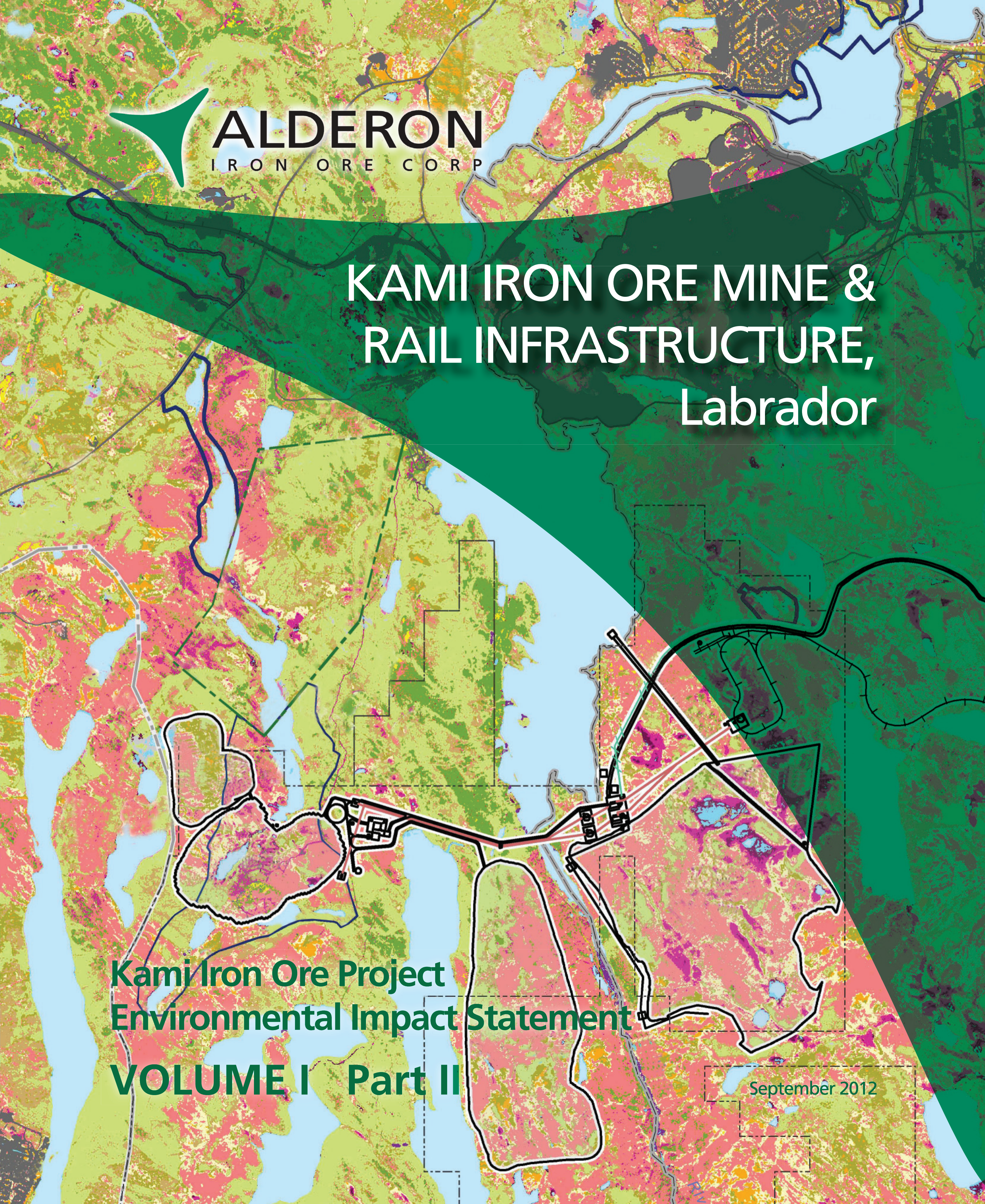
ALDERON
IRON ORE CORP

KAMI IRON ORE MINE & RAIL INFRASTRUCTURE, Labrador



Kami Iron Ore Project
Environmental Impact Statement

VOLUME I Part II

September 2012

ENVIRONMENTAL IMPACT STATEMENT DOCUMENT ORGANIZATION

VOLUME I : KAMI IRON ORE MINE AND RAIL INFRASTRUCTURE, LABRADOR

Plain Language Summary

Executive Summary

Printed on EarthChoice ® (Rainforest Alliance Certified and FSC Certified) Paper

VOLUME II : KAMI CONCENTRATE STORAGE AND LOAD-OUT FACILITY, QUÉBEC

Plain Language Summary

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14.0 ATMOSPHERIC ENVIRONMENT

14.1 Valued Ecosystem Component Definition and Rationale for Selection

Atmospheric Environment has been selected as a VEC because of:

- Regulatory provisions of the federal *Canadian Environmental Protection Act* and the *Air Quality Regulations* under the NLEPA;
- Health Canada policy and guidelines for noise impact through annoyance on community health;
- Sensitivity of human health to air quality;
- Sensitivity of the environment to air contaminants;
- Aesthetics connected to the contamination of the atmosphere by air pollutants, noise and lighting; and
- National and provincial concerns with greenhouse gas emissions as promulgated in the requisite reporting inventories of emissions.

Ground-borne vibration effects from rail operations were assessed because of their importance to stakeholders as well as seasonal or permanent residential users near the rail line. The assessment identifies and quantifies the vibration effects from rail construction and operation of the rail line, describes the assessment approach, and evaluates the Project's compliance with applicable regulatory limits and guidelines.

14.1.1 Issues

The following issues were raised by the public and other stakeholders:

- Dust;
- Noise;
- Air quality;
- Cumulative effects on air quality; and
- Greenhouse gas emissions.

Details on the issues raised by Aboriginal groups and stakeholders are provided in Table 14.1. The frequency of issue type is summarized in Figure 14.1.

Table 14.1 Issues Raised by Aboriginal Groups and Stakeholders

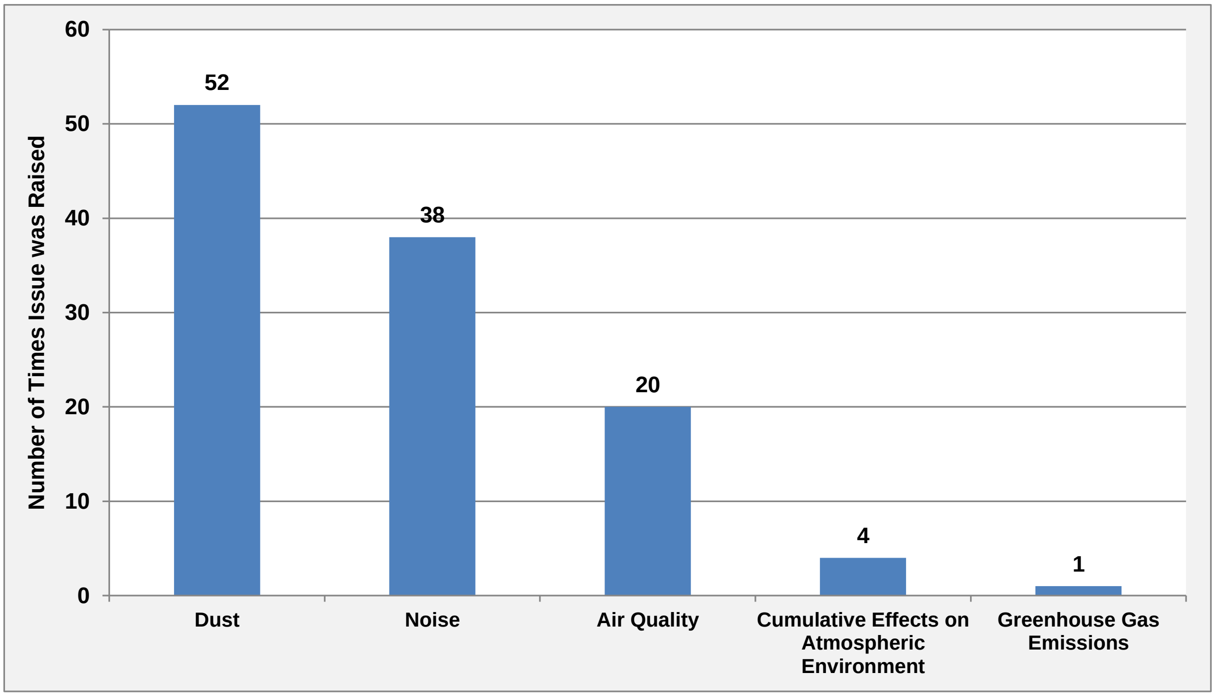
Issue	Community / Organization	Summary of Comments Raised During Consultation and Engagement Activities	Response / Location in the EIS
Change in Air Quality	Wabush / Fermont	Concerns about potential effects on air quality, air pollution and effect on quality of life. Questions asked: • Are there measures to minimize atmospheric pollution from the various components associated with mining? • Will the Project diminish quality of life and purity of air on the territory? • What will you do if air quality is affected? Will you close the mine?	Potential effects to air quality from the Project have been assessed in the EIS. The main effect from the Project on air quality will be increased level of dust. Mitigation measures for all potential effects, including dust emissions have been identified, including dust suppression, equipment preventative maintenance programs, and engineering controls such as covered conveyors. Emissions from the blast site will be monitored to ensure they are within regulatory limits. Results of the assessment of effects on the atmospheric environment are provided in Section 14.6. Chapter 25 of the EIS has evaluated physical health and community health (including quality of life) associated with mine operations.
	Fermont	Toxic plumes are associated with blasting, what will you do if it comes to Fermont? Will the air inhaled be safe with people with respiratory illnesses in the Town of Fermont? Will toxic emissions from blasting be transported by wind to the Fermont and neighbouring Québec territory?	The distance between Fermont and the open pit, where blasting would mainly occur, is 5 km. Emissions from blasting will become less concentrated as they leave the mine site. Emissions from the blast site will be monitored to ensure they are within regulatory limits. This means that the concentrations of emissions will be comparable to normal combustion sources used by residents, such as woodstoves and barbecues. Details on the nature of emissions is provided in Section 14.6. Chapter 25 of the EIS has evaluated physical health, and community health (including quality of life) associated with mine operations.

Issue	Community / Organization	Summary of Comments Raised During Consultation and Engagement Activities	Response / Location in the EIS
	Wabush / Fermont	Questions about air quality monitoring: • Explain air quality programs, including rationale for monitoring locations, parameters, etc. • Does the Alderon mine foresee measures (sensors) to ensure that the quality of air of the Town of Fermont? • Will tools used to monitor air quality be made available for public consultation?	Alderon conducted baseline programs for air quality to characterize existing conditions of the atmospheric environment that could be affected by the Project. In addition to using data from existing monitoring stations, Alderon installed monitoring stations on the shores of Long Lake, Wabush and Fermont. This data was used to model dispersion of particulate matter resulting from the Project. Parameters measured included total particulate matter, $PM_{2.5}$ and PM_{10}. A monitoring program will be implemented during operations, comparable to that used in similar industries. Results are provided in Section 14.5. Additional details on baseline air quality data and the proposed monitoring program are provided in Section 14.10 and Appendix F.
Noise	Fermont / Lab City / Wabush / Cabin Owners	Concern about noise pollution from air and other transportation, blasting and operations by cabin owners (Round Rail, Riordan Lake), residents, and recreation users at Duley Lake Park Reserve. Community members can hear and feel blasting from other mines (ArcelorMittal mine, IOC) that are located further away than the Project so they are concerned about noise effects from operations that are very close. Questions asked: • How could it be possible not to be affected by your mine? • Will the noise break windows or dishes? • Will blasting for the Project would be heard in Fermont, or in the surrounding recreational areas?	Noise levels have been measured and predicted carefully to help design the Project and to ensure they are within regulatory limits. Following the EA approval, a Blasting Plan will be developed and implemented in compliance with all applicable laws, regulations and industry best practices, and with consideration of safety, environmental and social issues as identified throughout the EIS. Noise predictions are provided in Section 14.6 and information on the Blasting Plan is provided in Section 2.6.2.

Issue	Community / Organization	Summary of Comments Raised During Consultation and Engagement Activities	Response / Location in the EIS
	Fermont	At the Mont Wright ArcelorMittal mine (where participants work), there is a required evacuation of all personnel for a 1,000-m area when blasting occurs. Participant identified that there may be issues associated with communication regarding blasting to ensure no one is found in the area.	Warnings are issued in the affected area using loud signalling devices before blasts are initiated and audible. Potential effects from blasting activities are discussed in Section 14.6.
	Le mouvement citoyen de Fermont	Are measures in place to reduce noise effects? Have studies been undertaken on the effects of noise on the Town of Fermont? Will Alderon follow noise limits developed by the L'organisation Mondial de la Santé (World Health Organization)?	Noise levels have been predicted for the Town of Fermont and will be within the regulatory limits even during highest levels of mine operation. Noise predictions have been provided in Section 14.6.
	Labrador City / Wabush	Where the railway crosses the road, will there be a whistle? If so, this may have an effect on community members by creating noise disturbance.	Train whistle signals are required by railway regulation at all public crossings at grade and as required to warn trespassers on the right-of-way. The proposed rail line does not include any public crossings at grade thereby reducing the potential for train whistle noise. See Section 2.5.7 for more details on the proposed rail line.
	Sept-Îles	Are the requirements for dust, noise, etc. different in Newfoundland than in Québec?	The Project is being designed to meet federal and provincial guidelines, including those of Newfoundland and Labrador and Québec. See Section 14.2.3 for an overview of relevant regulations and guidelines.
Dust	Cabin Owners	Dust is an issue of importance. Since the Consolidated Thompson operation started, dust is now coming into the Duley area for the first time. Concern that winds will send dust all over. Several cabin owners expressed concern with the prevailing winds blowing dust towards Wabush from the tailings impoundment. Suggestion that a new town site may be required. Cabin owners are expecting	Dust emissions have been measured and predicted in the assessment so that the Project design will comply with the prescribed limits. Alderon will implement mitigation to reduce significant adverse environmental effects on properties. Dust emission modelling and control technologies are discussed in Section 14.6.

Issue	Community / Organization	Summary of Comments Raised During Consultation and Engagement Activities	Response / Location in the EIS
		compensation for noise and dust.	
	Fermont / Lab City / Wabush/Cabin Owners	Dust from operations, tailings, road traffic and blasting is an issue of main concern for all three communities. Questions asked: • What are the plans for dust management? • How do these plans take prevailing winds and storms into consideration? Participants suggested dust mitigation including revegetation, and altering the placement of waste rock material when wind is coming from the northeast.	In the EIS, potential effects from dust are predicted and assessed. Weather conditions were included in the assessment by considering three full years of weather data, including prevailing wind and other conditions. Based on the results of this assessment, mitigation measures have been identified to manage dust from tailings, blasting and traffic. During operations, four full time water trucks will be used to control dust on the roads. The TMF will be managed to control dust through moisture, revegetation and other management practices. Conveyors will be covered to minimize dust. More detail on dust management and control is provided in Section 14.6.
	NNK	In Schefferville, dust from the tailings is a major issue. • What will be the effects of dust from this Project? • What kind of engineering control measures will be put In place?	
	NNK	Could the silty sand from the tailings be used to make concrete or other construction purposes?	Alderon will progressively revegetate the tailings management facility and materials will not be available for other uses. However, Alderon could consider alternative uses as appropriate. Information on the TMF is available in Sections 2.5.4 and 2.6.2.
		Characterization of existing ground quality—will watering of road create run-off?	The road material presents no hazard from runoff. Watering rates will be managed to maximize effectiveness and minimize wasted runoff.
Greenhouse Gas Emissions	Wabush	Inquiry about incorporation of more eco-friendly mining alternatives: alternatives to fossil fuels for mine fleet; off-setting electrical usage with solar or wind energy; use of composite rail ties.	The processing facilities and excavators for the Project are drawing on electrical energy that will be substantially renewable in origin, from hydroelectric generating stations. GHG emissions have been assessed and compared with provincial total and national total. This analysis is provided in Section 14.6.

Figure 14.1 Frequency of Issue Type related to Atmospheric Environment



The assessment of environmental effects has been discussed with government agencies, and most notably at a meeting with Pollution Prevention Division, Newfoundland and Labrador Department of Environment and Conservation on April 18, 2012 (DOEC 2012). The meeting included an outline of the results from the baseline study and a presentation and discussion of the methodology for environmental effects. The regulator expressed satisfaction with the overall approach for baseline monitoring and predictive modelling and suggested additional data sources relevant to the background research program.

14.2 Environmental Assessment Boundaries

14.2.1 Spatial Boundaries

The spatial boundaries for the environmental effects assessment of the Atmospheric Resources are defined below.

Project Development Area (PDA): The PDA includes the area of physical disturbance for the Project and includes the physical area planned for the pit, waste rock disposal areas, concentrator/processing area, Tailings Management Facility (TMF), on-site roads, rail line, and on-site transmission line. The PDA is the area represented by the physical Project footprint as defined in the Project Description.

Local Study Area (LSA): The LSA is the maximum area within which Project-related environmental effects can be predicted or measured with a reasonable degree of accuracy and confidence. The LSA includes the PDA and any adjacent areas where Project-related environmental effects may reasonably be expected to occur. For Atmospheric Environment, the LSA is defined as an area that is 40 km (east–west) by 40 km (north–south), extending from the centre of the Project-related activities and incorporating the towns of Labrador City and Wabush, Labrador and Fermont, Québec. The LSA is analogous to the local modelling domains used for dust modelling (Figure 14.2). The acoustic modelling covered a slightly smaller domain within the LSA, 25 km (east–west) by 25 km (north–south).

Regional Study Area (RSA): The RSA is the area within which cumulative effects for the Atmospheric Resources might occur, depending on physical and biological conditions and the type and location of other past, present and reasonably foreseeable projects. The RSA includes an area that incorporates Wabush Mines, Iron Ore Company of Canada's operations, Bloom Lake Mine and Rail Spur, Schefferville Iron Ore Mine, and the DSO Iron Ore Project, given potential overlapping air contaminants and sound emissions.

For a change in GHG emissions, since the environmental effect of GHG on the environment is a global concern, the spatial boundary is provincial, national and global in geographic extent.

14.2.2 Temporal Boundaries

The temporal boundaries are the construction phase (approximately two years), the operation and maintenance phase (approximately 17 years) and the decommissioning and reclamation phase (approximately two years).

Figure 14.2 Local Study Area, Atmospheric Environment

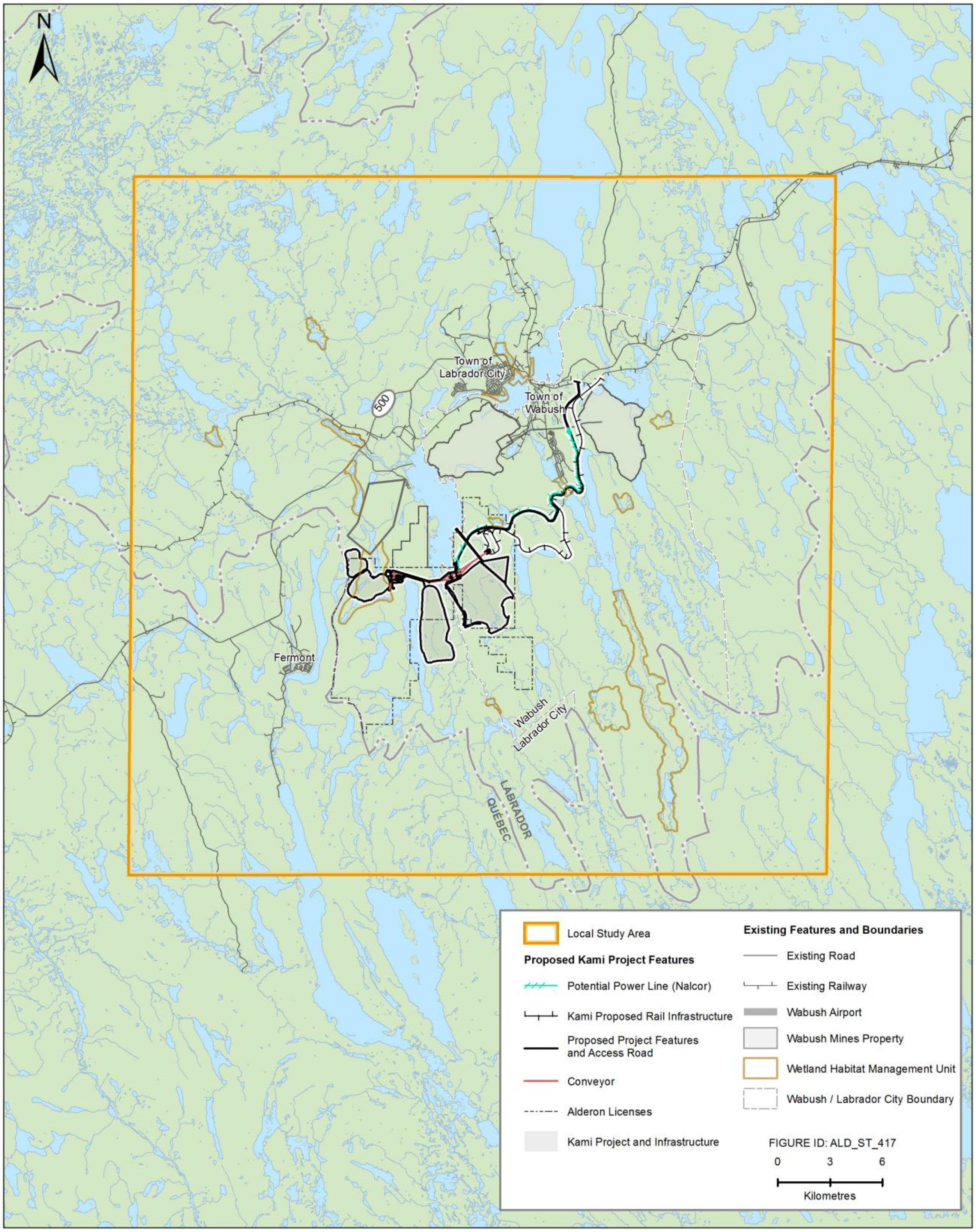
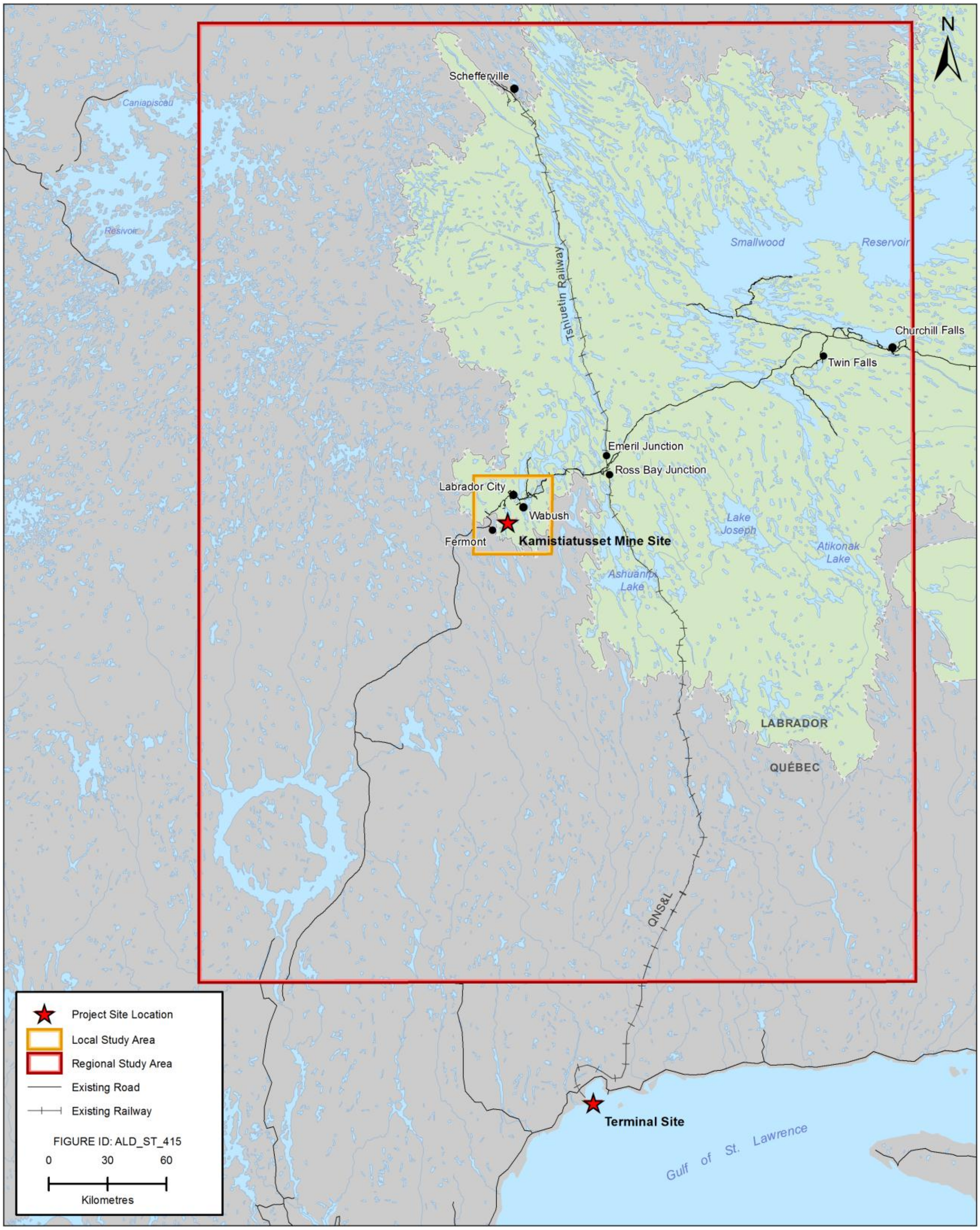


