Sec 8.5.8, pg 8-19
Concern: "*Reclamation refers to standard measures taken during construction to limit adverse environmental effects and return affected lands to a stable condition and equivalent land capability*."
Please explain what stable condition is and how Enbridge will know when such a condition has been reached.

One of the goals of revegetation during reclamation is to "*encourage the re-establishment of natural plant communities and establish self-sustaining native vegetation communities, although not necessarily pre-disturbance vegetation communities*." **Enbridge should explain how they will encourage re-establishment.**

Enbridge has committed to the goal of achieving equivalent land capability, which may or may not include pre-disturbance community types. Unfortunately, equivalent land capability simply means that some boreal plant species will be present on the reclaimed site. To achieve this goal it appears that nothing will be done actively (i.e. planting or seeding species) to ensure a wide variety of plant species are present after reclamation is complete. The idea that encouraging the re-establishment of natural plant communities, or natural recovery, is a successful strategy for reclamation is based on the belief that a succession of native plant species will invade and establish within reclamation sites after disturbance. Unfortunately, this belief is not supported by direct evidence in the scientific literature or reports from other developments. Where there is exposed mineral soil, plant species will become established within reclaimed sites in the first few years of reclamation. However, species that establish are typically non-native species and not those found in adjacent native forested stands (e.g. Appendix F in OSVRC 1998). Moreover, after the first few years of reclamation, no other species can establish because the few species that have established early dominate the site. Believing that natural recovery will provide an adequate diversity of species means that not enough will be done in the critical early period of reclamation. If Enbridge does not plant or seed a wide variety of native species in the first few years of reclamation, then their reclamation sites will bear little resemblance to the diverse ecosite phases and wetland types in the pre-disturbance landscape.

The main goal of reclamation should be to reclaim sites such that they are as similar as possible to the pre-disturbance landscape. This is of particular importance to First Nations because they would like the vegetation resources they have relied on in the past to be present, as much as possible, in the post-development landscape. This goal could be achieved by measuring the similarity between the pre-disturbance and reclamation landscape in terms of the percent of the total area in each ecosite and wetland type and the species composition of each ecosite and wetland type. Having this baseline information and then agreeing on what thresholds of these characteristics define reclamation success, Enbridge could actually clearly evaluate reclamation success.

Why will Enbridge only commit to reclaiming the minimum standard of equivalent land capability and not reclaiming the diverse pre-disturbance vegetation communities? Enbridge should consider using similarity indices to evaluate the success of their reclamation strategies.

Issue: Community-based Monitoring

There is little mentioned by Enbridge regarding concrete plans to work with local Aboriginal groups to assess the feasibility of establishing community-based monitoring initiatives to help ensure the effectiveness of reclamation techniques.

Enbridge should undertake pre-development discussions to determine a more proactive way to involve the SRFN in reclamation. They should also determine what the SRFN value in terms of vegetation reclamation (equivalent land capability) and discuss with them what their end-point and interim goals are for vegetation reclamation.

3.2 Wildlife & Biodiversity

The Wildlife Environmental Impact Assessment provided by Enbridge is a comprehensive document that is well beyond the level of assessment typically seen for pipeline applications in Alberta. The amount of baseline data collected is noteworthy and represents a significant amount of effort. Unfortunately, it does not appear that these data have been used to their full potential with data summaries only presenting average densities (without even the inclusion of standard errors). Also, no explicit link between the assessment of impacts on wildlife and the resulting effects on traditional resource use and culture is apparent.

Enbridge has identified several sensitive areas for wildlife in their PEAA, which in Alberta include the Little Smoky woodland caribou herd, several ungulate winter ranges, the Swan Hills Bear Management Area, the Grande Cache Bear Management Area, and Trumpeter Swan nesting areas. The ESA has concluded significant impacts on some Key Indicators (KIs) in the Cumulative Effects and Combined Cumulative Effects assessments (details provided below). **Further discussion regarding these significant impacts is strongly recommended because, at present, there is little confidence for the SRFN that Enbridge is prepared, capable and willing to resolve complex wildlife-related issues associated with Project development.** In turn, this leads to the questioning of the overall capability and preparedness of Enbridge to address and mitigate expected and unexpected Project effects on wildlife.

The outcome of the impact assessment on Woodland caribou should also be discussed as the outcome of no significance may be dependent on the selected linear feature density threshold (details provided below). The selected threshold for caribou is <u>not</u> the most conservative

option available which is counter to Enbridge's statement: "*the assessment of project effects and cumulative effects is based on sound science and is highly conservative.*" (Volume 1, Section 6, page 6-9).

Issue: Linear Disturbance and CEA methods

Enbridge's calculations indicate that the density of linear disturbances in the REAA is currently 1.66 km/km^2 (Base Case) and will increase to 1.70 km/km^2 with the addition of the Project (Volume 6A, Section 9, Table 9-73). Data sources and methods used for these analyses were not readily apparent and therefore, not reviewed. It is often the case that data on all foreseeable future forestry operations, infrastructure and any other projects that do not trigger environmental assessments (for example, seismic, exploratory drilling, smaller pipelines) are not included in the cumulative effects assessment.

Also, statements such as "…*to assess project effects on caribou, approximations are used. Approximately 78.8 km of powerline easements occur outside the REAA and therefore, are not included in the linear density analysis*." (Volume 6A, Section 9, page 9-57) and "*Cutlines and trails are not considered to be disturbance features in this linear analysis*" (Volume 6A, Section 9, page 9-58) lead us to believe that all of the disturbance analyses are underestimated, and NOT conservative.

