Baffinland

EARLY REVENUE PHASE

ADDENDUM TO
FINAL ENVIRONMENTAL IMPACT STATEMENT

VOLUME 6
TERRESTRIAL ENVIRONMENTS

Preamble

The Approved Project is for an iron ore mine and associated facilities located on North Baffin Island, in the Qikiqtaaluk Region of Nunavut (Figure 1-1.1 in the FEIS). The Project involves the Construction, Operation, Closure, and Reclamation of an 18 million tonne-per-annum (Mt/a) open-pit mine that will operate for 21 years. The high-grade iron ore to be mined is suitable for international shipment after only crushing and screening with no chemical processing facilities. A railway system will transport 18 Mt/a of the ore from the mine area to an all-season deep-water port and ship loading facility at Steensby Port where the ore will be loaded into ore carriers for overseas shipment through Foxe Basin. A dedicated fleet of cape-sized ice-breaking ore carriers and some non-icebreaking ore carriers and conventional ships will be used during the open water season to ship the iron ore to markets. The Approved Project was issued Project Certificate No. 005 by the Nunavut Impact Review Board on December 28, 2012.

An Early Revenue Phase (ERP) has been proposed as an amendment to the Approved Project. The ERP comprises the production of 3.5 Mt/a of iron ore that is to be transported via the upgraded existing road to Milne Port where it will be stockpiled for shipment during the open water season.

Once the ERP is approved, the total production level of the Mary River Project will be 21.5 Mt/a.

The ERP introduces the following additional activities that were not assessed in the FEIS of the Approved Project:

1. Mine Site
    a. Loading of ore into trucks; and
    b. Ore haulage truck fleet and maintenance facilities.
2. Tote Road
    a. Haulage of ore along the Tote Road.
3. Milne Port
    a. Ore stockpiling and loading onto ships.
4. Marine Shipping
    a. Ore carrier loading at Milne Port; and
    b. Ore carrier shipping volume and timing.

The Project Description and related assessments for approval of the ERP are addressed in this Addendum to Final Environmental Impact Statement.

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1.2 STUDY AREAS (NO CHANGE)

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Table 6-2.2 Preliminary Seismic Parameters for the Project Area (No Change)

2.1.3 Geotechnical and Geomechanical Conditions (No Change)

2.1.4 Geochemistry (Change)

Geochemical assessments of the potential for metal leaching and acid rock drainage (ML/ARD) were completed for the Mine Site and for prospective quarry and borrow sites along the Railway alignment and existing Milne Inlet Tote Road (to be upgraded). A summary of the work completed is provided in the following sections.

2.1.4.1 Mine Site (No Change)

2.1.4.2 Milne Inlet Tote Road (Change)

A screening level ML/ARD assessment has been completed for a number of proposed quarries and borrow pits along the existing Milne Inlet Tote Road (Figure 3-2.2, Volume 3). Full details of this investigation are provided in Appendix 6B-2 of the Approved Project's FEIS and summarized below.

Drill core and unconsolidated surficial materials were collected from potential quarry and borrow pit locations along the Tote Road route during a geotechnical investigation and aggregate sourcing program completed by AMEC. Selected samples were submitted for geochemical analyses. The objective of sample selection for ML/ARD characterization was to collect samples that are representative of the geochemical variation of the different soil and rock types expected to be used as borrow and quarry material for the Milne Inlet Tote Road upgrade.

The geology along the route includes relatively flat lying Paleozoic sedimentary rocks and more structurally complex Precambrian rocks. Potential quarry sites sampled included granitic gneiss and schist along the Precambrian portion of the route and carbonate rich sedimentary rocks in the Paleozoic section. Borrow materials sampled included sand and silty sand with variable quantities of gravel, cobbles and boulders.

Sulphide content of all samples was low (maximum of 0.04 % total sulphur), and all Paleozoic rock samples analyzed were carbonate rich (mostly limestone or dolomite). Borrow materials were also carbonate rich with only a single sample that was carbonate deficient with a correspondingly low neutralization potential.

The Precambrian rocks consistently exhibited a low neutralization potential with little evidence of carbonates. Diligence through adequate levels of sampling and monitoring during extraction operations will be necessary to ensure that the low concentrations of sulphide observed in the study are confirmed elsewhere, particularly for any materials identified as having low neutralization potentials.

Based on this screening level ML/ARD assessment, the currently proposed quarries and borrow pits along the Tote Road route appear to have a low potential for ML/ARD and are expected to be suitable as quarry or borrow sources. Individual quarry and borrow sites will be subjected to additional site specific ML/ARD characterization at a sampling density sufficient to address potential geological variability. Collection and analysis of material from future drilling or excavation programs related to quarry and borrow pit development is planned.

2.1.5 Groundwater/Hydrogeology (No Change)

2.2 ISSUES SCOPING (CHANGE)

The ERP's landforms, soils and permafrost effects assessment focuses on the potential effects from Project interactions that had not already been considered in the Approved Project. As stated in Volume 3, Section 1.2, the ERP introduces the following additional activities that were not assessed in the FEIS of the Approved Project:

1. Mine Site
    a. Loading of ore into trucks; and
    b. Truck fleet and maintenance facilities.
2. Tote Road
    a. Haulage of ore along the Tote Road.
3. Milne Port
    a. Ore stockpiling and loading onto ships.
4. Marine Shipping
    a. Ore carrier loading at Milne Port; and
    b. Ore carrier shipping volume and timing.

2.3 SENSITIVE LANDFORMS (CHANGE)

2.3.1 Assessment Methods (No Change)

2.3.2 Potential Effects and Proposed Mitigation (Change)

Table 6-2.3 discusses sensitive landforms that were mapped within the PDA, along with the potential Approved Project and ERP Project activities that could affect them adversely. Avoidance of sensitive landforms and potential hazard areas is the first mitigation measure that was used in the planning of the Project to date. Not all areas of concern can be avoided. The following sub-sections provide an overview of the site specific potential effects and the proposed mitigation measures to be used in development of the Project.

Table 6-2.3 ERP Project Activities That May Destabilize/Degrade Thaw-sensitive Landforms (Change)

Location	Activity	Sensitive Landforms	Project Phase
Milne Port	Ground clearing for additional facilities, including laydown areas, temporary accommodations, concrete batch plant, access roads, aggregate sources, and new airstrip	• Ice-rich permafrost • Saline permafrost • Thaw-sensitive ground	Construction, lasting into post-closure
Milne Inlet Tote Road	Road realignment, development of quarries and borrow pits	• Ice-rich permafrost • Thaw-sensitive ground	Construction, lasting into post-closure
Mine Site	Ground clearing for additional facilities including accommodations and support buildings, access roads, laydown areas, upgrading the existing airstrip, foundation preparation for waste rock disposal areas, open-pit development, machine and equipment pads	• Ice-rich permafrost • Thaw-sensitive ground	Construction, lasting into post-closure

Milne Port (Change)

Although limited investigations have been completed to date, it is understood that Milne Port is located in an area composed of coarse grained, well drained sandy beach deposits, that do not appear to be ice-rich based on geotechnical investigations to date (AMEC 2010a). Potentially thaw-sensitive soils exist south of the airstrip and outside of the existing facility footprint but within the location of the proposed airstrip expansion/extension. This is a bearing capacity issue with the airstrip, to be dealt with during detailed design (no investigation to date). Likely mitigation will be use of geotextile and more fill in the airstrip base or similar measures to assist with the bearing capacity.

Project activities at Milne Port to date have consisted of the development of camp facilities, upgrades to an airstrip, laydown areas, sewage ponds and tank farm. Geological composition has precluded the identification of minimal thaw settlement and thaw weakening. Standard issues related to the creation and control of sediment and erosion were the focus, although standard measures for design and construction of foundations in/on permafrost soils will be used. Wet areas (west and south of existing airstrip) that are covered with a substantial layer of organics over thaw-sensitive soils will be avoided for the construction of infrastructure to the maximum extent possible, and infrastructure will be established in areas with better ground conditions where possible.

Milne Inlet Tote Road (Change)

The Milne Inlet Tote Road was initially developed in the 1960s as a track. The road was upgraded to all-season capability in 2007–2008 to make the road accessible for conventional highway tri-axle trucks with pup trailers to haul the bulk sample. At that time, and as indicated in the Definitive Feasibility Study (Aker Kvaerner 2008), upgrades were intended to be temporary and the road was to revert back to use as a winter road only. Because of the limited duration for use of the road, the upgrades were designed to be just sufficient to complete the task of moving the bulk sample. The upgrades were completed primarily to address the following issues;

- environmental protection and archaeology;
- safety (i.e., road widening, grading and pullouts);
- road base/embankment construction for weak foundations and thaw-sensitive soils; and
- hydrology, river and stream crossings.

The hauling of the bulk sample was completed between late 2007 and October 2008. The road required regular maintenance during the hauling but was constructed to a sufficient level to complete the task. Observations from the construction and hauling are noted in the following sections.

The Tote Road remains in the upgraded condition and is used for fuel and freight transfer between Milne Port and the Mine Site to support on-going exploration and camp maintenance activities. Since 2008 the road has required periodic maintenance and upgrades; in particular additional culverts have been installed as required to maintain the serviceability of the road.

Road upgrades undertaken during the 2013-2014 workplan (DFO File No: NU-06-0084) have the potential to disrupt sensitive landforms, and special measures can be required to prevent or mitigate the disruption or resultant effects, and long-term maintenance may be necessary. The following is a summary of the main issues that were encountered during the 2007–2008 upgrading of the Milne Inlet Tote Road.

- Shallow ground ice and ice-rich soils are expected to be present at a number of locations along the Tote Road alignment. Specific areas where this was encountered during the road upgrades include;
    - Km 9+400 (original alignment) where the original road alignment was cut into the side slope of a small hill. The upgrades completed in 2007 required additional excavation to widen the road. This excavation exposed ice lenses approximately 0.1 m thick. Since completion of the upgrades no substantial movement of the excavation has occurred, although minor repairs are expected to have been completed.
    - Km 73: An area of ice lenses were likely encountered at approximately km 73 (located on the Mary River side of water crossing CV040). The lenses were not directly encountered; however, during the spring melt in 2008 a series of depressions were located at this location. It is expected that the excavation of material reduced the natural insulation and caused the ice lenses to melt. The depressions ranged from one to three metres across and showed settlement of approximately 0.5 m. Fill was placed over these areas to reconstruct the road embankment.
    - Mine Haul Road: Additional ice lenses were reportedly encountered during construction of the Mine Haul road to Deposit No. 1. The thickness and extent of these lenses were not recorded.
    - Borrow Areas: The excavation of road embankment material from the 75 m corridor along the road alignment resulted in the creation of numerous localized depressions. Some of these areas have subsequently filled with water; others are free draining but have the potential for erosion and sediment transport. A portion of these areas have been identified as having active thaw settlement. Remedial measures will be required to prevent continuing settlement and to maintain road integrity and safety.

- Thaw-sensitive Soils (Thaw Weakening/Liquefiable Soils): Areas of saturated silty material were encountered at various locations along the road alignment. Between approximately km 67 and km 72 the road embankment was constructed to a thickness of at least 0.3 m over this material which removed the traffic issues. At some locations woven geotextile was installed under the road embankment directly onto the silty material.
- Sandy/Marshy Areas: Several low-lying sandy and marshy areas were identified along the road alignment. The areas were;
  - Between km 58 and km 62. Woven geotextile was placed directly on the existing road alignment; an embankment of 0.5 to 1.0 m was placed on top.
  - Between km 77 and km 85. A road embankment of at least 0.5 m thick was constructed. Woven geotextile and geogrid were also used in localized areas to assist with the road construction.
  - Other smaller areas identified with liquefiable soil conditions were treated in a similar manner.
- Cohesion-less Soils: Numerous locations of uniform sand were identified along the road alignment; the longest section between approximately km 90 and km 91. Due to minimal cohesion this material proved to be problematic for wheeled vehicles. A surface layer of well-graded sand and gravel was installed. Other areas of cohesion-less sand located along the road alignment were treated in a similar manner.
- Erosion and Sediment Control: Control of erosion and sediment transport during and following the road upgrades was a key issue. The following specific issues were observed:
  - The removal of road construction materials in borrow areas exposed the underlying soils to erosion and caused increased turbidity in the runoff. The use of silt fences, riprap and other erosion protection and sediment ponds decreased the turbidity of the downstream runoff.
  - Ditching also increased the turbidity of downstream runoff, and practice was stopped. The problem was identified. In areas where ditching was required or has already been completed the ditches were lined.
  - Water flow adjacent to the road embankment was seen to increase the turbidity in the runoff water. Turbidity was reduced by applying erosion protection to the side slopes.
  - During high flows some erosion was observed at the inlet end of some culverts. This was resolved by applying erosion protection measures such as riprap to reinforce the road embankment.
  - Typical sediment control measures (silt fences) were very difficult to properly install in rocky and/or frozen ground.
  - Difficulty recognizing sedimentation from turbid water due to high silt content in soils.
  - In general preventing the suspension of fines was found to be the most effective method of minimizing turbidity in the downstream runoff. Once the fine soils become suspended they are difficult to remove due to their fine particle size and the quantity of runoff.

Mitigation Measures Addressing Sensitive Landforms in Road Upgrades

The operation of a more permanent road will require additional measures to minimize effects to sensitive landforms, and soil generally, to ensure long-term functionality (AMEC 2010b). A description of proposed upgrades is provided in Volume 3, Section 2.3.1 of the ERP Project. The following summarizes the mitigation measures that will be implemented during upgrades to the Milne Inlet Tote Road during the ERP Project:

- Cuts will be minimized to the extent possible with a preferential use of fills over cuts.
- The road embankment will be constructed of sand and gravel or quarried rock, with an increased reliance on quarried rock as a construction material, since it is generally a more superior, less erosive, construction material. Rock or well-compacted sand and gravel will minimize erosion of the embankment by water flows near the road.
- The road embankment will be sufficiently elevated to allow blowing snow to blow across the surface.
- Borrow of construction materials along the road alignment will be minimized, reducing the chance of suspension of fines in the runoff from the embankment. Borrow materials will primarily be obtained from rock quarries or larger centralized borrow sources to minimize the potential for sediment transport and erosion.
- Riprap or other erosion protection measures will be applied to upstream and downstream ends of culverts to prevent scour and erosion of the road embankment.
- Water crossings with a history of overtopping or with observed higher flows will be upgraded to include additional culverts and/or be replaced by box culverts, arch culverts or bridges. Operation observations since construction of the road upgrades in 2007 and 2008 will be critical to the design of these upgrades.
- Remediation of borrow areas excavated during the original upgrade work.

Table 6-2.4 Mitigation Measures for Effects/Risks Associated with Sensitive Landforms at the Mine Site (No Change)

Mine Site (No Change)

2.3.3 Assessment of Residual Effects (No Change)

Table 6-2.5 Mitigation Measures for Effects/Risks Associated with Sensitive Landforms along the Railway (No Change)

2.3.4 Prediction Confidence (No Change)

2.4 SUBJECTS OF NOTE (CHANGE)

2.4.1 Soils (No Change)

2.4.2 Wetlands and Eskers (No Change)

2.4.3 Aesthetics of Natural Environment (Change)

The ERP Project will have negative effects on the aesthetics of the natural environment in addition to those predicted in the Approved Project's FEIS:

- Increased industrial activity at Milne Port including ore haul truck unloading, ore stockpiling, ship loading, and camp occupation; and
- Additional dust emissions as a result of handling ore at Milne Port, including evidence of a red ore dust footprint in the vicinity of the ore stockpiling and handling area.

Effects to aesthetics on the Tote Road and Milne Inlet were relatively short term for the Approved Project (limited to the Construction Phase with some permanent residual effects to the landscape), the effects for the ERP Project will be moderate term (life of Project) with greater residual effects than previously assessed, given that Milne Port will have a greater level of disturbance (evidence of occupation) that will be evident following reclamation at the end of the Project life. Table 6-2.6 describes the potential effects on the aesthetics of the natural environment.

Table 6-2.6 Potential Effects on the Aesthetics of the Natural Environment Resulting from ERP Project Components and Activities (Change)

Location	Current Condition	Effect of Project components and activities on Aesthetics
Milne Port	Pre-development infrastructure (Camp, tank farm, lay down area and airstrip)	Port infrastructure, ore storage, ship loading, dock, ships in port, air quality (road and laydown area dust), deposition of red ore dust confined to immediate area, noise
Milne Inlet Tote Road	Tote Road	Dust, noise, traffic
Mine Site	Pre-development infrastructure (camp, tank farm, lay down area and airstrip)	Mine site infrastructure, open-pit, ore stockpiles, waste rock stockpile, noise Visual effect: modification of Nulujaak as a landmark (mining of top, creation of large waste rock stockpiles)

2.4.4 Palaeontological Resources (No Change)

2.5 IMPACT STATEMENT (NO CHANGE)

2.6 AUTHORS (CHANGE)

This impact statement was prepared by Charlotte Dubec and Richard Cook and reviewed by Kevin Hawton, P.Eng., all of Knight Piésold Ltd. Additional information based on the 2011 Geotechnical Investigation program was provided by Ramli Halim, P. Eng. of Hatch Ltd. and Bruce Smith, P. Eng of Thurber Engineering Ltd. ERP addendum updated by M. Setterington (EDI) and R. Cook (Knight Piésold Ltd).

SECTION 3.0 - VEGETATION (CHANGE)

The ~21,000 km² RSA used for the vegetation effects assessment for the ERP Project (Figure 6-3.1), and described broadly in Section 6-1.2, encompasses the proposed Milne Inlet Port site, the Tote Road south to the Mary River Mine Site, the proposed rail route south to Steensby Inlet, and the proposed Steensby Port.

3.1 ISSUES SCOPING (CHANGE)

The ERP's vegetation effects assessment focuses on the potential effects from Project interactions not already considered in the Approved Project. As stated in Volume 3, Section 1.2, the ERP introduces the following additional activities that were not assessed in the FEIS of the Approved Project:

1. Mine Site
   a. Loading of ore into trucks; and
   b. Truck fleet and maintenance facilities.
2. Tote Road
   a. Haulage of ore along the Tote Road.
3. Milne Port
   a. Ore stockpiling and loading onto ships.
4. Marine Shipping
   a. Ore carrier loading at Milne Port; and
   b. Ore carrier shipping volume and timing.