Figure 14.3 Regional Study Area, Atmospheric Environment



14.2.3 Administrative Boundaries

The administrative boundaries are based on regulatory limits and standards such as those outlined in the federal *Canadian Environmental Protection Act* and the *Air Quality Regulations* under the NLEPA. Health Canada has developed policy and guidelines for noise levels. These limits are set by regulatory authorities to reflect environmental protection objectives with the intent of being protective of air quality and human and environmental health.

Air Quality

Air quality will be assessed in the context of potential Project-related criteria air contaminants (CACs) and their ground-level concentrations (GLCs), as well as potential emissions of non-criteria air contaminants. For the purposes of this environmental assessment, the Project-related CACs include carbon monoxide (CO), nitrogen oxides (NO_x), sulphur dioxide (SO_2), total suspended particulate matter (TSP), particulate matter less than 10 microns in diameter (PM_{10}), and particulate matter less than 2.5 microns in diameter ($PM_{2.5}$).

The federal government has set objectives for air quality, which are taken into account by federal agencies in project environmental assessment reviews. These objectives also form the basis for the air quality regulation of several provinces, including Newfoundland and Labrador. The Newfoundland and Labrador regulatory limits generally correspond to the upper limit of the Maximum Acceptable category of air quality, which are set under the *Canadian Environmental Protection Act* (CEPA). The National Ambient Air Quality (NAAQ) Objectives and the *Newfoundland and Labrador Air Pollution Control Regulations* for specified CACs are presented in Table 14.2.

Table 14.2 *Air Pollution Control Regulations* and Ambient Air Quality Objectives

<table>
<tr><th rowspan="3">Pollutant and units (alternative units in brackets)</th><th rowspan="3">Averaging Time Period</th><th rowspan="3">Newfoundland and Labrador Maximum Permissible Ground Level Concentration</th><th colspan="4">Canada</th></tr>
<tr><th rowspan="2">Canada Wide Standards</th><th colspan="3">Ambient Air Quality Objectives</th></tr>
<tr><th>Maximum Desirable</th><th>Maximum Acceptable</th><th>Maximum Tolerable</th></tr>
<tr><td rowspan="3">Nitrogen dioxide µg/m^3 (ppb)</td><td>1 hour</td><td>400 (213)</td><td>-</td><td>-</td><td>400 (213)</td><td>1000 (532)</td></tr>
<tr><td>24 hour</td><td>200 (106)</td><td>-</td><td>-</td><td>200 (106)</td><td>300 (160)</td></tr>
<tr><td>Annual</td><td>100 (53)</td><td>-</td><td>60 (32)</td><td>100 (53)</td><td>-</td></tr>
<tr><td rowspan="4">Sulphur dioxide µg/m^3 (ppb)</td><td>1 hour</td><td>900 (344)</td><td>-</td><td>450 (172)</td><td>900 (344)</td><td>-</td></tr>
<tr><td>3 hour</td><td>600 (228)</td><td></td><td></td><td></td><td></td></tr>
<tr><td>24 hour</td><td>300 (115)</td><td>-</td><td>150 (57)</td><td>300 (115)</td><td>800 (306)</td></tr>
<tr><td>Annual</td><td>60 (23)</td><td>-</td><td>30 (11)</td><td>60 (23)</td><td>-</td></tr>
</table>

Pollutant and units (alternative units in brackets)	Averaging Time Period	Newfoundland and Labrador Maximum Permissible Ground Level Concentration	Canada			
			Canada Wide Standards	Ambient Air Quality Objectives		
				Maximum Desirable	Maximum Acceptable	Maximum Tolerable
Total Suspended Particulate Matter (TSP) µg/m^3	24 hour	120	-	-	120	400
	Annual	60	-	60	70	-
$PM_{2.5}$ µg/m^3	24 hour	25	30 (by 2010) Based on the 98th percentile ambient measurement annually, averaged over 3 consecutive years	-	-	-
PM_{10} µg/m^3	24 hour	50	-	-	-	-
Carbon Monoxide mg/m^3 (ppm)	1 hour	35 (31)	-	15 (13)	35 (31)	-
	8 hour	15 (13)	-	6 (5)	(13)	(17)

Greenhouse Gas Emissions

For climate and GHG emissions, national guidance is provided by the CEA Agency (CEA Agency 2003) and includes guidance on the environmental assessment of GHG emissions from the Project and from the related industrial sector. In the guidance document it is suggested that, where Project emissions are medium or high, preparation of a GHG Management Plan is required. Further regulation at the federal level is anticipated to occur in the future. The intentions are described in the “Regulatory Framework for Air Emissions” (GOC 2007), and “Turning the Corner: Regulatory Framework for Industrial GHG Emission” (GOC 2008).

Acoustic Environment

There are no regulations regarding noise emissions in Newfoundland and Labrador. Health Canada has published *Health Canada’s Suggested Information Needs for Consideration of Human Health in Environmental Assessments* (Health Canada 2009), which is now incorporated into *Useful Information for Environmental Assessments* (Health Canada 2010b). These documents provide objectives for noise levels based on day-night average sound levels and percent annoyance. The concept of annoyance is based on work by the US EPA investigating community responses to perceived noise issues. Health Canada policy is that annoyance is a community health effect, therefore within their mandate. Although Health Canada does not publish regulations with respect to noise, and does not have noise guidelines, their publications provide guidance on the assessment methods for measuring noise effects, with emphasis on annoyance methods from US EPA (1974). Annoyance is calculated from the daytime and weighted nighttime sound levels by a response function to give percent highly annoyed (%HA). In short, the 15 daytime hours and 9 nighttime hours, exactly from 07:00 to 22:00 and 22:00 to 07:00, are energy averaged, with a bias of +10 dB applied to the nighttime before averaging. This bias reflects the greater sensitivity or responsiveness of the community to noise effects during this time.

The methods for computing %HA are to be found in Canadian Standards Association *in ISO 1996-1:2003, Acoustics – Description, measurement and assessment of environmental noise*. For the operations phase of the Project, the %HA should also be calculated using the same procedure for the baseline and project conditions. If, after mitigation has been applied, the %HA increases by 6.5% or more, the potential environmental effect may again be substantial.

A summary of Health Canada's (2010) guidance to noise assessments is provided in Table 14.3.

Table 14.3 Summary of Health Canada's Guidance to Assessing Noise

Phase	Criterion	Limit	Rationale
Construction <2 months Temporary	Community consultation is advised.	-	-
Short Term Construction (< 1 year)	Mitigation is advised if levels are predicted to result in widespread complaints.	-	Mitigation required if resulting levels are predicted to result in widespread complaints or strong community reaction.
Construction > 1 year or Operation with noise levels between 45-75 dB	%HA.	Change in %HA between project and baseline <6.5%.	Annoyance is deemed to be a community health effect and mitigation is required if the %HA between baseline and project exceeds 6.5%.
Construction (> 1 year) or Operation with noise levels (45-75 dB)	Noise Levels.	75 dBA.	> 75 dB mitigation required.

In addition to these limits, Health Canada also advises proponents to adhere to a number of other guidelines that include World Health Organization (WHO) (1999) dealing with sleep disturbances and community noise. WHO has established a guideline of 30 dBA inside a dwelling to avoid sleep disturbance.

The province of Québec has provincial guidelines in place which are applicable to ambient noise levels in Fermont in addition to the Health Canada guidelines. The guidelines provide separate 1-hour maximum noise level limits for each of 4 different zoning types as presented in Table 14.4. The maximum 1-hour noise level limit for a site is considered the greater of either the baseline residual noise levels of a site or the levels listed within Table 14.4 for the applicable zone. Within these guidelines, day is defined as being the period from 7:00 AM to 7:00 PM and night as the period from 7:00 PM to 7:00 AM.

Table 14.4 Day and Night Maximum 1-hour Noise Levels for each Zoning Type

Zoning	Night (dBA) (1900h - 0700h)	Day (dBA) (0700h - 1900h)
I	40	45
II	45	50
III	50	55
IV	70	70
Note, d'instructions 98-01 sur le bruit 2006		

The four zoning types are defined as follows:

- **Sensitive areas:**
  - Zone I: Planning for single-family dwellings (detached or attached), including healthcare and educational institutions. Includes existing dwellings within agricultural zones.
  - Zone II: Planning for houses in multiple dwelling units, mobile home parks, institutions, or campsites.
  - Zone III: Land for commercial use or recreational parks. However, the noise level expected for the night period only applies at the point of reception for residential properties located within or neighboring the zone. In other cases, the maximum noise level expected for the day (55 dBA) also applies at night.
- **Non-sensitive areas:**
  - Zone IV: Land zoned for industrial or agricultural purposes. However, on the ground of an existing house in an industrial zone and established in accordance with the laws in force at the time of its construction, the criteria is 50 dBA at night and 55 dBA during the day.

Due to the large multiple dwelling units central within the community, Fermont is classified as falling within the Zone II guidelines for the purposes of this assessment.

Vibration

Vibration is an oscillatory motion and can be described in terms of the displacement, velocity and acceleration. The peak particle velocity (PPV) is defined as the maximum instantaneous positive or negative peak of the vibration signal. PPV is often used to monitor blasting and vibrations related to structural damages. However, human response to vibration is assessed for an average vibration as opposed to peak particle velocity. The parameter used is root mean square (rms) amplitude.

Both ppv and rms vibration are described in m/second (inch per second in the USA); also they are described in decibel notation. When described in decibel the reference velocity of $5x10^{-8}$ m/second is typically used ($1x10^{-6}$ inches/second in the USA). Rumbling sound caused by the vibration of room surfaces is called ground-borne noise.

Table 14.5 provides the assessment criteria that can be applied to rail vibration and ground-borne noise.

Table 14.5 Characterization of Vibration Criteria

Description	Ground-borne Vibration		Ground-borne Noise
	V (dB re 10^6 inch/sec)	V (dB re $5x10^8$ m/sec)	dBA (re $20x10^6$ Pascals)
Residences and cabins where people can normally sleep (frequent use of tracks also assumed)	72	66	35
Federal Transit Administration (2006); Transit Corporative Research Program (2009)			

There are no large structures within the immediate vicinity of the Project rail line and all of the vibration receptors are cabins. Increasing perceptible vibration may cause annoyance. Annoyance cannot be measured directly, but meeting guidelines / limits provided in standards (such as the criteria in Federal Transit Administration) minimizes the potential for annoyance.

Lighting

Light is a Project emission originating from a project's luminaires, or lighting units. Lighting units consist of all Project lamps and their associated parts for distributing and positioning the light. Proper lighting during all phases of the Project is necessary for a safe and productive mine, rail, and utility corridor. However, improperly designed lighting can result in adverse effects ranging from a minor social nuisance to environmental disruption. Lighting effects can be classified as being of three distinct types:

- **Light trespass or light spill** is the light that is emitted by a facility and received at a property where it may disturb sleep by shining in windows, cause harsh and objectionable outdoor illumination, and potentially compromise security by imposing a light distribution that may negatively affect visibility. This type of effect is best avoided by using full cutoff fixtures as appropriate that create directed light toward work areas as required. The full cutoff fixture will avoid the transmission of light outside of the property.
- **Sky glow** is the result of illumination that is directed upward, typically as a result of the use of lighting that has significant upward directivity, or is omnidirectional, such as "bare bulbs". The sky glow reduces the aesthetic quality of the night sky, making it impossible under serious situations to observe any stars or features of the night sky. This upward lighting is also thought to affect the navigational ability of birds. Sky glow is greatly reduced through the use of full horizontal cutoff fixtures, and other design and operational measures to minimize the use of excessive lighting.

- **Glare** is the familiar problem that results from exposed and poorly directed lights such as the bright headlights in oncoming traffic. Paradoxically, glare, an excess of light, impairs vision in those affected, with consequent impairment of safety and security, in addition to the degradation of aesthetics. Again, glare is reduced by the use of appropriate lighting fixtures, an efficient site lighting design, and operational measures that reduce excessive and energy-wasteful illumination.

There are currently no regulations, guidelines, or policies in place within the province of Newfoundland and Labrador that regulate the amount of obtrusive light being emitted from facilities. However, the Commission Internationale de L'Éclairage (CIE), also known as the International Commission on Illumination, has developed sets of maximum values for both light trespass and glare that should not be exceeded. These guidelines have been adopted in Great Britain and form the basis of a number of recommendations in the Leadership in Energy and Environmental Design (LEED) Green Building Council Certification Program of Canada (LEED 2004). These values are based on environmental zones and time of day.

The CIE has established four environmental zones as a basis for outdoor lighting regulations (CIE 2003). These four zones are summarized in Table 14.6. The location of the Project and surrounding areas (Wabush / Fermont) would be considered to fall in an E2/E3 (rural / suburban) category.

Table 14.6 CIE Environment Zones

Zone	Surrounding	Lighting Environment
E1	Natural	Intrinsically Dark
E2	Rural	Low District Brightness
E3	Suburban	Medium District Brightness
E4	Urban	High District Brightness

The maximum values recommended by CIE for light trespass (illumination) on properties by environmental zone and time of day are presented in Table 14.7.

Table 14.7 CIE Maximum Values of Light Trespass (Illumination) on Properties

Time of Day[1]	CIE Maximum Values of Light Trespass on Properties by Environmental Zone (in lux)			
	E1	E2	E3	E4
Pre-Curfew (19:00 – 23:00)	2	5	10	25
Post-Curfew (23:00 – 6:00)	0	1	2	5

Notes:
1 Terminology, environmental zones and values defined by CIE (2003).

The maximum values recommended by CIE for glare (intensity of luminaires) offsite by environmental zone and time of day are presented in Table 14.8.

Table 14.8 CIE Maximum Values for Glare (Intensity of Luminaires) Offsite

Time of Day[1]	CIE Maximum Values for Glare in Designated Directions by Environmental Zone (in cd)			
	E1	E2	E3	E4
Pre-Curfew (19:00 – 23:00)	2,500	7,500	10,000	25,000
Post-Curfew (23:00 – 6:00)	0*	500	1,000	2,500

Notes:
1 Terminology, environmental zones and values defined by CIE (2003).
* If for public lighting value may be up to 500 cd.

Reference levels of sky glow are presented in Table 14.9. The higher the number, the more the sky is dominated by the natural background; the lower the number, the greater the degree of sky glow that is caused by reflection from the atmosphere of anthropogenic lighting.

Table 14.9 Reference Levels of Sky Glow

Sky Glow (mag/arcsec^2)	Corresponding Appearance of the Sky
21.7 (Rural)	The sky is crowded with stars that appear large and close. In the absence of haze the milky way can be seen to the horizon. The clouds appear as black silhouettes against the sky.
21.6	The above with a glow in the direction of one or more cities is seen on the horizon. Clouds are bright near the city glow.
21.1	The milky way is brilliant overhead but cannot be seen near the horizon. Clouds have a greyish glow at the zenith and appear bright in the direction of one or more prominent city glows.
20.4	The contrast of the milky way is reduced and the detail is lost. Clouds are bright against the zenith sky. Stars no longer appear large and near.
19.5	Milky way is marginally visible, only near the zenith. Sky is bright and discoloured near the horizon in the direction of cities. The sky looks dull grey.
18.5 (Urban)	Stars are weak and washed out and reduced to a few hundred. The sky is bright and discoloured everywhere.

Source: Berry (1976)

14.3 Establishing Standards or Thresholds for Determining the Significance of Environmental Effects

The following terms will be used to characterize residual environmental effects for the Atmospheric Environment, direction, magnitude, geographical extent, frequency, duration, reversibility, and ecological context. The definitions of these terms are presented below.

- **Direction:**
  - Adverse: condition of the atmospheric resources is worsening in comparison to baseline conditions and trends;
  - Positive: condition of the atmospheric resources is improving in comparison to baseline conditions and trends; or

- Neutral: no change in the condition of the atmospheric resources compared to baseline conditions and trends.

- **Magnitude:**
  - Negligible: no measurable adverse effect anticipated;
  - Low: effect occurs that is detectable but is within normal variability of baseline conditions;
  - Moderate: effect occurs that would cause an increase with regard to baseline but is within regulatory limits and objectives; or
  - High: effect occurs that would singly or as a substantial contribution in combination with other sources cause exceedances of objectives or standards beyond the Project boundaries.
- **Geographical Extent:**
  - Site-specific: effect restricted to the Project footprint within the LSA;
  - Local: effect restricted to the LSA;
  - Regional: effect restricted to the RSA; or
  - Global: Provincial, National or Global scale (GHG Emissions only).
- **Frequency:**
  - Once: effect occurs once;
  - Sporadic: effect occurs at sporadic intervals;
  - Regular: effect occurs on a regular basis and at regular intervals; or
  - Frequently: effect occurs continuously throughout the Project life.
- **Duration:**
  - Short-term: effect occurs for less than two years;
  - Medium-term: effect occurs for between 2 and 15 years; or
  - Long-term: effect persists beyond 15 years.
- **Reversibility:**
  - Reversible: effect ceases when Project operations cease; or
  - Irreversible: effect continues after Project operations cease;
- **Environmental and Socio-economic Context:**
  - Undisturbed: effect takes place within an area that is relatively or not adversely affected by human activity; or
  - Disturbed: effect takes place within an area with human activity. Area has been substantially previously disturbed by human development or human development is still present.

The significance criteria for environmental effects on Atmospheric Resources are described below.

For a change in ambient air quality, a significant adverse residual environmental effect is defined as a Project-related environmental effect that degrades the quality of the ambient air such that the maximum Project-related ground-level concentration being assessed repeatedly exceeds the respective air quality objective, guideline or standard.

For a change in greenhouse gases, following the CEA Agency guidance, "the environmental assessment process cannot consider the bulk of GHG emitted from already existing developments. Furthermore, unlike most project-related environmental effects, the contribution of an individual project to climate change cannot be measured" (CEA Agency 2003). It is, therefore, recognized that it is not possible to assess significance related to a measured environmental effect on climate change on a project-specific basis. At the same time, it is recognized that a scientific consensus is emerging in respect of global emissions of GHG and consequent changes to global climate as generally representing a significant cumulative effect. Project emissions of GHG will contribute to these significant cumulative effects, but the contribution, although measurable and potentially important in comparison to local and provincial levels, will be small in a global context. Policies and regulations are being developed by the Government of Canada for regulating GHG emissions for specific sources or industry sectors.

Thus, instead of setting a specific residual environmental effects significance criterion for environmental effects on climate change and determining whether and how it can be met, a change in GHG emissions is considered by: conducting a preliminary scoping of GHG emissions; determining jurisdictional considerations (including GHG policies or plans); determining the industry profile (where possible); and by considering the magnitude, intensity, and duration of Project emissions as directed by the CEA Agency guidance (CEA Agency 2003). The Project-related GHG emissions are compared to similar projects, and to provincial, national, and global GHG emissions. Three categories are described in the CEA Agency guidance: low, medium, and high. In this EIS these are attributed to numerical values (on a tonnes CO_{2eq} per annum basis) of less than 10^5, greater than 10^5 and less than 10^6, and greater than 10^6, for low, medium, and high categories, respectively. Where the GHG emissions are considered to be either medium or high, a GHG Management Plan must be prepared.