Enbridge should clearly outline their data sources and methods used in these analyses, including their list of proposed regional projects. Seismic lines have a demonstrated impact, particularly on woodland caribou. Enbridge must present a new analysis, one that includes seismic lines as a disturbance feature. This analysis must show the peer reviewed research that has provided information on the impacts of seismic lines to wildlife.

Issue: Baseline Case
Reference: Section 9.4.1, p. 9-46
Concern: The baseline case is defined as those "*conditions before the Project*". **Although baseline data should be representative of current conditions, has Enbridge considered the historic (pre-disturbance or pre-development) biophysical environment conditions in their impact assessment?**

Issue: Winter Tracking Surveys
Reference: Wildlife Field Data and Field Surveys TDR, Section 6
Concern: Winter tracking surveys were only conducted in late winter (February - March, 2009). It is not apparent why an early-winter tracking survey was omitted. Using both an early- and late- winter tracking survey would have provided a more extensive understanding of wildlife presence/absence and habitat use than a single survey in late winter. **Please provide rationale to justify the choice of a single late-winter tracking survey.**

It appears that each "triangle" consisted of three, 1-km transects. **Please provide justification that these three transects within a triangle represent independent samples. What is the rationale for sampling using triangles? (With regards to pellet surveys, did the individual transects within "alternate shapes (e.g., rectangles)" (p.7-2) represent independent**

samples? The amount of data collected is noteworthy and likely presents a large enough sample to conduct statistical analyses. However, valid comparative statistical analyses are only possible if the transects are independent replicates (i.e., no pseudo-replication). The benefits of statistical analysis are numerous and include the ability to conduct trend analyses, frequency and distribution analyses, and many other types of data interpretation that could lend strength to wildlife models and to any arguments regarding Project impacts to wildlife. Particularly for monitoring purposes, before and after comparisons must have a scientifically rigorous foundation.

It does not appear that vegetation category/habitat type was recorded or taken into consideration in the results summary. **Was track density by habitat type calculated? Was each 1-km transect within a single vegetation category (i.e., an independent sample of habitat)?** Further to this point, it is not apparent how the results of the winter tracking surveys were incorporated into the impact assessment other than to identify the distribution and abundance of targeted wildlife in the 1 km-wide corridor. **Were the data incorporated into wildlife habitat models (i.e., zones of influence, habitat use)? Were the data used to validate habitat models (as, it appears, pellet data were)?**

Issue: Determination of Significance for Wildlife
Reference: Section 9.2.7, p.9-38
Concern: "*For this assessment, an effect is considered not significant when the Project is not expected to result in an effect on the long-term viability of a wildlife population (e.g., subpopulation, herd or management unit, as appropriate). It is considered significant when there is a moderate to high probability that the Project may result in an effect on the long-term viability of that same population.*" **How was it determined if long-term viability of a wildlife population is impacted? Is this quantitatively evaluated? How were wildlife habitat suitability models linked to long-term viability of a population?** As presented, this definition of significance appears to be a qualitative one. Qualitative assessments are prone to biases or not fully informed conclusions by responsible authorities.
The same question applies to the cumulative effects assessment for wildlife. "*The ESA assesses whether the cumulative effect of all projects shifts the resource in question to an unacceptable state (which is considered a significant effect*)" (p.9-38, Section9.2.7). **What was considered an "unacceptable" state? How is this defined/determined? Were First Nations consulted on what is considered by them to be an unacceptable state?**
With respect to the environmental criterion "*Magnitude (the amount of change in a measureable parameter relative to the baseline)*", how was it determined whether a measurable effect was likely or unlikely to impact the sustainability of the wildlife resource in the PEAA?

Issue: Mammal Movement
Reference: Section 9.4.2.2, p. 9-57
Concern: "*There is no measurable parameter for the assessment of change in movement on mammals.*" Change in the movement patterns of mammals could be measured by way of a well-planned sampling

design. For instance, one could measure the relative densities of moose and furbearers, at increasing distances from oil and gas disturbances using Control-Impact (CI) design. The CI design would enable comparison of target wildlife species abundance and distribution between impacted and control areas. Comparisons would focus on changes in relative abundance and distribution as a function of distance from oil and gas disturbance, specifically targeting linear disturbances (i.e., pipeline right-of-ways), using winter track count and pellet group surveys stratified by distance category and habitat type. This approach would also provide baseline information for a comparison of conditions before and after development to fully develop rigorous Before-After Control-Impact Studies (BACI; McDonald et al. 2000). **Would Enbridge consider using such an approach to measure changes in mammal movement?**

Issue: Wildlife Mitigation Measures
Reference: Section 9.3, Table 9-10, p. 9-44.
Concern: Mitigation measure 39 proposes to discourage bears from using Right-of-Ways (RoWs) by planting non-palatable natural vegetation, while mitigation measure 40 proposes to enhance willow and dogwood browse along RoWs (roads). As bears have been known to be attracted to fruit bearing bushes such as dogwoods and to willow buds, these mitigation measures appear to be somewhat contradictory. **In the case where these mitigation measures are in conflict, which will take priority?**
Furthermore, mitigation measure 44 appears to be in conflict with mitigation measure 40. Mitigation measure 40 proposes to enhance willow and dogwood browse along RoWs (decommissioned roads), yet mitigation measure 44 states that seed mixtures that will attract ungulates will be avoided during reclamation. Perhaps mitigation measure 44 should be reworded to say *"...that will attract Woodland caribou..."*. **Please clarify what will be planted and where it will be planted.**