Figure 6-3.1 Vegetation Communities within the Mary River Regional Study Area (No Change)

3.2 VEGETATION (CHANGE)

3.2.1 Assessment Methods (Change)

3.2.1.1 Vegetation Abundance and Diversity (No Change)

3.2.1.2 Vegetation Health (Change)

Dust (TSP)

There are no known dust deposition thresholds specific to effects on vegetation. Health Canada/Environment Canada's national ambient air quality objectives for particulate matter (CEPA/FPAC Working Group 1998) state that because of the lack of quantitative dose-effect information, it is not possible to define a reference level for vegetation and dust deposition. The High Lake Project (Wolfden Resources Inc. 2006), a proposed base metal mine in western Nunavut, developed thresholds for the magnitude of effect on vegetation health ranging from 4.6 g/m²/a for a low magnitude effect to ≥50 g/m²/a for a high magnitude effect (Table 6-3.1). Spatt and Miller (1981) observed a decline in species abundance with a deposition rate of 1.0 to 2.5 g/m²/d and observed some effects for deposition rates of 0.07 to 1 g/m²/d. For human health purposes, Alberta has a dust deposition criterion for residential and recreation areas of 5.3 g/m²/30 day and Ontario has an annual deposition criterion of 4.6 g/m²/a. Therefore, the following annual TSP deposition thresholds are used:

Low: 1–4.6 g/m²/a;

Moderate: 4.6–50 g/m²/a; and

High: > 50 g/m²/a.

Table 6-3.1 Dust Deposition Rates and Criteria for Potential Effects on Vegetation Health (No Change)

Source of Information	Dust (TSP) deposition rate	Equivalent annual dust deposition rate (g/m²/a)	Comments
High Lake Impact Assessment (Wolfden 2006)	1.0–4.6 g/m²/a	1.0–4.6	Predicted low magnitude effect on vegetation health
	4.6–50 g/m²/a	4.6–50	Predicted moderate magnitude effect on vegetation health
	50–200 g/m²/a	50–200	Predicted high magnitude effect on vegetation health
Spatt and Miller (1981)	0.07 g/m²/d	26	Some effects to *Sphagnum* species
	1.0–2.5 g/m²/d	365–913	Decline in *Sphagnum* species abundance
Alberta	5.3 g/m²/30 d	64	Alberta Guidelines for Residential and Recreational Areas (human health)
Ontario	4.6 g/m²/a	4.6	Ontario Ambient Air Quality Criteria (human health)

Atmospheric Emissions

The World Health Organization (WHO 2000) established critical levels of sulphur dioxide (SO_2) and nitrogen dioxide (NO_2) emissions at which detrimental effects on vegetation begin to occur. Annual mean concentrations of 30 µg/m^3 were associated with the eradication of sensitive lichen, but it was recommend that an air quality guideline of 10 µg/m^3/a of SO_2 be established (WHO, 2000). Determining critical loads of NO_2 are less clear because increasing levels of NO_2 may or may not be beneficial. However, based on available information, the WHO (2000) suggested a critical level of atmospheric concentrations of NO_2 of 30 µg/m^3 as an annual mean before detrimental effects are recognized in plants.

The WHO (2000) guideline for nitrogen deposition to natural systems range from 5–20 kg/ha/a. Graham *et al.* (1997) suggest that 5–15 N kg/ha/a is a critical load for Arctic and alpine heaths. To summarize the available guidelines, critical levels beyond which plant health may be affected include:

- Annual atmospheric concentration of SO_2 ≥ 10 µg/m^3/a on lichens;
- Annual atmospheric concentrations of NO_2 ≥ 30 µg/m^3/a; and
- Annual deposition of nitrogen ≥ 12 kg N/ha/a.

Based primarily on the WHO recommended guidelines, the magnitude of effects of potential SO_2 and NO_2 emissions are as follows:

Low:	≤ 5 µg/m^3/a SO_2
	≤10 µg/m^3/a NO_2
Moderate:	5–10 µg/m^3/a SO_2
	10–25 µg/m^3/a NO_2
High:	≥10 µg/m^3/a SO_2
	≥ 25 µg/m^3/a NO_2

Similarly for the deposition of nitrogen:

Low:	0–6 kg N/ha/a
Moderate:	6–12 kg N/ha/a
High:	≥ 12 kg N /ha/a

Models were developed as part of the Air Quality assessment (Volume 5, Section 2) for the concentrations, rates and dispersion patterns of TSP and atmospheric SO_2 and NO_2. From those models, emissions isopleths were developed at several concentration ranges above and below threshold levels for effects on plant health. The resulting isopleths were overlaid on the vegetation class data (minus the area of vegetation within the PDA, accounted for in the section on Abundance and Diversity) to estimate the area of each class affected by annual rates of deposition of dust (TSP), and annual concentration of NO_2. Annual deposition (N kg/ha/a) was calculated from the predicted 30-day nitrogen deposition rate presented in µg/m²/second.

Some vegetation classes will be more sensitive than others to dust and emissions. Based on the literature review summarized above, estimates of sensitivity (Table 6-3.4) were applied to the ten terrestrial vegetation classes identified in the Ecological Land Classification (Approved Project FEIS Appendix 6D). Two specific vegetation types not included in the ELC but described in the vegetation baseline report include riparian willow shrub lands/riparian shoreline shrub, and snowbank associations. Both are relatively tolerant of dust and emissions because of their association with moist habitats, and willow is a generally tolerant species. The sensitivity classes are used to summarize the potential effects of dust and emissions on vegetation classes.

3.2.1.3 Culturally Valued Vegetation (No Change)

Table 6-3.2 Vegetation classes predicted to be sensitive to Annual TSP Deposition, NO_2 Emissions and Nitrogen Deposition (No Change)

3.2.2 Potential Effects and Proposed Mitigation (Change)

3.2.2.1 Vegetation Abundance and Diversity (Change)

Construction of Milne Port and improvements to the Tote Road (Approved Project) and the Mine (Approved Project) will remove 48.9 km² of terrestrial habitat (Table 6- 3.3). Surface disturbance has already occurred at the Milne Port site (328,450 m²), Tote Road (495,000 m²) and Mine (522,500 m²) as a result of previously approved activities. Given that each of these components already exists, loss of vegetation will be limited to 47.5 km². A conservative approach was used in the assessment by assuming that the entire PDA will be disturbed (e.g., habitat removed) during construction and operations and reclamation will likely be delayed due to Arctic growing conditions.

All plant communities and species documented during baseline studies will likely be present after mine closure. Comparison of the representation of plant communities within the RSA after removing the plant habitat within the PDA indicates that none of the plant communities will be disproportionately affected. Less than 2 % of the wetlands, and less than 1 % of all other habitats of the area occupied by each plant community within the RSA could be removed in the PDA (Table 6-3.4).

Table 6-3.3 Summary of Predicted Loss of the Terrestrial Habitat within the ERP component of the PDA (Change)

Project Component	Loss of terrestrial habitat due to PDA (km^2)	Potential Direct Loss of Vegetation
Milne Inlet Port	2.8	Existing area of disturbance at Milne Inlet (328,450 m^2)
Milne Inlet Tote Road	18.7	Existing footprint of 99 km x 5 m wide (495,000 m^2; 0.495 km^2)
Mine Site	27.4	Additional loss to existing footprint 522,500 m^2 (0.52 km^2). Minor loss of vegetation with expansion of the footprint of mine and infrastructure areas, but all vegetation loss will occur within the PDA.
Rail and Steensby Port	72.3	Additional loss to existing footprint at Steensby Port (56,000 m^2 [0.06 km^2]). Moderate losses of vegetation, including blueberry and crowberry habitat, all within the PDA, but minor on a regional scale.
Total	**121.3**	

Table 6-3.4 Predicted Loss of Broad Vegetation Community Types as a Result of Disturbance within the PDA, ERP combined with the Approved Project (Change)

RSA Vegetation Cover Classes	Baseline RSA		Affected RSA	
	Area (km²)	% of RSA	Affected Area (km²)	Change (%)
Wetlands (NLC 11)	124.9	0.41	2.24	-1.79
Wet sedge - Graminoids and bryoids (NLC 2)	1,276.9	4.16	6.57	-0.51
Tussock graminoid tundra (NLC 1)	1,726.3	5.62	8.69	-0.50
Moist to dry non-tussock graminoid/dwarf shrub tundra: 50–70 % cover (NLC 3)	2,546.8	8.29	13.04	-0.51
Dry graminoid prostrate dwarf shrub tundra: 70–100 % cover (NLC 4)	71.8	0.23	0.15	-0.21
Prostrate dwarf shrub - Dryas/heath, usually on bedrock (NLC 7)	4,124.9	13.43	22.14	-0.54
Sparsely vegetated bedrock (NLC 8)	4,295.6	13.99	29.68	-0.69
Sparsely vegetated till-colluvium (NLC 9)	2,922.2	9.52	11.50	-0.39
Bare soil with cryptogam crust - Frost boils (NLC 10)	2,783.4	9.06	20.08	-0.72
Barrens (NLC 12)	3,673.4	2.25	4.25	-0.12
Water/Ice/Snow/Unclassified (NOC 15, 13, 14)	7,165.0	23.33	2.94	0.04
Total	**30,711**	**100**	**121.32**	**-0.40**

Note(s):
1. Calculations include all of PDA Milne to Steensby Inlet.

3.2.2.2 Vegetation Health (Change)

Dust (TSP) (Change)

For the ERP Project, dust will be generated at Milne Inlet, Tote Road and at the Mine. The air quality assessment (ERP Volume 5, Section 2) identified the predicted dust effects from the point sources and along the linear transportation corridor, with dust deposition expected to be greatest adjacent to the Mine Site. Much of that area will be encompassed within the PDA where vegetation removal is predicted to be complete (addressed in the Vegetation Abundance and Diversity section). Mitigation of dust effects on vegetation are addressed by those measures used to mitigate effects on air quality as described in the Approved Project's FEIS Volume 5, Section 2.

A total of 447.6 km² of vegetated habitat can experience some level of dust deposition. The largest area will be at the Mine Site, followed by the Tote Road and then Milne Port. Plant health may be affected in 4.9 km² of terrestrial habitat surrounding the Mine Site (outside of the PDA), where the threshold of >50 g/m²/a TSP will be exceeded. Due to prevailing winds and less terrestrial habitat in the port areas, the High threshold is exceeded in only 0.1 km² of terrestrial habitat outside of the PDA at Milne Inlet, and 1.6 km² along the Tote Road (Table 6-3.5; Figure 6-3.2).

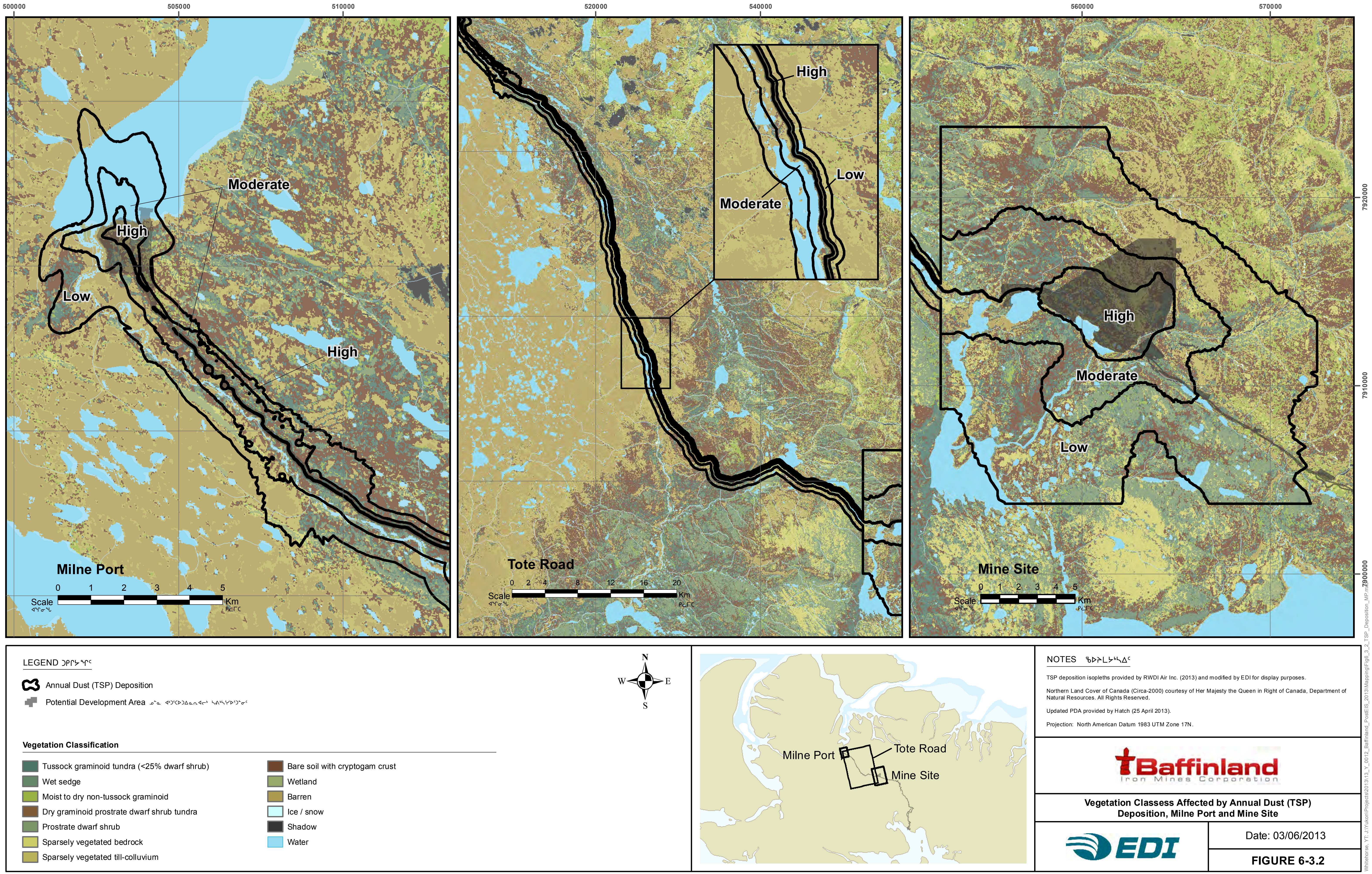
Table 6-3.5 The Area Outside the PDA Affected by Annual TSP Deposition on Vegetated ELC Units for the ERP Project (Change)

Project Location	Area (km^2) Affected by Annual Dust (TSP) Deposition outside of the PDA			
	Low (1–4.6 g/m²/a)	Moderate (4.6–50 g/m²/a)	High (> 50 g/m²/a)	Total Terrestrial Area Outside of PDA Affected by Annual TSP
Milne Port	19.5	8.6	0.1	28.1
Tote Road	81.1	57.3	1.7	140.1
Mine Site	199.5	72.1	4.9	276.5
Railway and Steensby	2.9	0	0	2.9
Total	**303.0**	**138.0**	**6.7**	**447.6**

Table 6-3.6 Vegetation Classes Affected by Annual Dust (TSP) Deposition (Change)

RSA Vegetation Cover Classes[1]	Baseline RSA Area		Area (km²) affected by Annual Dust (TSP) Deposition			RSA affected by TSP	
	Area (km²)	% of RSA	Low (1–4.6 g/m²/a)	Moderate (4.6–50 g/m²/a)	High (> 50 g/m²/a)	Area (km²)	% of class in RSA
Wetlands	125	0.4	2.1	1.1	0.0	3.2	2.6
Wet sedge - Graminoids and bryoids	1,277	4.2	11.8	6.4	0.2	18.4	1.4
Tussock graminoid tundra	1,726	5.6	28.7	17.1	0.6	46.4	2.7
Moist to dry non-tussock graminoid/Dwarf shrub tundra:50–70 % cover	2,547	8.3	21.7	6.0	0.4	28.0	1.1
Dry graminoid prostrate dwarf shrub tundra: 70–100 % cover	72	0.2	0.2	0.1	0.0	0.4	0.5
Prostrate dwarf shrub – Dryas/heath, usually on bedrock	4,125	13.4	45.1	13.7	0.2	59.0	1.4
Sparsely vegetated bedrock	4,296	14.0	22.0	5.8	0.2	28.0	0.7
Sparsely vegetation till colluvium	2,922	9.5	40.8	11.4	0.5	52.7	1.8
Bare soil with cryptogam crust – Frost boils	2,783	9.1	78.8	30.7	1.6	111.1	4.0
Barrens	3,673	12.0	18.8	7.4	0.1	26.4	0.7
Water/Ice/Snow/Unclassified	7,165	23.3	19.1	12.8	1.2	33.1	0.5
Total	**30,711**	**100**	289.2	112.5	5.0	406.7	1.3

Note(s):
1. Predicted high sensitivity to TSP vegetation classes (**Table 6-3.2**) are highlighted in grey.



Milne Port
Moderate
High
Low
High
Tote Road
High
Low
Moderate
Mine Site
High
Moderate
Low
Scale
Km
LEGEND
Annual Dust (TSP) Deposition
Potential Development Area
Vegetation Classification
Tussock graminoid tundra (<25% dwarf shrub)
Wet sedge
Moist to dry non-tussock graminoid
Dry graminoid prostrate dwarf shrub tundra
Prostrate dwarf shrub
Sparsely vegetated bedrock
Sparsely vegetated till-colluvium
Bare soil with cryptogam crust
Wetland
Barren
Ice / snow
Shadow
Water
N
W
E
S
Milne Port
Tote Road
Mine Site
NOTES
TSP deposition isopleths provided by RWDI Air Inc. (2013) and modified by EDI for display purposes.
Northern Land Cover of Canada (Circa-2000) courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved.
Updated PDA provided by Hatch (25 April 2013).
Projection: North American Datum 1983 UTM Zone 17N.
Baffinland
Iron Mines Corporation
Vegetation Classess Affected by Annual Dust (TSP) Deposition, Milne Port and Mine Site
EDI
Date: 03/06/2013
FIGURE 6-3.2

No vegetation classes are disproportionally affected by annual TSP deposition outside of the PDA, with effects limited to 0.5–4.0 % of the vegetation class available in the RSA (Table 6-3.6). Areas that may be more sensitive to dust deposition are found in the areas of dust fall.