For a change in the acoustic environment, a significant adverse residual environmental effect is defined as a Project-related environmental effect that results in sound pressure levels at the nearest residential receptors or sensitive receptors (i.e., daycares, schools, hospitals, places of worship) that cause a change in calculated %HA from baseline greater than 6.5 percent, or which exceed provincial guidelines, where applicable.

For a change in vibration, a significant adverse residual environmental effect would be associated with intermittent levels that are high in magnitude, or persistent vibrations with medium-term duration that occur at sensitive receptor buildings. Such vibrations would result in an exceedance of the vibration criteria presented in Table 14.5.

For a change in lighting, a significant adverse residual environmental effect is defined as an increase in Project related light emissions such that the guidelines for light trespass and glare are exceeded and where the Project related sky glow would be typical of an urban environment.

14.4 Potential Project-VEC Interactions

The potential effects that will be assessed for Atmospheric Environment are change in air quality, change in GHG emissions, change in acoustic environment, change in vibration and change in lighting. In Table 14.10 below, each Project activity and physical work for the Project is listed, and each interaction ranked as 0, 1, or 2 based on the level of interaction each activity or physical work will have with the Atmospheric Environment.

Table 14.10 Potential Project Environmental Effects to Atmospheric Environment

Project Activities and Physical Works	Potential Environmental Effects				
	Change in Air Quality	Change in GHG Emissions	Change in Acoustic Environment	Change in Vibration	Change in Lighting
Construction					
Site Preparation (including clearing, excavation, material haulage, grading, removal of overburden and stockpiling)	2	2	2	1	1
Construction of Roads	2	2	2	1	1
Construction of Site Buildings and Associated Infrastructure (maintenance facilities, offices, plant, crushers, concentrator, conveyors, gatehouse, pumphouses, substation, security fencing, sanitation system)	2	2	2	1	1
Construction of Mine Tailings Management Facility (TMF)	2	2	2	1	1
Construction of Railway and Load-out Facilities (silos)	2	2	2	1	1
Construction of Power Line	1	1	1	1	1
Construction of Stream Crossings	1	1	1	1	1
Installation of Water Supply Infrastructure (wells, pumps, pipes)	1	1	1	1	1
Onsite Vehicle / Equipment Operation	1	1	1	0	0
Waste Management	0	0	0	0	0
Transportation of Personnel and Goods to Site	1	1	1	0	0
Expenditures	0	0	0	0	0
Employment	0	0	0	0	0

Project Activities and Physical Works	Potential Environmental Effects				
	Change in Air Quality	Change in GHG Emissions	Change in Acoustic Environment	Change in Vibration	Change in Lighting
Operation and Maintenance					
Open Pit Mining (including drilling, blasting, ore and waste haulage, stockpiling, dewatering)	2	2	2	2	2
Ore Processing (including crushing, conveying, storage, grinding, screening)	2	2	2	1	1
Concentrator Operations (gravity and magnetic separation, tailings dewatering, tailings thickener, concentrate conveyance to load-out)	2	2	2	1	1
Tailings Disposal in TMF	2	2	2	1	1
Waste Rock Disposal on Surface	2	2	2	1	1
Water Treatment (including mine water and surface runoff) and Discharge	1	1	1	1	1
Rail Load-Out by Silo Discharge	2	2	2	1	1
Rail Transport	2	2	2	2	1
Onsite Vehicle / Equipment Operation and Maintenance	1	1	1	0	0
Waste Management	0	0	0	0	0
Transportation of Personnel and Goods to Site	1	1	1	0	0
Fuel Storage and Dispensing	1	1	1	0	0
Progressive Rehabilitation	1	1	1	0	0
Expenditures	0	0	0	0	0
Employment	0	0	0	0	0
Decommissioning and Reclamation					
Site Decommissioning	1	1	1	1	1
Site Reclamation (building demolition, grading, scarifying, hydroseeding)	1	1	1	0	0
Accidents and Malfunctions					
Train Derailment	2	2	2	0	0
Forest Fire	2	2	2	0	0
Polishing Pond Dyke Breach	1	1	1	0	0

Project Activities and Physical Works	Potential Environmental Effects				
	Change in Air Quality	Change in GHG Emissions	Change in Acoustic Environment	Change in Vibration	Change in Lighting
KEY 0 No interaction. 1 Interaction occurs; however, based on past experience, the resulting effect can be managed to acceptable levels through standard operating practices and/or through the application of best management or codified practices. No further assessment is warranted. 2 Interaction occurs, and resulting effect may exceed acceptable levels without implementation of specific mitigation. Further assessment is warranted.					

The Project interactions on each environmental effect are ranked as 0, 1, and 2 for a change in air quality, change in GHG emissions, change in acoustic environment, change in vibration, and change in lighting, based on anticipated quantities of emissions and project experience of the Study Team. Those interactions that have been ranked as 0 or 1 are discussed here, but screened out of further detailed analysis because, although an interaction may occur, the resulting effect can be managed to acceptable levels through standard mitigation measures and management practices. Those that have been ranked as 2 are also briefly discussed within this section, but are further analyzed in the environmental effects analysis section (Section 14.6) because the resulting effect may exceed acceptable levels without implementation of specific mitigation.

Interactions Ranked as 0

During both the construction and operation of the Project the following activities are not anticipated to interact with the Atmospheric Environment to result in an environmental effect:

- Waste Management;
- Expenditures; and
- Employment.

In addition to the above activities, the transportation of personnel and goods to the site during both Project construction and operation has been ranked as a 0 in terms of a change in vibration and change in lighting. There is no source of vibration or extrusive light emissions from the operation of such equipment and therefore no interaction. Activities including onsite vehicle / equipment operation and maintenance during Project construction and operation, fuel storage and dispensing and progressive rehabilitation during Project operation and site reclamation during decommissioning are also not anticipated to generate vibration or light emissions. The interaction of these activities with a change in vibration and a change in lighting are thus ranked as 0.

The following Accidents and Malfunctions have also been ranked as 0 in terms of a change in vibration and a change in lighting, train derailment, forest fire, and polishing pond dyke breach. If either of these accidental events were to occur, they would not likely result in vibration or light emissions and therefore the interaction of these activities with a change in vibration and a change in lighting is not anticipated.

Interactions Ranked as 1

Activities including the construction of a power line, construction of stream crossings, the installation of water supply infrastructure, water treatment during Project operation, and site decommissioning do have the potential to result in emissions of criteria air contaminants (CACs), greenhouse gases (GHGs), sound, light, and vibration due to the operation of various pieces of equipment required to conduct such tasks. The emissions resulting, however, will be minimal and the resulting effect can be managed to acceptable levels using standard mitigation measures and management practices. Thus the interaction of these activities with a change in air quality, change in GHGs, change in the acoustic environment, change in vibration, and change in lighting are ranked as 1.

During both construction and operation of the Project the transportation of personnel and goods to the site and the onsite operation and maintenance of vehicles and equipment will result in emissions of CACs, GHGs and sound. However, based on past experience, these emissions are expected to be nominal and are unlikely to result in an exceedance of regulatory standards and have therefore been ranked as 1.

Site preparation, construction of roads, site buildings, the mine tailings management facility and the railway and load out facilities are expected to result in vibration and light emissions. These activities are not expected to include substantive sources of vibrations, and will be short in duration and sporadic. The only sources of light for the activities above will be from construction equipment, and will therefore be temporary, intermittent, and low-magnitude. Such emissions are not expected to exceed regulatory criteria and therefore interactions with a change in vibration and a change in lighting have been ranked as a 1.

During the operation of the Project, light emissions will be generated from ore processing, concentrator operations, tailing disposal, waste rock disposal, water treatment, rail load-out, and rail transport. The Project will be constructed using full horizontal cutoff lighting, resulting in negligible sky glow, and light spill emissions. Light emissions resulting from Project operations have therefore been ranked as a 1.

The following activities do have potential to result in vibration during Project operation because of the usage of motor powered equipment: ore processing, concentrator operations, tailings disposal in TMF, waste rock disposal, and rail load-out by silo discharge. While the vibration levels for some of these activities will likely be measurable, with planned mitigation, the resulting vibration levels are expected to be low and confined to the Project site. The interaction of these activities with a change in vibration is thus ranked as a 1.

During site reclamation, emissions of CACs, GHGs, and sound will be emitted through the operation of various pieces of diesel operated equipment. Such emissions, however, will be nominal and temporary and can be managed to acceptable levels using standard mitigation measures and management practices. The interaction of this activity with a change in air quality, change in greenhouse gases, and a change in acoustic environment are therefore ranked as 1.

In the unlikely event of a polishing pond dyke breach, CACs, GHGs, and sound could be emitted from the operation of various pieces of equipment involved in the subsequent clean up. The likelihood of such an event occurring is small and would result in nominal emissions as the amount of diesel powered equipment that would be in operation would be nominal. The interactions of these activities with a change in air quality, change in GHGs, and change in the acoustic environment are thus ranked as 1.

Interactions Ranked as 2

The activities, including site preparation, construction of roads, buildings, the mine tailings management facility, and the railway and load-out facility, during Project construction and open pit mining, ore processing, concentrator operations, tailings disposal, waste rock disposal, and rail transport during Project operation will result in emissions of CACs, GHGs, and sound through the combustion of diesel, releases of dust, and operation of numerous motors and generators. During Project operation, material haulage will result in emissions of light from the head lights of the haulage trucks operating during the nighttime. The interactions of these activities with a change in air quality, change in GHGs, change in the acoustic environment, and change in lighting (for open pit mining) may exceed acceptable levels without the implementation of Project-specific mitigation and these interactions have therefore been ranked as 2 and are further assessed in the Section 14.6.

During Project operation, the activities, including open pit mining and rail transport, could potentially result in vibration levels that exceed criteria without the implementation of Project-specific mitigation. Such interactions are therefore ranked as a 2 and will be further assessed in Section 14.6.

Accidental events, including a train derailment and forest fire, will result in emissions of CACs, GHGs, and sound due to the potential spill of fuel, the combustion of fuel, and the operation of emergency and clean up vehicles involved. The interactions of these accidental events with a change in air quality, change in GHGs, and a change in the acoustic environment may exceed acceptable levels and were therefore ranked as 2 and will be further assessed in Section 14.8.

Thus, in consideration of the nature of the interactions and the planned implementation of known and proven mitigation, the potential environmental effects of all Project activities and physical works that were ranked as 0 or 1 in Table 14.10, on the Atmospheric Environment during all phases of the Project are rated as not significant, and are not considered further in the assessment.

The measurable parameters used for the assessment of the environmental effects presented above and the rationale for their selection is provided in Table 14.11.

Table 14.11 Measurable Parameters for Atmospheric Environment

Environmental Effect	Measurable Parameter	Rationale for Selection of the Measurable Parameter
Change in Air Quality	• Emissions and ambient concentrations of criteria air contaminants (CAC) and non-criteria air contaminants (Non-CAC) (µg/m³).	• Air Quality is characterized by chemical and physical properties of the atmosphere, as affected by the release of combustion gases and particulate matter into the atmosphere (e.g., NO_x, PM, and SO_2). • Regulatory objectives, guidelines and/or standards exist provincially and federally for the measurable parameters.
Change in GHG Emissions	• GHG emission rates of CO_2, N_2O and CH_4 resulting from the Project.	• The inventory and analysis of GHG emissions are widely recognized when assessing related environmental effects on climate (CEA Agency 2003).
Change in Acoustic Environment	• Changes in ambient sound levels as measured in A-weighted sound pressure levels in decibels and percent annoyance.	• Health Canada has published Guidance on Noise Assessment for projects requiring assessment under CEAA. This includes consideration of daytime and nighttime noise exposure of sensitive receptors and percent annoyance. Nova Scotia also has noise guidelines that are applied in this assessment.
Change in Vibration	• Peak particulate velocity (PPV) / Root square mean velocity (rms).	• Used to determine vibration levels from construction / operation equipment.
Change in Light Emissions	• Light Spill - Light output from the project perimeter on vertical surface of receptors. • Glare - Horizontal contrast between project lighting and background lighting. • Sky Glow - Ratio of upward directed lighting to total lighting.	• Light received beyond the project perimeter is spill or trespass lighting. • Increased glare is a safety issue and an aesthetic issue. • Sky glow is a result of wasted light shining upwards, and from excessive lighting reflected upwards.

14.5 Existing Environment

The open pit mine (Rose Pit) and associated workings are to be located to the south of Labrador City, southwest of Wabush, and east of Fermont, Québec.

In addition to the above noted nearest communities, there are a number of cabins located around the lakes that surround the Project, including but not limited to, Long Lake, Mills Lake, and Riordan Lake. There is also a provincial park reserve, Duley Lake Provincial Park Reserve, located north of the Project.

The Project site also includes the waste rock disposal areas, ore processing infrastructure, TMF, ancillary infrastructure to support the mine and process plant, and the rail line to connect the mine site to the QNS&L rail line. This infrastructure will be constructed east of the open pit mine and south of Labrador City and Wabush. The proposed rail line will pass in close proximity to the Town of Wabush.

Descriptions of the existing ambient air quality, GHG emissions, acoustic environment, vibration levels, and sources of light in and around the project site are provided below.

Local knowledge pertaining to the Atmospheric Environment is presented in Table 14.12.

Table 14.12 Local Knowledge – Atmospheric Environment

Date	Stakeholder	Community	Comment
16 November 2011	Individual	Wabush	The Project is located to the Southeast of town, so wind will bring dust to Town.
15 November 2011	Individual	Fermont	People can hear the blast from IOC.
16 March 2012	Individual	Fermont	Vibrations from the Arcelor Mittal Mine, located 17 km from Fermont, can be felt by residents.
15 March 2012	Individual	Fermont	Fermont mine is 17 km to northwest and dust from their operations come to Fermont.
14 March 2012	Individual	Labrador City	Cabin owner indicated that he heard a blasting event last year that "shook the building".
07 March 2012	Individual	Fermont	Bloom Lake Mine is around 10 km from here and we already can see the dust.
07 March 2012	Individual	Fermont	Even Mont Wright has effects, even though they will put grasses on the tailings. The dust comes here anyway. Formerly there was a big problem at Labrador City and with the grass seeding on the tailings it helps a lot. The results are exceptional. There used to be red cars everywhere.
15 Mar 2012	Individual	Fermont	Suggested that the Project needs to avoid placing waste rock material in Rose South when wind comes from the northeast.

Ambient Air Quality

Particulate matter has been identified as the greatest air quality public concern for the Project. DOEC compiles annual ambient air quality monitoring reports for many communities across the province, including Labrador City and Wabush. Monthly maximum values for sulfur dioxide (SO_2), nitrogen dioxide (NO_2), total particulate matter (TSP) and particulate matter less than 2.5 microns in diameter ($PM_{2.5}$) are recorded, and any exceedances to provincial standards are identified.

A summary of the 2011 maximum and annual concentrations tabulated for seven Labrador City and three Wabush locations is presented in Table 14.13. Details are available in the Newfoundland and Labrador Department of Environment and Conservation's 2011 Annual Report (DOEC 2012). All values are in units of $\mu g/m^3$.

Table 14.13 2011 Maximum 1-hr, 3-hr, 24-hr and Annual Average Air Contaminant Values for Labrador City and Wabush

City	Facility	SO_2				NO_2			TSP		$PM_{2.5}$
		1-hr	3-hr	24-hr	Annual	1-hr	24-hr	Annual	24-hr	Annual	24-hr
Labrador City	Indian Point	74.7	53.2	24.0	1.8	83.1	39.5	7.0	95.4	26.2	18.6
Labrador City	Town Depot	370.5	129.5	42.4	2.2	85.1	43.8	8.6	*145.6*	22.3	19.9
Labrador City	Smokey Mountain	44.9	36.3	10.6	1.3	89.0	69.7	19.4	93.5	13.8	10.0
Labrador City	Bartlett Drive	-	-	-	-	-	-	-	98.3	22.5	-
Labrador City	Hudson Drive	-	-	-	-	-	-	-	83.3	18.2	-
Labrador City	Tamarack Drive	-	-	-	-	-	-	-	*206.6*	31.4	-
Labrador City	Vanier Avenue	-	-	-	-	-	-	-	111.3	16.6	-
Wabush	Bond Street	49.2	30.6	11.9	2.8	-	-	-	-	-	15.2
Wabush	Shea Street	-	-	-		-	-	-	100.3	10.3	-
Wabush	Substation	-	-	-	-	-	-	-	*258**	21.9	-

Notes:
* Substation accumulated 4 24-hour exceedances in 2011. Only the maximum yearly 24-hr exceedance shown.

Provincial reporting demonstrates that, while total particulates do occasionally exceed standards, the average air quality is good, and that SO_2 and NO_2 ambient concentrations are well below standard levels.

Additional air quality monitoring of particulate matter less than 2.5 microns in diameter ($PM_{2.5}$) and particulate matter less than 10 microns in diameter (PM_{10}) was completed within Wabush, Fermont, and the northern edge of Duley Lake Provincial Park Reserve (referred hereafter as Duley Lake) during the summer of 2011 and winter of 2012 by Stantec (Appendix F). PM_{10} was chosen instead of TSP since it is a better indicator of risk to human health. Wabush and Fermont were chosen since they are the closest residential areas to the Project. Duley Lake was chosen due to the number of cabins there in proximity to the Project. Nitrogen oxides (NO_x) were not monitored as they are monitored in existing programs that indicate no significant issues with the NO_x levels. Monitoring for $PM_{2.5}$ and PM_{10} occurred over a two week period during the summer of 2011 and another two week period during the winter of 2012, and is summarized in Table 14.14. Additional details pertaining to the methodology and results obtained during this monitoring can be found in the Air Quality Monitoring Baseline Report (Appendix F). Newfoundland and Labrador regulations for 24-hour concentrations of $PM_{2.5}$ and PM_{10} are 25 µg/m^3 and 50 µg/m^3 respectively.

Table 14.14 2012 Baseline Particulate Matter Testing for Fermont, PQ, and Wabush and Duley Lake, NL

Location	Particulate Exceedances (per 14-day sample)			
	Summer		Winter	
	$PM_{2.5}$	PM_{10}	$PM_{2.5}$	PM_{10}
Fermont	not detected*	not detected*	2	not detected
Wabush	not detected*	1*	not detected	not detected
Duley Lake	1**	not detected***	n/a	n/a

Notes:
* Out of 13 samples.
** Out of 12 samples.
*** Out of 11 samples.
n/a = not applicable.

In general, exeedances are low, and might be attributable to other nearby activities (e.g., ATV operation). Detailed information from the baseline monitoring study can be found in the Air Quality Monitoring Baseline Study (Appendix F).

Greenhouse Gas Emissions

In March 2004, the Government of Canada, under Environment Canada, implemented the Greenhouse Gas Emissions Reporting Program (GHGRP), which involved the mandatory reporting for any facilities in Canada emitting more than 100 kt of CO_{2eq}. The reporting threshold was subsequently lowered to 50 kt CO2eq in 2009.

The total GHG emissions from Newfoundland and Labrador in 2010 reported by eight facilities under the GHGRP equaled 4,545,909 tonnes CO_{2eq}, or two percent of Canada's total GHG emissions (Environment Canada 2011).

The national total GHG emissions reported by 537 facilities under the GHGRP equalled 261,868,761 tonnes CO_{2eq}. Canada is also responsible for submitting an annual GHG inventory report under the United Nations Framework Convention on Climate Change (UNFCCC). In 2010, total GHG emissions in Canada were estimated to be 692 Mt CO_{2eq}, of which 562 Mt CO_{2eq} (74 percent) was attributed to the energy sector. Fossil fuel combustion accounted for 90 percent of energy sector emissions, contributing 503 Mt CO_{2eq}. UNFCCC GHG reporting includes stationary combustion sources (e.g., electricity production, fossil fuel production, mining, and oil and gas extraction), transportation (e.g., road, railways, and navigation) and fugitive sources (e.g., coal mining) within the energy sector. A summary of Canada's estimated GHG emissions by Sector for 2005 through to 2010 is provided in Table 14.15.

Table 14.15 Summary of Canada's Estimated GHG Emissions 2005 – 2010 (Mt CO_{2eq})

GHG Emission Categories	2005	2006	2007	2008	2009	2010
Total	**740**	**726**	**751**	**731**	**690**	**692**
Energy	599	585	611	591	560	562
Stationary Combustion	*124*	*117*	*126*	*114*	*98*	*101*
Transport	*193*	*192*	*196*	*194*	*187*	*195*
Fugitive Sources	*63*	*65*	*63*	*62*	*59*	*59*
Industrial Processes	60	60	59	59	51	52
Mineral Products	*9.9*	*9.9*	*9.8*	*9*	*7*	*8*
Chemical Industry	*9.3*	*8.1*	*7.9*	*9.4*	*7*	*6.5*
Metal Production	*19.7*	*20.3*	*19.2*	*18.8*	*15.6*	*15.5*
Production and Consumption of Halocarbons and SF6	*5.5*	*5.3*	*5.7*	*5.8*	*6.5*	*7.3*
Other & Undifferentiated Production	*15*	*17*	*17*	*15*	*15*	*15*
Solvent & Other Product Use	0.38	0.33	0.33	0.34	0.26	0.24
Agriculture	58	57	57	58	56	56
Waste	22	23	23	22	22	22
Land Use, Land-use Change and Forestry	54	65	51	-17	-12	72

Notes:
* Sources include coal mining, oil, natural gas, venting and flaring.
Summarized from Environment Canada 2012.

Global GHG emissions are estimated to be 44,000 Mt CO_{2eq}, with 33,000 Mt from CO_2 alone (Netherlands Environmental Assessment Agency 2011; United States Environmental Protection Agency [US EPA] 2011). Canada therefore contributes 1.7 percent of the total global GHG emissions.

Acoustic Environment

In typical rural towns, similar in size to that of Wabush or Labrador City, the acoustic environment is likely dominated by:

- traffic, the main component of the "hum" in urban areas;
- sounds of construction;
- workplace sounds such as service stations or workshops; and
- recreational sounds from sports fields and similar activities.

These sounds usually overshadow those typical of more isolated locations including: wind, running water, animal sounds, and bird calls.