Issue: Residual Effects on Woodland Caribou
Reference: Section 9.6.3.2, p.9-150
Concern: "*There will be some regrowth of vegetation (e.g., grasses, forbs) along the RoW during operations, which may offer some foraging opportunities for caribou."* It does not appear that Enbridge has considered this regrowth of vegetation as caribou habitat during operations; however, **given Woodland caribou tendency to avoid linear disturbance, is it likely that caribou would use a disturbed RoW for forage?**

Issue: Habitat Availability – Grizzly Bear
Reference: Section 9.6.3.2, p. 9-161, Table 9-62.
Concern: Grizzly bear fall feeding habitat availability will decrease by 37% during the construction phase in the Green area of Alberta and will decrease by 15% during operations. And yet, Enbridge has concluded that there will be no significant effect on Grizzly bear habitat availability**. As a 37% and 15% decrease in habitat availability during construction and operations, respectively, seems quite high but does not result in a significant impact, is there a habitat availability threshold that would be considered significant for Grizzly bear?**

Issue: Habitat Availability – Grizzly Bear
Reference: Section 9.6.3.2, p. 9-162
Concern: Enbridge states that **"***Bears appear to prefer disturbed RoWs early in the spring season (Gibeau* and *Herrero 1998) because of emergent vegetation, which helps to offset some of the habitat lost during construction*." Yet, in the following paragraph, Enbridge states that "*because of vegetation management for the project, berry-producing shrubs will most likely not become established on the RoW*." Furthermore, mitigation measure 39 proposes to discourage bears from using RoWs by planting non-palatable natural vegetation. **How will vegetation on RoWs help offset habitat loss during construction if Enbridge is proposing mitigation measures to discourage bears from using RoWs? If this perceived offset in habitat loss is not realized, would the magnitude of the effect of the project on grizzly bear feeding habitat change?**

Issue: Cumulative Effects – Change in Linear Feature Density in the REAA
Reference: Section 9.6.4.1, Table 9-73, p. 9-188 – Grizzly Bear
Concern: The change in linear density from base case to project case, base case to future case, and project case to future case exceeds the linear density threshold for Grizzly bear (0.6 km/km^2; AGBRT 2008) in the Green area of Alberta. Thus, the cumulative effects of fragmentation already appear to be considerable. Although it is stated that "*the additional contribution of the Project is not likely to increase this existing effect substantially*" (p. 9-189), this revelation that a linear density threshold has been exceeded before the proposed pipeline is considered, is cause for considerable concern with regards to the future of the Grizzly bear population. **We strongly recommend the SRFN discuss this issue further with Enbridge and the regulators to ensure potential impacts to Grizzly bears due to habitat loss are not overlooked.** A cumulative effects assessment is typically completed in order to highlight these important issues and propose mitigation, monitoring and effects management. **Specifically, the SRFN is advised to discuss the measures proposed by Enbridge to counter the potential impacts of increased linear disturbance beyond a recommended threshold for Grizzly bears.**

Issue: Cumulative Effects - Mortality
Reference: Section 9.8.4.2 – Grizzly Bear
Concern: The Alberta Grizzly Bear Recovery Plan 2008 to 2013 makes the recommendation that Grizzly bear mortality should not exceed 4% of the provincial population per year. Enbridge has concluded that "*Results from these analyses* [current mortality rates] *indicate that even the project-related death of a single grizzly bear in certain GBPU or BMAs could push the mortality rate above the 4% mortality threshold, highlighting the importance of mortality risks and the ramifications they may have on populations in both provinces (AGBRT 2008).*" (p.9-231). The Gateway project threatens to push Grizzly bear mortality over a threshold identified in an Alberta Recovery Plan for a species that is considered "may be at risk". Enbridge has concluded that there will be a significant residual cumulative effect on Grizzly bear mortality in Alberta Bear Management Units (BMUs) without effective mitigation and compensation. **The SRFN is strongly encouraged to discuss the proposed mitigation measures to manage**

this effect and must consider the possibility that mitigation (i.e., access management plan, no-net gain in linear features) will not be effective, leaving compensation as the alternative solution. This issue is made that much more critical given that there is only a Low level of confidence in mitigation measures related to Grizzly bear mortality (Table 9-86, Section 9.8.5).

Issue: Cumulative Effects – Change in Linear Feature Density in the REAA
Reference: Section 9.6.4.1, Table 9-73, p. 9-188 – Woodland Caribou
Concern: The linear density threshold used by Enbridge for woodland caribou is 1.8 km/km^2. The table identifies almost all scenarios (base case, project case, and future case) as having linear densities that exceed this threshold, though not all of the values in the table do appear to exceed this value. **Is this an error in the Table? Furthermore, there is a "c" superscript in the table that is not defined under "Notes". Please clarify.**