No vegetation classes considered sensitive to dust deposition will be disproportionally affected, and most of the habits will remain intact within the RSA (Table 6-3.6). The vegetation class with the greatest proportion potentially experiencing dust fall is Bare soil with cryptogam crust - Frost boils (NLC 10) where overall 4 % of the available cover in the RSA is subject to dust fall, but only 1.6 ha (0.06 % of available cover) is subject to the High threshold where effects may be detected. Some of the more sensitive communities may experience declined growth, reduced biomass, or changes in community composition. All areas experiencing dust deposition during winter may experience earlier green-up as a result of earlier snow melt . The extent of areas experiencing earlier snow melt is unknown and unpredictable.

Metals in Dust (No Change)

Table 6-3.7 Total Predicted Soil Metal Concentration in Comparison to U.S. EPA EcoSSLs and CCME Soil Guidelines (No Change)

Atmospheric Emissions (Change)

The largest terrestrial area experiencing nitrogen dioxide emissions (outside of the PDA) is in Milne Port, followed by the Mine Site. The high threshold of ≥ 25 µg $NO_2/m^3/a$ is not exceeded outside of the PDA at Milne Port, but a 2.7-km² area outside of the PDA at the Mine Site does experience that high threshold (Table 6-3.8; Figure 6-3.3).

All vegetation classes are present in each of the areas affected by NO_2 emissions, but no vegetation classes are disproportionally affected by nitrogen dioxide emissions outside of the PDA (Table 6-3.10). Overall, 0.4 % of the RSA is affected by NO_2 emissions. The range of effects on individual vegetation classes ranges from 0.1–1.3 % of individual class availability throughout the RSA (Table 6-3.10). The greatest effects are predicted to be on the more sensitive vegetation classes, including the sparsely vegetated classes found on shallow or no soils (e.g., colluvium and bedrock). Mitigation of emissions on vegetation will be addressed by those measures used to mitigate effects on air quality as described in Volume 5, Section 2.

Table 6-3.8 The Area Outside of the PDA Affected by Atmospheric Nitrogen Dioxide (NO_2) on Vegetated ELC Units (Change)

Project Location	Area (km²) Affected by Annual Nitrogen Dioxide Emissions			
	Low (≤10 µg/m³/a)	Moderate (10–25 µg/m³/a)	High (≥ 25 µg/m³/a)	Total Terrestrial Area Outside PDA Affected by Annual NO_2
Milne Port	118.3	4.9		123.2
Mine Site	nd	9.8	2.7	12.8
Total	**118.3**	**14.7**	**2.7**	**135.7**

An area of 0.5 km² outside of the PDA will be affected by nitrogen deposition, but none of those areas exceeds the estimated threshold of ≥12 kg N/ha/a (Table 6-3.11; Figure 6-3.4). Sensitive vegetation classes are those associated with drier habitats, heath, and moss/lichen dominated units. No vegetation classes outside of the PDA will experience nitrogen deposition above threshold levels (Table 6-3.11). Vegetation classes sensitive to nitrogen deposition will experience increased levels of deposition, but none beyond threshold levels (Table 6-3.11). The effects of N deposition may therefore be undetectable. Mitigation of nitrogen deposition on vegetation will be addressed by those measures used to mitigate effects on air quality as described in Volume 5, Section 2.

Sulphur dioxide (SO_2) emissions were so low that they did not approach even the low threshold for effects significance (Max: 1.48 µg/m³/a), were limited to a 1.8 km² area outside of the PDA around the Mine Site, and is therefore not considered further.

The most noticeable effects on vegetation may occur in areas where the thresholds are exceeded for all three air quality parameters (i.e., annual TSP deposition, annual NO_2 emission concentrations, and annual deposition of nitrogen). This occurs in a 45.8 ha area at the Mine Site, all except 0.3 ha encompassed within the PDA. The vegetation within the PDA is assumed to be removed through construction and operation activities, and that loss is accounted for in the abundance and diversity section.

Table 6-3.9 Vegetation Classes Outside the PDA Affected by Atmospheric Nitrogen Dioxide (NO_2) Emissions (Change)

RSA Vegetation Cover Classes[1]	Baseline RSA Area		Area (km²) Affected by NO_2 Emissions			RSA Affected by NO_2	
	Area (km²)	% of RSA	Low (≤10 µg/m³/a)	Moderate (10–25 µg/m³/a)	High (≥ 25 µg/m³/a)	Area (km²)	% of class in RSA
Wetlands	125	0.4	1.4	0.1	0.0	1.5	1.2
Wet sedge - Graminoids and bryoids	1,277	4.2	2.8	0.8	0.1	3.7	0.3
Tussock graminoid tundra	1,726	5.6	4.8	2.5	0.4	7.6	0.4
Moist to dry non-tussock graminoid/Dwarf shrub tundra:50–70 % cover	2,547	8.3	2.7	0.8	0.2	3.7	0.1
Dry graminoid prostrate dwarf shrub tundra: 70–100 % cover	72	0.2	0.1	0.0	0.0	0.1	0.1
Prostrate dwarf shrub – Dryas/heath, usually on bedrock	4,125	13.4	2.2	1.4	0.1	3.7	0.1
Sparsely vegetated bedrock	4,296	14.0	1.7	0.3	0.1	2.1	0.0
Sparsely vegetated till colluviums	2,922	9.5	16.4	1.5	0.2	18.1	0.6
Bare soil with cryptogam crust – Frost boils	2,783	9.1	14.6	3.5	0.5.	18.6	0. 7
Barrens	3,673	12.0	45.2	1.4	0.1	46.6	1.3
Water/Ice/Snow/Unclassified	7,165	23.3	26.5	2.4	1.0	29.9	0.4
Total	**30,711**	**100**	118.3	14.7	2.7	135.7	0.4

Note(s):

1. Predicted high sensitivity to NO_2 emission vegetation classes (Error! Reference source not found.) are highlighted in grey.

Table 6-3.10 Area Outside the PDA Affected by Nitrogen (N) Deposition on Vegetated ELC Units (Change)

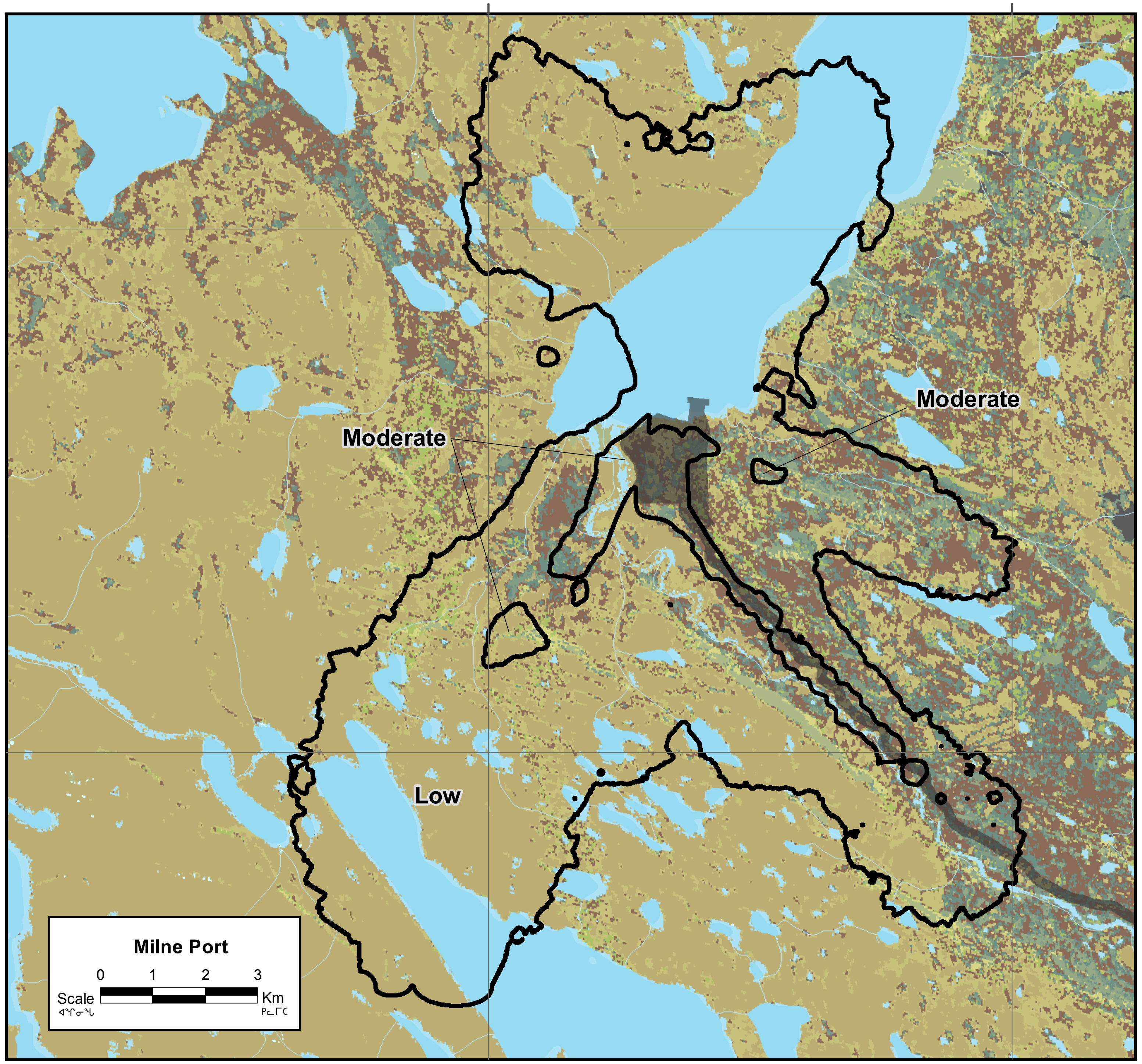
Project Location	Area (km²) Affected by Annual Nitrogen Deposition			
	Low (≤6 kg N/ha/a)	Moderate (6–12 kg N/ha/a)	High (≥12 kg N/ha/a)	Total Terrestrial Area (-PDA) Affected by N Deposition
Milne Port	0.1	0	0	0.1
Mine Site	0	0.4	0	0.4
Total	0.1	0.4	0	0.5

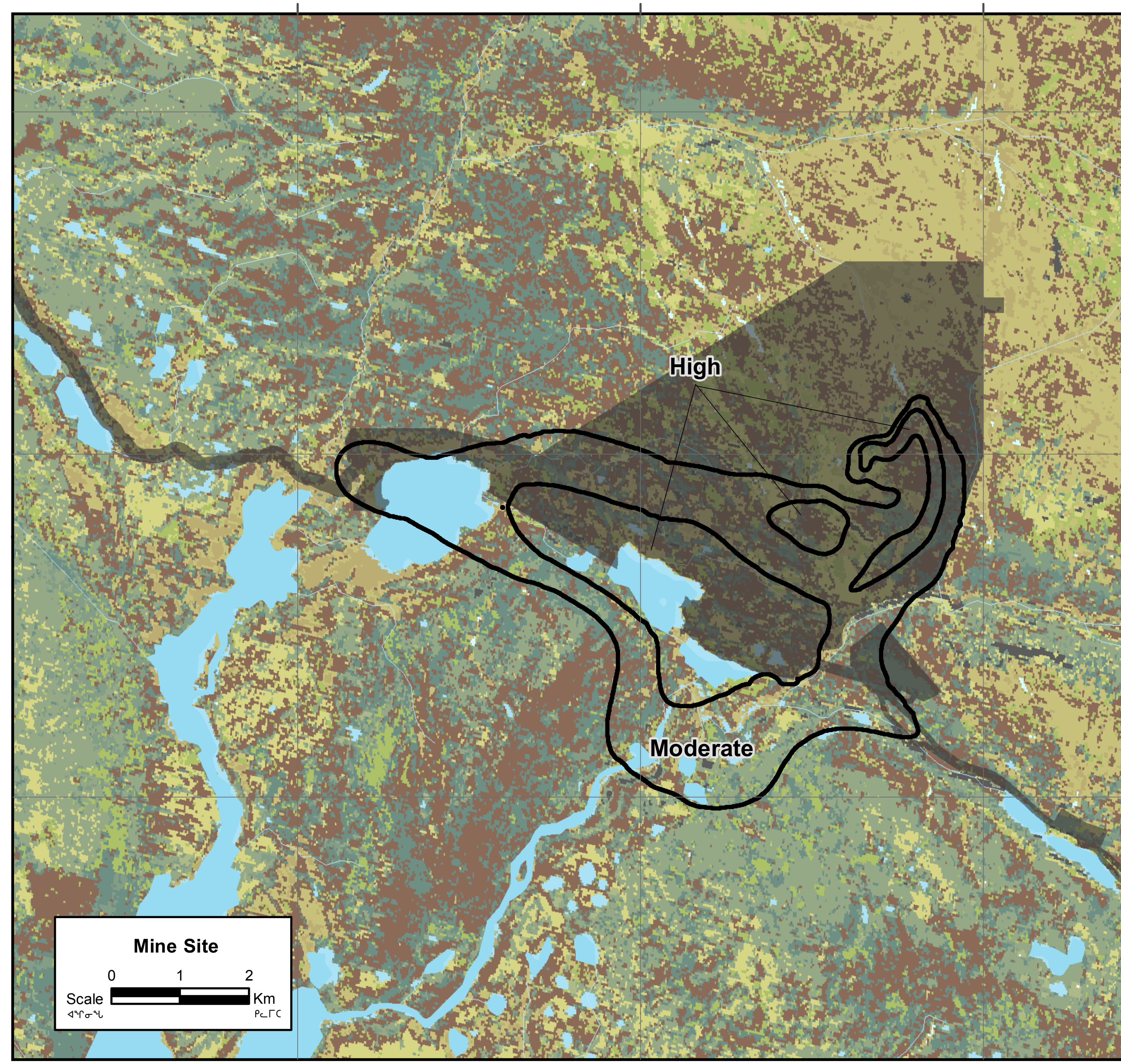
Table 6-3.11 Vegetation Classes Outside the PDA Affected by Atmospheric Nitrogen (N) Deposition (Change)

RSA Vegetation Cover Classes[1]	Baseline RSA Area		Area (km²) Affected by Nitrogen Deposition			RSA Affected by Nitrogen Deposition	
	Area (km²)	% of RSA	Low (<6 kg N/ha/a)	Moderate (6–12 kg N/ha/a)	High (>12 kg N/ha/a)	Area (km²)	% of class in RSA
Wetlands	125	0.4	0.0	0.0	0.0	0.0	0.0
Wet sedge - Graminoids and bryoids	1,277	4.2	0.0	0.00	0.0	0.004	<0.001
Tussock graminoid tundra	1,726	5.6	0.01	0.00	0.0	0.006	<0.001
Moist to dry non-tussock graminoid/Dwarf shrub tundra:50–70 % cover	2,547	8.3	0.0	0.01	0.0	0.006	<0.001
Dry graminoid prostrate dwarf shrub tundra: 70–100 % cover	72	0.2	0.0	0.0	0.0	0.0	0.0
Prostrate dwarf shrub – Dryas/heath, usually on bedrock	4,125	13.4	0.0	0.00	0.0	0.001	<0.001
Sparsely vegetated bedrock	4,296	14.0	0.0	0.02	0.0	0.02	<0.001
Sparsely vegetated till colluvium	2,922	9.5	0.02	0.00	0.0	0.20	<0.001
Bare soil with cryptogam crust – Frost boils	2,783	9.1	0.02	0.00	0.0	0.02	<0.001
Barrens	3,673.0	12.0	0.01	0.0	0.0	0.01	<0.001
Water/Ice/Snow/Unclassified	7,165	23.3	0.02	0.33	0.0	0.33	0.00
Total	**30,711**	**100**	0.1	0.4	0.0	0.42	<0.001

Note(s):

1. Predicted high sensitivity to N deposition vegetation classes (**Table 6-3.2**) are highlighted in grey.





LEGEND

Nitrogen Dioxide Emissions

Potential Development Area

N S E W

Vegetation Classification

- Tussock graminoid tundra (<25% dwarf shrub)
- Wet sedge
- Moist to dry non-tussock graminoid
- Dry graminoid prostrate dwarf shrub tundra
- Prostrate dwarf shrub
- Sparsely vegetated bedrock
- Sparsely vegetated till-colluvium
- Bare soil with cryptogam crust
- Wetland
- Barren
- Ice / snow
- Shadow
- Water

NOTES

Nitrogen dioxide isopleths provided by RWDI Air Inc. (2013) and modified by EDI for display purposes.

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Updated PDA provided by Hatch (25 April 2013).

Projection: North American Datum 1983 UTM Zone 17N.