Directive 38 in Alberta (ERCB 2007) that is accepted by British Columbia and verified by Stantec in a number of locations in Nova Scotia, provides for “default” values of baseline sound levels of 35 dBA at night, and 45 dBA during the day. The daytime increase is due to the increase in wind sounds, animal sounds, and the remote sounds of human activity. In areas where there is a significant housing density, or adjacent to a well-travelled road, the levels tend to be increased by 5 dB or more (ERCB 2007). Professional experience confirms this range, although rare, extremely quiet, still nights, may reach minimum levels under 30 dBA and spring peepers can cause local sound levels of over 60 dBA at night.

In the vicinity of human settlements, sound levels are likely to be in the order of 40 dBA at night and 50 dBA during the day, although the proximity of arterial road traffic and industrial activity can increase levels by 5 dBA in suburban areas. Mining activity at both the surrounding Wabush and IOC mine sites are likely to contribute to these levels.

In general, the level of background sound likely increases at the towns and local mine site and decreases moving outward into the surrounding rural and undeveloped land. The Project site is located roughly 13 km from both Wabush and Labrador City, and roughly 10 km and 20 km to the Wabush and IOC mine sites, respectively.

In summer 2011 and winter 2012, baseline noise monitoring was conducted by Stantec at Fermont, Duley Lake, and Wabush. A total of four monitoring sites were selected for this program. These sites are listed in Table 14.16 and Sites 1 through 3 correspond to those used for the baseline air monitoring program, discussed above.

Table 14.16 Baseline Noise Monitoring Sites

Site No.	UTM Coordinates		Site Description
	Easting (m)	Northing (m)	
1	629449	5851022	Residential Property in Fermont, Quebec
2	634479	5862308	Recreational Area Near Duley Lake
3	643272	5863149	Residential Property in Wabush, Labrador
4 (winter 2012 only)	643263	5863138	Residential Property in Wabush, Labrador

During the winter noise monitoring period, 24-hour noise monitoring events were carried out at Sites 1 and 3 on both a weekday and weekend day, and at an additional site located within Wabush, city central near both a school and church (Site 4). Noise monitoring was not conducted at Site 2 during the winter period due to power and access limitations at this site.

Baseline sound pressure levels (L_{eq}) were measured using Larson and Davis Type I Sound Pressure Level Meters, model SoundTrack LxT1. These meters are laboratory calibrated and calibration checks are made in the field before and after sampling. The meters were positioned on tripods approximately 1.5 meters above grade when monitoring. The meters were also equipped with a wind screen to reduce extraneous noise due to the wind. A signal from the sound level meters was connected directly to a digital audio recorder so that the recordings could be reviewed afterward and any abnormalities in the data could later be checked. The meter was set up to log one minute L_{eq} values and one hour L_{eq}, L_{min}, L_{max}, L_{10} and L_{90} values for a period of twenty-four consecutive hours.

The hourly L_{eq} values collected at each noise monitoring site during the summer monitoring period are presented in Table 14.17.

Table 14.17 Hourly Baseline Noise Monitoring Results (dBA) – Summer 2011 Monitoring Period

Time of Day	Site 1 - Fermont (dBA) (July 15 – July 16)	Site 2 – Duley Lake (dBA) (July 13 – 14)	Site 3 - Wabush (dBA) (July 7 – 8)
12:00	-	-	48
13:00	-	-	52
14:00	-	-	55
15:00	-	-	52
16:00	-	-	52
17:00	-	-	49
18:00	-	-	52
19:00	-	41	51
20:00	40	45	57
21:00	38	43	54
22:00	32	41	46
23:00	26	40	34
0:00	25	41	32
1:00	26	39	33
2:00	26	39	32
3:00	25	40	40
4:00	47	40	49
5:00	42	38	40
6:00	40	38	43
7:00	42	40	52
8:00	38	47	56
9:00	46	35	54
10:00	33	38	52
11:00	43	43	-
12:00	38	43	-
13:00	42	41	-
14:00	49	42	-
15:00	46	39	-
16:00	46	37	-

Time of Day	Site 1 - Fermont (dBA) (July 15 – July 16)	Site 2 – Duley Lake (dBA) (July 13 – 14)	Site 3 - Wabush (dBA) (July 7 – 8)
17:00	41	39	-
18:00	41	-	-
- = no data collected			

The day (L_d), night (L_n), and day night (L_{dn}) average sound levels, computed using the data presented in the above tables, are listed in Table 14.18. The L_d represents the sound level averaged between 7:00 AM and 10:00 PM. The L_n represents the sound level averaged between 10:00 PM and 7:00 AM. The L_{dn} represents the day and night average sound level after a 10 db penalty has been added to the nighttime period (10:00 PM to 7:00 AM).

Table 14.18 Day, Night, Day Night Average Sound Levels (L_d, L_n and L_{dn}) for Each Monitoring Site During the Baseline Summer 2011 Monitoring Event

Average Sound Level	Site 1 – Fermont (dBA)	Site 2 – Duley Lake (dBA)	Site 3 – Wabush (dBA)
L_d	43.4	42.0	53.1
L_n	39.6	39.7	42.5
L_{dn}	46.9	46.7	52.9
%HA	1.46	1.43	3.18

Currently there are no provincial guidelines or standards applicable to ambient noise in the province of Newfoundland and Labrador.

Health Canada provides guidance on noise using the average day night sound level (L_{dn}) and the percent highly annoyed (%HA, see Table 14.3). The calculations are based on pre and post Project noise. The limits differ for Project construction and operation. In terms of construction, they differ depending on the length of the construction period.

The hourly L_{eq} values collected at each noise monitoring site during the winter monitoring period are presented in Table 14.19 below.

Table 14.19 Hourly Baseline Noise Monitoring Results (dBA) – Winter 2012 Monitoring Period

Hour of the Day	Site 1 - Fermont (dBA)		Site 3 - Wabush (dBA)		Site 4 – Wabush (dBA) Weekday (Feb. 27 - 28)
	Weekday (Feb. 21 - 22)	Weekend (Feb. 26 - 27)	Weekday (Feb. 16 - 17)	Weekend (Feb. 18 - 19)	
10:00	37	44	-	-	-
11:00	43	50	-	-	-
12:00	40	52	-	33	39
13:00	41	52	38	40	37
14:00	38	42	45	37	49
15:00	40	43	44	35	41
16:00	41	46	42	34	39

Hour of the Day	Site 1 - Fermont (dBA)		Site 3 - Wabush (dBA)		Site 4 – Wabush (dBA) Weekday (Feb. 27 - 28)
	Weekday (Feb. 21 - 22)	Weekend (Feb. 26 - 27)	Weekday (Feb. 16 - 17)	Weekend (Feb. 18 - 19)	
17:00	43	46	41	47	37
18:00	42	38	41	40	38
19:00	44	39	39	34	38
20:00	40	38	48	34	38
21:00	37	39	39	38	39
22:00	32	42	42	30	39
23:00	32	39	38	30	33
0:00	28	36	36	30	31
1:00	24	36	38	32	32
2:00	30	39	39	28	30
3:00	30	32	32	32	32
4:00	32	35	32	32	34
5:00	37	39	34	34	34
6:00	41	40	35	37	40
7:00	40	50	37	34	44
8:00	40	40	40	37	42
9:00	40	41	37	34	39
10:00	-	-	39	31	55
11:00	-	-	54	36	37
12:00	-	-	53	41	36
13:00	-	-	-	50	40
14:00	-	-	-	51	-
15:00	-	-	-	48	-

The L_d, L_n, and L_{dn} for each monitoring site for the winter period is presented below in Table 14.20.

Table 14.20 Day, Night, Day Night Average Sound Levels (L_d, L_n and L_{dn}) for Each Monitoring Site During the Baseline Winter Monitoring Event

Average Sound Level	Site 1 – Fermont (dBA)		Site 2 – Duley Lake (dBA)		Site 3 – Wabush (dBA)
	Weekday	Weekend	Weekday	Weekend	Weekday
L_d	40.8	46.5	46.4	43.8	45.1
L_n	34.6	38.6	37.5	32.7	35.4
L_{dn}	42.6	47.4	46.8	43.4	45.2
%HA	0.835	1.56	1.44	0.927	1.17

No significant difference was observed when comparing the data collected on the weekdays at Sites 1 and 3 to that collected on the weekend.

Vibration

There are no known vibration generation sources identified near the proposed rail line or other areas within the proposed Project site. Most of the normal industrial vibration sources are attenuated below perception over the first 100 m from the source. Due to the absence of major anthropogenic activities in the vicinity of the Project site and rail line, ambient vibration is expected to be well below average human perception, with the exception of the blasting operations at existing mines.

Lighting

The urban areas of Labrador City, Wabush, and Fermont are primarily residential areas, with most sources of employment located outside of the residential areas. Lighting conditions are typical of an E3 CIE environmental zone, and the nighttime sky shows modest effect of the urban area, and very little effect of industry or commercial areas that affect many cities. As a result, the sky is an aesthetic resource with inherent value.

The existing levels of light pollution were expected to be low, and a series of light readings were made in Wabush, Labrador City, Duley Lake, and Fermont to confirm this using a Unihedron Sky Quality Meter. As reference levels of sky glow are not familiar units, benchmark comparison numbers are presented in Table 14.21. The higher the number, the more the sky is dominated by the natural background; the lower the number, the greater the degree of sky glow that is caused by reflection from the atmosphere of man-made lighting.

Table 14.21 Reference Levels of Sky Glow

Sky Glow (mag/arcsec^2)	Corresponding Appearance of the Sky
21.7 (Rural)	The sky is crowded with stars that appear large and close. In the absence of haze the Milky Way can be seen to the horizon. The clouds appear as black silhouettes against the sky.
21.6	The above with a glow in the direction of one or more cities is seen on the horizon. Clouds are bright near the city glow.
21.1	The Milky Way is brilliant overhead but cannot be seen near the horizon. Clouds have a grayish glow at the zenith and appear bright in the direction of one or more prominent city glows.
20.4	The contrast of the Milky Way is reduced and the detail is lost. Clouds are bright against the zenith sky. Stars no longer appear large and near.
19.5	Milky Way is marginally visible, only near the zenith. Sky is bright and discoloured near the horizon in the direction of cities. The sky looks dull grey.
18.5 (Urban)	Stars are weak and washed out and reduced to a few hundred. The sky is bright and discoloured everywhere.
Source: Berry (1976)	

The results of the monitoring conducted in and surrounding the Project Area are presented in Table 14.22.

Table 14.22 Sky Glow Readings

Urban Area	UTM Northing (m)	UTM Easting (m)	Date	Time	Weather	Temperature (°C)	Light Measurement (mag/arcsec2)
Fermont	629527	5851237	June 16	00:30	Clear	19	19.35
						18	19.11
						17	19.39
	628725	5851306	June 16	00:40	Clear	16	19.41
						16	19.04
						15	19.47
Duley Lake	633982	5862247	June 16	00:50	Clear	16	20.07
						16	20.11
						15	20.17
	634724	5862503	June 16	00:55	Clear	15	20.08
						15	20.15
						15	20.18
	634990	5861243	June 16	01:00	Clear	15	20.06
						14	20.17
						13	20.26
Labrador City	640781	5868070	June 17	0:45	Scattered Clouds	18	17.68
						18	17.9
						18	17.8
						17	17.88
						17	17.75
	639472	5868467	June 17	0:00	High scattered clouds	18	15.37
						18	15.69
						18	16.12
						18	16.47
						18	16.24
	640363	5866674	June 17	0:50	Scattered Clouds	18	18.72
						18	18.45
						18	18.77
						17	18.7
						17	18.76

Urban Area	UTM Northing (m)	UTM Easting (m)	Date	Time	Weather	Temperature (°C)	Light Measurement (mag/arcsec2)
Wabush	643205	5862975	June 17	0:20	Cloudy	17	19.21
						18	19.09
						17	19.08
						17	19.17
						17	19.24
	643509	5863591	June 17	0:30	High scattered clouds	17	19.14
						17	19.23
						17	19.24
						17	19.14
						17	19.19
	642889	5864015	June 17	0:15	Cloudy	18	18.56
						18	18.54
						18	18.41
						18	18.36
						17	18.41

14.6 Assessment of Project-related Environmental Effects

In this section, the change in air quality, change in greenhouse gas emissions, change in acoustic environment, change in vibration and change in lighting are assessed on the basis of baseline data (Section 14.5), emissions inventories and modeling predictions. Based on the discussion of Project interactions with the Atmospheric Environment, presented in Section 14.4, only the interactions ranked as 2 are considered further in the assessment of Project related environmental effects. All other interactions previously ranked as 0 or 1 were rated as not significant.

14.6.1 Construction

14.6.1.1 Change in Air Quality

Potential Environmental Effects

During the construction of the Project, emissions of air contaminants will result from site preparation activities, construction of roads, site buildings and associated infrastructure, the construction of the TMF and railway and load out facilities. These emissions include particulate matter (TPM, PM_{10} and $PM_{2.5}$) and combustion gases (CO, NO_x, SO_2) through the combustion of fuel in construction equipment and emissions of particulate matter, or "dust" (TPM, PM_{10} and $PM_{2.5}$) through the operation of heavy earth moving equipment handling overburden and traveling on unpaved roads. On-road vehicle traffic associated with onsite activities will also generate air emissions through the combustion of fuel and travel on unpaved roads.

The areas of the Project that will require site preparation include the waste rock disposal areas, the process plant and concentrator site, railway line and site roads, the crushed ore stockpile areas and the TMF. Site preparation activities will involve site clearing and grading and will involve the use of various earth moving and excavating equipment. During the construction of site roads and infrastructure a number of different diesel-operated equipment will be in use, including but not limited to, mobile cranes, boom trucks, generators, dump trucks, cement plants and mixers, and numerous pick-up trucks.

During the construction of the Project it is intended that power will be supplied by Nalcor. If this power supply is not available at the start of construction, temporary power will be supplied by use of diesel powered gensets. Air emissions from the gensets have been estimated and are included in Table 14.23.

Mitigation of Potential Environmental Effects

Several measures for mitigating air contaminant emissions during the construction of the Project are planned, and include:

- Use of dust suppressants (e.g. water and/or calcium chloride) during activities and situations that have an increased potential to generate airborne dust;
- Adherence to a comprehensive equipment preventative maintenance program to maintain the vehicles, and to maximize fuel efficiency and vehicle performance; and
- Implementation of ambient air quality monitoring programs.

Characterization of Residual Project Environmental Effects

To assess the residual project environmental effects on a change in air quality during Project construction a detailed emissions inventory of Project related releases of CACs was prepared. Releases of air contaminants were determined for the following construction activities: site preparation, construction of site buildings and associated infrastructure, construction of the mine tailings management facility, and construction of the railway and load-out facility. A summary of the estimated emissions are presented in Table 14.23.

Table 14.23 Estimated Emissions of CACs during Project Construction

Activity	Total CAC Emissions (tonnes/a)					
	CO	NO_x	SO_2	TPM	PM_{10}	$PM_{2.5}$
Transportation of equipment - general	2.00	2.26	0.008	0.055	0.055	0.042
Transportation of equipment - rail	5.17	2.27	0.010	0.071	0.071	0.058
Transportation of equipment - TMF	0.178	0.907	0.0030	0.022	0.022	0.017
Equipment operation - general	135.90	301.99	10.17	19.38	--	--
Equipment operation - rail	89.86	181.60	6.76	13.78	--	--
Equipment operation - TMF	10.28	20.96	0.87	1.63	--	--

Activity	Total CAC Emissions (tonnes/a)					
	CO	NO_x	SO_2	TPM	PM_{10}	$PM_{2.5}$
Unpaved roads	--	--	--	1,077	179	2.07
Fugitive dust (ground clearing)	--	--	--	116	--	--
Cement plant operation	--	--	--	0.11	0.04	--
Total	**243**	**510**	**18**	**1,227**	**179**	**2**

This emissions inventory is comparable to any civil construction project comprising site clearing and preparation, and the Project activities are spread over a large footprint. Therefore the effect of Project construction on a change in air quality is predicted to be moderate in magnitude, local in geographic extent, short term in duration, will occur regularly, and is reversible.

14.6.1.2 Change in Greenhouse Gas Emissions

The construction of the Project will result in emissions of greenhouse gases (CO_2, CH_4, N_2O) through fuel consumption and energy usage during site preparation and construction of infrastructure. The GHG emissions are generated by combustion of gasoline and diesel fuel in light vehicles, heavy trucks, light and heavy earth-moving equipment and construction equipment.

The activities associated with construction of the Project will result in the release of GHG emissions to the atmosphere. The environmental effect is the recognized contribution to changes in local and global climate conditions. However, the environmental effect of the GHG emissions from any specific facility on global climate change cannot be measured (CEA Agency 2003). Nevertheless, the change in GHG emissions associated with the Project can be quantified in an absolute sense and placed in perspective with jurisdictional (provincial, national, global) emissions, as well as with other comparable industries (industry profile).

Mitigation of Potential Environmental Effects

Mitigation measures for mitigating releases of GHGs during Project construction would be similar to those used to mitigate releases of CACs from the combustion of fuel in light vehicles, heavy trucks, light and heavy earth-moving equipment and construction equipment, as described above under change in air quality, and include:

- Implementation of a GHG Management Plan;
- Adherence to a comprehensive equipment preventative maintenance program to maintain the vehicles, and to maximize fuel efficiency and vehicle performance; and
- The implementation of an idling policy to minimize the consumption of fuel when the equipment and vehicles are stationary for extended periods of time.

Characterization of Residual Project Environmental Effects

To assess the residual project environmental effects on a change in greenhouse gas emissions during Project construction, an emissions inventory for the construction phase of the Project was prepared. Releases of GHGs were determined for the following construction activities: site preparation, construction of site buildings and associated infrastructure, construction of the mine tailings management facility and construction of the railway and load out facility. A summary of the estimated emissions are presented in Table 14.24. Emission factors for Greenhouse Gas (GHG) emissions of CO_2, N_2O and CH_4 were retrieved from Transport Canada's UTEC (Transport Canada, 2011b).

The emissions of GHGs during the construction of the Project will be temporary and are expected to be small relative to the emissions that will be produced during Project operation and maintenance. The availability of electric power from renewable sources contributes to a lower level of GHG emissions than would occur from comparable projects in areas served by fossil fuel power generation. The effect of Project construction on a change in greenhouse gas emissions are predicted to be moderate in magnitude, global in geographic extent, short term in duration, will occur regularly, and is reversible.

Table 14.24 Estimated GHG Emissions during Project Construction

Activity	Total GHG Emissions (tonnes)			
	CO_2	CH_4	N_2O	CO_2e
Transportation of equipment - general	372	0.02	0.02	377
Transportation of equipment - rail	423	0.02	0.03	434
Transportation of equipment - TMF	138	0.01	0.004	140
Equipment operation - general	43,533	NQ	NQ	43,533
Equipment operation - rail	29,902	NQ	NQ	29,902
Equipment operation - TMF	4,066	NQ	NQ	4,066
Total	**78,434**	**0.05**	**0.05**	**78,452**

14.6.1.3 Change in Acoustic Environment

During the construction of the Project, sound emissions will occur from the following activities: site preparation; construction of roads, construction of site buildings and associated infrastructure, construction of TMF, and construction of the railway and load-out facility.

The construction phase will involve the use of a number of pieces of heavy diesel powered equipment preparing the Rose Pit, waste rock piles, and other project components for the operational phase. In Rose Pit, overburden will be removed prior to the mining of the ore deposit. This will involve earth moving equipment such as loaders, graders, and haul trucks. Similar operations will occur in the waste rock disposal areas. North of Rose Pit, the overburden from Rose Pit will be deposited. The construction of site infrastructure occurs during this phase, including the process facilities (pumphouses, crushers, processing plant), the conveyor systems, the railroad loop, and the site roads.

Facility construction will involve steel erection, welding, concrete pouring, and the transportation of the construction elements to the site. The communities of Fermont, Labrador City, and Wabush are separated from the facilities by distances of the order of 5 to 10 km, and are unlikely to experience noise resulting from the civil works. The cabins on Long Lake and Riordan Lake are within 5 km, and within a few hundred meters in certain cases and will experience some noise levels due to the construction. The railroad may affect cabins on these lakes, and will be within a few hundred meters of the residential areas of the town of Wabush.

The spatial footprint of the construction activities is essentially the same as that of the operational phase, and the equipment list is shorter. A quantitative analysis was performed for the operational phase, and it is assumed that the operational levels are higher than those to be found during construction as the operational model is based on the year of highest on-site equipment use, and maximum production rate.

Mitigation of Potential Environmental Effects

The most effective mitigation for construction equipment is the stringent requirement for equipment to be in proper working repair, with mufflers in place. Speed restrictions will be developed and enforced on-site for noise control as well as safety concerns. The movement of vehicles on-site can cause nuisance sounds because of back-up alarms. This is only anticipated in the closest cabins. Construction planning will include traffic routing that optimizes the efficiency while reducing the potential nuisance by maximizing forward movement of vehicles on the on-site roads.

Monitoring programs for noise levels will be instituted with the first appearance of heavy equipment on-site. The program will include a documented, and transparent system of complaint recording and investigation, and a protocol for investigating repeat offending sources, so that special mitigation can be designed and applied as required.

Characterization of Residual Project Environmental Effects

The construction phase of the Project will affect the same areas that are affected during the operational phase, specifically the cabins on Long Lake, and the residential areas of Wabush, but will be temporary. The distances are sufficient so that individual sound is unlikely to be distinguished, but an industrial “hum” may be perceived in the closest affected zones. These areas will be monitored routinely to assess the adherence of the construction contractors to noise reduction requirements.

Therefore, the effect of Project construction on a change in the acoustic environment are predicted to be moderate in magnitude, local in geographic extent, short term in duration, regular in frequency and reversible.

14.6.1.4 Change in Vibration

As previously discussed, the construction of the Project will involve site preparation and the construction of buildings and associated infrastructure, TMF and the railway and load-out facility. These construction activities will utilize typical machinery such as excavators, loaders, and graders as defined above under Air Quality. However, due to the distance from the Project site to the nearest receptors, vibration from the operation of heavy construction equipment will generally not be of concern.

Blasting may be required during the construction of the Project facilities. Blasting is expected to be occasional and sporadic in nature. It will involve a blast design and will be implemented under a strictly controlled environment.

Mitigation of Potential Environmental Effects

As vibration due to construction equipment will be attenuated within 75 m, vibration is not predicted to have an adverse effect at any nearby receptors during Project construction. Therefore specific mitigation measures for vibration are not considered to be necessary.

Characterization of Residual Project Environmental Effects

Typical vibration levels from construction equipment are expected to be minimal. Therefore, the effect of Project construction on a change in vibration is predicted to be low in magnitude, local in terms of geographic extent, short term in duration, sporadic in frequency and reversible.