The linear density threshold of 1.8 km/km^2 used by Enbridge (referenced: Francis et al. 2002, p. 9-162) is high when compared to current peer reviewed literature. The use of the 1.8 km/km^2 density threshold is of concern given that the source of this threshold is a non peer-reviewed presentation relating to caribou in the Yukon. Current, peer-reviewed studies conducted in Alberta and north-eastern British Columbia clearly indicate that the threshold range at which caribou are considered to remain viable in the landscape is much lower at 0.75 – 0.8 km/km^2 (Weclaw and Hudson 2004, Sorensen et al. 2008, Thiessen 2009). Adequate justification for the use of the 1.8 km/km^2 threshold in linear feature density is critical as conclusions regarding the significance of residual and cumulative residual effects would likely become significant using a threshold range of 0.75 – 0.8 km/km^2**. Enbridge should provide adequate justification for the use of the higher threshold value stemming from Yukon-based, non-peer reviewed source.**
Given that the use of a lower threshold value of 0.75 – 0.8 km/km^2 taken from current, local research would provide the desired "*more conservative estimate*" of environmental effects of the Project on Woodland caribou, is Enbridge willing to reconsider their assessment of impacts?

Depending on which linear density threshold is considered acceptable for Woodland caribou, the change in linear density within the REAA for the Little Smoky Caribou Herd (in the Green area in Alberta) is very close to (or exceeds) thresholds (Volume 9, Table 9-79, p. 9-226). Thus, the cumulative effects of fragmentation already appear to be considerable. Although it is stated that "*the additional contribution of the Project is not likely to increase this existing effect substantially*" (p. 9-189), this revelation that a linear density threshold has been exceeded or that a linear density threshold is being rapidly approached, is cause for considerable concern with regards to the future of Woodland caribou populations – especially the Little Smoky herd which has a population status of "Immediate Risk of Extirpation" in Alberta (Alberta Woodland Caribou Recovery Team 2005). **Enbridge should discuss this issue further with First Nations and the regulators to ensure potential impacts on habitat, movement, and mortality are not overlooked.** A cumulative effects assessment is typically completed in order to highlight these important issues and propose mitigation, monitoring and

effects management. **Specifically, the SRFN is advised to discuss the measures proposed by Enbridge to counter the potential impacts of increased linear disturbance beyond a recommended threshold for Woodland caribou.** This issue is made that much more critical given that there is only a "*Low to Moderate level of confidence"* in mitigation measures related to Woodland caribou habitat (Table 9-74, Section 9.6.5).

Issue: Combined Effects and Combined Cumulative Effects
Reference: Section 9.10.4, p. 9-259
Concern: "*For species such as caribou, habitat availability and mortality risk are interrelated. In the case of the Little* Smoky *Caribou Herd, it appears that the cumulative effects of development are significant, even though the Project's contribution is not significant*" (p.9-259, Section 9.10.4). **Enbridge should discuss the implications of this significant project impact on Woodland caribou.**

Issue: Project Impact to Beavers
Concern: Beavers have been specifically highlighted by the Swan River First Nation as a species they are concerned about but beavers have not been considered in the assessment. **Enbridge needs to provide a detailed explanation as to why the Project is unlikely to result in a measurable effect on beaver habitat availability, mortality, or movement.**

Issue: Species Occurrence
Reference: Section 9.4.4.1, p. 9-60
Concern: "*However, because some data in government databases is considered sensitive, exact species occurrence locations were not provided. As a result, some data could not be used to determine the overlap of species locations with the PEAA*." **While this statement is likely true, Enbridge could propose that the relevant authority conduct a cross-check of the proposed pipeline route with the government database to ensure that there is no overlap with sensitive species locations.**

Issue: Monitoring
Concern: No specific or concrete wildlife monitoring program details are provided by Enbridge. However, the following statement alludes to what could be strong goals set forth by Enbridge "*Combined project and cumulative effects have the potential to greatly increase the risk of significant overall effects on certain species assessed for the Project. Therefore, it is imperative that follow-up and monitoring initiatives be aggressively implemented to mitigate each of the three project effects assessed at both the project level and within the cumulative effects case. Northern Gateway is committed to working as a steward of the environment, fostering cooperation with other proponents, regional regulators, researchers, participating Aboriginal groups and other interested parties to achieve the desired goal of sustainable wildlife populations together with the planned development of the pipelines."* (Volume 9, page 9-259, emphasis added).
Enbridge is requested to expand upon this overall general, but "*aggressive*" approach to be taken in monitoring impacts to wildlife. Will specific adaptive management plans be ready should the results of monitoring programs reflect unanticipated, negative results? The

SRFN should request a solid commitment from Enbridge to be involved in the issues scoping, development and implementation of any wildlife monitoring programs.

Issue: Addressing First Nation Concerns
Concern: The information in the ESA does not appear to specifically address issues raised by the SRFN. There is no explicit link between the assessment of effects on wildlife and the resulting effects on traditional resource use and culture. Targets for re-establishment of populations are not provided specifically for Traditional Resources. This information could be derived by examining the baseline data in association with estimates of pre-disturbance conditions for wildlife or wildlife habitat and pre-disturbance use of wildlife by the SRFN. **It is not clear why this was not done to alleviate some of the uncertainty the SRFN have with respect to what Enbridge envisions as a post-construction and post-project landscape.**

Issue: Wildlife Health
Concerns have been voiced by the SRFN regarding regional contaminant levels in the Swan Hills region having an impact on wildlife health. Although human health risks are assessed in the Application, it does not appear that wildlife health has even been considered.
How will Enbridge attempt to alleviate the uncertainty voiced by the SRFN with respect to wildlife health and the potential contamination of traditional resources such as moose and waterfowl?