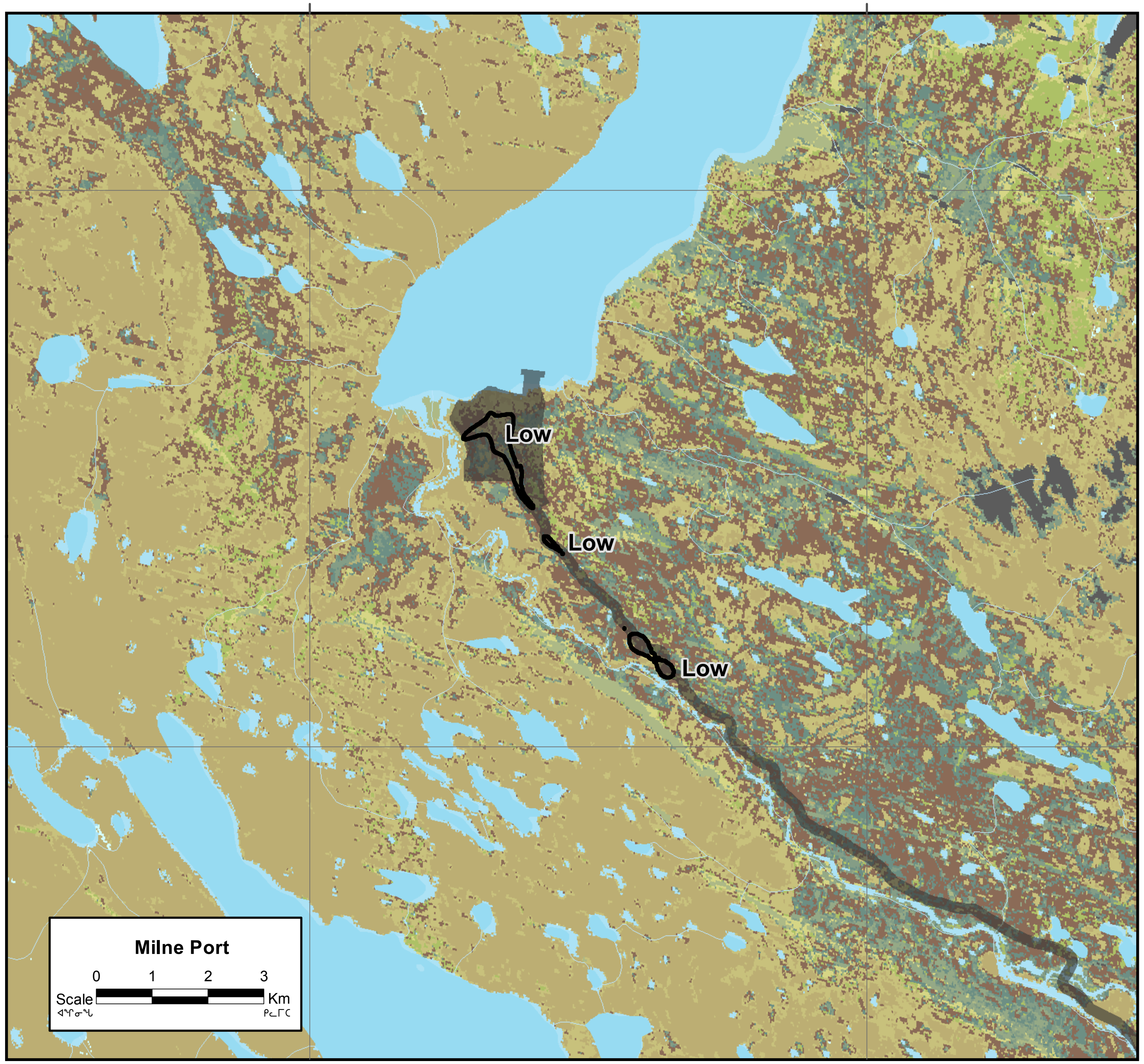
Baffinland Iron Mines Corporation

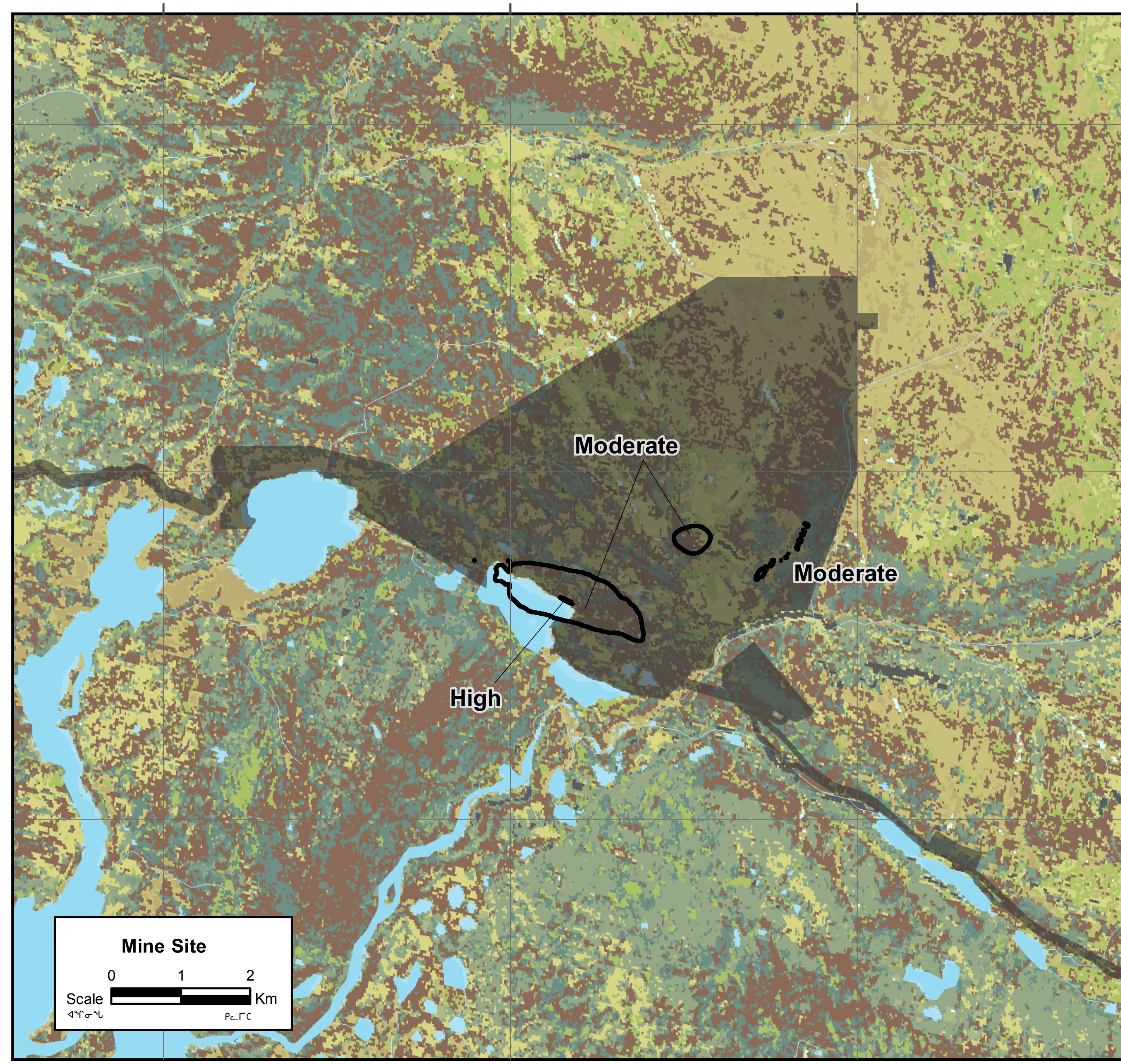
Vegetation Classess Affected by Annual Nitrogen Dioxide Emissions, Milne Port and Mine Site

EDI

Date: 03/06/2013

FIGURE 6-3.3





LEGEND

Nitrogen Deposition

Potential Development Area

Vegetation Classification

- Tussock graminoid tundra (<25% dwarf shrub)
- Wet sedge
- Moist to dry non-tussock graminoid
- Dry graminoid prostrate dwarf shrub tundra
- Prostrate dwarf shrub
- Sparsely vegetated bedrock
- Sparsely vegetated till-colluvium
- Bare soil with cryptogam crust
- Wetland
- Barren
- Ice / snow
- Shadow
- Water

NOTES ᖃᐅᔨᒪᔭᑲᐃᑦ

Nitrogen deposition isopleths provided by RWDI Air Inc. (2013) and modified by EDI for display purposes.

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Updated PDA provided by Hatch (25 April 2013).

Projection: North American Datum 1983 UTM Zone 17N.

Baffinland Iron Mines Corporation

Vegetation Classess Affected by Annual Nitrogen Deposition, Milne Port and Mine Site

EDI

Date: 03/06/2013

FIGURE 6-3.4

Y_0012_Baffinland_PostEIS_2013\Mapping\Fig6_3_4_nDep.mxd

3.2.2.3 Culturally Valued Vegetation (Change)

Direct loss of blueberry cover will occur within the 48.9 km² ERP PDA. Even if the entire PDA is cleared, the reduction of blueberry cover will be minor and indistinguishable from the baseline condition (Table 6-3.12 and Figure 6-3.5) at the scale of the RSA. The PDA is found within 3.9 km² of high blueberry cover, equivalent to 1.5 % of that cover in the RSA. Furthermore, much of the Milne Port, Tote Road and Mine Site are already disturbed areas, so the reduction of blueberry cover will be small because there will be limited new disturbance in those areas. Not all vegetation within the PDA will be removed and not all vegetation removed will be blueberry cover; consequently, this estimate of blueberry cover loss is likely an overestimate of the true effect. Mitigations identified for reducing effects of the ERP Project on vegetation abundance and diversity will be suitable for mitigating effects to culturally valued vegetation.

Table 6-3.12 The Expected Effect to Potential Blueberry Cover within the RSA (Change)

Blueberry Cover Categories	Baseline RSA (km²)	Affected PDA (km²)	RSA cover after effect (km²)	Change (%)
Low (0–20 %)	23,628.2	110.0	23,572.3	0.46
Med-Low (>20–40 %)	324.1	2.8	321.30	0.86
Med-High (>40–60 %)	98.1	1.5	96.6	1.5
High (>60–80 %)	267.0	3.9	263.1	1.5

Figure 6-3.5 Blueberry Cover within the Regional Study Area (No Change)

3.2.3 Assessment of Residual Effects (Change)

Vegetation Abundance and Distribution (Change)

The additional loss of vegetation within the PDA as a result of the ERP program is a residual effect — it is not expected that disturbed areas will become re-vegetated until after closure of the mine. Some of the footprint may never return to baseline conditions. The predicted levels of vegetation abundance and distribution effects based on the evaluation criteria are summarized in Table 6-3.13.

Vegetation Health (Change)

During the ERP Project construction, operation, and closure activities, annual dust deposition will occur beyond threshold levels outside of the PDA, and there will be some effects on vegetation. Those effects are limited to a small portion of vegetated areas in the RSA (5 ha, <0.01 %), and small proportions of each vegetation class (0.0–1.6 %) relative to their individual availability in the RSA. The effects are reversible when the dust-producing activities cease.

After Project closure, when the air emissions and nitrogen deposition cease, the effects of nitrogen additions to the ecosystems will persist. This can result in long-term effects on plant community composition and individual species resilience. The prediction is that those ERP-related effects will be limited to only small proportions (<0.1 %) of the more sensitive vegetation classes within the RSA. The predicted levels of vegetation health effects based on the evaluation criteria are summarized in Section 3.2.1.

Metals contained in dust will likely accumulate to some degree in soils beyond the PDA, although the affected area is expected to be relatively small in comparison to the RSA. Plant responses to metals in soil are extremely varied depending on the species in question, but are primarily determined by soil pH. Since soil and substrate pH were found to be in a neutral range of 6 to 7.5 (based on baseline results) within the

Project study area, bioavailability of metals is expected to continue at low levels, thereby minimizing or preventing any potential phytotoxic effects. Any effects will be small in extent and could be minimized by several monitoring and mitigation measures during the Project and upon closure. The predicted levels of vegetation health effects resulting from metals in soils based on the evaluation criteria are summarized in Section 3.2.1.

Culturally Valued Vegetation (Change)

Loss of blueberry cover within the PDA of the Project is a residual effect; it is not expected that blueberry cover will return to the pre-development state until after closure of the mine. Some of the blueberry-producing habitat will likely be permanently changed. The predicted levels of vegetation health effects based on the evaluation criteria are summarized in Section 3.2.1.

Table 6-3.13 Effects Assessment Summary: Vegetation (No Change)

3.2.4 Prediction Confidence (No Change)

3.2.5 Follow-up (Change)

Follow-up monitoring started in 2012 with an expanded lichen and soil sampling program that included both near and far site sampling plots, described in the 2012 Terrestrial Environment Monitoring Report (EDI 2013). Vegetation sampling in the future will include near and far site sampling of soil and *Vaccinium* sp. as an enhanced baseline and monitoring of metals in plants and soils. In addition to the air quality monitoring program described in Volume 10 of the Approved Project's FEIS, a dust fall monitoring program was developed for implementation in 2013.

3.3 SUBJECTS OF NOTE (NO CHANGE)

3.4 IMPACT STATEMENTS (NO CHANGE)

3.4.1 Vegetation Abundance and Diversity (No Change)

3.4.2 Vegetation Health (No Change)

3.4.3 Culturally Valued Vegetation (No Change)

3.5 AUTHORS (NO CHANGE)

SECTION 4.0 - MIGRATORY BIRDS AND HABITAT (CHANGE)

4.1 ISSUES SCOPING (NO CHANGE)

4.2 KEY INDICATORS (NO CHANGE)

Table 6-4.1 Key Indicator Species of Birds Selected for the Mary River Project (No Change)

4.2.1 Peregrine Falcon (No Change)

4.2.2 Snow Goose (No Change)

4.2.3 Common and King Eider (No Change)

4.2.4 Red-throated Loon (No Change)

4.2.5 Thick-billed Murre (No Change)

4.2.6 Lapland Longspur (No Change)

4.2.7 Species at Risk (No Change)

Table 6-4.2 Status of Avian Species at Risk with the Potential occur in the Mary River RSA (No Change)

4.3 POTENTIAL PROJECT INTERACTIONS WITH BIRDS (NO CHANGE)

4.3.1 Key Issues (No Change)

4.4 ASSESSMENT METHODS (NO CHANGE)

4.4.1 Measurable Parameters (No Change)

4.4.2 Thresholds (No Change)

Table 6-4.3 Potential Effects, Measurable Parameters and Thresholds for Key Indicators (Change)

Effect	Measurable Parameters	Thresholds (Magnitude and Extent)
Habitat	Changes in the quality and availability of habitat within the RSA and seasonal range	**Level I**: confined to the LSA, 10 % in the RSA, or 3 % in the seasonal range **Level II**: >10 %–25 % change in the RSA, or >3 % to 5 % across the seasonal range. **Level III**: >25 % change in the RSA, > 5 % across seasonal range.
Habitat Loss	Changes in the quality and availability of habitat within the RSA	Negligible to low change (<10 %) Moderate change (10–25 %) High change (>25 %)
	Changes in the density of birds within the RSA	
	Changes in nest occupancy rates or breeding success rates within the RSA	
Movement	Project Infrastructure barriers to known caribou trails	**Level I**: Barriers on <10 % of known trails **Level II**: Barriers on >10 % to 25 % of known trails **Level III**: Barriers on >25 % of known trials
Mortality	Increased mortality risk to caribou due to Project	**Level I**: Negligible to low change (<10 %) **Level II**: Moderate change (10–25 %) **Level III**: High change (>25 %)
Health	Potential increased metals content in forage and resultant potential uptake	**Level I**: No discernible change to metals in forage. **Level II**: Measurable and biologically relevant increase in metals in forage in the Zone of Influence **Level III**: Exceeds published guidelines to the point that caribou suffer from ingestion.
Health and mortality	Change in population size due to mortalities within the LSA	Negligible to low change (<10 %) Moderate change (10–25 %) High change (>25 %)

Figure 6-4.1 Bird Marine and Terrestrial Study Areas (No Change)

4.4.3 Assessment of Habitat Loss (No Change)

4.4.4 Assessment of Mortality Risk and Health Risk (No Change)

4.5 PEREGRINE FALCON (CHANGE)

4.5.1 Potential Effects and Proposed Mitigation (Change)

Issue 1 — Habitat (Change)

Baseline data from 2012 were used to estimate pre-development peregrine falcon distribution and baseline data from 2006 through 2008 was used to assess baseline habitat quality and availability within the RSA. A number of occupied raptor territories and nests are located within the footprint of the PDA (Figure 6-4.2). In 2012 there were two active peregrine falcon nest sites within the PDA and an additional 25 within a 3 km radius. No active gyrfalcon territories or nests were found within the PDA in any of the survey years, but three are within a 3 km radius. In 2012, there were 13 cliff nest sites within the PDA (five within the ERP Project Portion of the PDA), 102 within 3 km, and 174 sites within the remainder of the RSA (Table 6-4.4). Nests within the PDA may or may not be included within the direct footprint of Project infrastructure, depending on final design specifications. They will experience direct disturbance from construction and operations activities. Nests within the 3 km radius of the PDA may experience some indirect habitat loss due to sensory disturbances, but no direct habitat loss will occur. Nests greater than 3 km from the PDA are unlikely to experience disturbances.

In 2012, 74 occupied peregrine falcon nest sites were productive, with productivity of 1.05 chicks per productive site for 2012, which was lower than in 2011 (3.26), suggesting wide inter-annual variability in baseline conditions for productivity (EDI, 2013).

Table 6-4.4 Distribution of Cliff-nesting Raptor Nest Sites within the Mary River RSA as of 2012 (Change)

Species	Nests within PDA	Nests within 3 km of PDA	Nests > 3km from PDA but in RSA	Total Nests in RSA in 2012
Peregrine falcon	2	25	46	73
Gyrfalcon	0	3	0	3
Rough-legged hawk	4	35	57	96
Other cliff nests	0	3	8	11
Vacant nests	7	36	63	106
Total sites	13	102	174	289

An assessment of habitat loss to nesting and foraging areas was conducted based on habitat suitability modeling. Habitat suitability maps for peregrine falcons nesting and foraging habitat were developed for the RSA based on Ecological Land Classification Modeling and are presented in Appendix 6E. Approximately 7 % of the RSA is currently considered high quality peregrine falcons nest habitat (Table 6-4.5). The model result that 93 % of the RSA contains moderate quality habitat is probably a model error because it is difficult to distinguish “cliffs” from rugged steep terrain. The Project’s baseline bird biologist (M. Evans) estimated that up to 35 % of the RSA contained suitable cliff nesting habitat (M. Evans, pers. obs.). Most of these cliffs are located in close proximity to seemingly productive tundra hunting grounds. Approximately 23 % and 56 % of the RSA contains high and moderate (respectively) quality peregrine falcon foraging habitat (Table 6-4.5).

The habitat effects assessment determined that, within the RSA, 137 km² of high value nesting habitat (7.9 % of total baseline high value habitat) and 320 km² of moderate value habitat (1.4 % of the total moderate value habitat) may be affected by Project activities (Table 6-4.5). Of the 137 km² of high value nesting habitat affected, 29 km² (1.7 %) will be completely lost to direct effects within the PDA. While the remainder will still be available to peregrine falcons, some sensory disturbance may be present. The effects assessment also concluded that 137 km² and 245 km² of high and moderate value foraging habitat respectively will be affected. This equates to 2.5 % of the total available high quality foraging habitat and 1.8 % of the total available moderate quality foraging habitat. Because habitat effectiveness is reduced as a result of direct loss to the PDA, and reduced effectiveness within a zone of influence due to sensory disturbances, there is a related increase in nil and low quality habitat in both cases.

Overall, there appears to be an abundant supply of suitable cliff-nesting habitat within the RSA, particularly in the eastern and southern areas, with adjacent productive tundra foraging habitat. The availability of nesting habitat for peregrine falcons and other cliff-nesting species does not appear to be limiting and it is suspected that any birds disturbed by Project activities may readily relocate to areas away from potential disturbances.