14.6.1.5 Change in Lighting

During construction, portable lighting units may be used in the Rose Pit area for preparation of the site, and at the locations of the fixed facilities. Portable light units typically illuminate an area lateral to the unit and are typically bright powerful lights that unavoidably cause some glare and vertically directed illumination.

Mitigation of Potential Environmental Effects

The construction lighting will be subject to guidelines in the Environmental Protection Plan. The principles will be to use only as much lighting as is necessary, and to locate portable lighting equipment where it is not visible in surrounding urban areas.

Characterization of Residual Project Environmental Effects

The effect of Project construction on a change in lighting is predicted to be low in magnitude, local in geographic extent, short term in duration, will occur sporadically, and reversible.

14.6.2 Operation and Maintenance

14.6.2.1 Change in Air Quality

Potential Environmental Effects

The operation of the Project will involve the following activities:

- Open pit mining (drilling, and blasting);
- Ore and waste rock haulage;
- Processing of the extracted ore (crushing, conveying, storage, reclaiming, grinding, screening);
- Concentrator operations (gravity and magnetic separation, tailings dewatering, tailings thickener, concentrate conveying);
- Tailings disposal in TMF; and
- Rail load out and rail transport.

The main sources of air emissions from the above activities are the combustion of fuel in the equipment, which produces emissions of particulate matter (TPM, PM_{10}, $PM_{2.5}$) and combustion gases (SO_2, CO, NO_x), burning of No. 2 light fuel oil in boilers and the fugitive releases of dust from material handling and haul truck and vehicle travel on unpaved roads.

Table 14.25 provides a list of the general mining equipment that will be in use during the operation of the Project, fuel consumption and utilization. The quantities of the equipment in use in any given year of operation will differ depending on the production. It is expected that during the first four years of operation only one processing line will be in operation, with the second commencing in year 4. During the operation of the Project the majority of the operations will occur 24 hours a day seven days a week.

Table 14.25 Mining Equipment List for Project Operation and Fuel Consumption Information

Mining Equipment	Fuel consumption (L/h)	Utilization (%)	Quantity (Year 4)
Primary Equipment			
Shovel (Ore) (Bucyrus 395HR converted to Caterpillar 7395)	E	70	1
Shovel Komatsu PC5500	E	70	2
Shovel (Waste) (Bucyrus 495HD converted to Caterpillar 7495 HD)	E	70	2
Wheel Loader (CAT994)	144	70	2
Haul Truck (Komatsu 930E)	250	70	50
Blasthole Drill (Bucyrus 49HR converted to Caterpillar MD6640)	E	70	6

Mining Equipment	Fuel consumption (L/h)	Utilization (%)	Quantity (Year 4)
Secondary Equipment			
Wheel Dozer (Caterpillar 844)	64	70	3
Track Dozer (Caterpillar CAT D9)	60	70	2
Track Dozer (Caterpillar CAT D10)	85	70	4
Motor Grader (Caterpillar 16M)	42	70	3
Water Truck 20,000 gallons(Caterpillar CAT777F)	82	70	4
Auxiliary Equipment			
Air Track Drill (200 HP 80 to 100mm)	60	50	1
RC Drill (Explorac R50, Cubex QCR920)	E	50	1
Wheel Loader (Caterpillar 988H)	60	50	1
Service Truck (250 HP 22,000 GVW)	20	50	2
Forklifts 15 tones	10	50	1
Forklifts 2.5 tones	10	50	1
Pickup 3/4 Ton (4x4 crew cab Chevrolet 2500) Mine Ops.	10	50	6
Pickup 3/4 Ton (4x4 crew cab Chevrolet 2500) Maint.	10	50	4
Pickup 3/4 Ton (4x4 crew cab Chevrolet 2500) Eng.,Survey.,Geol.,	10	50	3
Pickup 3/4 Ton (4x4 crew cab Chevrolet 2500) Ore Cotrol, Samplers	10	50	2
Pickup 3/4 Ton (4x4 crew cab Chevrolet 2500) Blasting	10	50	3
Pickup 1 Ton (4x4 crew cab Chevrolet 2500) Flatbed	10	50	1
Pickup 1 Ton (4x4 crew cab Chevrolet 2500) Service Body	10	50	1
Water truck fill station	10	50	1
Light Plant (1000 w. diesel generator)	20	50	5
Dewatering Pump (250 HP electric submersible)	E	50	2
Mobile Pump (125 HP diesel)	20	50	1
Portable Generator 600kw	20	50	1
Aggregate Plant	50	50	1
E = electric			

In addition to the mining equipment presented above, other pieces of equipment will be on site for activities such as TMF, stockpile and railway maintenance, including but not limited to, boom trucks, dump trucks, graders, loaders, pick-ups, rollers, excavators, rail track tamper, and rail ballast regulator.

As defined by the United States Environmental Protection Agency (US EPA 1995), fugitive dust is dust that is released to the atmosphere from open sources, instead of being discharged to the atmosphere via a confined flow stream, and is created from the mechanical disturbance of granular material. Fugitive dust generally consists of three size ranges of particulate matter including, total suspended particulate (TSP) (particulate matter 30 microns or less in diameter), PM_{10} (particulate matter with a diameter of 10 micrometers or less) and $PM_{2.5}$ or fine particulate (particulate matter with a diameter of 2.5 micrometers or less).

During the operation of the Project fugitive releases of dust will occur through the following operational activities:

- Handling of overburden and travel of dump trucks on gravel roads;
- Drilling and blasting within the Rose Pit mine;
- Material handling – through the loading and unloading of extracted ore and waste rock, stockpiling, reclaiming, conveying and conveyor transfer points and rail loading;
- Processing of the ore – crushing, grinding and screening; and
- Unpaved roads – Vehicle and haul truck travel on unpaved roads.

Wind erosion of the TMF, waste rock disposal areas, and the ROM and crushed ore stockpiles may also occur throughout operation.

The amounts of dust created from the above activities can varying depending on a number of factors including, but not limited to, the size of the matter being disturbed, local climatic conditions including wind speed and direction and precipitation, frequency of disturbance, the moisture and silt content of the material being disturbed, as well as mechanical stresses, including factors like material drop height and vehicle speed on unpaved roads (Golder Associates 2010).

Typically, the distance that dust will travel from its source is mostly dependent on the size of the matter being disturbed and the local climatic conditions. In general, larger particulate matter will tend to be deposited closer to the source of the emissions than that of finer particulate (Golder Associates 2010).

Mitigation of Potential Environmental Effects

The design principles for the Project include the use of Best Available Control Technology, which have been proven in other applications, and suitable for use to achieve the control efficiencies assumed in this assessment of effects on air quality. Detailed equipment and technology information will be provided after detailed engineering as an integral component of an application for operating permit approval.

The following established mitigation measures have been used in this assessment for mitigating air contaminant emissions during the operation and maintenance of the Project:

- Use of qualified blasting contractors with blast design plans that incorporate dust emission controls (e.g. blast mats);
- Use of dust suppressants (e.g. water) on all gravel roads within the site boundaries, with emphasis on the haul truck routes from the Rose Pit mine to the waste rock disposal sites and the crusher buildings, to reduce fugitive dust emissions from truck travel on unpaved roads;
- Use of a binder substance within the dust suppression application (e.g. calcium chloride) during drier periods of the year to aid in keeping the roads moist for longer periods of time will be investigated;
- Use of covered conveyors when required, to reduce fugitive releases of dust from the conveying (handling) of crushed ore and ore concentrate;
- Dust collection systems on all conveyor transfer points to reduce the fugitive releases of dust during the transfer of material;
- Dust collection system on the exhaust vents of both process plants;
- Water sprays on the crushed ore and ROM stockpiles;
- Implementation of an ambient air quality monitoring program outside of the Project site boundaries;
- Progressive reclamation on the waste rock piles and in the TMF; and
- Adherence to a comprehensive equipment maintenance program to maintain equipment and to maximize efficiency (reduce releases of combustion gases) and reliability.

As the majority of the air emissions related to Project operation will consist of fugitive releases of dust due to material handling and haul truck and vehicle travel on unpaved roads, an Environmental Protection Plan (EPP) will be prepared that incorporates mitigation and control measures outlined above. Road dust emissions will be managed to ensure that dust suppression is occurring at an appropriate frequency.

Characterization of Residual Project Environmental Effects

Detailed emission inventories of Project-related CAC emissions were prepared to assess the residual project environmental effects on a change in air quality during Project operation and maintenance. Dispersion modelling was conducted to predict the ground level concentrations of particulate matter (TSP, PM_{10}, $PM_{2.5}$) from all Project related fugitive dust sources. Control measures were also applied to the fugitive dust sources, where determined necessary, prior to modeling.

The emission inventories and dispersion modelling scenarios were based on full production rate of 16 million tonnes of concentrate per year. This includes operation of both process lines, and represents the equipment inventory during year 4. In year 4, the greater numbers of mining equipment are in operation at one time. Further, the simulations assume that operation occurred 24 hours a day, seven days a week.

This section of the Atmospheric Environment VEC provides a summary of the findings of the emissions inventory and dispersion modelling results. More details pertaining to the methodologies and assumptions used to prepare the inventory and model and the results obtained are presented in the Air Quality Monitoring Baseline Report (Appendix F), which was developed in support of this environmental assessment. Modelling was conducted in accordance with the requirements of the provincial *Air Pollution Control Regulations* and the following two guidance documents, "Guidance for Plume Dispersion Modelling (GD-PPD-019.1)" and "Determination of Compliance with the Ambient Air Quality Standards (GD-PPD-009.3)". The results obtained were compared to the National Ambient Air Quality Objectives and Canada Wide Standards.

As described above, air emissions during the operation of the Project will primarily be emitted through the combustion of fuel in mining equipment and onsite vehicles and from the release of fugitive dust through material handling and haul truck travel on unpaved roads.

A summary of the releases of combustion gases and particulate matter from the combustion of fuel within the mining equipment, as presented above in Table 14.23, is provided below in Table 14.26. These emissions are based on full production of the mine (16 million tonnes per year).

Table 14.26 CAC Emissions for Equipment During Project Operation

Equipment	Emissions of CACs (tonnes/a)					
	CO	NO_x	SO_2	TPM	PM_{10}	$PM_{2.5}$
Primary Mining Equipment						
Wheel Loader	1.89	2.74	0.94	1.45	1.39	1.30
Haul Truck	477	936	32.3	77.0	73.9	69.3
Secondary Mining Equipment						
Wheel Dozer (Caterpillar 844)	0.72	1.77	0.52	0.81	0.78	0.73
Track Dozer (Caterpillar CAT D9)	0.41	1.01	0.30	0.47	0.45	0.42
Track Dozer (Caterpillar CAT D10)	1.23	3.04	0.89	1.40	1.34	1.26
Motor Grader (Caterpillar 16M)	4.98	9.44	0.42	1.13	1.08	1.02
Water Truck 20,000 gallons (Caterpillar CAT777F)	4.60	20.2	0.10	0.66	0.63	0.59
Auxiliary Equipment						
Air Track Drill	0.09	3.27	0.11	0.17	0.16	0.15
Wheel Loader	0.25	0.37	0.13	0.19	0.19	0.17
Service Truck	3.77	0.19	0.00	0.00	0.00	0.00
Forklifts 15 tones	0.34	1.01	0.03	0.05	0.05	0.04
Forklifts 2.5 tones	0.34	1.01	0.03	0.05	0.05	0.04
Pickup 3/4 Ton Mine Ops.	2.05	0.11	0.00	0.00	0.00	0.00
Pickup 3/4 Ton Maint.	2.05	0.11	0.00	0.00	0.00	0.00

Equipment	Emissions of CACs (tonnes/a)					
	CO	NO_x	SO_2	TPM	PM_{10}	$PM_{2.5}$
Pickup 3/4 Ton Eng.,Survey, Geol.,	2.05	0.11	0.00	0.00	0.00	0.00
Pickup 3/4 Ton Ore Control, Samplers	2.05	0.11	0.00	0.00	0.00	0.00
Pickup 3/4 Ton Blasting	2.05	0.11	0.00	0.00	0.00	0.00
Pickup 1 Ton Flatbed	2.05	0.11	0.00	0.00	0.00	0.00
Pickup 1 Ton Service Body	2.05	0.11	0.00	0.00	0.00	0.00
Water truck fill station (diesel pump)	0.66	3.08	0.20	0.00	0.01	0.00
Light Plant (1000 w. diesel generator)	5.25	6.55	0.28	0.68	0.65	0.61
Mobile Pump (125 HP diesel)	1.33	6.16	0.41	0.01	0.01	0.01
Portable Generator 600kw	1.33	6.16	0.41	0.01	0.01	0.01
Aggregate Plant	1.43	2.84	0.13	0.21	0.20	0.19
Tailings Management Facility Equipment						
Pickup Truck	2.05	0.11	0.00	0.00	0.00	0.00
Excavator	1.04	1.97	0.09	0.24	0.23	0.22
Boom Truck	2.29	4.54	0.20	0.33	0.32	0.30
Water Truck	0.08	0.36	0.00	0.01	0.01	0.01
Dump Truck	0.15	3.18	0.10	0.16	0.16	0.15
Loader	0.34	0.49	0.17	0.26	0.25	0.23
Dozer	0.20	0.48	0.14	0.22	0.21	0.20
Vibratory Roller	0.77	1.47	0.06	0.17	0.16	0.15
Sheepsfoot Roller	0.77	1.47	0.06	0.17	0.16	0.15
Boiler House						
Boiler (up to 5)	12.0	48.0	170.3	4.73	2.37	0.57
Railway						
Locomotives	4.81	34.3	0.12	0.89	0.89	0.89
Railway Inspector Pick-up Truck	0.21	0.11	0.00	0.00	0.00	0.00
Rail Ballast Regulator	0.11	0.11	0.00	0.02	0.02	0.01
Rail Track Tamper	0.11	0.11	0.00	0.02	0.02	0.01
Boom Truck	2.29	4.54	0.20	0.33	0.32	0.30
Total	**547.2**	**1,107**	**208.6**	**91.9**	**86.0**	**79.1**

A summary of the mining activities that will result in emissions of fugitive dust and the control technologies that are being proposed to control the fugitive releases of particulate from each activity are provided in Table 14.27.

Table 14.27 Planned Mitigation for Project Activities Generating Emissions of Dust

Activity	Planned Mitigation	Control Efficiency (%)
Blasting	-	-
Drilling	-	-
Material Handling - Loading Mined Ore into Haul Trucks	-	-
Unpaved Road - Haul Truck Travel to Primary Crusher No.1	• Dust suppression / vehicle restrictions.	98
Unpaved Road - Haul Truck Travel to Primary Crusher No.2	• Dust suppression / vehicle restrictions.	98
Material Handling - Unloading of Mined Ore to Gyratory Crushers	-	-
Material Handling - Loading of Waste Rock to Haul Trucks	-	-
Unpaved Road - Haul Truck Travel to Rose North Waste Rock Disposal Area	• Dust suppression / vehicle restrictions.	98
Unpaved Road - Haul Truck Travel to Rose South Waste Rock Disposal Area	• Dust suppression / vehicle restrictions.	98
Material Handling - Unloading of Waste Rock	-	-
Wind Erosion - Rose North Waste Rock Disposal Area	• Progressive reclamation / frozen ground 50% of time / best engineering practices.	50
Wind Erosion - Rose South Waste Rock Disposal Area	• Progressive reclamation / frozen ground 50% of time / best engineering practices.	50
Wind Erosion - ROM Stockpile (Sm)	• Water sprays.	90
Wind Erosion - ROM Stockpile (Lg)	• Water sprays.	90
Crusher Buildings Vents	• Dust control.	99
Material Handling - Loading to Crusher Conveyor	• Dust control.	99
Material Handling - Conveying to Crushed Ore Stockpile	• Covered conveyor.	99
Material Handling - Stacking Conveyor	• Dust control.	99
Wind Erosion- Crushed Ore Stockpile 1	• Water sprays.	90
Wind Erosion - Crushed Ore Stockpile 2	• Water sprays.	90
Material Handling - Reclaim of Crushed Ore from Stockpile	• Apron feeder reclaim system.	95
Material Handling - Conveying of Reclaimed Crushed Ore to Process Plants	• Covered conveyor.	99
Process Plant Feeders	• Dust control.	99

Activity	Planned Mitigation	Control Efficiency (%)
Process Plants - Grinding / Screening[3]	• Dust collection system.	99
Material Handling - Final Concentrate Loading to Conveyor	• Dust control.	99
Material Handling - Final Concentrate Conveying	• Covered conveyor.	99
Material Handling - Rail Car Loading	• Handling of moist material / enclosed silo.	98
Wind Erosion - Tailings Pond	• Progressive reclamation / frozen ground 50% of time / best engineering practices.	50

The residual fugitive particulate emissions (TSP, PM_{10}, $PM_{2.5}$) due to the operation of the Project, after considering the mitigation presented above, are provided in Table 14.28.

Table 14.28 Estimated Fugitive Dust Emissions

Activity	Fugitive Dust Emissions (tonnes/year)		
	TPM	PM_{10}	$PM_{2.5}$
Blasting	2.46	1.29	0.06
Drilling	1.10	1.10	1.10
Material Handling - Loading Mined Ore into Haul Trucks	34.4	16.3	2.46
Unpaved Road - Haul Truck Travel to Primary Crusher No.1	15.07	4.01	0.41
Unpaved Road - Haul Truck Travel to Primary Crusher No.2	43.2	11.5	1.14
Material Handling - Unloading of Mined Ore to Gyratory Crushers	34.4	16.3	2.46
Material Handling - Loading of Waste Rock to Haul Trucks	73.8	35.0	5.30
Unpaved Road - Haul Truck Travel to Rose North Waste Rock Disposal Area	10.0	2.65	0.25
Unpaved Road - Haul Truck Travel to Rose South Waste Rock Disposal Area	94.6	25.2	2.52
Material Handling - Unloading of Waste Rock	73.8	35.0	5.30
Wind Erosion - Rose North Waste Rock Disposal Area	1.80	0.88	0.35
Wind Erosion - Rose South Waste Rock Disposal Area	0.06	0.03	0.01
Wind Erosion - ROM Stockpile (Sm)	0.01	0.00	0.00
Wind Erosion - ROM Stockpile (Lg)	0.09	0.03	0.02
Crusher Buildings Vents	25.5	13.0	3.82
Material Handling - Loading to Crusher Conveyor	25.5	12.6	12.6
Material Handling - Conveying to Crushed Ore Stockpile	25.5	12.6	12.6
Material Handling - Stacking Conveyor	25.5	12.6	12.6
Wind Erosion- Crushed Ore Stockpile 1	0.01	0.01	0.00

Activity	Fugitive Dust Emissions (tonnes/year)		
	TPM	PM_{10}	$PM_{2.5}$
Wind Erosion - Crushed Ore Stockpile 2	0.01	0.01	0.00
Material Handling - Reclaim of Crushed Ore from Stockpile	127.4	63.1	63.1
Material Handling - Conveying of Reclaimed Crushed Ore to Process Plants	25.5	12.6	12.6
Process Plant Feeders	23.3	11.9	3.50
Process Plants - Grinding / Screening[3]	46.7	15.7	1.07
Material Handling - Final Concentrate Loading to Conveyor	9.59	4.79	4.79
Material Handling - Final Concentrate Conveying	9.59	4.79	4.79
Material Handling - Rail Car Loading	19.2	9.59	9.59
Wind Erosion - Tailings Pond	139.4	69.7	27.9
Total	**887.2**	**392.2**	**190.3**

The complete Project operation emissions inventory, including both the emissions related to the combustion of fuel in mining equipment and vehicles and the fugitive releases of particulate matter are presented in Table 14.29.

Table 14.29 Summary of Project CAC Emissions during Operation

Activity	Emissions of Various CACs (tonnes/a)					
	CO	SO_2	NO_X	TPM	PM_{10}	$PM_{2.5}$
Mining and other Project Equipment	547.2	208.6	1106.8	91.9	86.0	79.1
Fugitive Emissions	-	-	-	887.1	392.2	190.3
Total Project Emissions	**547.2**	**208.6**	**1,107**	**979.0**	**478.2**	**269.4**

In order to predict the ground level concentrations of combustion gases and particulate matter due to the combustion of fuel in the engines of all mining equipment and fugitive releases of TSP, PM_{10} and $PM_{2.5}$ during Project operations, dispersion modelling was carried out using CALPUFF, version 6.4. CALPUFF is a non-steady state Lagrangian puff dispersion model that has the ability to account for such factors as variable and curved pollutant trajectories, variable meteorological conditions, spatial variability to winds and turbulence fields, retention of previous hour emissions, calm and low wind speed conditions, causality effects, wet and dry deposition, building downwash, plume fumigation, and complex terrain algorithms.

There are three major components to the CALPUFF model, CALMET (meteorological modelling package with both diagnostic and prognostic wind field generators), CALPUFF (a Gaussian puff dispersion model) and CALPOST (post processing program), as well as a series of pre-processors related to geophysical and meteorological parameters.

Specifics pertaining to the model domain, data pre-processing, CALMET, CALPUFF and CALPOST are described in detail in the, Air Quality Monitoring Baseline Report (Appendix F). Three years (2006 to 2008) of surface air data was acquired from Environment Canada for the Wabush Airport for use in this modelling study. As there are no upper air stations near the Project location itself, a Mesoscale Metrological Model (version 5) (MM5) dataset was procured from TRC Solutions for use in this study. The data set consisted of three years (2006, 2007, 2008) of MM5 data at 12 km resolution. A joint wind speed and direction frequency diagram for the Wabush Airport data is presented in Figure 14.4.