4.0 Aquatic Resources

4.1 Surface Water Quality and Hydrology

Issue: Choice of Measured Parameters

The rationale for the choice of measured parameters for surface water flow (hydrology) and water quality is based on a regulatory perspective. There is no mention of Traditional Resources being considered even though some ATK programs were completed at the time of the assessment (including SRFN). **It is unclear how Enbridge can be sure that the selected baseline measures, the collected data, and sample site locations or future monitoring plans will be relevant or meaningful to SRFN community if there is no baseline information on how SRFN use aquatic resources.**

Issue: Climate Change

Known and significant trends in air temperature, precipitation, and evapotranspiration, and climate change do not appear to have been considered in the ESA. No attempt is made to determine how the hydrological cycle may change during the life time of the project. The observed trends and expected changes in air temperature, precipitation, and evapotranspiration can change the hydrological cycle in a way that floods and droughts may increase or decrease, which must be taken into consideration in designing surface water mitigation measures. As air temperatures are now higher, especially in the winter, these statistically significant warming trends must be reported and applied in impacts analyses**. Please include known and accepted climate trends to predict the climate for the life of the project. Provide rationale for why known and significant trends in air temperature, precipitation, and evapotranspiration, and climate change have been widely ignored. This data should be considered when designing surface water mitigation measures.**

Issue: Cumulative Effects Assessment

All cumulative effects assessments for surface water quality and hydrology components are considered non-significant. Enbridge makes numerous statements regarding the current conditions of surface water quality and suspended solids loads in many of the waterways that cross paths with the pipeline RoW as being "*already affected by existing development."* (Vol 6A, Section 10, page 10-7). Enbridge also states that *"The Project will cause small changes to measurable hydrological parameters. The effects of other projects (e.g., logging) that could act cumulatively are far greater than the effects of the Project."* (Vol 6A, Section 10, page 10-3). Because the cumulative effects are predicted to be non significant, there are no follow-up or monitoring programs proposed. This argument appears flawed. The effects of the Project on key characteristics of regional watersheds should not be simply dismissed based on the prediction that the area is already impacted. **Enbridge should monitor all possible pathways of impact, including**

at the regional level, even if the predicted effect is *low* or *negligible*. A predicted result is not the same as an actual result: without an appropriate monitoring strategy, the actual impacts cannot be known.

Issue: Cumulative impacts of other pipelines

Enbridge acknowledges that impacts from other pipelines (exiting or proposed) can have cumulative effects on the environment. They provide this example: *"the Pembina Pipeline Project could affect cumulative effects. It is likely that pipeline projects will use similar routing in some areas as to the Enbridge Northern Gateway Project. As a result, it would be prudent for all proponents to meet to discuss cumulative effects and potential mitigation strategies for specific sites/sections of the route, should all projects proceed."* (Vol 6A, Section 10, page 10-75). Hydrological cycles in the watersheds are changing at least partly because of ever increasing clearing of the land, including linear developments. Each new disturbance or development deems their contribution to cumulative impacts to be "negligible." **At what point does the cumulative impact become "significant" and "unacceptable"? Meetings to discuss multiple disturbances to watersheds are a step in the right direction in terms of dealing with regional impacts. What would be discussed at these meetings? SRFN is encouraged to follow-up with Enbridge on this commitment.**

Issue: Runoff from roads and pump stations

Enbridge states that "*pump stations will be equipped with runoff management systems for controlled release to the Environment" (*Vol 6A, Section 10, page 10-25), but no further details are provided. **Site run-off containment is discussed in detail for the marine systems but what about elsewhere along the pipeline route? What will the quality of the discharged water be? Will water for camps and hydrostatic testing be recycled to reduce demand?**

Issue: Decommissioning

"For decommissioning, the pipelines will be abandoned in place. There will be no instream works to remove pipeline crossings" and *"During decommissioning, the pipeline RoW will also return to pre-disturbance conditions, restoring predisturbance hydrological characteristics over time."* (Vol 6A, Section 10, page *10-33)*

Enbridge should provide evidence to show that leaving pipelines in place, rather than removing them, is acceptable practice. What are the long term impacts of leaving the pipeline in the ground indefinitely? What are the cumulative effects of leaving multiple pipelines from multiple companies in the ground after decommissioning?

Will monitoring continue after abandonment of the pipeline to ensure there are no negative impacts? What will be used to judge when the hydrological characteristics of the RoW will be restored to pre-disturbance conditions? Will success of this process be monitored?

Issue: Follow-up and Monitoring

The following examples of general statements regarding monitoring programs should be disconcerting to the SRFN: *"The pipeline RoW and associated infrastructure, including access roads, should be monitored annually and after any extreme high flow events." "The environmental effects of construction will be monitored in some streams during clearing for the pipelines and infrastructure to verify sediment yield in affected watersheds." "Visual reconnaissance at some water body crossings will be performed to verify mitigation measures are adequate and no visual increases of TSS can be observed. (*Vol 6A, Section 10, page 10-95, emphasis added). **Only through rigorous monitoring can changes and impacts be detected, and the success of any mitigation efforts be evaluated. It is important that Enbridge commit to a detailed and thorough surface water quality and quantity monitoring plan for both construction and operations phases.**

Issue: Monitoring Design

No details, in terms of BACI (before-after-control-impact), sample size, statistical analyses, models, and assumptions, on surface water monitoring design are provided. No testable questions are provided that would guide the monitoring program and no targets are reported. Some of the key concerns raised by the SRFN are related to surface water contamination via spills from the pipelines or through release of chemicals into the environment through operations and construction activities. Concerns about environmental contamination are justified given Enbridge's poor track record of pipeline spills. Adequate monitoring would enable the SRFN to track any changes in water quality over time, particularly being able to see the damage caused by a spill.