Table 6-4.5 Change in Effectiveness of Peregrine Nesting and Foraging Habitat within the Terrestrial RSA (Change)

Habitat Model	Habitat Rating	Baseline Conditions		Loss due to PDA and ZOI (km²)		Post-development Conditions	
		Area (km²)[1]	% RSA	Area (km²)	% RSA	Area (km²)	% RSA
Peregrine Falcon Nesting	High	1,726	7.1 %	-137	-0.6 %	1,549	6.4 %
	Medium	22,563	92.8 %	-320	-1.3 %	21,767	89.5 %
	Low	24	0.1 %	340	1.4 %	356	1.5 %
	Nil	1	<0.1 %	117	0.5 %	118	0.5 %
Peregrine Falcon Foraging	High	5,486	22.6 %	-137	-0.6 %	5,349	22.0 %
	Medium	13,683	56.3 %	-245	-1.0 %	13,438	55.3 %
	Low	5,145	21.2 %	264	1.1 %	5,409	22.2 %
	Nil	0	0.0 %	118	0.5 %	118	0.5 %

Note(s):

1. Total area in RSA = 30,711 km². 6,397 km² was not included in the ELC modeling exercise.
2. Habitat suitability values were classed as: nil (0–5), low (5.1–25), moderate (25.1–75), and high (75.1–100).

Milne Port and Milne Inlet Tote Road — The coastal tundra area in Milne Inlet provides foraging habitat for raptors, although the nearest identified nest is that of a rough-legged hawk approximately 1.5 km south-southwest of the Port's PDA. The Tote Road is bound by steep cliffs on both sides for much of its length and provides an abundance of high quality cliff nesting habitat. No active peregrine falcon nests were identified within the Tote Road PDA, but there are several within 3 km of the PDA that may experience Project-related disturbance. Some nests located within 100 m of the road may experience indirect habitat loss due to disturbance from road traffic through the Construction Phase given their close proximity. However, current operations have not affected nesting at this location so it is thought that Project-related road traffic is unlikely to induce the falcons to leave the nest. The existing road is located within suitable foraging habitat but this habitat loss has already occurred.

Mine Site — The Mine Site will be a focus of activity throughout all Project phases. At least four sites have been occupied by peregrine falcons and one by rough-legged hawks since baseline work began in 2006. The only site within the Mine PDA known to have produced peregrine falcon chicks was site 100 in 2008, when the bulk sample program was operating and the local lemming population appeared to be at a high. In 2012, one site (107) was occupied by a rough-legged hawk, three eggs were observed, but the nest likely failed or was predated after the chicks hatched. Some of the sites are likely alternate nesting sites, or used interchangeably by peregrine falcons and rough-legged hawks. The birds nesting at these locations have experienced Project-related disturbances since 2006, from the bulk sample activities in 2008, and will continue to experience disturbance through the ERP and the Approved Project. Although they are located within the PDA, they are expected to remain outside of the Project footprint.

Disturbances to foraging habitats adjacent to the Mine Site will occur throughout Construction, Operation, and Closure Phases. The existing Mary River camp and the mine infrastructure areas are located in low-lying tundra considered typical falcon foraging habitat, and the expansion of these areas during the Construction Phase will result in the loss of suitable foraging habitat. The open-pit mine area and waste rock stock pile areas are characterized by high elevation and rocky habitat with very little vegetation, not suitable foraging habitat for peregrine falcons. Due to the abundance of suitable foraging habitat in the vicinity, these disturbances are expected to have minimal effects on peregrine foraging abilities.

Issue 2 – Mortality (No Change)

Issue 3 – Health (No Change)

Mitigation (Change)

The Project area has a high density of breeding peregrine falcons and although the above assessment has concluded that the Project will have no population-level effects, the potential to disturb and disrupt individuals is possible, and proper mitigation procedures still be put in place. The two main focuses will be on minimizing habitat loss (nesting and foraging habitat) and minimizing behavioural disturbances (disruption of migratory patterns, foraging and nesting behaviour) by establishing 500 m protective buffers zones around all active nests. The boundaries of potential quarries to supply railway construction were delineated based on this 500 m buffer zone. General mitigation procedures of influence will focus primarily on avoidance of known nests, or avoidance of areas where birds exhibit territorial behaviour indicative of a nearby nest.

Within the Project footprint, supplemental adaptive measures and management will be applied to nests intersecting or completely within the PDA. Ontario is the only known jurisdiction to have completed a set of habitat management guidelines (OMNR 1987). Given the long-term use of peregrine falcon nesting sites, a nest-specific management plan will be prepared for each nest within a 3 km radius of the PDA. Each management plan will describe buffer zones vertically and horizontally around the nest sites and restrictions within the zones, and scheduling of activities will be prepared for each nest site. A site-specific management plan will allow buffers to be varied based on topography, line-of-sight, bird response, and history of disturbances at the nest site. If a pair of nesting falcons is established at an eyrie, efforts will be made to identify their hunting areas. If the prey habitat is left largely undisturbed, it may be possible to change some components without affecting the peregrine falcons.

Breeding peregrine falcons have demonstrated a certain degree of tolerance to mining activities, as discussed above. However, they are still susceptible to disturbance during the breeding season, especially during nest initiation (when breeding pairs are more likely to abandon a nest site) and late nestling stages (when nestlings are susceptible to premature nest departure). Based on the results of previous published studies, and based on the results of the 2008 bulk sample monitoring program, 500 m buffer zones are suggested to minimize disturbance, to be adjusted on a nest-specific basis, according to the site-specific management plan. Peregrine falcons are also protected by the Government of Nunavut's *Wildlife Act* which sets further regulations and guidelines designed to minimize disturbance to these birds. This information was incorporated into the mitigation and management planning process.

4.5.2 Assessment of Residual Effects (No Change)

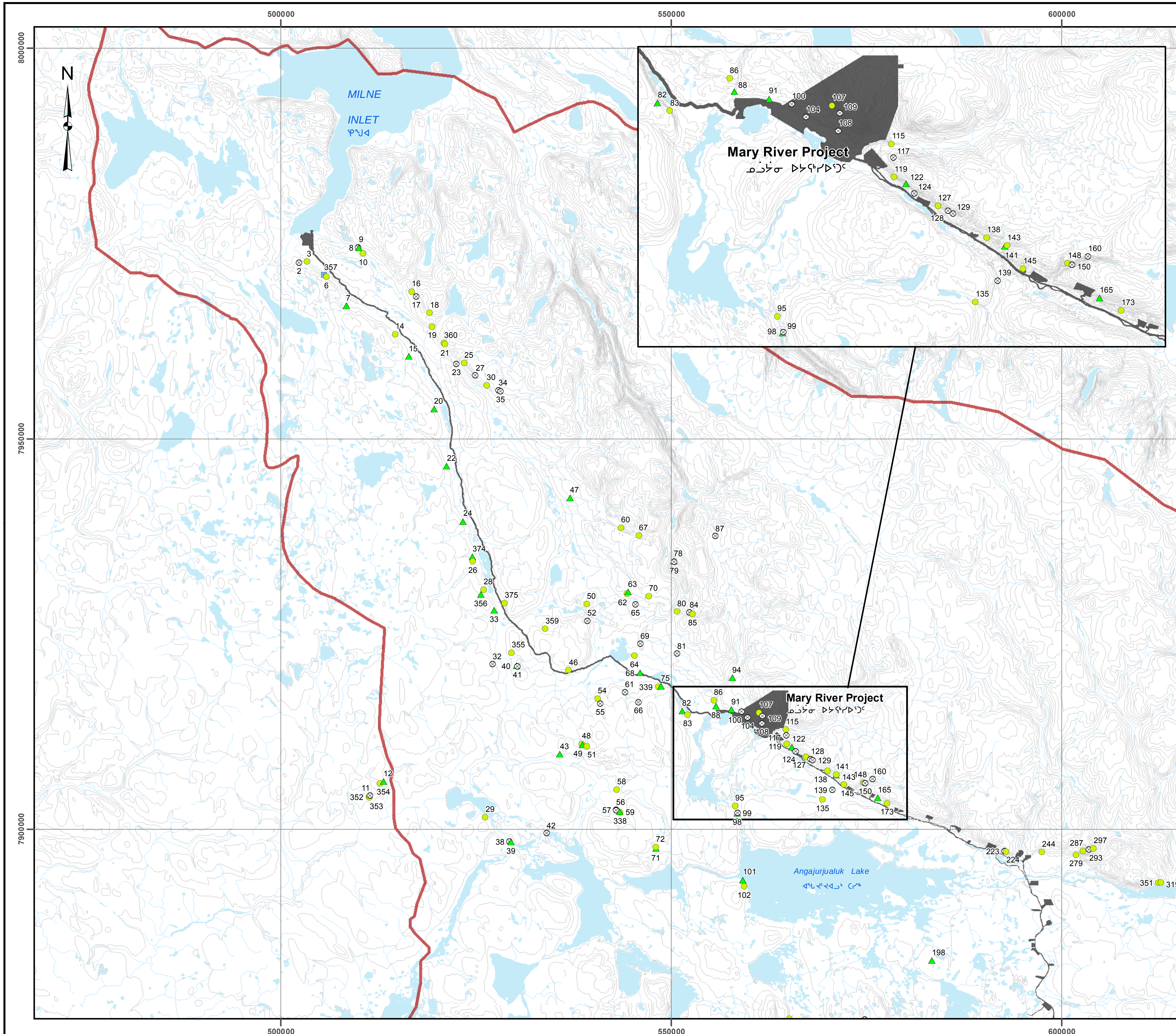
Table 6-4.6 Residual Effects Assessment Summary: Peregrine Falcon (No Change)

4.5.3 Prediction Confidence (Change)

The level of confidence of the assessment is high based on the analyses of a large database gathered during several years of field work, particularly the occupancy and productivity surveys conducted in 2011 and 2012 (EDI 2013). The effects assessment was also based on discussions with local research agencies, the gathering of IQ knowledge, and the examination of results from previous mining projects in northern Canada. The degree of prediction confidence for the 2006–2011 bird data is considered high and the likelihood of a significant effect on peregrine falcons is considered low. Confidence is based:

- A high degree of confidence in the data collected during four years of baseline studies, using standardized aerial survey methods;
- A high degree of confidence in the data analyses, consistent with other bird studies; and
- A high degree of survey coverage (100 %) of suitable terrestrial habitats within ~5 km of Project infrastructure, and continued monitoring and research in 2011 and 2012 since completion of the baseline studies in 2008.

4.5.4 Follow-up (No Change)



LEGEND

Species / nest occupancy

- Common raven
- Gyr falcon
- Peregrine falcon
- Rough-legged hawk
- Unoccupied
- Not visited
- Topographic contour (20m interval)
- Potential Development Area
- Regional Study Area

NOTES

Map Projection: North American Datum UTM Zone 17N.

Updated PDA provided by Hatch (25 April 2013).

This document is not an official land survey and the spatial data presented is subject to change without notice.

0 2.5 5 10 15 20 25 Km

Baffinland Iron Mines Corporation

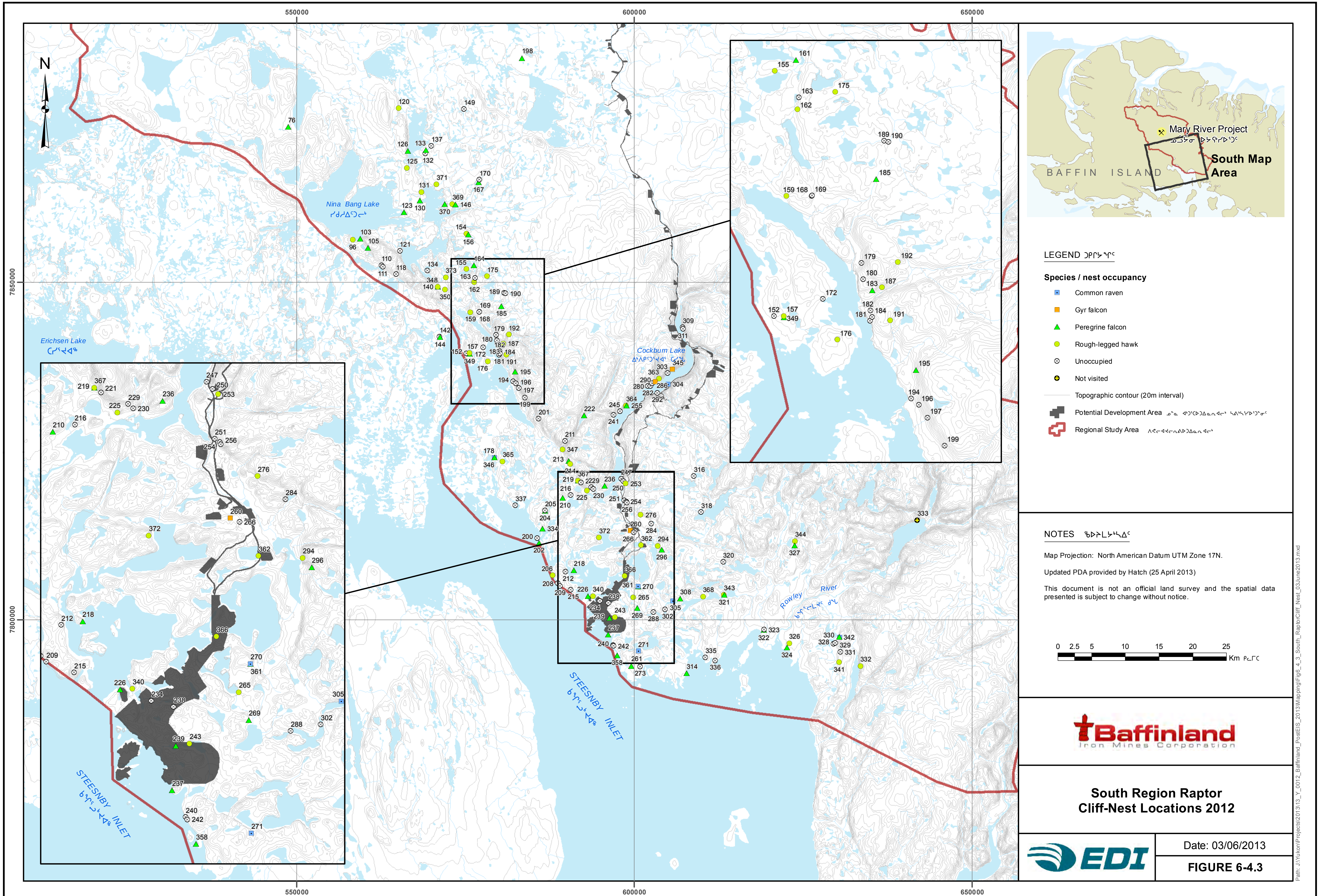
North Region Raptor Cliff-Nest Locations 2012

EDI

Date: 03/06/2013

FIGURE 6-4.2

Path: J:\Yukon\Projects\2013\13_Y_0012_Baffinland_PostEIS_2013\Mapping\Fig6_4_2_North_RaptorCliff_Nest_03June2013.mxd


South Region Raptor
Cliff-Nest Locations 2012
Date: 03/06/2013
FIGURE 6-4.3
Baffinland
Iron Mines Corporation
EDI
LEGEND
Species / nest occupancy
Common raven
Gyr falcon
Peregrine falcon
Rough-legged hawk
Unoccupied
Not visited
Topographic contour (20m interval)
Potential Development Area
Regional Study Area
NOTES
Map Projection: North American Datum UTM Zone 17N.
Updated PDA provided by Hatch (25 April 2013)
This document is not an official land survey and the spatial data presented is subject to change without notice.
0 2.5 5 10 15 20 25 Km
Mary River Project
South Map Area
BAFFIN ISLAND
Nina Bang Lake
Erichsen Lake
Cockburn Lake
STEESNBY INLET
Rowley River
550000
600000
650000
7850000
7800000
N

4.6 SNOW GOOSE (CHANGE)

4.6.1 Potential Effects and Proposed Mitigation (Change)

Issue 1 — Habitat (Change)

During the breeding season, a relatively small number of snow geese appear to nest within the bulk of the terrestrial RSA and these are mostly concentrated in well-vegetated lowland areas, often around small to mid-sized water bodies and/or wetlands. A breeding colony has never been located within the RSA or within the zone of influence of air traffic.

The effects assessment using habitat suitability modeling for snow goose within the terrestrial RSA indicated that there could be effects within 28 km² and 554 km² of high and medium quality habitat, respectively (Table 6-4.7). This equates to 2.4 % of the baseline high value habitat and 2.1 % of the total medium value habitat. Because habitat effectiveness is reduced as a result of direct loss to the Project footprint, and reduced effectiveness within a zone of influence due to sensory disturbances, there is an associated increase in nil and low quality habitats.

Table 6-4.7 Change in Effectiveness of Snow Goose Nesting and Foraging Habitat within the RSA (Change)

Habitat Rating	Baseline Conditions		Change due to PDA and ZOI (km²)		Post-development Conditions	
	Area (km²)[1]	% RSA	Area (km²)	% RSA	Area (km²)	% RSA
High	1,187	3.9 %	-28	0.1 %	1,159	3.8 %
Medium	25,897	84.7 %	-554	1.8 %	25,343	82.9 %
Low	3,326	10.9 %	461	1.5 %	3,787	12.4 %
Nil	152	0.5 %	121	0.4 %	273	0.9 %

Note(s):
1. Total area in RSA = 30,711 km². 150 km² was not included in the ELC model.
2. Habitat suitability values were classed as: nil (0–5), low (5.1–25), moderate (25.1–75), and high (75.1–100).

Milne Port and Milne Inlet Tote Road (Change)

Snow geese nest and moult in the Milne Port and Milne Inlet Tote Road areas where there will be some direct habitat loss due to Project components and activities. Shipping through Milne Inlet and Eclipse Sound is not expected to interact with moulting snow geese, as they tend to congregate inland.