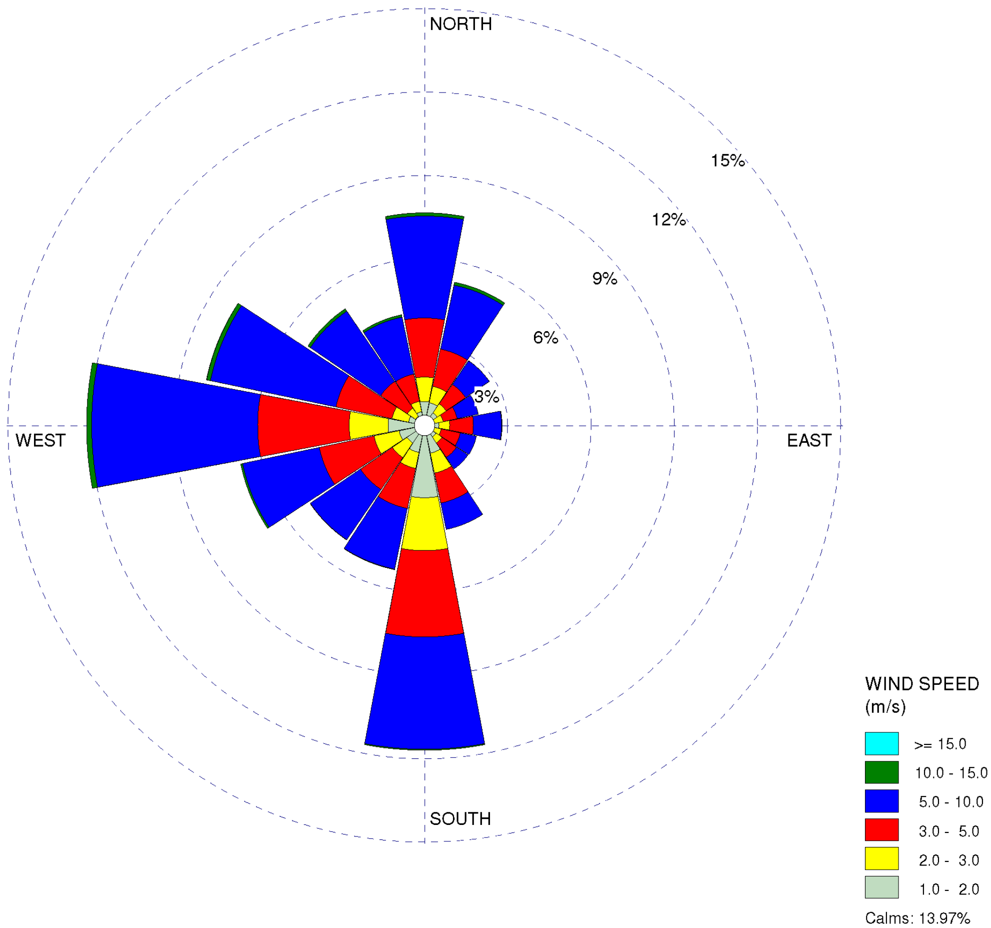
As shown in Figure 14.4, the prevailing winds in the area surrounding the proposed Project are from the West and South.

The maximum predicted ground level concentrations of CO, SO_2, NO_x, TSP, PM_{10} and $PM_{2.5}$ during Project operation for the provincial regulated time periods for each air contaminant at the nearest communities to the Project site are presented in Table 14.30. The Newfoundland and Labrador *Air Pollution Control Regulations* have also been included for comparison.

Figure 14.4 Joint Wind Speed and Direction Frequency Diagram, Wabush Airport (2006 – 2008)

WIND ROSE PLOT:
Station # 1

DISPLAY:
Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD: **Start Date: 1/1/2006 - 00:00** **End Date: 12/30/2008 - 23:00**	COMPANY NAME:	
		MODELER:	
	CALM WINDS: **13.97%**	TOTAL COUNT: **26277 hrs.**	
	AVG. WIND SPEED: **3.78 m/s**	DATE: **7/23/2012**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

Table 14.30 Maximum Predicted Ground Level Concentrations of Particulate Matter

Receptor Location	UTM Coordinates		CO (µg/m^3)		SO_2 (µg/m^3)				NO_x (µg/m^3)			TSP (µg/m^3)		PM_{10} (µg/m^3)	$PM_{2.5}$ (µg/m^3)
	Easting (m)	Northing (m)	1 hour	8 hour	1-hour	3 hour	24 hour	Annual	1 hour	24 hour	Annual	24-hour	Annual	24-hour	24-hour
Wabush North	643,450	5,862,878	19.1	12.8	14.7	7.94	2.86	0.117	36.2	11.2	0.553	13.7	0.643	11.4	7.14
Wabush South	644,629	5,861,476	21.0	13.8	11.1	7.50	1.90	0.113	37.3	11.9	0.549	9.96	0.598	8.58	5.17
Labrador City South	640,162	5,866,713	12.7	5.76	8.39	6.19	1.48	0.086	23.4	5.89	0.418	5.61	0.454	4.89	2.95
Labrador City West	637,554	5,866,543	12.9	5.73	7.53	7.02	2.25	0.098	24.0	4.42	0.511	6.03	0.498	5.36	3.43
Long Lake North	634,974	5,861,752	18.6	7.89	11.4	7.63	2.61	0.135	34.6	7.35	0.895	12.1	0.960	10.3	6.93
Long Lake South	636,197	5,857,258	27.5	12.0	44.8	23.0	6.98	0.438	54.3	13.6	2.28	35.7	3.63	29.9	25.2
Fermont	629,544	5,851,406	30.3	17.5	23.6	10.4	2.91	0.089	57.7	13.3	0.658	11.4	0.518	10.3	5.94
NL Regulatory Limit	-	-	35,000	15,000	900	600	300	60	400	200	100	60	120	50	25

The operation and maintenance of the Project will result in emissions of particulate matter and combustion gases, however, based on the current planned mitigation theses emissions will not result in any exceedances of the provincial *Air Pollution Control Regulations*, the National Ambient Air Quality Objectives (NAAQ) maximum acceptable levels or the Canada Wide Standards within the nearby communities.

An analysis of the metal content in the ore was previously conducted and the breakdown is presented below (BBA 2011):

Fe	MnO	Mn	Al_2O_3	MgO	CaO	TiO_2	Cr_2O_3	V_2O_5	P_2O_5	S
65.5%	0.95%	0.75%	0.20%	0.43%	0.44%	0.04%	<0.01%	<0.01%	<0.01%	0.053%

For this assessment, it was assumed that all particulate matter related to the Project will contain metal up to the levels presented above. Based on this analysis it was determined that the respective metals standards would be met provided that the particulate standards are met.

The dispersion modelling also incorporated a number of other discrete receptors representing the cabins located within the LSA. The locations of these cabins, based on data received from Newfoundland and Labrador Crown Lands and Québec Ministère des ressources naturelles et de la faune, and supplemented through direct consultation with cabin owners at various public events held by Alderon, are illustrated on Figure 14.5.

Figures 14.6 through to 14.9 illustrate the maximum predicted ground level concentrations of NO_x, TSP, PM_{10} and $PM_{2.5}$ for the 24-hour time period, on Project mapping, as predicted by the model. The locations of the nearby cabins are also presented.

As is evident in the above mapping a number of cabins located at the southern end of Long Lake will be affected by particulate matter from the operation of the Project (total of 16 for $PM_{2.5}$, 13 for PM_{10} and 4 for TPM). As well as shown in Figure 14.4 (the windrose), the prevailing winds are from the west and south. Winds are predicted to blow from the south towards the southern end of Long Lake approximately 11% of the time. Alderon will implement mitigation measures to reduce significant adverse effects on properties, if they occur.

As previously shown air quality resulting from the operation of the Project is not expected to exceed applicable regulations or guidelines in Fermont, Wabush or Labrador City. As presented in Figure 14.4 (windrose) winds typically blow from the northeast towards Fermont approximately 5 percent of the time, from the south west towards Wabush approximately 10 percent of the time and from the south towards Labrador City approximately 11 percent of the time. During these conditions it is likely that the affected communities would experience slightly higher concentrations of particulate.

As presented above, the effect of Project operation on a change in air quality is predicted to be moderate in magnitude, local in geographic extent, medium term in duration, continuous during the life of the Project and reversible.