Enbridge should provide details on the surface water monitoring design and provide testable questions that would guide the monitoring program. Please provide specific targets for predictions from the Application and for traditional resources provided by SRFN.

Enbridge should monitor all possible areas of impact, even if the predicted result is *low* or *negligible*. A predicted result is not the same as an actual result: without an appropriate monitoring strategy, the actual impacts cannot be known.

Issue: Testable Predictions

There are no testable questions, predictions or hypotheses listed as part of the monitoring program. Below is a list of example statements made in the ESA that could be formed into questions or predictions on which to focus a monitoring plan:

- *Water quality will be altered only at local sites and for short durations.*
- *Water quality impacts will be negligible.*
- *Unanticipated spills are expected to be minimal and with mitigation, will be negligible.*
- *Suspended sediment inputs will be localized and can be corrected via mitigation.*
- *Mitigation is effective.*

It is evident that all such statements are qualitative and cannot be tested rigorously. These statements, when integrated into a monitoring programs, must be formulated so as to being quantifiable. To do so, definitions must be prepared for terms such as "short duration", "negligible", "minimal", "localized", "corrected", and "effective".

Issue: Community Monitoring
Enbridge provides a standard list of mitigation measures to deal with surface water issues raised during consultation. They do state that they will "*implement a monitoring plan involving community members before, during and after construction to assess the effects of the Project on surface water resources*" (Vol 6A, Section 10, page 10-5). **Enbridge needs to provide further details regarding this monitoring plan and a firm commitment that this will move forward if the Project is approved.**

4.2 Fish and Fish Habitat

The proposed Northern Gateway pipeline route crosses 195 fish-bearing watercourses in Alberta. There are an additional 78 waterbodies that will be crossed that have "*non-classified drainage/no visible channel*". Most watercourse crossings are in the Peace River drainage and the Athabasca River drainage and are Class C (moderate sensitivity, damage potential by unconfined or unrestricted activities within the water body). Some watercourses are Class B (high sensitivity; damage potential by any type of activity within the water body). A total of 38 different fish species are present in the watercourses crossed by the pipeline RoW in Alberta, with 15 of those being of conservation concern. For the Northern Gateway Project, watercourse crossing techniques in Alberta are largely open cut (81) and isolation (94), with only 6 considered for trenchless crossings. There are no specific references to the presence or location of any traditional fisheries used by the SRFN in the PDA, or the REAA. Therefore, there is no discussion of the possible effects of the project on any such fisheries. Given the conclusion of no impacts of the project on aquatic ecology, there may be unspoken assumptions that SRFN fisheries would be similarly unaffected. **Enbridge should use ATK to complement its fish surveys and should verify the accuracy of their conclusions and the adequacy of their monitoring programs with the SRFN.** There are no specific or concrete plans described for monitoring of fish and fish habitat. For the high risk watercourse crossings that will result in a HADD (Harmful Alteration, Disruption or Destruction of fish habitat), the ESA states only that Enbridge will develop a Habitat Compensation Plan and monitoring program based on approval conditions by the regulatory agencies.

Issue: Baseline surveys and seasonality
Standard baseline fish and fish habitat surveys were completed during the spring or summer between 2005 and 2009 for most of the proposed watercourse crossings. Surveys to assess overwintering habitat potential were completed at 35 watercourse crossings that were selected for individual crossing method review and proposed for winter construction. If there is differential fish usage of the habitat by

season, which is very likely, the field work conducted outside of the winter would not capture this variability. **Will winter construction only occur in those watercourses that have had overwintering studies completed? Will further studies be completed to capture seasonal variability in all, but especially the high-sensitivity watercourses? How will Enbridge deal with differential seasonal habitat use by fish?**

Issue: Non-fish aquatic ecosystem components overlooked

The Northern Gateway ESA does not appear to have collected data on, or provided information about, other vital aquatic resources such as benthic invertebrates, algal community or other vertebrates that may be impacted by the watercourse crossings. Because no baseline data appears to have been conducted, there will be no way of monitoring changes in benthic invertebrate abundance and composition as a result of impacts from the Project. **Enbridge is requested to discuss potential impacts to all aquatic ecosystem components and comment on this information gap.**

Issue: Non-classified drainages/no visible channel crossings

It is stated that 78 waterbodies in Alberta will be crossed that have "*non-classified drainage/no visible channel",* but nothing further is mentioned about these crossings.

Although it is understandable that these are not discussed in the Fish and Fish Habitat section of the ESA, where are these crossing discussed and assessed? Are wetlands associated with them? Enbridge should provide information about these watercourse crossings and assess the impacts to them.