Mine Site (No Change)

Issue 2 — Mortality (No Change)

Issue 3 — Health (No Change)

Mitigation (No Change)

4.6.2 Assessment of Residual Effects (No Change)

Table 6-4.8 Residual Effects Assessment Summary: Snow Goose (No Change)

4.6.3 Prediction Confidence (No Change)

4.6.4 Follow-Up (No Change)

4.7 COMMON AND KING EIDER (CHANGE)

4.7.1 Potential Effects and Proposed Mitigation (Change)

Issue 1 — Habitat (Change)

Hundreds of common and king eider use the areas of the two proposed port sites as stop-overs during spring and fall migrations, and dozens of female eiders were seen raising young in the marine waters of Steensby Inlet. No large nesting colonies of common eider were located along the shorelines of Steensby Inlet or Milne Inlet during any of the baseline surveys. Nesting by king eider was observed along inland freshwater bodies (total of four nests located) and was reported for common eider along the coastline of Milne Inlet (total of three nests). These birds may be displaced from coastal and terrestrial habitats used for staging, nesting, foraging, and brood-rearing by port construction at Milne Inlet, and/or by sensory disturbances in habitats adjacent to the Project footprint during construction, operation, and closure activities. Disturbed eiders may abandon traditional nesting and foraging areas; however, it is predicted that they will simply move to less disrupted, seemingly suitable habitat, located as close as within 1 km of the zone of disturbance, which will include both the port footprint areas and the turning radius of the ore carriers. Aerial and ground surveys conducted from 2006–2008 indicated that there is an abundant supply of suitable coastal habitat (common eider) and inland tundra (king eider) nearby for these species to move to. Although it is possible that during the first year of construction individual displaced birds may be forced to forego breeding for a single year as they spend time seeking out and establishing themselves in new breeding habitats, they will be able to move quickly to nearby habitat. Therefore, displacement of eiders to nearby areas from the relatively small footprint and zones of influence will have little to no effect on their migratory behaviour and nesting success during all three phases of the Project.

A habitat suitability map for common and king eider nesting and foraging habitat was developed for the RSA based on Ecological Land Classification Modeling (see the Bird Baseline report in Appendix 6E of the Approved Project's FEIS). Based on an effects assessment of those data, there could be a loss of 433 km^2 of high quality habitat within the RSA (Table 6-4.9), or equivalent to 2.1 %. Since habitat effectiveness is reduced as a result of direct loss to the Project footprint, and reduced effectiveness within a zone of influence due to sensory disturbances, there is an associated increase in lower quality habitats.

The habitat suitability model created for eiders combined the habitat preferences of king eider (typically inland on Arctic tundra, often along freshwater lakes and ponds (Suydam 2000)) with the habitat preferences of common eider (usually closely tied to marine habitats, coastal islands or islets (Goudie *et al*. 2000)). This resulted in a substantial portion of the RSA being identified as high value habitat for eiders. The model may somewhat overestimate the amount of high value habitat present within the RSA; however, the percent of the eider habitat is expected to be relatively low in comparison to the available habitat.

Table 6-4.9 Change in Effectiveness of Eider Nesting and Foraging Habitat within the RSA (Change)

Habitat Rating	Baseline Conditions		Change due to PDA and ZOI (km²)		Post-development Conditions	
	Area (km²)[1]	% RSA	Area (km²)	% RSA	Area (km²)	% RSA
High	20,284	66.4 %	-433	-1.4 %	19,851	65.0 %
Medium	920	3.0 %	187	0.6 %	1,107	3.6 %
Low	9,263	30.3 %	126	0.4 %	9,389	30.7 %
Nil	94	0.3 %	121	0.4 %	215	0.7 %

Note(s):

1. Total area in RSA = 30,711 km². 151 km² was not included in the ELC model.
2. Habitat suitability values were classed as: nil (0–5), low (5.1–25), moderate (25.1–75), and high (75.1–100).

Issue 2 — Mortality (No Change)

Issue 3 – Health (No Change)

Mitigation (No Change)

4.7.2 Assessment of Residual Effects (No Change)

Table 6-4.10 Residual Effects Assessment Summary (Terrestrial RSA): Common and King Eider (No Change)

4.7.3 Prediction Confidence (No Change)

4.7.4 Follow-up (Change)

Nest searches will be conducted at the port sites during the eider nesting season in 2013 prior to any clearing of land. Nest site mitigation (no disturbance buffers as suggested by EC-CWS) will be implemented if active nests are found. Baffinland will also conduct shoreline foraging and nesting habitat surveys along portions of the Milne Inlet shoreline near the port that may be subject to wake activity, similar to those conducted in Steensby Inlet in 2012 (EDI 2013).

4.8 RED-THROATED LOON (CHANGE)

4.8.1 Potential Effects and Proposed Mitigation (Change)

Issue 1 — Habitat

Red-throated loon nests were found near marine coastlines in the Milne Port areas and on freshwater bodies throughout the LSA that will be affected by the construction of Project facilities. Loons were also seen foraging and raising young throughout the RSA. During baseline studies, a habitat suitability map for red-throated loon nesting and foraging habitat was developed for the RSA based on Ecological Land Classification Modeling (See the Approved Project's FEIS, Appendix 6E).

Loons may be displaced by port construction and/or disrupted by noise disturbances during construction, operation, and closure activities. The potential effects of sensory disturbance may be the abandonment of traditional nesting and foraging areas; this may persist during Construction, Operation, and Closure Phases, then decline shortly into post-closure. Based on 2006–2008 baseline studies around the Mary River exploration camp, loons will likely move 300–500 m to less disruptive habitat. Baseline surveys also indicated that there is an abundant supply of nearby suitable habitat within the RSA. Therefore, displacement of loons from the ZOI to nearby areas should have little to no effect on their nesting success during the life of the Project.

Within the RSA there could be effects on 111 km² (1.89 %) of high quality habitat (**Table 6-4.11**). Because habitat effectiveness is reduced as a result of direct loss to the Project footprint, and reduced effectiveness within a zone of influence due to sensory disturbances, there is an associated increase in nil, low and medium quality habitat.

Table 6-4.11 Change in Effectiveness of Red-throated Loon Habitat within the Terrestrial RSA (Change)

Habitat Rating	Baseline Conditions		Change due to PDA and ZOI (km²)		Post-development Conditions	
	Area (km²)[1]	% RSA	Area (km²)	Area (km²)[1]	% RSA	% RSA
High	5,893	19.3 %	-111	-0.4 %	5,783	18.9 %
Medium	1,546	5.1 %	21	0.1 %	1,567	5.1 %
Low	9,187	30.1 %	22	0.1 %	9,209	30.1 %
Nil	13,935	45.6 %	68	0.2 %	14,003	45.8 %

Note(s):
1. Total area in RSA = 30,711 km². 151 km² was not included in the ELC model.
2. Habitat suitability values were classed as: nil (0–5), low (5.1–25), moderate (25.1–75), and high (75.1–100).

Milne Port and Milne Inlet Tote Road — Noise from vessel and port operations and vehicle traffic may disturb loons; however, the birds were identified in relatively low densities, and high value habitats are limited. Displacement of birds from a small amount of habitat relative to the total available habitat is assessed as not significant along the road corridor. In 2008, six pairs of loons successfully raised young in water bodies within 300 m of the Tote Road during the bulk sample operation when traffic was present.

Mine Site — Noise from mining activities, aircraft and vehicle traffic are likely to result in sensory disturbance that will result in decreased use of loon habitats adjacent to the Project footprint. Monitoring during the bulk sampling program suggests that the distance over which this disturbance takes place is generally limited to 300 m. Disturbance could cause loons to abandon the areas directly adjacent to the mine and force them to move to other areas, such as suitable habitat areas nearby to the west. A pair of red-throated loons and a pair of yellow-billed loons nested on Sheardown Lake, which is 500 m from the current runway at the Mary River Camp and approximately 3 km from Deposit No. 1 (although their nests were found to be depredated by gulls in each year of survey), and therefore the sensory disturbance effects on loons are expected to be low.

Issue 2 — Mortality (No Change)

Issue 3 – Health (No Change)

Mitigation (No change)

4.8.2 Assessment of Residual Effects (No Change)

4.8.3 Prediction Confidence (No Change)

4.8.4 Follow-Up (Change)

Although no follow-up monitoring was suggested in the Approved Project's FEIS, a roadside waterfowl survey was conducted in 2012, and another will be conducted in 2013 to determine the presence of breeding loons within the Tote Road and Milne Port ZOI.

Table 6-4.12 Residual Effects Assessment Summary: Red-throated Loon (No Change)

4.9 THICK-BILLED MURRE (CHANGE)

Issue 1 — Disturbance to Colonies and Migration (Change)

Thick-billed murre colonies or large feeding flocks were not identified around the shoreline and waters of Milne Inlet during field surveys, nor are any identified within this area in the regional literature. Therefore, no effects are expected in Milne Inlet during Project construction, operation, and closure.

Several thick-billed murre colonies were identified within the marine RSA, but the closest that ERP Project shipping traffic will come to a colony is where the route passes through Key Marine Habitat 15 — Cape Graham Moore at the southeastern tip of Bylot Island at the eastern entrance of Eclipse Sound, ~70 km northeast of Pond Inlet. The shipping route also passes Key Marine Habitat 21 — Cape Searle (Qaqulluit) and Reid Bay (Minarets; Akpait) on eastern Baffin Island, approximately 100 km southeast of Qikiqtarjuaq (Mallory and Fontaine 2004; Figure 6-4.4). Both of these Key Marine areas have associated large colonies of thick-billed murres. Approximately 30,000 murres nest about 7 km north of Cape Graham Moore, and the colony at Akpait, with >133,000 murre pairs, is one of the five largest colonies in Canada (Mallory and Fontaine 2004).

Although the proposed shipping route travels through Key Marine Habitat 15 near Cape Graham Moore, it will remain >12 km from the known colony. The shipping route does not intercept Key Marine Habitat 21 southeast of Qikiqtarjuaq. There is no information to suggest that ships passing at distances > 5 km will disturb nesting thick-billed murres (Chardine and Mendenhall 1998).

Ships will pass through waters that are on the migration route of thick-billed murres travelling south. The adult and young birds are flightless and may not be able to avoid oncoming ship traffic.

Issue 2 — Chronic Contaminant Release (No Change)

4.9.1 Potential Effects and Proposed Mitigations (No Change)

4.9.2 Assessment of Residual Effects (No Change)

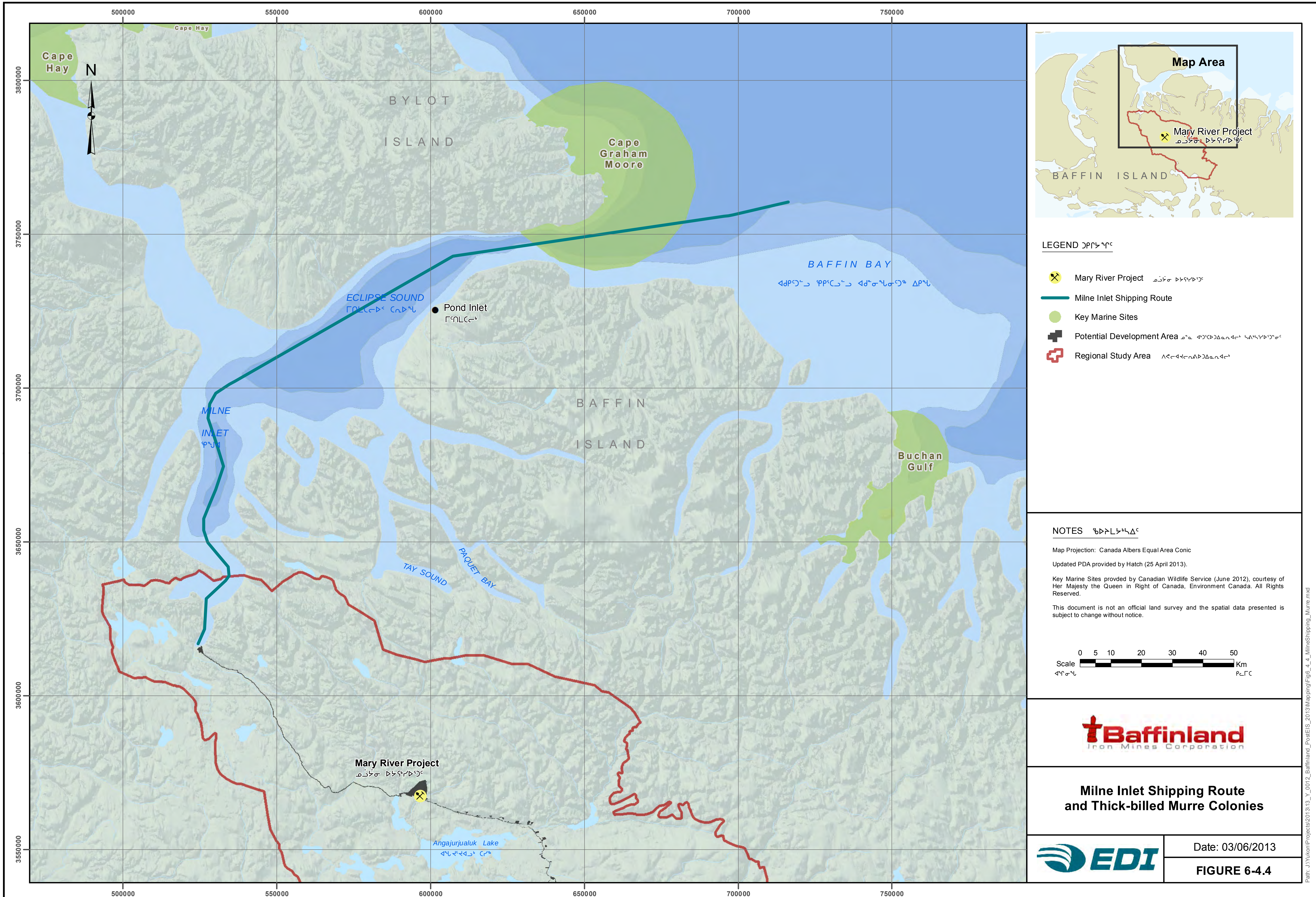
4.9.3 Prediction Confidence (No Change)

4.9.4 Follow-up (No Change)

Table 6-4.13 Residual Effects Assessment Summary: Thick-billed Murre (No Change)

4.10 LAPLAND LONGSPUR (NO CHANGE)

4.10.1 Potential Effects and Proposed Mitigation (No Change)



Milne Inlet Shipping Route and Thick-billed Murre Colonies

FIGURE 6-4.4

Table 6-4.14 Predicted Change in Lapland Longspur Densities within the Terrestrial RSA (No Change)

4.10.2 Assessment of Residual Effects (No Change)

4.10.3 Prediction Confidence (No Change)

Table 6-4.15 Residual Effects Assessment Summary: Lapland Longspur (No Change)

4.10.4 Follow-Up (No Change)

4.11 SPECIES AT RISK (NO CHANGE)

4.11.1 Harlequin Duck (No Change)

Figure 6-4.4 Species at Risk Observations, Mary River Project RSA (No Change)

4.11.2 Ross's and Ivory Gulls (No Change)

4.11.3 Red Knot (No Change)

4.11.4 Short-eared Owl (No Change)

4.11.5 Assessment of Residual Effects (No Change)

4.12 ADDITIONAL SUBJECTS OF NOTE (NO CHANGE)

4.12.1 General Mitigation Measures for all Bird Species (No Change)

4.12.2 Nest Management Plan (No Change)

Table 6-4.16 Recommended Setback Distances for Activity near Bird Nests (No Change)

4.12.3 Important Habitat Areas (No Change)

4.12.4 Seabirds and Seabird Colonies (No Change)

4.12.5 Potential Increase in Predation Due to Project Development (No Change)

4.12.6 Bird Collision Risk with Communication Towers, Tall Structure and Overhead Wires (No Change)

4.12.7 Impact of Aircraft Disturbance on Staging, Nesting and Moulting Birds (No Change)

4.12.8 Impact of Wake on Coastal Foraging and Nesting Habitat (No Change)

Figure 6-4.5 Conservation Areas, Important Bird Areas (IBAs) and Key Habitat Sites (No Change)

Figure 6-4.6 Airstrip Zone of Influence with Snow Goose Breeding Colonies and Moulting Areas (No Change)

4.13 IMPACT STATEMENTS (NO CHANGE)

4.13.1 Peregrine Falcon (No Change)

4.13.2 Snow Goose (No Change)

4.13.3 Common and King Eider (No Change)

4.13.4 Red-throated Loon (No Change)

4.13.5 Thick-billed Murres (No Change)

4.13.6 Lapland Longspur (No Change)

4.14 AUTHORS (NO CHANGE)

SECTION 5.0 - TERRESTRIAL WILDLIFE AND HABITAT (CHANGE)

5.1 ISSUES SCOPING (NO CHANGE)

5.2 CARIBOU (CHANGE)

5.2.1 Assessment Methods (Change)

The magnitudes of the effects were determined relative to the scale of occurrence within either the RSA or within the range of the north Baffin Island caribou herd. The RSA was identified to ensure that the range of direct and indirect potential disturbances as a result of the Project's activities could be examined and potential effects could be spatially quantified. The RSA was chosen to represent wildlife and habitat at an ecologically relevant scale and to reflect regional habitat use and seasonal movement patterns on north Baffin Island. The RSA also had to be a reasonable size so that surveys and information could be gathered in an economical fashion and provide information that is directly relevant to Project management and mitigation. The 21,053 km² RSA was described in the Terrestrial Wildlife Baseline Report (Approved Project's FEIS Appendix 6F). The range of the north Baffin Island caribou herd encompasses an area from south of the Barnes Ice cap, extending north along the southern coast to the southern Brodeur Peninsula, and inland to east of Pond Inlet. Caribou are known to exist throughout this region, and effects on caribou as a result of the Project are assessed within the entire range. The maximum extent of the north Baffin Island caribou range is estimated at 134,308 km² (Figure 6-5.1). Residual effects assessments and the overall effects summary are described in the context of the north Baffin herd — the caribou population that interacts with the Project.

Thresholds and Adaptive Management (Change)

Thresholds are specified limits of acceptable change to measurable parameters, beyond which adaptive management is implemented (Hegmann *et al*,. 1999; AXYS 2001). Table 6-5.1 lists the upper threshold limits that have been proposed for this Project's caribou KIs and their respective potential effects and measurable parameters.

Adaptive management plans are implemented when unexpected effects are observed or if effects are larger than predicted and exceed specified thresholds. This assessment proposes three threshold levels (≤10 %, >10–25 %, and >25 % change; see Table 6-4.3) for measurable parameters that will serve as triggers for adaptive management. Based on data from the 2006–2008 baseline studies and a review of mitigation plans used at other similar northern projects (e.g., Snap Lake Diamond Mine (De Beers 2004), Diavik Diamond Mines (Diavik 2005), Doris North proposed gold mine (Miramar 2005), EKATI™ Diamond Mine (Rescan 2005), Jericho Diamond Mine (Golder 2005), High Lake Base Metals Mine (Wolfden Resources 2006), the upper threshold level for changes in abundance was set at 25 %. This assessment predicts that effects on caribou within the LSA will be negligible, and therefore, adverse changes to the populations beyond 25 % are highly unlikely. However, if changes beyond 25 % are recorded, and are linked to Project activities (i.e., equal and simultaneous change are not observed in nearby control sites), then an immediate cessation of all Project activities in the affected area(s) between mid-May and October will be implemented while a full review of previously prescribed mitigation measures is conducted for the species that has experienced a Level III change in abundance.