Figure 14.5 Cabin Locations

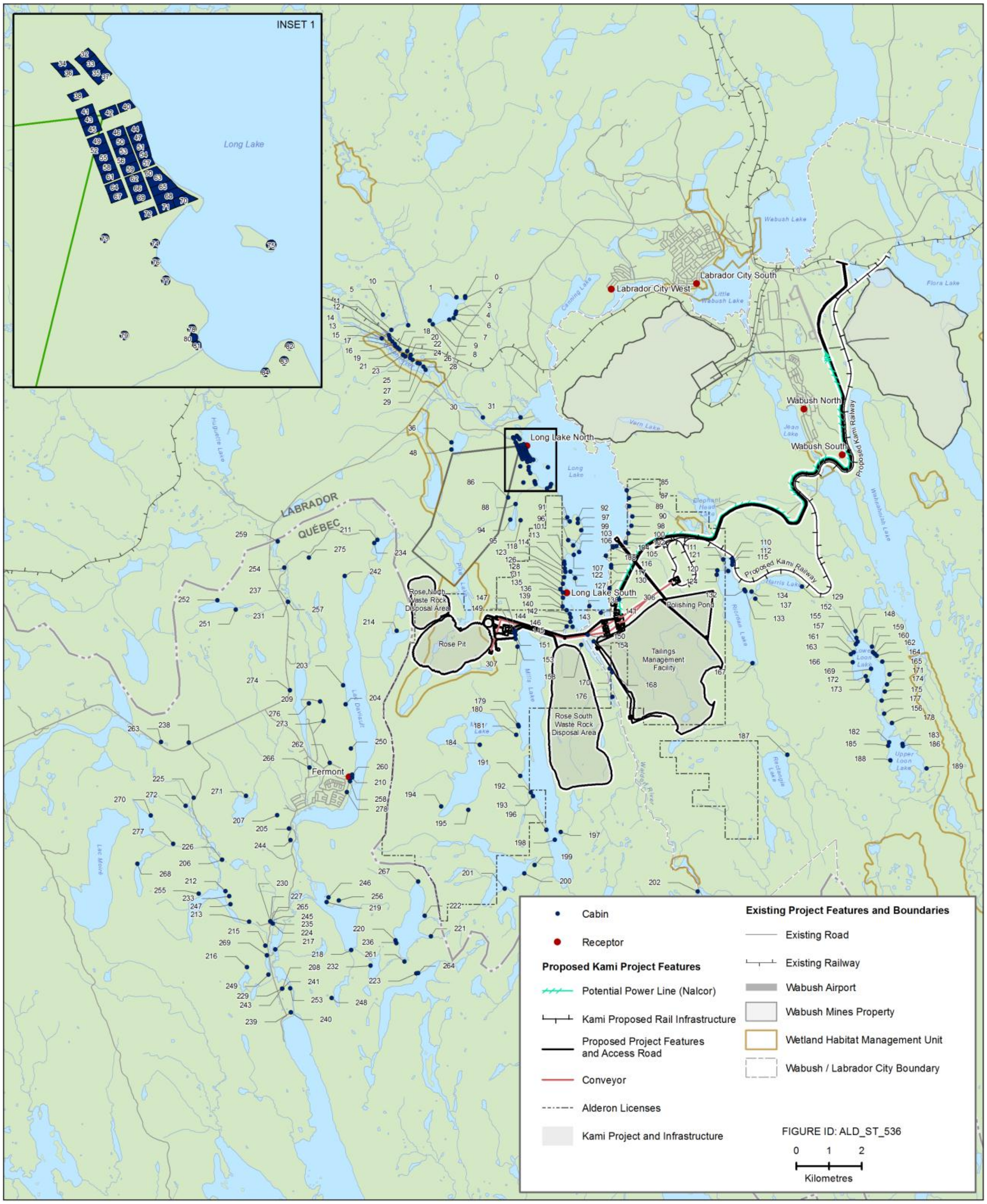


Figure 14.6 Maximum 24-hour Predicted Ground Level Concentration for TSP

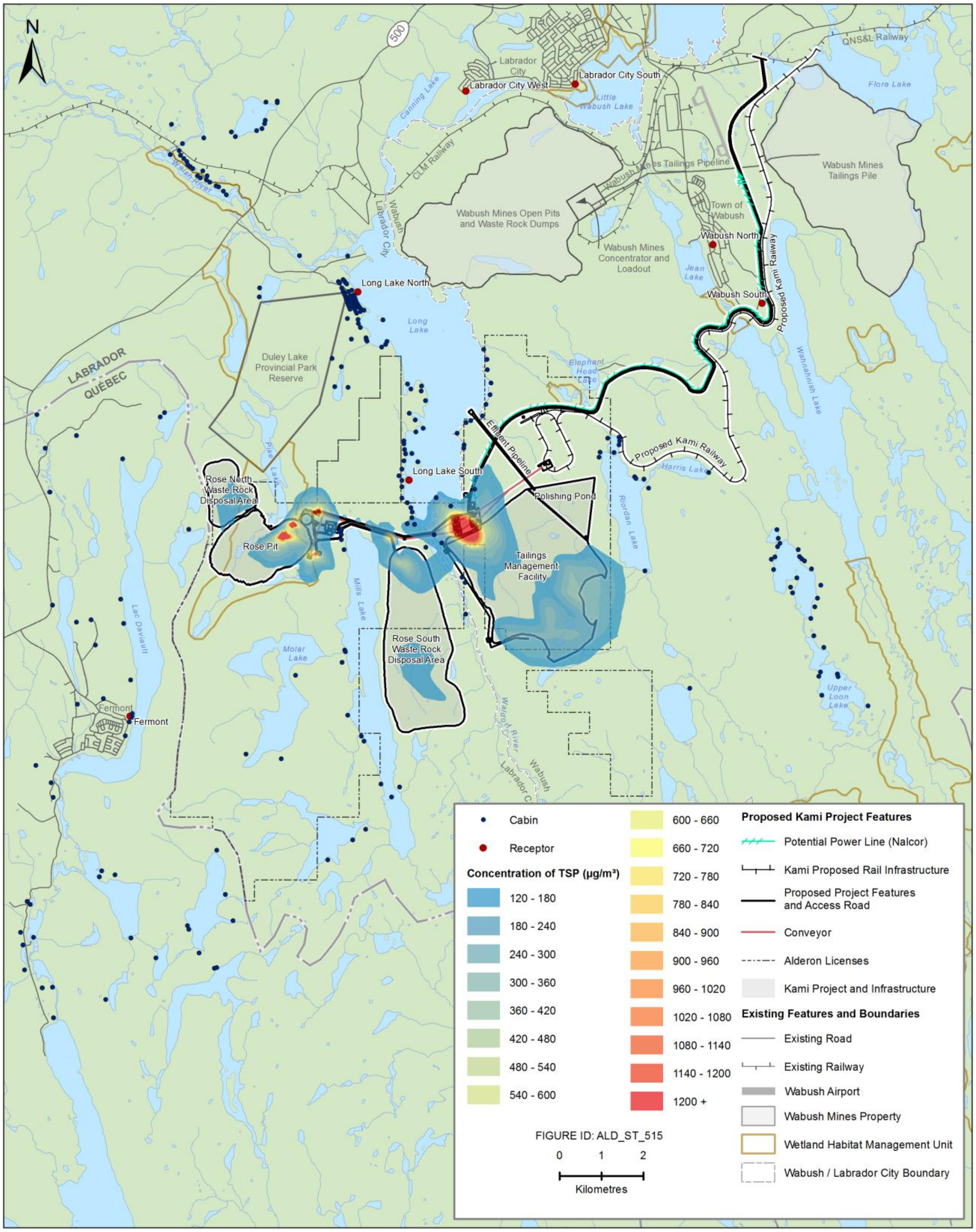


Figure 14.7 Maximum 24-hour Predicted Ground Level Concentration for PM_{10}

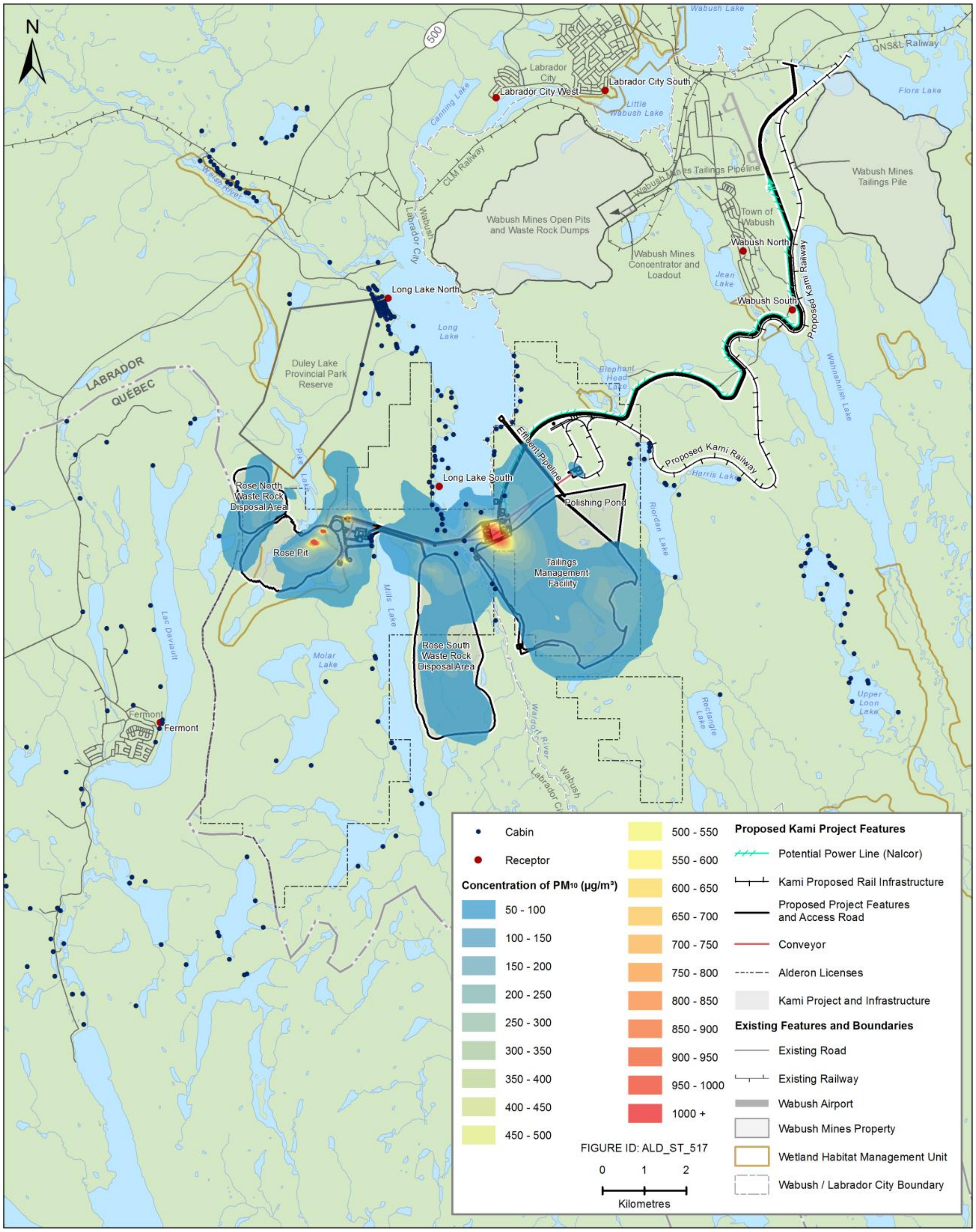


Figure 14.8 Maximum 24-hour Predicted Ground Level Concentration for $PM_{2.5}$

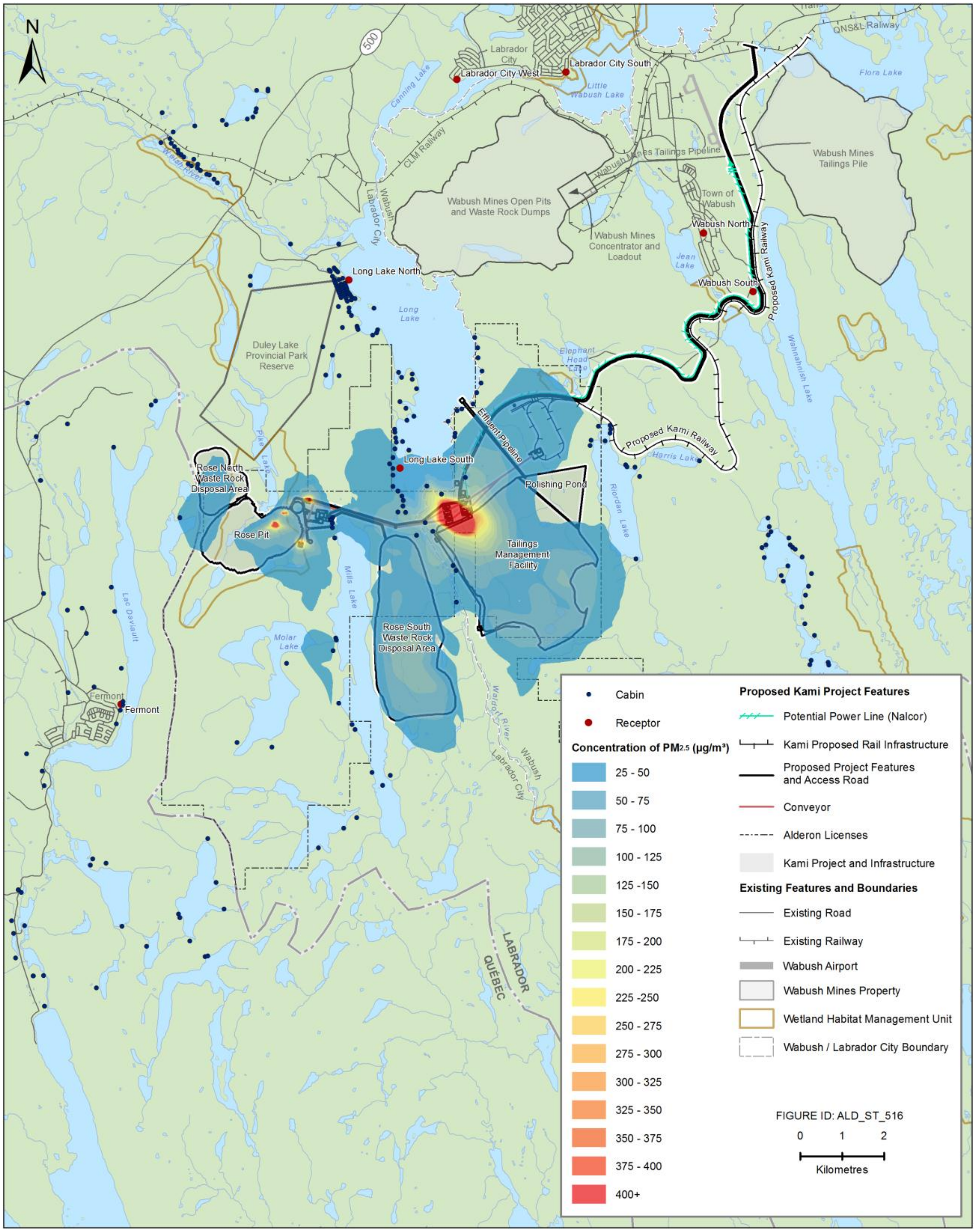
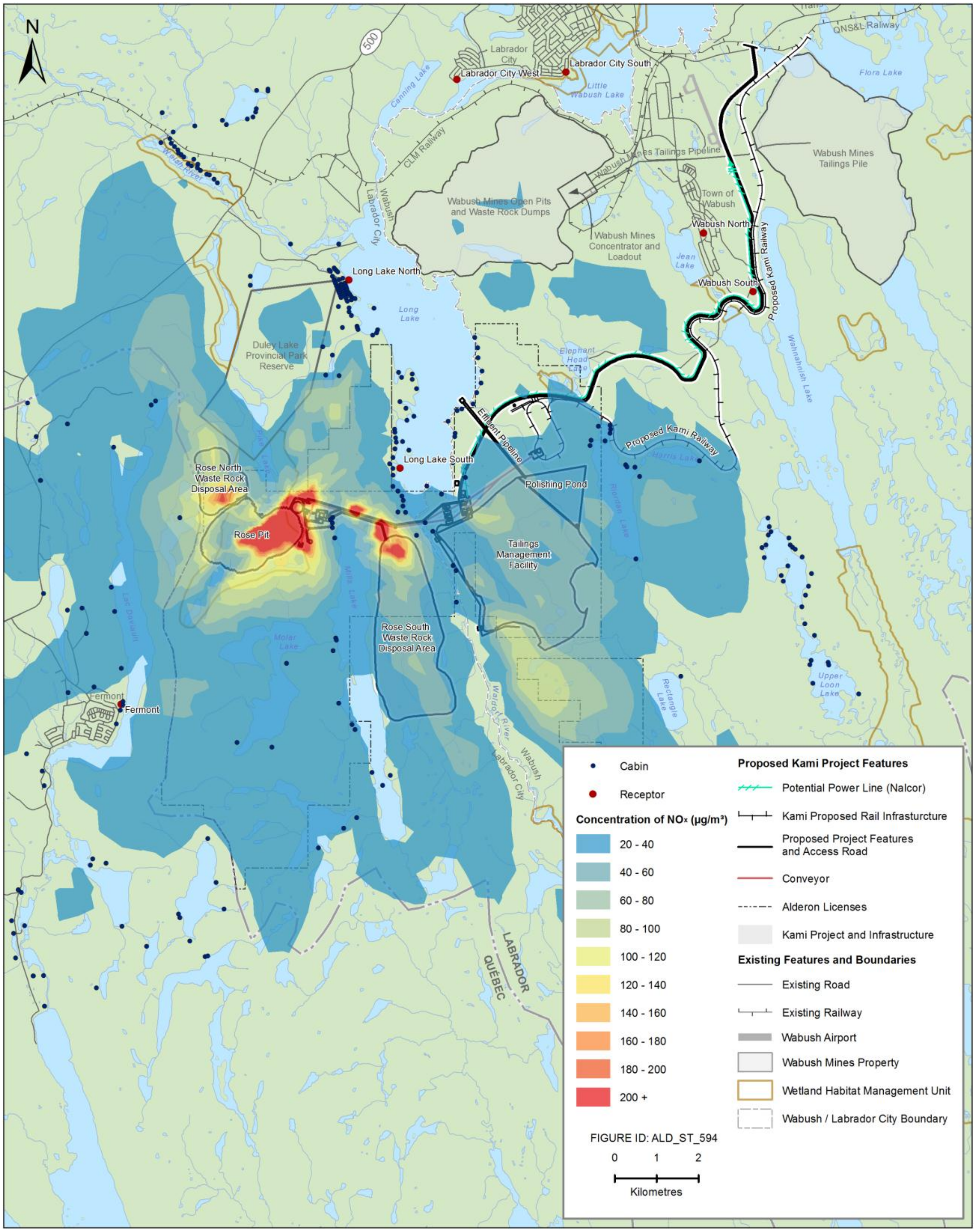


Figure 14.9 Maximum 24-hour Predicted Ground Level Concentration for NO_x



14.6.2.2 Change in Greenhouse Gas Emissions

Potential Environmental Effects

During Project operation and maintenance GHG emissions will result from the combustion of fuel in mining equipment and onsite vehicles and through the combustion of No.2 fuel oil in boilers to produce steam to heat various buildings. These emissions will occur throughout the life of the Project (approximately 17 years).

In addition to the above direct sources of GHG emissions, the use of electricity to power other mining equipment and buildings onsite will result in the release of in-direct GHG emissions.

Mitigation of Potential Environmental Effects

As the majority of the greenhouse gas emissions during Project operation will result from the combustion of fuel in mining equipment, mitigation would be similar to that presented for the construction of the Project and includes:

- Adherence to a comprehensive equipment preventative maintenance program to maintain the vehicles, and to maximize fuel efficiency and vehicle performance; and

The implementation of an idling policy to minimize the consumption of fuel when the equipment and vehicles are stationary for extended periods of time.Characterization of Residual Project Environmental Effects

To assess the residual project environmental effects on a change in greenhouse gas emissions during Project operation and maintenance, a detailed GHG emissions inventory was prepared, which included determining both direct and indirect Project related emissions. A summary of the direct releases of GHG emissions from the operation of the mining equipment, maintenance equipment and boilers previously presented in Table 14.23 and Section 14.5 is provided below in Table 14.31. Emission factors for Greenhouse Gas (GHG) emissions of CO_2, N_2O and CH_4 were retrieved from Transport Canada's UTEC (Transport Canada, 2011b).

Table 14.31 GHG Emissions during Project Operation

Equipment	GHG Emissions (tonnes/a)			Tonnes CO_{2eq}/a)
	CO_2	CH_4	N_2O	CO_{2eq}
Primary Mining Equipment				
Wheel Loader	6,118	-	-	6,118
Haul Truck	209,527	-	-	209,527
Secondary Mining Equipment				
Wheel Dozer (Caterpillar 844)	3,388	-	-	3,388
Track Dozer (Caterpillar CAT D9)	1,936	-	-	1,936
Track Dozer (Caterpillar CAT D10)	5,808	-	-	5,808
Motor Grader (Caterpillar 16M)	1,935	-	-	1,935

Equipment	GHG Emissions (tonnes/a)			Tonnes CO_{2eq}/a)
	CO_2	CH_4	N_2O	CO_{2eq}
Water Truck 20,000 gallons (Caterpillar CAT777F)	4,552	0.25	0.16	4,608
Auxiliary Equipment				
Air Track Drill	694	-	-	694
Wheel Loader	819	-	-	819
Service Truck	413	0.05	0.11	448
Forklifts 15 tones	127	-	-	127
Forklifts 2.5 tones	127	-	-	127
Pickup 3/4 Ton Mine Ops.	602	0.04	0.08	628
Pickup 3/4 Ton Maint.	401	0.02	0.05	418
Pickup 3/4 Ton Eng.,Survey.,Geol.,	301	0.02	0.04	314
Pickup 3/4 Ton Ore Cotrol, Samplers	201	0.01	0.03	209
Pickup 3/4 Ton Blasting	301	0.02	0.04	314
Pickup 1 Ton Flatbed	100	0.01	0.01	105
Pickup 1 Ton Service Body	100	0.01	0.01	105
Water truck fill station (diesel pump)	114	-	-	114
Light Plant (1000 w. diesel generator)	1,286	-	-	1,286
Mobile Pump (125 HP diesel)	228	-	-	228
Portable Generator 600kw	228	-	-	228
Aggregate Plant	582	-	-	582
Tailings Management Facility Equipment				
Pickup Truck	100	0.01	0.01	105
Excavator	403	-	-	403
Boom Truck	931	-	-	931
Water Truck	4,552	0.25	0.16	4,608
Dump Truck	681	-	-	681
Loader	1,092	-	-	1,092
Dozer	922	-	-	922
Vibratory Roller	301	-	-	301
Sheepsfoot Roller	301	-	-	301
Boiler House				
Boiler (up to 5)	53,438	0.124	0.623	53,634
Railway				
Locomotives	4,619	-	-	4,619
Railway Inspector Pick-up Truck	100	0.01	0.01	105
Rail Ballast Regulator	15	-	-	15

Equipment	GHG Emissions (tonnes/a)			Tonnes CO_{2eq}/a)
	CO_2	CH_4	N_2O	CO_{2eq}
Rail Track Tamper	15	-	-	15
Boom Truck	931	-	-	931
Total	**308,291**	**1**	**1**	**308,729**
(-) emission factor not available				

A number of the major pieces of equipment associated with the operation and maintenance of the Project use electricity. Indirect GHG emissions associated with this electricity use were also estimated based on the energy required by the equipment and a GHG emission intensity for Newfoundland and Labrador A summary of the indirect Project GHG emissions by activity / equipment is provided in Table 14.32.

Table 14.32 Indirect Project GHG Emissions

Equipment	kWh	Maximum Year Emissions (tonnes/year)			
		CO_2	CH_4	N_2O	CO_{2e}
Ore shovel	14700000	294	0.00294	0.00588	295.88454
Waste shovel	17600000	352	0.00352	0.00704	354.25632
Blasthole drill	27900000	558	0.00558	0.01116	561.57678
Dewatering	13900000	278	0.00278	0.00556	279.78198
Total	**74100000**	**1482**	**0.01482**	**0.02964**	**1491.4996**

Table 14.33 below shows the comparison of the estimated Project GHG emissions (direct emissions) to the other nearby mines and the provincial, national and global GHG emission totals, as previously presented in Existing Conditions.

Table 14.33 Comparison of Estimated Project Direct and Indirect GHG Emissions to Provincial, National and Global Estimates

Type of Emission	GHG Emissions (Mt CO_{2eq})	% of Total Emissions
Project Direct	0.309	-
Project Direct + Indirect	0.310	-
Industry Profile	8.0	3.9
Provincial	4.5	6.9
National	262	0.12
Global	44,000	0.0007

As illustrated in the above table, GHG emissions resulting from the operation and maintenance of the Project will represent approximately 4 percent of the industrial standard for the mineral products industry, 7 percent of the provincial total reported emissions, less than 1 percent of the national and global reported emissions. As per the CEA Agency guidance (2003) the Project would be considered to be a “medium” emitter.

As presented above, the effect of Project operation and maintenance on a change in greenhouse gas emissions is predicted to be moderate in magnitude, global in geographic extent, medium term in duration, continuous throughout the lifetime of the Project, and reversible.

14.6.2.3 Change in Acoustic Environment

Potential Environmental Effects

During the operation of the Project sound emissions will result from the following activities: open pit mining, ore processing, concentrator operations, tailings disposal, waste rock disposal, rail load-out and rail transport.

Noise emissions from the above activities during normal operations are from the following sources:

- Vehicles:
  - Ore haul trucks;
  - Waste rock haul trucks;
  - Water trucks; and
  - Pickups / small vehicles.
- Drilling equipment;
- Process facilities:
  - Pumphouses;
  - Crushers; and
  - Process Plants.
- Material movement:
  - Conveyor systems; and
  - Load out equipment.
- Railroad; and
- Blasting.

Each of these categories of noise emission is made up of various numbers of component pieces of equipment. The maximum equipment on-site is to be found in year 4 or 5 of operation, and the assessment of noise effects is based on this inventory.

The mining process, in terms of noise generation, begins with the rock drills in the quarry. The rock drills make holes in the rock on the basis of a plan drawn up by mining engineers. The depth, spacing, size, and number of blast holes are designed to achieve a yield of rock broken into suitable sizes for processing.

Each hole contains a charge, and the charges are linked together with fuse that is designed to cause a slight delay in the transmission of the detonation signal. The delay is important in maximizing the blast effectiveness, and in reducing the noise generation. The delay works with the blast vibration to help maximize the breaking of the rock. The blast occurs as a ripple of detonations, not as a single instantaneous explosion. Explosive power into the atmosphere generates noise, but is a waste of charge, as the energy is intended to be sent into the rock. For this reason, charges are buried in the holes, and a small part of the energy reaches the surface in the form of sound waves. The overall sound of the blast is determined by the size of the overall blast pattern, and by how effectively the plan is designed and executed. In ideal circumstances, the blast is more like a rumble of thunder in the distance than an explosive crack. Blasts are executed by professional explosives contractors, and are always monitored for comparison with the local applied limit. Some perception of the blast is unavoidable, but strict adherence to the limit through careful design and execution, as well as conducting the blasts during the daytime with adequate warning can greatly reduce the annoyance to the public.

Following the blast, the heavy equipment is used to load haul trucks with waste rock and ore. The waste rock is taken to the disposal site and dumped there. The sound emissions from this process are the emissions from heavy diesel engines. The ore is transported to one of two primary crushers near the pit. In these crushers, the ore is reduced to a size that can be conveyed to the processing plant. The crushers will be enclosed within buildings with sound attenuation features so that year-round operation is possible. Sound is emitted to the atmosphere via the louvers, or discharge points for building ventilation requirements, and these exit points are also noise attenuating.

The route from the crusher to the processing plant is via a large conveyor system. Conveyors can vary greatly in noise level. The ore and rubber belt carrying the ore are not sources of noise themselves, but the rollers supporting the belt can be. Rollers that are out of round, or have bad bearings, can cause sound emissions. In this project, proven German technology is employed for better performance of the conveyor elements that can emit noise.

At the processing plant, the ore is milled to reduce it to a better size for separation. The milling, water pumps, and screener / classifiers produce noise, but these are, like the crushers, within a building designed to attenuate sound and permit year-round operation. Again, some sound will be emitted from the ventilation openings in the building.

Two streams emerge from the process building, the wet tailings to the impoundment facility, and the ore concentrate that is conveyed by another conveyor system to the rail load-out area. The characteristics of this conveyor are similar to those of the crusher-process conveyor. The main source of noise on the rail load-out loop is the locomotive itself. The train moves slowly on the loop during loading, and then departs for Sept-Iles, joining the existing rail line on the north side of Wabush. The three locomotives on the train are the largest single noise sources. Wheel noise is another source of sound from the train, particularly on the track section ends. On steep turns, flange squeal may also be an issue, but oiling systems are available as design mitigation elements to reduce the generation of this sound.

In addition to the flow-path for the ore described above, some other, generally minor sources of noise exist on the site. These include the four water trucks that are in use for dust control, and a number of small pick-up trucks and other service vehicles. Other stationary sources include water pumphouses at both the crusher end and the process plant. These are also in buildings with sound attenuation features, but ventilation openings allow some sound emissions.

Mitigation of Potential Environmental Effects

Mitigation features for noise have been designed into the Project lay-out. The primary design feature is the separation distance from the communities of Fermont, Wabush, and Labrador City that ranges from 5 to 10 km. It is not possible to relocate the pit, but the waste rock pile and the rail loop are proposed to be located as far as technically and economically feasible from the communities and most cabins.

To operate year-round in the local climate the buildings housing much of the noise generating equipment will be insulated, and this affords the opportunity to also attenuate the noise levels. The perforations for ventilation that are required will be located on the side of the buildings facing away from the nearest cabins to reduce the directional transmission effectiveness. Within the pit, the walls offer a natural form of noise barrier.

The south end of Wabush is susceptible to noise from the trains on three sides. Therefore, welded track sections will be used, to reduce wheel noise in that area, and design consideration will be given to oiler systems to reduce flange squeal if the potential for it exists in the turning zone.

Characterization of Residual Project Environmental Effects

To assess the sound levels resulting from the operation and maintenance of the Project, Project operations have been assessed quantitatively using mathematical modelling of sound propagation. The modeling was conducted using the algorithms of ISO9613-1 and ISO9613-2 as implemented in the software Cadna by Datakustik. This was used for all sources but rail. The noise due to rail movement was predicted using “Sound from Trains Environmental Analysis Method” (STEAM) of the Ontario Ministry of the Environment, and these predictions were then incorporated into Cadna to predict the overall sound levels due to the project. These predictions were added to the baseline sound levels inferred from the baseline monitoring program, and compared with the relevant criteria from Health Canada and the Province of Québec for Fermont.

The inventory of sources employed in the model are summarized in Table 14.34.

Table 14.34 Project Operation Noise Sources and Sound Power Levels

Quantity of Sources	Source Description	Sound Power Level s (dBA)
22	Haul Truck	93.2
30	Haul Truck	100
2	Wheel Loader	92
6	Blasthole Drill	129
3	Wheel Dozer	91.6
4	Track Dozer	91.7
3	Motor Grader	91.4
4	Water Truck	91.7
1	Air Track Drill	91.6
1	Service Truck	91.1
2	Forklifts	90.8
20	Pickups	90.8
1	Water Truck Fill Station	90.8
1	Light Plant	91.1
1	Aggregate Plant	91.5
2	Excavator	100
6	Conveyor	94
1	Rail Line	69/m
1	Rail Loop	66/m

For the purposes of the model, it was assumed that all sources were in simultaneous operation, and that the operation was 24 hours/day, 7 days/week. The terrain was incorporated into the noise model in the form of height data from the Canadian federal government site, Geobase. Vegetation, and the attenuation due to vegetation, was not included in the model to be conservative.

The results of the noise prediction for operations are shown in Figure 14.10. The isopleths in this figure are the predicted sound levels in dBA. The map shows the spatial distribution of sound levels. In addition, tables of specific receptors were used for the evaluation, comprising representative receptors in the three main communities, and on the affected areas of Long Lake, as well as all of the other identified individual cabins in the modeling domain. The results for the representative receptors are presented in Table 14.35.

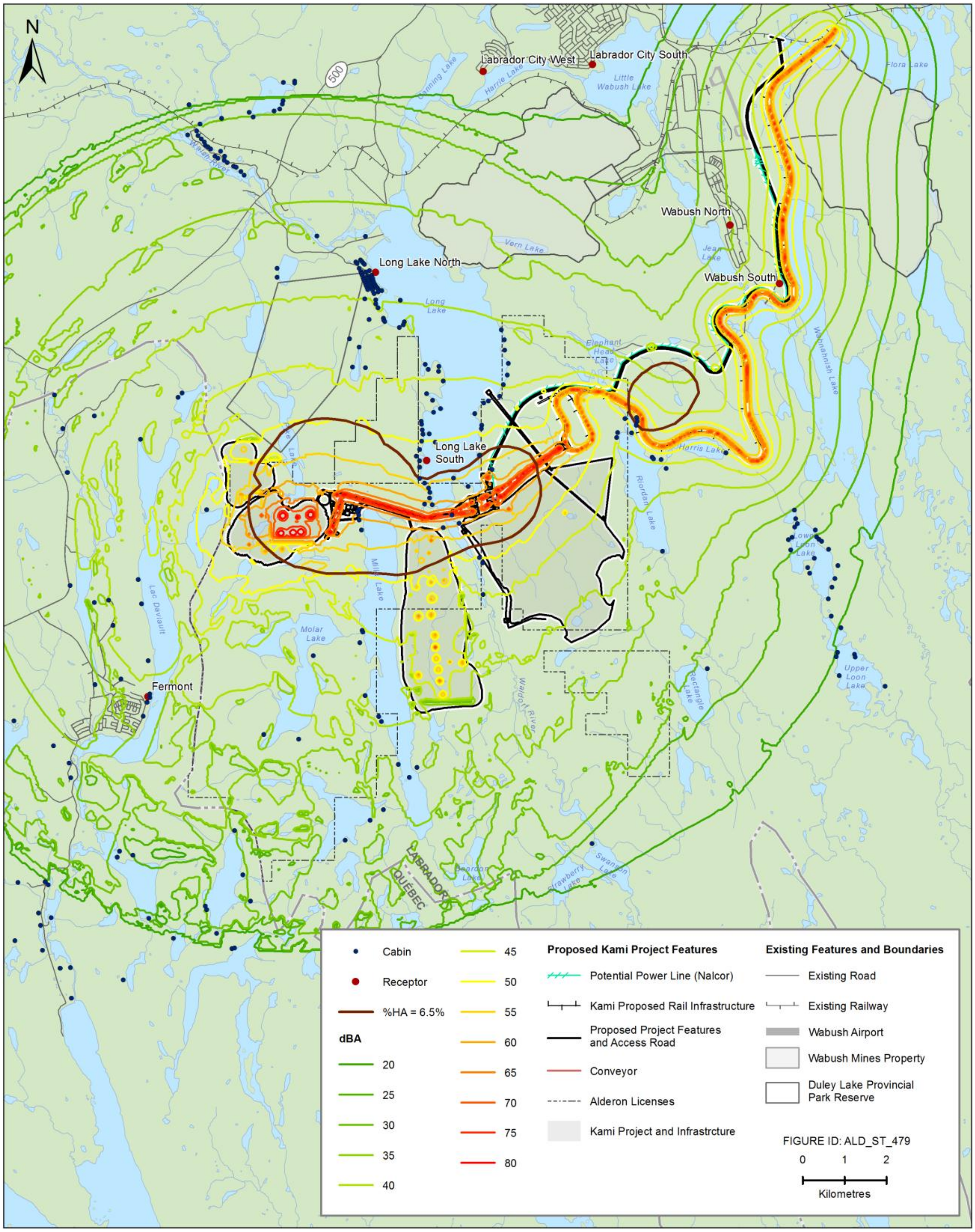
Table 14.35 Existing Sound Pressure Level (SPL), Predicted SPL and Cumulative SPL for Project Operation

Receptor	Existing				Kami Mine			Cumulative Total				
	L_d (dBA)	L_n (dBA)	L_{dn} (dBA)	%HA	L_d (dBA)	L_n (dBA)	L_{dn} (dBA)	L_d (dBA)	L_n (dBA)	L_{dn} (dBA)	%HA	Δ %HA
Wabush North	53	43	53	3.22	15	15	22	53	43	53	3.22	0.00
Wabush South	53	43	53	3.22	18	18	24	53	43	53	3.23	0.00
Labrador City South	53	43	53	3.22	6	6	12	53	43	53	3.22	0.00
Labrador City West	53	43	53	3.22	6	6	12	53	43	53	3.22	0.00
Long Lake North	42	40	47	1.41	37	37	43	43	42	48	1.76	0.35
Long Lake South	42	40	47	1.41	47	47	54	49	48	55	3.93	2.51
Fermont	43	39	47	1.44	40	40	46	45	43	49	2.05	0.60

Wabush is closer to the rail line, and shows little effect from the mine facilities. At Wabush North (see Figure 14.10), the incremental change is very small, and the increase in the Health Canada metric of percent highly annoyed (%HA) is negligible. In the south, the rail causes a greater increase in sound, particularly in the nighttime average, with a consequent increase of 3 percent, under the significance criterion of 6.5 percent (Figure 14.10).