Issue: High-Sensitivity Pipeline Watercourse crossings

There are 30 "*high-sensitivity*" pipeline watercourse crossings in Alberta, with the majority being in the Peace River drainage (70%), followed by the Athabasca watershed (27%) and the North Saskatchewan (3%). The presence of salmonids and/or species of conservation concern and excellent spawning or overwinter habitat are the primary reasons for the high sensitivity rating of these watercourse crossings. There are another 33 crossings that are considered "*moderate sensitivity*" crossings. The high-sensitivity crossings include: Athabasca River, Chickadee Creek, Mink Creek, Paddle River, Pembina River, Sakwatamau River, Tributary to Two Creeks, Two Creeks and tributary, Bald Mountain Creek, Big Mountain Creek, Calahoo Creek, Deep Valley Creek and tributary, Iosegun River, Latornell River and tributary, Little Smoky River Patterson Creek Pinto Creek, Simonette River and tributary, Smoky River and tributary, tributary to Waskahigan River, Wapiti River, and Waskahigan River**. This is a large number of watercourse crossings in highly sensitive watercourses. The SRFN need to consider if the risk associated with disturbing these systems is acceptable given that some of the proposed mitigation measures are expected to only have "*moderate*" effectiveness.**

Issue: High Risk Watercourse Crossings

Watercourse crossings in Alberta are largely open cut (81) and isolation (94), and 6 trenchless crossings. Open cut crossings are associated with the highest levels of risk, mostly due to

sedimentation. A total of 13 high risk watercourse crossings exist in the Alberta section of the Project. The high risk watercourse crossings are expected to result in temporary or permanent reductions of fish habitat productive capacity at the crossing and within the downstream ZOI. Some of the high risk crossings within the SRFN traditional territory include: Paddle River, Sakwatamau River, Chickadee Creek, Two Creek, Little Smoky River, Waskahigan River, Deep Valley Creek and its tributary.

Enbridge states that the "*residual effects of project-related pipeline construction, operations and decommissioning activities on the productive capacity of fish habitat at high risk sites are predicted to be not significant, provided that mitigation and compensation measures are implemented as planned..... All potential effects are expected to be reversible, including temporary or permanent losses of fish habitat productive capacity associated with high-risk pipeline crossings. These losses will be reversible because of the implementation of fish habitat compensation plan that, when fully functional, will result in the no-net-loss of fish habitat productive capacity*." (Volume 6A, Section 11, page11-106).

Statements such as this one, that fully rely on successful mitigation and conceptual compensation plans, need to be supported with concrete examples and peer-reviewed literature. Otherwise, they are merely unsubstantiated promises of success. **SRFN is strongly urged to discuss this issue further with Enbridge. Enbridge needs to provide further information as to what will occur if mitigation and compensation measures are NOT implemented as planned or if the measures are NOT as successful as expected?**

Enbridge also states that "*the precise extent of the potential HADD will remain unknown until the final watercourse crossing designs are complete.*" (Volume 6A, Section 11, page 11-26) **Concrete compensation plans should be in place and discussed with SRFN prior to Project approvals.**

Issue: Impact Significance Ratings

The final impact ratings for the Project summarize the anticipated severity of the residual effects and cumulative effects on fish and fish habitat. All of the Project-related impacts are ultimately rated as moderate, low, or negligible and all impacts are deemed to be non-significant (see Volume 6A, Section 11, Tables 11-23 and 11-29). However, at present, it is debatable whether the impact levels selected are defensible without further rationale for the selection; in fact many of the impact ratings at this point appear to be overly optimistic. For example, duration/ frequency of occurrence and reversibility of problems with changes to sedimentation, and changes to contaminant concentrations, habitat structure and cover and food supply and nutrient concentrations are invariably long-term, chronic issues whenever access and infra structure increases in a watershed and vegetation cover decreases. It appears, however, that Enbridge considers these to be infrequent, short-term problems only. **Enbridge needs to provide a defensible rationale for each rating in Table 11-23 and 11-29. Since the ratings currently used to assess the direction, extent, magnitude, duration, etc. of each impact indicate mainly minimal concerns, changing any of the ratings would probably result in a higher level of overall impact.**

Issue: Watershed health

The outcome of the impact assessments for fish and fish habitat is not a measure of watershed health or the ability of the area to sustain traditional hunting and gathering activities. In fact, Enbridge clearly states that other regional developments have already compromised the health of the local and regional watershed ecosystems (Volume 6A, Section 10, page 10-6). Accordingly, independent watershed assessments to determine the relative health or productive capacity of the various watersheds affected by the Project are needed. Watershed assessments are common practice in sensitive watersheds, and in some jurisdictions a requirement before further development is allowed to proceed if certain thresholds are exceeded (e.g. percent area recently logged). This allows opportunity for other mitigating or compensatory measures to offset additional further impacts, small or large. At the very least, watershed assessments would help put the effects of past, present and future developments on watershed health into proper perspective. This perspective is presently lacking. **Enbridge should provide watershed assessments for each watershed affected by the proposed Project, taking into account all developments past, present and future. Watershed assessments are needed to put the current health of potentially affected watersheds and their ability to sustain TR use into proper perspective.**

Issue: Lack assessment of cumulative "health" of the area

Two key questions often expressed by FN in any development is what is the current "health" of the area affected by the proposed Project compared to pre-development time, and how will the development further impact the health of the area and current FN use of traditional resources? The current ESA does not describe the current health of the PEAA or REAA relative to pre-development conditions. **Please provide a discussion of what the Project plus all other planned (e.g. oil and gas, forestry, roads, pipelines, etc.) or expected developments (more cropland, cut blocks, forest roads, etc) will have on the "health" of the REAA relative to pre-development conditions.**

Issue: Lack of concrete monitoring plans

No specific plans are described for monitoring the project in a way that would allow the detection or quantification of any residual impacts of the project on the aquatic ecology of the area. Test sites, control sites or reference sites are not explicitly referred to or identified anywhere in the ESA. No specific predictions or hypotheses are described for monitoring that can be tested, supported or rejected. There are no specific targets, thresholds or standards identified in the ESA for any indicators or monitoring designs, nor are any specifically provided by the regulators for use in assessing the impacts of the project.