Habitat (Change)

To assess the predicted effects of the Project on caribou habitat, studies were reviewed of the effects of industrial activities on the use of habitat by caribou. The findings of the review were used to predict changes in the probability of caribou using habitat within the RSA or within the range of the north Baffin Island caribou herd.

For comparisons within the RSA, changes to the resource selection probability function (RSPF) that was developed for the terrestrial wildlife baseline report (Approved Project's FEIS Appendix 6F) was used. The model was used to quantify the probability of caribou using habitats within the their seasonal range during the winter, calving, and summer (growing) seasons and to predict the direct and indirect effects of mine activity on caribou habitat effectiveness. The RSPF modeling was limited to the extent of the collared information, but the data were extrapolated to model the probability of habitat use across their entire historical range.

Figure 6-5.1 Regional Study Area and Range of North Baffin Island Caribou Herd (No Change)

Direct habitat effects were quantified by assuming that the habitat within the footprint of the mine will become unavailable to caribou (i.e., the probability of finding caribou within the PDA is reduced to 0). Indirect effects were more difficult to predict because the zone of influence (ZOI) from the Project infrastructure and activities is often specific to the type of activity (*e.g.*, oil and gas compared to mining) and location of the activity (*e.g.*, forest compared to tundra).

The ZOI for the rail and port sites were determined to be smaller than the ZOI of the Tote Road and the Mine Site. Reduced caribou use of areas near industrial sites from has generally been documented at distances ranging from 1–14 km (Table 6-5.1). The reason for the difference lies in a recent article that documents a 14 km ZOI around the EKATI™ and Diavik mine sites in the Northwest Territories (Boulanger *et al*. 2012).

The authors suspected that one of the main mechanisms causing the observed ZOI is dust deposition. Dust may be generated from trucking on the Tote Road and the mining activity at the Mine Site; however, the train will not generate significant dust along the Railway and the port facility will only generate minimal dust. Consequently, dust generation along the road will be reduced compared to the Mine Site.

Predicted indirect habitat effects using the RSPF habitat model were qualified by reducing the probability of observing caribou within each of the pixels. Indirect effects of the Tote Road and Mine Site were predicted by multiplying RSPF values within 0–3.5 km, 3.5–7.0 km, >7.0–10.5 km, and >10.5–14 km by 0.30, 0.40, 0.60, and 0.80, respectively (Table 6-5.1). Indirect effects of the Railway and Milne and Steensby Ports were predicted by multiplying RSPF values within 0–2 km, >2–4 km, and >4–14 km from the PDA by 0.25, 0.75, and 0.90, respectively (Table 6-5.1, Figure 6-5.2). The RSPF values beyond 14 km of the PDA were assumed to be unaffected, so RSPF values remained unchanged. The combined area of the ZOI (including waterbodies) of the Project is 7,696 km² (37 % of the 21,053 km² RSA, and 5.7 % of the 134,308 km² north Baffin Island caribou range).

To determine the magnitude of effect, analysts compared the summed RSPF values within the RSA and across the entire range pre-disturbance and post-disturbance. The overall magnitude of effect was determined at the scale of the north Baffin Island caribou range (i.e., % difference in pre-disturbance and post-disturbance values). Cows and calves during and after the calving period are most sensitive to human disturbances. Collared north Baffin caribou cows show high fidelity to calving sites (Approved Project FEIS Appendix 6F). The effect of the Project on calving caribou is assessed by determining the proportion of collared cows that calved in the ZOI and, would therefore, be affected by disturbance. Collared caribou are assumed to be representative of the north Baffin caribou herd; therefore, the proportion of known calving sites within and outside the ZOI is considered representative of north Baffin caribou.

Table 6-5.1 Summary of the Factor used to Reduce RSPF Values with Distances from Project Infrastructure (Change)

Project Area	Zone of Influence (ZOI)	Habitat Selection Multiplier	Calving season multiplier	Subspecies or Herd	Source of Information
All	PDA	0.00	0.00	na	na
Steensby Port, Milne Port, Railway	>PDA–2.0 km	0.25	0.125	Central Arctic herd (Alaska), woodland (Alberta)	Cameron *et al*. 1992; Dyer *et al.* 2001
	>2.0–4.0 km	0.75	0.375	Woodland (Newfoundland), central Arctic herd, reindeer (Norway)	Weir *et al*. 2007; Cameron *et al*. 2005; Vistnes and Nellemann 2001
	>4.0–14.0 km	0.90	0.45	Woodland (Ontario)	Vors *et al*. 2007; Mayor *et al*. 2007; 2009
Milne Inlet Tote Road, Mine Site	>PDA–3.5 km	0.30	0.15	Bathurst herd	Boulanger *et al.* 2012
	>3.5–7.0 km	0.40	0.20	Bathurst herd	Boulanger *et al.* 2012
	>7.0–10.5 km	0.60	0.30	Bathurst herd	Boulanger *et al.* 2012
	>10.5–14 km	0.80	0.40	Bathurst herd	Boulanger *et al.* 2012
All	>14.0 km	1.00	1.00	na	Vors *et al.* 2007; Mayor *et al*. 2007; 2009; Boulanger *et al.* 2012

Movement (No Change)

Mortality (No Change)

Health (No Change)

Overall Project Effect (No Change)

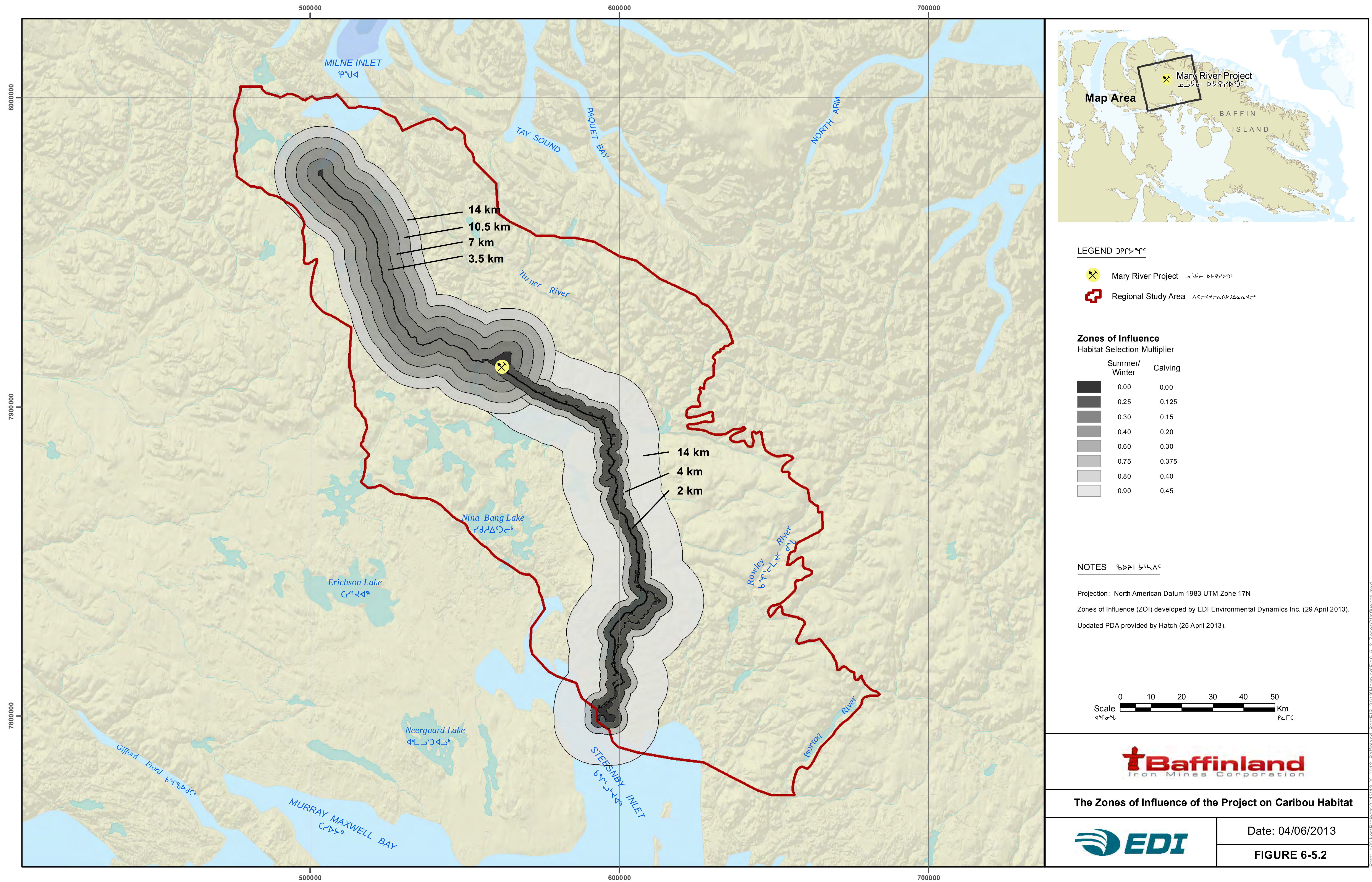


FIGURE 6-5.2 The Zones of Influence of the Project on Caribou Habitat

Figure 6-5.3 Key Caribou Movement from IQ and Aerial Surveys (No Change)

5.2.2 Potential Effects and Proposed Mitigation (Change)

Habitat

Caribou habitat effectiveness can be reduced by 2.07 %, 3.55 % and 4.25 % across the north Baffin Island caribou range during the calving, growing and winter seasons, (Table 6-5.2; Figures 6-5.4 to 6-5.6). Most north Baffin caribou yearly ranges are generally relatively small and all caribou exhibit movement patterns more similar to those of sedentary caribou (Approved Project's FEIS Appendix 6F, Figure 14). Caribou do not show predictable long distance movements during any season.

Project mitigations to reduce effects on habitat loss include reclamation of disturbed areas post-construction and operation to reduce the direct loss of habitat; dust suppression around the Mine Site, Tote Road, and Milne Inlet; and limiting potential sensory disturbances to only those reasonably required for mining activities.

Table 6-5.2 Change in Effectiveness of Caribou Habitat within the RSA for the ERP and Approved Project (Change)

Season	Baseline Sum of Probabilities – North Baffin	Baseline Sum of Probabilities – RSA	Loss to ZOI	% Diff. in RSA	% Diff. in North Baffin
Calving	2,310,306	387,006	-47,930	-12.4 %	-2.1 %
Growing	6,372,250	1,042,060	-226,003	-21.7 %	-3.6 %
Winter	4,741,184	828,562	-201,445	-24.3 %	-4.2 %

Note(s):
1. Values shown are the sum of all pixel values (probability of caribou using the habitat) within the RSA for each season.

Calving dates were identified by visually estimating plots of caribou movement looking for reduced movements associated with calving (Approved Project's FEIS Appendix 6F). Calving sites were defined by creating minimum convex polygons from calving caribou collar data using the estimated calving dates plus ten days post-calving. None of the identified calving sites overlap with the PDA. Ten of 39 collared caribou appears to have calved within the 14 km ZOI (Table 6-5.3, Figure 6-5.7). Assuming that collared caribou are representative of north Baffin caribou, 25.6 % of the caribou calved within the ZOI.

Table 6-5.3 Yearly location of known calving sites relative to PDA and ZOI for each collared female caribou (No Change)

The variation in calving locations shown by some caribou suggests that alternative and suitable calving sites exist throughout most of the area, and the low abundance of caribou means there is limited competition of calving habitat; therefore, caribou that calved within the ZOI could use alternative calving locations if this area becomes less desirable because of human activity. However, there is a strong indication that north Baffin collared caribou use the same calving sites in consecutive years — 67 % of collared caribou calved in the same location. While the collar data is the best available data for north Baffin caribou and is assumed to be representative of the north Baffin caribou, it does not show all caribou calving sites. North Baffin caribou are assumed to calve in other areas that contain suitable habitat throughout the region. The calving sites identified using collar data identify those where monitoring effort can initially be focused.

The DIAND Caribou Protection Measures are intended to mitigate human impacts on the large migratory caribou herds. The Caribou Protection Measures identify known calving grounds as “Caribou Protection Areas” and provide protection of these areas from human disturbance during the 15 May–15 July calving period. No designated Caribou Protection Areas exist within the Terrestrial Wildlife RSA. There are no known caribou calving grounds where caribou form large calving groups within the north Baffin caribou herd range. The 2008–2011 collar data clearly show that caribou are dispersed across suitable habitat within the herd’s range, and that individual animals generally return to calve in similar sites each year. Given that calving caribou are dispersed throughout the RSA and no Caribou Protection Areas exist within the terrestrial wildlife RSA, the DIAND Caribou Protection Measures do not directly apply to the Project area. Nevertheless, Baffinland will mitigate effects by minimizing disturbance to calving caribou during the calving period identified in the DIAND Caribou Protection measures. Calving caribou are predicted to avoid calving near disturbance, so disturbances that occur prior to the calving season should cause caribou to avoid those disturbances, and choose an alternate site. Based on the collar data and the habitat model there appears to be an abundance of alternative calving areas. Potential Project effects on calving caribou will be mitigated through planning construction locations and activities prior to the calving season and maintaining those disturbances through the season. No large changes to location or magnitude of construction and operation will occur during 15 May–15 July, unless the change is to reduce disturbance for the remainder of the calving period.

The greatest disturbance to calving caribou will be associated with railway construction. Baffinland will partially mitigate this disturbance by planning construction activities to minimize disturbance around the Cockburn Lake area — the location of most calving sites. Activities at the Mine Site and Steensby port facility will be continuous, and few mitigation measures are available at these sites to limit disturbance. Only one known calving site occurs within the ZOI of the Mine Site, and no known calving sites occur within the ZOI of the port. To partially mitigate the impact of mining activity, Baffinland will not increase mine construction or operational activity during the 15 May–15 July calving season identified in the Caribou Protection Measures.

After mitigation, the Project is expected to have a not significant effect on calving caribou due to of human disturbance. Collar data and IQ indicates calving in more rugged areas north and east of the Mine Site, and the area around Cockburn Lake. The documented calving sites in the vicinity of Cockburn Lake are the mostly likely to be affected by construction and operation activity for the Approved Project. There is a small possibility of caribou calving near the Mine Site and Tote Road, components of the ERP Project.

LEGEND

- Mary River Project
- Potential Development Area

Caribou Winter Habitat Selection Probability

High Probability (0.48)

Low Probability (0.00)

Zones of Influence Habitat Selection Multiplier

0.125
0.15
0.20
0.30
0.375
0.40
0.45

NOTES

Map Projection: Canada Albers Equal Area Conic.

Updated PDA provided by Hatch (25 April 2013).

Ferguson, M. 1989. Baffin caribou. Pp. 142 in Hall, E. (ed). People and caribou in the Northwest Territories. Department of Renewable Resources, Government of the Northwest Territories. Yellowknife, NT. 190 pp.

This document is not an official land survey and the spatial data presented is subject to change without notice.

Scale 0 10 20 40 60 80 100 Km

Baffinland Iron Mines Corporation

Caribou Habitat Selection Probability During the Calving Season

EDI

Date: 04/06/2013

FIGURE 6-5.4

Whitehorse, YT: J:\Yukon\Projects\2013\13_Y_0012_Baffinland_PostEIS_2013\Mapping\Fig6_5_4_RSPF_Caribou_Calving.mxd

LEGEND

Mary River Project

Potential Development Area

Caribou Winter Habitat Selection Probability

High Probability (0.26)

Low Probability (0.00)

Zones of Inluence Habitat Selection Multiplier

0.25
0.30
0.40
0.60
0.75
0.80
0.90

NOTES

Map Projection: Canada Albers Equal Area Conic.

Updated PDA provided by Hatch (25 April 2013).

Ferguson, M. 1989. Baffin caribou. Pp. 142 in Hall, E. (ed). People and caribou in the Northwest Territories. Department of Renewable Resources, Government of the Northwest Territories. Yellowknife, NT. 190 pp.

This document is not an official land survey and the spatial data presented is subject to change without notice.

Scale 0 10 20 40 60 80 100 Km

Baffinland Iron Mines Corporation

Caribou Habitat Selection Probability During the Summer Season

EDI

Date: 04/06/2013

FIGURE 6-5.5

Whitehorse, YT: J:\Yukon\Projects\2013\13_Y_0012_Baffinland_PostEIS_2013\Mapping\Fig6_5_5_RSPF_Caribou_Summer.mxd

LEGEND

- Mary River Project
- Potential Development Area

Caribou Winter Habitat Selection Probability

High Probability (0.45)

Low Probability (0.00)

Zones of Influence Habitat Selection Multiplier

0.25
0.30
0.40
0.60
0.75
0.80
0.90

NOTES

Map Projection: Canada Albers Equal Area Conic.

Updated PDA provided by Hatch (25 April 2013).

Ferguson, M. 1989. Baffin caribou. Pp. 142 in Hall, E. (ed). People and caribou in the Northwest Territories. Department of Renewable Resources, Government of the Northwest Territories. Yellowknife, NT. 190 pp.

This document is not an official land survey and the spatial data presented is subject to change without notice.

Scale 0 10 20 40 60 80 100 Km

Baffinland Iron Mines Corporation

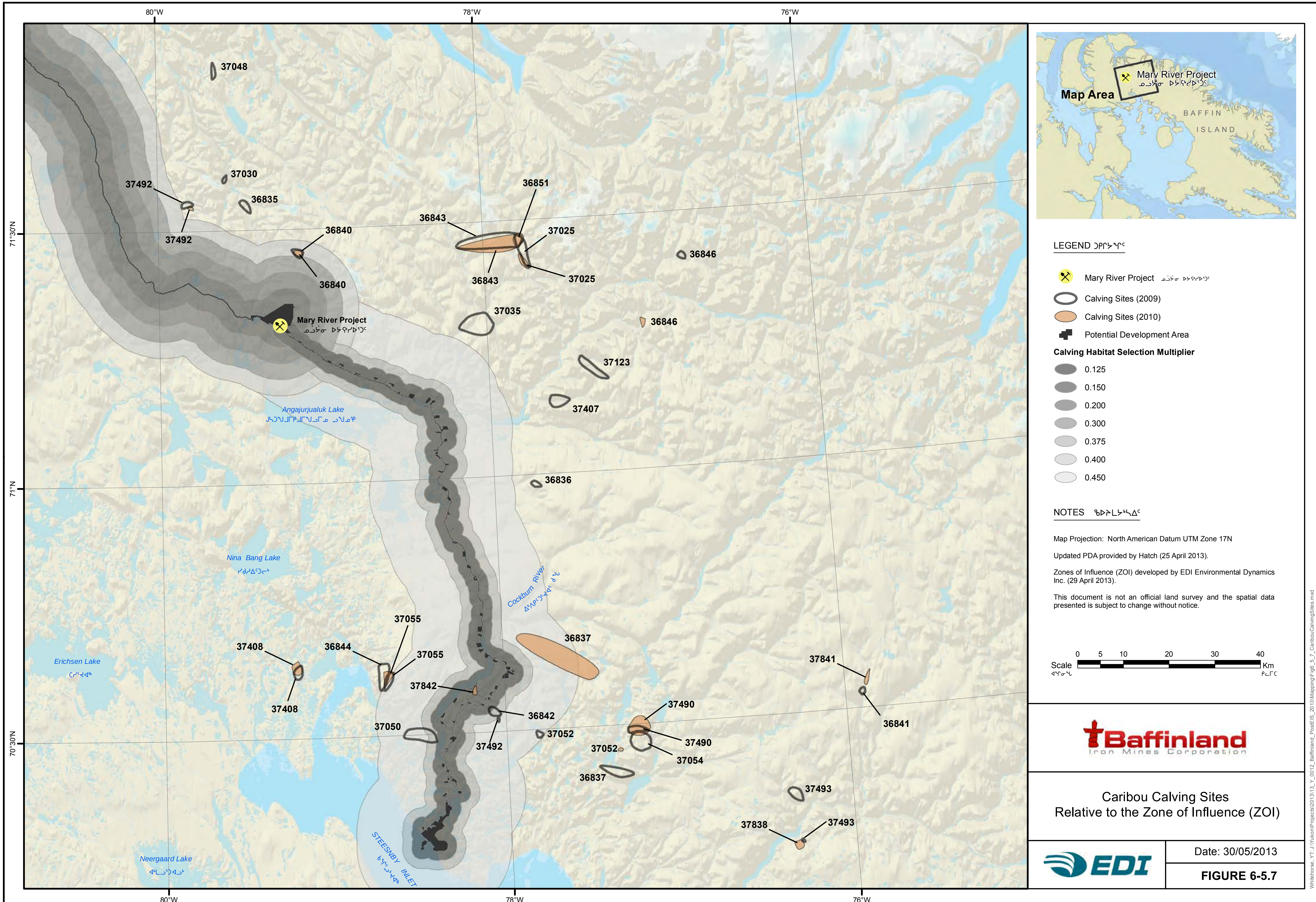
Caribou Habitat Selection Probability During the Winter Season

EDI

Date: 04/06/2013

FIGURE 6-5.6

Whitehorse, YT: J:\Yukon\Projects\2013\13_Y_0012_Baffinland_PostEIS_2013\Mapping\Fig6_5_6_RSPF_Caribou_Winter.mxd



Caribou Calving Sites
Relative to the Zone of Influence (ZOI)

Date: 30/05/2013

FIGURE 6-5.7

Movement (Change)

Literature regarding caribou movement (e.g., permeability, accessibility, barrier effect, etc.) is discussed in the context of roads or pipelines, and to a lesser extent, railways, but provides additional insight into transportation infrastructure effects on wildlife. Bergerud *et al*. (1984) looked at behaviour in eight different caribou herds that were exposed to industrial development or transportation corridors. They found that caribou are very resilient to human disturbance, and that seasonal movements and range habitation are a function of population size rather than to anthropogenic disturbance.

Snow management along the Tote Road will not result in a barrier to caribou movement during the winters. To avoid snow drifting on roads, Baffinland smoothes the snow piles on the edges of the roadways to reduce the probability of drifting, but that also mitigates snow embankments as a barrier to caribou movement. Snow accumulation along the road embankment will likely facilitate caribou movement across the landscape and reduce any barrier that was potentially caused by the embankment (e.g., snow will fill voids, and slopes will become more gradual).

In winter there is hard packed snow cover, which allows easy movement across the landscape. It is not anticipated that caribou will use the plowed road as a travel corridor, and there will be minimal risk of collision-related mortality

The mine and ports will not be significant barriers to caribou movement. Currently, the caribou within the region are non-migratory and it is not expected that migratory caribou will return to the area until the population begins to increase, perhaps first becoming apparent in the 2030s. The density of caribou in the region is low compared to numbers observed during the end of the twentieth century, so few caribou will come in contact with the mine infrastructure and they are not expected to be migratory.

When caribou migrate into the area again, the Project will be in the closure stage or in the final years of extraction. Effects to the movement of migratory caribou is possible; however, migratory caribou will not simply appear in the area; there will likely be a gradual increase in numbers across two or three decades, so monitoring of the non-migratory caribou and early migratory caribou during operation of the mine will provide some insight into potential mitigation requirements.

For a conservative approach in this assessment, it was estimated that traffic along the roadway during a normal day of mine operation would result in 200 passes at any point along the road. Assuming that trucks are an average of 35 m long and travel 50 km/h, then a caribou standing beside the road will be blocked from crossing by trucks for a total of 8 minutes 59 seconds. This corresponds to approximately 0.6 % of a normal operation day. If caribou will not cross the roadway 100 m before and after a truck passes, then the barrier affect increases to 4.2 % of a normal operation day. Other road maintenance and snow removal vehicles will also travel the route occasionally, but will not substantially increase the barrier.

Insects also play a role in caribou movement across transportation infrastructure. Caribou tend to move across roads/railways more frequently when insect harassment is high, essentially reducing the behavioural effect of the disturbance (Murphy and Curatolo 1987; Wolfe *et al*,. 2000). Effects on movement are also most pronounced in females and calves, suggesting further consideration for movement needs to be taken during times of calving and post-calving (Nellemann and Cameron 1996, 1998; Murphy and Curatolo 1987; Wolfe *et al*,. 2000; Klein 1971). Overall, the pertinent literature suggests that a range of caribou responses to the Railway are possible. By applying a precautionary approach and employing an adaptive management strategy, any negative impacts on caribou movement can be mitigated (Approved Project's FEIS Volume 10, Section 2.0).

No significant adverse effect to caribou movement across the roadway is anticipated because of trucks creating a barrier to movement. As caribou numbers increase, as is predicted by IQ and harvest data, monitoring of caribou movement across the roadway will be implemented.

Figure 6-5.8 Average, maximum and minimum mean monthly snow depth in the north Baffin region (MERRA climate data, 1979–2011) (No Change)

Figure 6-5.9 Number of days a rain-on-snow event or freezing rain occurred during fall months in the north Baffin region from 1979 to 2009 (MERRA climate data, 1979–2011) (No Change)

Table 6-5.4 Sections of the Railway That May Impede Caribou Movement (No Change)

Table 6-5.5 Trail-Specific Assessment of Potential Barriers to Movement along the Railway (No Change)

Table 6-5.6 Key and Broad Movement Areas and Railway Barrier Assessment (No Change)

Table 6-5.7 Estimate of Time That Railway Traffic Presents a Barrier to a Single Point Along the Rail Line (No Change)

Mortality (Change)

During the previous four years of exploration, there was no caribou mortality caused by Baffinland personnel or from Project activities. Wildlife are given the right-of-way; thus traffic controls are in place should caribou be observed on or near the road. On-site staff are restricted from harvesting wildlife. Garbage (as a potential attractant to scavengers) is incinerated and not stored on site.

In caribou ranges where railway infrastructure exists, the risk of mortality is greatest in the winter months when there is decreased light and visibility for the train conductor, when caribou are using the tracks for easier travel, or when are concentrated in groups on the rail line (Klein 1971; van der Grift 2001). Similarly, railway collisions with moose tend to increase with increasing snow depth and colder ambient temperatures (Gundersen *et al*,. 1998).

Smaller and younger caribou (i.e., calves, yearlings, and two year olds) moving to and from islands south of Steensby Inlet could have an increased risk of mortality from shipping traffic creating 'ice debris' making it more difficult to swim (Miller *et al*,. 2005); however, there is currently little to no use of these areas and mortality is expected to be negligible.

Caribou abundance is expected to remain low and migratory caribou are not expected to return to the area in the short-term. Currently, the caribou are in the trough (bottom) of a population cycle. Consequently, a very low probability of direct Project-related mortality is expected.

If caribou mortality were to increase as a direct result of the Project, the effects can be readily mitigated by increasing traffic controls on the Tote Road. The timing and duration can only be determined by repeated on-site observations of caribou behaviour as the Project proceeds through construction and operation. All mortalities will be reported and carcasses promptly removed from the Railway to prevent possible collisions with scavengers.

The Project's transportation infrastructure will not provide improved access to the RSA. Caribou harvest of the area is primarily a winter activity by hunters using snow machines. Snow machines will not benefit from the Tote Road. The ability of snow machines to access the RSA is dependent on snow cover, ice, and topography. Employment with Baffinland will improve local people's knowledge of the area. Most employees will be working at the Mine Site or the Milne Port facility where most of the mining and shipping activity will occur, so increased knowledge of the RSA will be primarily within these areas. Hunter access and knowledge of the RSA will not significantly change from baselines conditions, so no mitigations are required.

Health

Metals in soils and vegetation from aerial deposition potentially effecting caribou health is assessed in the Approved Project's FEIS Appendix 6G-2. In summary, caribou exposure to metals in soil and vegetation is expected to be low due to the relatively small area outside the various PDAs where dust deposition is predicted to be high enough to have an effect on plant/forage health. As a result, the likelihood of substantial increases in metals loading to caribou (and hence, to local people eating caribou), is predicted to be low.

The majority of north Baffin caribou will eventually interact with the Project's predicted ZOI (see Wildlife Baseline Report, Appendix 6F of the Approved Project's FEIS). A total of 22 different collared caribou had part of their home range within the ZOI. Of those 22, four individuals have parts of their home range within a detectable dust fall gradient, three of which had part of their range in the High Threshold zone (Table 6-5.8). The proportion of the ranges in the High Threshold zone varied form <0.01 to 0.3 %.

Mitigation of dust effects on forage food will be addressed by those measures used to mitigate effects on air quality as described in the Approved Project's FEIS Volume 5, Section 2. Potential effects of dust fall within the PDA are not considered further since vegetation removal is predicted for the entire PDA and is encompassed within the expected area of caribou habitat loss.

Table 6-5.8 Summary of predicted caribou exposure to annual dust deposition (TSP) within the ZOI (Change)

Collar ID	Location	Home/collar range			Home Range affected by annual dust deposition (TSP)			% in TSP zone
		Total (km^2)	Area in ZOI (km^2)	% in ZOI	Low (0–4.6 $g/m^2/yr$)	Moderate (>4.6–50 $g/m^2/yr$)	High (> 50 $g/m^2/yr$)	
36835	Mine site	7,566	1,411	18.6	155.7	89.1	21.7	3.5 %
36836	-	2,604	1,554	59.7	-	-	-	-
36837	Steensby Port	9,456	4,015	42.5	27.0	-	-	0.3 %
36840	Mine site	282	41	14.5	-	-	-	-
36841	Steensby Port	3,029	40	1.3	-	-	-	-
36842	Steensby Port	1,466	480	32.7	-	-	-	-
36843	Mine site	1,495	285	19.0	-	-	-	-
36844	Steensby Port	147	14	9.5	-	-	-	-
36847	Steensby Port	851	337	39.6	-	-	-	-
36848	Mine site	122	16	12.8	-	-	-	-
36851	Mine site	1,005	66	6.5	-	-	-	-
37025	Mine site	1,223	6	0.5	-	-	-	-
37030	Mine site	10,305	1,625	15.8	76.3	46.6	1.7	1.2 %
37035	Mine site	1,502	1,019	67.8	-	-	-	-
37050	Steensby Port	594	225	37.8	-	-	-	-

Table 6-5.8 Summary of predicted caribou exposure to annual dust deposition (TSP) within the ZOI (Change) (Cont'd)

Collar ID	Location	Home/collar range			Home Range affected by annual dust deposition (TSP)			% in TSP zone
		Total (km²)	Area in ZOI (km²)	% in ZOI	Low (0–4.6 g/m²/yr)	Moderate (>4.6–50 g/m²/yr)	High (> 50 g/m²/yr)	
37052	Steensby Port	554	51	9.1	-	-	-	-
37054	Steensby Port	935	36	3.8	-	-	-	-
37055	Steensby Port	568	98	17.2	-	-	-	-
37407	Steensby Port	2,267	736	32.5	-	-	-	-
37408	Steensby Port	1,210	330	27.2	-	-	-	-
37490	Steensby Port	2,018	1,028	50.9	-	-	-	-
37492	Tote Road	3,434	941	27.4	34.1	22.6	1.1	1.7 %
				Total	293.1	158.3	24.5	0.9 %

5.2.3 Assessment of Residual Effects (No Change)

Table 6-5.9 Effects Assessment Summary: Caribou (No Change)

5.2.4 Prediction Confidence (No Change)

5.2.5 Follow-Up (Change)

During construction, operation, and closure of the Mary River Project, monitoring of caribou abundance will be very important for determining the effectiveness of mitigations and the precision of effect predictions. The current low population of caribou in the RSA makes it difficult to predict effects because there are so few receptors of any potential effects. Consequently, monitoring will be necessary to determine how the effects change as abundance increases. An adaptive wildlife management plan will be the key to reducing any effects of the mine on the terrestrial wildlife.

The current low numbers of caribou in the RSA suggests that monitoring should focus on simple data at first and more intensive monitoring should be initiated only if certain indicators trigger further questions. The goal of the initial monitoring will be to collect data that tests predictions, where possible, and collect information that will trigger further monitoring if needed.

The three issues addressed in the assessment — Habitat, Movement, Mortality — will be monitored using several techniques as detailed in the Terrestrial Environmental Management and Monitoring Plan (Appendix 10D-11). A brief summary of those monitoring activities is described below.

Habitat

Habitat effectiveness could be reduced by mining activity. Two monitoring options could adequately address any habitat avoidance issues: 1) a collaring program, and 2) an aerial survey program. However, neither option should be attempted until there is good evidence that caribou abundance is increasing or there is a significant need to acquire the information to address real or perceived issues around caribou disturbance and avoidance of infrastructure.

Both options could adequately address habitat issues and have been used by mines in the past (i.e., EKATI™ and Diavik). The collaring option has the advantage of a baseline study that used the same type of data to quantify habitat selection, so a comparison of the pre-disturbance and post-disturbance RSPF models could provide excellent insight into the true extent and magnitude of the ZOI. A further advantage is that the data could be used to address movement issues. Alternatively, aerial surveys could be used to collect caribou occurrence data around the Project site (<20-30 km). An aerial survey would require extensive replication within and among seasons to adequately address a habitat avoidance issue.

If triggered, the collaring program should match the area and number of the original collaring study. The aerial survey will need to be designed.

<u>Movement</u>

Seasonal and daily movements of caribou could be altered by the mine infrastructure and/or activity. Few caribou exist within the RSA, so few caribou will be affected by the mine infrastructure and activity; however, if caribou return again in large numbers to the area or if the migratory caribou return, further monitoring will be necessary to determine adaptive management.

Data collected for the ERP can include:

- Wildlife monitors hired through the HTO will travel along the road twice per year. They will look for tracks that approach the road infrastructure and follow the trails to attempt to determine if the caribou were deterred from crossing the infrastructure; and
- Truck drivers and all employees will be required to report caribou sightings within the PDA and along the transportation corridor. Records will be kept of all sightings.

If the ground monitoring of caribou suggest barrier effects (trails approaching but not crossing the road) and anecdotal caribou abundance indices show increasing numbers then aerial surveys can be used to further investigate the potential effect.

If the Tote Road acts as a barrier to caribou movement, then it is expected that caribou trails will approach and parallel the embankments, but not cross. This can be easily monitored using ground or aerial methods in winter. Summer monitoring will need to rely on anecdotal observations from drivers and on-site environmental staff who may be monitoring animal behaviour near road and traffic.

<u>Mortality</u>

Direct mortality:

- Record all collisions and near misses with wildlife along the Milne Tote Road; and
- Record all known wildlife mortality observed by mine personnel while working on site (e.g., wolf kills, harvest, collisions).

Indirect mortality:

- Participate in hunter-harvest study to look for changes in harvest patterns before and after mine construction;
- Record "human log" of hunters that pass through the camp;

- Do not allow harvesters to use camp as a hunting camp; and
- Record all known wildlife mortality observed by mine personnel while working on site (e.g., wolf kills, harvest, collisions).

Health

Although caribou health was not assessed in this volume, a follow-up program will be conducted. Dust deposition rates will be measured as part of the air quality monitoring program (Approved Project FEIS Appendix 10D-1). A hunter-harvest study conducted in coordination with local HTOs and the GN-DoE will supply an abundance of data. The GN-DoE has initiated a regional caribou health monitoring program and this study could standardize methods so that the results are comparable. Data collected from that study could include information on health of caribou such as general observations, tissue and blood sampling for parasites, measures of fat, and other measures of health as are typical of northern caribou health studies. The data could be used to help monitor potential effects that have time component (i.e., length of exposure to disturbance). Those data can be collected immediately to acquire pre-development data and the study can be reassessed after five years to determine the efficiency and efficacy of the data.

5.3 SUBJECTS OF NOTE (NO CHANGE)

5.3.1 Lighting (No Change)

5.3.2 Carnivores (No Change)

5.4 IMPACT STATEMENTS (NO CHANGE)

5.4.1 Caribou Habitat (No Change)

5.4.2 Caribou Movement (No Change)

5.4.3 Caribou Mortality (No Change)

5.4.4 Caribou Health (No Change)

Table 6-5.10 Terrestrial Wildlife Impact Statement Summary for the Mary River Project (No Change)

5.5 AUTHORS (NO CHANGE)

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SECTION 7.0 - DEFINITIONS AND ABBREVIATIONS (NO CHANGE)

7.1 DEFINITIONS (NO CHANGE)

7.2 ABBREVIATIONS (NO CHANGE)