What will Enbridge measure in order to determine whether or not aquatic habitats and the fishery are impacted by the Project? Please explain what degree of change to any of

the measured parameters would be taken as evidence of impacts by the project. Please explain what these levels would mean to TR use of fish or water in the PEAA and REAA.

Issue: Inadequate linkage of potential impacts to SRFN use of fish

There is no indication that Traditional Resource use (fisheries in this case) was specifically considered in the impact assessment at any time. There is also no indication that information gathered in the ATK was used to elaborate on baseline conditions of large bodied fish or possible domestic fisheries in the REAA. No information is presented on when or where SRFN fish use occurs, what the extent of the fisheries might be, or its importance to FN needs. It is unclear how Enbridge can be sure that the selected baseline measures, the collected data, and sample site locations or future monitoring plans will be relevant to SRFN community and their use of these resources if there is no baseline information on SRFN fisheries in the Project area to begin with i.e., locations, timing of use, and catches. **Enbridge should provide information on the spatial extents of traditional fishing grounds in the REAA and discuss how traditional fishing grounds may be impacted by the project.**

Despite the obvious relationship between the fisheries resources and traditional land use, there were no relationships described between the results of the assessment and any SRFN fisheries, or what specific changes to these indicators would mean to SRFN use of fish. Enbridge should comment on this gap.

Issue: No discussion of impacts on aquatic TR

There was no discussion of what the potential effects of the proposed project would be on traditional resource use as it relates to aquatic ecology, or how the various parameters measured would be used to assess impacts of the project on traditional resource use. As mentioned earlier, since the conclusions throughout the aquatic components of the ESA are that the impacts of the project will be negligible, there may be an unspoken assumption that the SRFN fisheries or water use would be similarly unaffected.

Enbridge needs to provide assurances to the SRFN that the impacts to traditional aquatic resources will be negligible. Enbridge should provide data from other projects in the area that would provide justification for these impact predictions.

Issue: Habitat Compensation Plan

Enbridge states that a detailed Habitat Compensation Plan is underway but only a conceptual plan is presented in the Application. Enbridge writes "*Compensation goals will be determined in cooperation with DFO and through discussions with participating Aboriginal groups and directly affected stakeholders. Some of the compensation works may be constructed and/or maintained through partnerships with participating Aboriginal groups or community groups.*" (Volume 6A, Section 11, page *11-26).* **SRFN should discuss this further with Enbridge and request concrete commitments to follow up with these statements.**

Issue: First Nation consultation

Enbridge provides a summary of key issues from participating Aboriginal groups and the public for fish and fish habitat concerns (Volume 6A, Section 11, Table 11-2). Although this list is appreciated, it is unclear how any of these concerns have been directly addressed. No specific mitigation or follow-up actions are outlined in this table that would alleviate the concerns. Enbridge should show how these concerns and proposed mitigation measures were actually incorporated into the Project planning. **Enbridge should provide additional columns in this table (somewhat like a concordance table) to show where they have incorporated this information into their planning and a column that would have concrete targets for monitoring to ensure success of mitigation.**

5.0 KEY RECOMMENDATIONS

Key recommended actions are listed and should be addressed in a dialogue between the SRFN and Enbridge. Although the recommendations below highlight many of the overarching issues, they do not replace comments and questions raised throughout the report and are not, necessarily, mutually exclusive.

1) Enbridge is requested to clearly link impact assessments in the ESA to impacts on SRFN traditional resource use.

2) Enbridge should specifically address each of the concerns raised by SRFN and explain how the ESA and proposed follow-up programs resolve SRFN community concerns.

3) Enbridge should clarify how they determined that adding to an already high level of disturbance does not result in unacceptable effects. Enbridge is requested to quantify the levels of disturbance at which unacceptable levels of fragmentation occur, and then use this data in their impact predictions for vegetation communities, wildlife habitat, biodiversity, and traditional land use.

4) Enbridge should conduct an analysis of pre-industrial conditions to show how much land and natural resources have been disturbed to-date and then use this information to quantify the incremental yearly disturbance of the traditional resources that are of concern to the SRFN.

5) Enbridge needs to justify their belief that it would be acceptable for SRFN members to suspend their traditional land use activities for decades (and multiple generations) until the effects of disturbance are reversed.

6) Enbridge needs to provide recent and direct evidence that natural recovery results in the establishment of a wide variety of native plant species such that reclaimed ecosites are similar in species composition to pre-disturbance ecosites.

7) Enbridge is requested to create concrete plans, under guidance and input from the SRFN, to offset some of its proposed disturbances by re-establishing pre-disturbance conditions on currently existing disturbed areas.

8) Enbridge makes many poorly supported assumptions regarding effectiveness of mitigation and reclamation and needs to provide assurance that, where impacts have been deemed negligible, unexpected results could be revealed by adequate monitoring programs.

9) Given the risks and concerns associated with the Project, Enbridge should provide appropriate funding to SRFN to complete a comprehensive third-party technical review.

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