Labrador City was represented by receptors in the south and west, and both show only a negligible contribution from the Project to the ambient sound level that is not significant, and likely not to be perceptible (Figure 14.10).

Figure 14.10 Predicted Noise Levels



Long Lake is divided, with an acceptable change in %HA in the north of about 0.4 percent and a general increase of about 5.3 percent in the south (Figure 14.10). There are, however, a number of cabins where the criterion of 6.5 percent is exceeded. These 20 cabins are all clustered at the south, and the sound levels there are largely due to the conveyor, crushers, and processing plant. Alderon will implement mitigation measures to reduce significant adverse effects on properties, if they occur. The 6.5 percent criterion is illustrated as a red line on the noise prediction figure.

Fermont is a largely mixed residential town with numerous apartments and single family dwellings, such that the Québec night time sound limit of 45 dBA is applicable. The baseline monitoring program found levels there of 43 and 40, respectively, and the predicted level of 44.7 day, and 42.2 night would meet those limits. The Health Canada metric of change in %HA would be 0.5 percent, which is below the criterion of 6.5 percent.

As presented above, the effect of Project operation and maintenance on a change in the acoustic environment is predicted to be moderate in magnitude, local in geographic extent, medium term in duration, continuous during the life of the Project and reversible.

14.6.2.4 Change in Vibration

Potential Environmental Effects

During the operation of the Project vibration may result from drilling and blasting within the Rose Pit Mine and from the transport of the concentrate via rail.

The Project, as currently planned, consists of 17 km of main track and loop and 7 km of interchange. During operation approximately two loaded trains and two unloaded trains will pass on this rail daily, with a cycle time of 48 to 65 hours and six trainsets in total. Each trainset will consist of 240 35-foot gondola cars and three locomotives. A summary of the forecasted rail traffic is provided in Table 14.36.

Table 14.36 Summary of Planned Rail Traffic during Project Operation

	No. of Trains per Time Period	Time Period (hours)	No. of Locomotives per Train	No. of Cars per Train	Maximum Train Speed (km/h)
Empty Freight Daytime	2.0	15	3	240	50
Empty Freight Nighttime	2.0	9	3	240	50
Full Freight Daytime	1.0	15	3	240	50
Full Freight Nighttime	1.0	9	3	240	50

The sensitive receptors (cabins) located closest to the Project's rail line are listed in Table 14.37 and presented in Figure 14.5. Typically, ground borne vibration is a potential concern only if the dwelling is located within 75 m of the rail line or rail right-of-way. Table 14.37 shows those receptors that are located within 100 m of the Project rail line; of these three cabins, two (110 and 112) are located within the 75 m setback distance. All other receptors (cabins) are estimated to be more than 100 m from the rail line.

Table 14.37 Distances from Receptor to the Project Rail Line

Receptor ID	Estimated distance to the rail line [m]
R110	55
R112	70
R115	87

Mitigation of Potential Environmental Effects

A mitigation measure that will be employed to minimize vibration effects from the operation of the Project rail line is to limit train speed to 50 km/h or less. Further, a continuous welled track and ballast system will be used and an equipment maintenance program will be adhered to such that vibration is minimized.

Characterization of Residual Project Environmental Effects

To assess the residual project environmental effects on a change in vibration during Project operation an assessment of the potential vibration resulting from blasting within the Rose Pit and from the operation of the Project rail line on the nearest receptors was conducted.

To determine the potential effects that blasting in the Rose Pit could have on nearby cabins a blast audit was conducted. The analysis was based on a maximum weight of explosives equivalent to two holes per delay or 2,098 kg and ground borne vibration and airblast levels were predicted for those cottages within 3,530 m of the edge of the pit. Five cabins were found to be located within 1,000 m of the edge of the proposed Rose Pit. The predicted vibration levels for these cabins fell between 11.9 and 19.2 mm/s and 120 and 123 db for airblast levels. As damage to the weakest structural component of a building (the drywall sheets) typically occurs at vibration levels between 20 and 50 mm/s and as airblast levels are typically 150 db and greater before damage results, damage to the five nearest cabins due to blasting in the Rose Pit is not anticipated. As well as all other cabins and houses within the nearby towns are located at greater distances, and that vibration and airblast levels would decrease with distance, damage to these areas are also not expected.

To determine the potential effects from the operation of the railway, a generalized procedure based on the methodologies provided in Federal Transit Administration (FTA) (2009) and Transit Corporative Research Program (TCRP) (2009) were used to estimate ground borne noise and vibration. Vibrations from the rail line to a receptor depend on a number of factors including, but not limited to, rail type (freight trains), speed, vehicle parameters and track conditions receiver conditions. In this analysis the following assumptions were made:

- Rail type – diesel powered locomotives;
- Speed – 50 km/hour or less;
- Wheels – worn or flat wheels will not be used and will be reasonably well maintained;
- Tracks – will be installed on ballast as typical of such applications;
- Rock layer – no continuous rock layer greater than 15 – 20 m found between rail track and receptor; and
- Receivers – cabins are made of light weight structural elements which could amplify vibration.

Based on the above noted assumptions, Table 14.38 provides the estimated vibration and ground-borne noise due to the operation of the Project. The analysis considers favorable to moderate vibration propagation conditions, which aids vibration propagation without much attenuation.

Table 14.38 Predicted Project Vibration and Ground-borne Noise

Receiver ID	Vibration VdB (ref 10^{-6} in /sec)	Vibration VdB (ref $5x10^{-8}$ m /sec)	Ground-borne noise (ref $1x10^{-6}$ Pascals)
R110			
R112	72	66	35
R115	70	64	35
Vibration Criteria	72	66	35

The above table indicates that the estimated vibration and ground-borne noise meets the criteria previously presented in Section 14.2.

As presented above, the effect of Project operation and maintenance on a change in vibration is predicted to be moderate in magnitude, local in geographic extent, medium term in duration, sporadic in frequency and reversible.

14.6.2.5 Change in Lighting

Potential Environmental Effects

During Project operation light emissions will result from a number of activities, including open pit mining, ore processing and concentrator operations, tailings disposal, waste rock disposal and water treatment. The permanent lighting fixtures for the facilities will be of the full horizontal cut-off type as appropriate, and the effect of the site lighting, given the use of these fixtures, distance, and topographic shielding, are expected to be minimal. The cluster of operations –

concentrator, rail loading, and conveyor system at the south end of Long Lake, however will be generally visible to the cabins on the west shoreline.

The headlights of haulage trucks leaving the Rose Pit and travelling to the waste disposal piles and the crusher buildings and service vehicles within the Project Area are required for safe and efficient operation.

Potential effects of Project lighting on wildlife and migratory birds have been assessed in Chapter 19: Birds, Other Wildlife and Their Habitats, and Protected Areas.

Mitigation of Potential Environmental Effects

The lighting design guidelines are especially important at the south end of Long Lake, as this is one of the few groups of Project activities that can be observed directly. Proper shielding, and the use of full horizontal cutoff fixtures will be implemented as appropriate.

Most of the routes for haul trucks and service vehicles on-site will be shielded by topography and vegetation along their length, but individual vehicles may be visible from time to time. In detailed design, the vehicle routing will take advantage of topographic sheltering, where feasible, and tree cover will be left in place where practicable to reduce the line-of-sight from cabins to the on-site roads.

The main access road parallels the railway to the south and east of the town of Wabush. Although traffic on this road is much more limited – shift changes and service vehicles – tree cover will be left in place as a vegetation screen as much as possible to reduce line-of-sight visibility of Project traffic.

Characterization of Residual Project Environmental Effects

With mitigation in place, as discussed above, light from the Project is not expected have an effect on nearby individuals, communities, commercial or recreational activities, including tourism.

Based on the information presented, the effects of Project operation and maintenance on a change in lighting are predicted to be low in magnitude, local in geographic extent, medium term in duration, regular in frequency and reversible.

14.6.2.6 Decommissioning and Reclamation

As presented in Table 14.10, Project decommissioning and reclamation have the potential to interact with the Atmospheric Environment to result in an environmental effect on a change in air quality, change in greenhouse gas emissions, change in acoustic environment, change in vibration (decommissioning only) and a change in lighting (decommissioning only). These potential interactions were previously ranked as a 1 in Section 14.4.

Site decommissioning will be similar to the activities carried out during site construction and as stated above an interaction will occur with the Atmospheric Environment, however based on an environmental effects analysis that was similarly conducted for Project construction (Section 14.6), the resulting effect on a change in air quality, change in greenhouse gas emissions, change in acoustic environment, change in vibration and change in lighting can be managed to acceptable levels.

Site reclamation activities will also be similar to those activities to be conducted during Project construction and to progressive reclamation of the waste rock disposal areas and the tailings pond during Project operation. This activity was therefore previously assessed to be a 1 in Section 14.4, as with mitigation the effects of this activity on a change in air quality, change in greenhouse gas emissions and change in acoustic environment can be managed to acceptable levels.

Therefore, as no Project decommissioning and reclamation activities were ranked as a 2, (previously ranked as 1 in Section 14.4), no further assessment of this Project phase on the Atmospheric Environment is warranted.

14.6.2.7 Summary of Project Residual Effects

The residual environmental effects of the Project on the Atmospheric Environment are summarized in Table 14.39.

Table 14.39 Summary of Project Residual Environmental Effects: Atmospheric Environment

Project Phase	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	
Change in Air Quality											
Construction	• Fugitive dust suppression programs. • Equipment preventative maintenance programs. • Dust control for the crusher buildings and all conveyor transfer points. • Covered Conveyors, as required. • Use qualified blasting contractors with blast design plans that incorporate dust emission controls. • Progressive reclamation on the waste rock piles and TMF. • Limit on-site speed to 50 km/h.	A	M	L	ST	R	R	D	N	H	Ambient air quality monitoring.
Operation and Maintenance		A	M	L	MT	C	R	D	N	H	
Decommissioning and Reclamation		A	M	L	ST	R	R	D	N	H	

Project Phase	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	
Change in GHG Emissions											
Construction	• Equipment idling policy. • Equipment preventative maintenance programs. • Implementation of a GHG Management Plan.	A	M	G	ST	R	R	D	N	H	Annual monitoring of GHG emissions and reporting to Environment Canada.
Operation and Maintenance		A	M	G	MT	C	R	D	N	H	
Decommissioning and Reclamation		A	M	G	ST	R	R	D	N	H	
Change in Acoustic Environment											
Construction	• Use of mufflers on construction equipment. • Adherence to equipment maintenance programs. • Maintain a vegetation buffer between the Project and nearby residents and cabins. • Limit train speed to 50 km/h or less.	A	M	L	ST	R	R	D	N	H	Sound pressure level monitoring during both construction and operation, as appropriate
Operation and Maintenance		A	M	L	MT	C	R	D	N	H	
Decommissioning and Reclamation		A	M	L	ST	R	R	D	N	H	

Project Phase	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	
Change in Vibration											
Construction	• Adherence to equipment maintenance programs. • Limit train speed to 50 km/h or less. • Use of continuous welled track and ballast system.	A	L	L	ST	S	R	D	N	H	Vibration monitoring will be conducted along rail route located nearest the cabins and in residential areas as appropriate.
Operation and Maintenance		A	M	L	MT	S	R	D	N	H	
Decommissioning and Reclamation		A	L	L	ST	S	R	D	N	H	
Change in Light Emissions											
Construction	• Direct light where needed. • Retain a vegetation screen, where possible. • Locate portable lighting equipment where not visible in surrounding urban areas. • Use of full horizontal cut off light fixtures, as appropriate.	A	L	L	ST	S	R	D	N	H	
Operation and Maintenance		A	L	L	MT	R	R	D	N	H	
Decommissioning and Reclamation		A	L	L	ST	S	R	D	N	H	

Project Phase	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	

KEY

Direction:
- P Adverse: condition of the atmospheric resources is worsening in comparison to baseline conditions and trends.
- P Positive: condition of the atmospheric resources is improving in comparison to baseline conditions and trends.
- N Neutral: no change in the condition of the atmospheric resources compared to baseline conditions and trends.

Magnitude:
- N Negligible: no measurable adverse effect anticipated.
- L Low: effect occurs that is detectable but is within normal variability of baseline conditions.
- M Moderate: effect occurs that would cause an increase with regard to baseline but is within regulatory limits and objectives.
- H High: effect occurs that would singly or as a substantial contribution in combination with other sources cause exceedances of objectives or standards beyond the Project boundaries.

Geographic Extent:
- S Site-specific: effect restricted to the Project footprint within the LSA.
- L Local: effect restricted to the LSA.
- R Regional: effect restricted to the RSA.
- G Global: Provincial, National or Global scale (GHG Emissions only).

Duration:
- ST Short-term: effect occurs for less than two years.
- MT Medium-term: effect occurs for between 2 and 15 years.
- LT Long-term: effect persists beyond 15 years.
- P Permanent: will not change back to original condition.

Frequency:
- O Once: effect occurs once.
- S Sporadic: effect occurs at sporadic intervals.
- R Regular: effect occurs on a regular basis and at regular intervals.
- C Frequently: effect occurs continuously throughout the Project life.

Reversibility:
- R Reversible: effect ceases when Project operations cease.
- o Irreversible: effect continues after Project operations cease.

Environmental or Socio-economic Context:
- U Undisturbed: effect takes place within an area that is relatively or not adversely affected by human activity.
- D Developed: effect takes place within an area with human activity. Area has been substantially previously disturbed by human development or human development is still present.

Significance:
- S Significant.
- N Not Significant.

Prediction Confidence:

Based on scientific information and statistical analysis, and effectiveness of mitigation or effects management measure.
- L Low level of confidence.
- M Moderate level of confidence.
- H High level of confidence.

14.7 Assessment of Cumulative Effects

In association with the Project environmental effects discussed above, an assessment of the potential cumulative effects was conducted for other projects and activities that have potential to interact with the Project. Other projects and activities considered in the cumulative effects scoping are described in Chapter 6.

The zone of influence for the operation of the Project with respect to air quality, greenhouse gas emissions, the acoustic environment, vibration and lighting is the area within which the effects predictions exceed regulatory limits. The zone of influence for the Project is therefore limited to the Project site and a few hundred meters, which does not overlap with the zones of influence of other Projects.

Potential cumulative effects of the Project on a change in air quality, change in greenhouse gas emissions, change in the acoustic environment, change in vibration and change in lighting are assessed individually in the below sub-sections and a summary of the results is provided in Table 14.40.

Change in Air Quality

Degraded air quality can negatively affect the health of surrounding communities, wildlife and ecosystems. It is therefore important that the cumulative effects of new projects and existing and potential future projects are minimal.

The cumulative effects of existing (past) projects to air quality is most pronounced in the communities of Labrador City, Wabush, Fermont, and surrounding rural dwellings, where historical monitoring indicates little adverse effects from nearby developments. Baseline air quality monitoring has established that while there are sporadic exceedances in TPM, the annual and average concentrations of contaminants and particulates are well below provincial standards and federal guidelines.

Particulate emissions have been identified through air dispersion modeling as the major contributor to adverse air quality from the Project. Incorporating mitigation measures such as limiting hauling truck speed, dust suppression programs for roads and stockpiles, and covered conveyors as required will ensure no significant adverse residual effects to air quality occur. The environmental protection plan developed for the Project will also include ambient air quality monitoring within and exterior to the site boundary, allowing for adaptive air quality management of the Project. This network will operate in addition to the networks already established by IOC and Wabush Mines.

Table 14.40 Summary of Potential Cumulative Effects to Atmospheric Environment

VEC Existing Condition (Past & On-Going Activities)	• Air quality in the region is generally good, with rare short-term exceedances of air quality standards. Long-term and average ambient concentrations are well below standards and guidelines for contaminants and particulates. • Sounds pressure levels in surrounding areas typical of other urban or rural environments at 39-47 dB daytime and 32-40 dB nighttime. • No detectable vibrations due to site remoteness. • Light levels in urban areas typical of CIE E3 designation; rural cabins near site achieve an E2 rating.		
Project Residual Environmental Effects	• Heavy machinery, equipment, and facilities operating at the Project will be sources of air contaminants (CO, NO_x, SO_2, TPM, PM_{10}, $PM_{2.5}$ and VOCs), noise emissions, light emissions, and in the case of the rail line, vibrations. • Mitigation of emissions from the Project include proper and frequent vehicle and equipment maintenance, limiting hauling truck operational speed , watering of all potential dust sources, route planning to reduce trips and instances of back-up alerts, and take advantage of topographic or vegetation barriers. • With mitigation measures in place, air, noise, vibration, and light emissions all comply with provincial and federal standards and guidelines. • A comprehensive environmental protection plan which includes an air quality and noise monitoring network, and complaint systems for noise, light, and air quality will facilitate adaptive management of residual effects.		
Other Projects / Activities	**Likely Effect Interaction (Y/N)**	**Rationale**	**Cumulative Effects**
IOC Labrador Operations	Y	• Direct overlap in air emissions. • Light and noise emissions do not directly overlap, but affect the same area.	• Baseline measurements capture emissions from IOC. • Noise, vibration and light emissions will amount to a negligible increase in cumulative emissions with IOC. • Air dispersion modeling shows IOC and the Project could not affect residential areas simultaneously due to geographic orientation. • Zones of influence with respect to air quality do not overlap.
Wabush Mines (Cliffs Resources)	Y	• Direct overlap in air emissions. • Light and noise emissions do not directly overlap, but affect the same area.	• Baseline measurements capture emissions from Wabush mines. • Noise, vibration and light emissions will amount to a negligible increase in cumulative emissions with Wabush Mines. • Air dispersion modeling shows Wabush Mines and the Project could not affect residential areas simultaneously due to geographic orientation. A SSE wind could bring emissions from both sites to Labrador City; however, the majority of emissions would be due to Wabush mine site. • As Wabush mines site complies with air quality standards and guidelines, no significant affect is expected from interaction with the Project.

			• Zones of influence with respect to air quality do not overlap.
Mont Wright Mine (ArcelorMittal)	N	• Sites too distant to interact in a significant way.	• No cumulative atmospheric effect expected with the Project.
Bloom Lake Mine and Rail Spur (Cliffs Resources)	Y	• Potential sky glow interaction between sites.	• Mitigation on site will produce negligible amounts of sky glow.
Schefferville Iron Ore Mine (Labrador Iron Mines)	N	• Sites too distant to interact in a significant way.	• No cumulative atmospheric effect expected with the Project.
DSO Iron Ore Project (Tata Steel Minerals Canada)	N	• Sites too distant to interact in a significant way.	• No cumulative atmospheric effect expected with the Project.
Lower Churchill Generation Project (Nalcor Energy)	N	• Sites too distant to interact in a significant way.	• No cumulative atmospheric effect expected with the Project.
Infrastructure or other projects at Port of Sept-Îles	N	• Sites too distant to interact in a significant way.	• No cumulative atmospheric effect expected with the Project.
Urbanization	N	• Air emissions are discussed under the primary sources of emissions (IOC Labrador Operations and Wabush Mines).	• No cumulative atmospheric effect expected with the Project.

Cumulative Effects Summary (Project + All Relevant Projects / Effects)	**Direction**	**Magnitude**	**Geographic Extent**	**Duration**	**Frequency**	**Reversibility**	**Significance**	**Confidence**
	A	L	R	L	C	R	NS	H

The potential residual environmental effects of the Project may have measurable interactions with other existing and planned projects on ambient particulate matter, sound levels, and lighting. The cumulative effects of the Project combined with Wabush Mines and IOC Labrador Operations may exceed guidelines for ambient particulate matter in localized areas for short periods during certain meteorological events. The cumulative effects of the Project combined with Wabush Mines and IOC Labrador Operations may have negligible increases to sound levels in localized areas though will not exceed Health Canada criteria. The cumulative effects of the Project combined with Wabush Mines and IOC Labrador Operations and Bloom Lake Mines on lighting may be noticeable, but will not exceed the guidelines for light trespass and glare and will not result in sky glow typical of an urban environment. Therefore, the cumulative effects of the Project acting in combination with other past, present, and planned projects and activities on the Atmospheric Environment is determined to be not significant.

Note: Environmental effects descriptors and their definitions are as used in the assessment of Project-related environmental effects.

Even though IOC, Wabush, and the Project will not exceed emissions standards and guidelines in isolation, the potential exists for nearby communities to encounter exceedances by their combined emissions. In terms of air quality, however, the emissions from each site are not strictly additive, but are highly dependent on meteorological conditions. As illustrated in Figure 14.3, mine sites are oriented in such a way that surrounding dwellings cannot be affected by more than two mines simultaneously, and then only in the case of Labrador City due to a SSE wind. As well, as stated above the zone of influence for a change in air quality is where the predicted concentration of particulate matter exceeds the regulatory limits. This zone is comprised of the Project site and a few hundred meters beyond. Although the proposed Project will overlap spatially with other existing projects in the area with respect to air quality, the zone of influence of the proposed Project will not overlap with the zones of influence of other existing projects.

Given the above mitigation and monitoring associated with this Project and the IOC and Wabush mines, ambient air quality from all projects are predicted to remain within the provincial *Air Pollution Control Regulations*, the National Ambient Air Quality Objectives and Canada Wide Standards, with the exception of short and infrequent exceedances of ambient particulate emissions guidelines during meteorological-driven events consistent with those that occur at present. The cumulative adverse environmental effect on a change in air quality is therefore determined to be not significant.

Change in Greenhouse Gas Emissions

According to the CEA Agency (2003), the contribution of an individual Project to climate change cannot be measured. Therefore, given that climate change is global and not considered a local issue, a cumulative effects assessment for an increase in GHG emissions due to the cumulative operation of the Project with other existing and planned Projects is not required.

Change in Acoustic Environment

The cumulative effects on the acoustic environment of dwellings and other sensitive receptors (such as hospitals, schools, or places of worship) include noise emissions from the project and all other currently operational and/or proposed activities. The incremental addition of projects in an area can alter the original desired acoustic environment beyond what would be detected on a project-by-project analysis.

The Project is located in the vicinity of the urban areas of Fermont, Wabush, and Labrador City. Several cabins are also located near the mine. The railway connecting the mine site to Sept-Iles passes through the outskirts of Wabush and also in the vicinity of several cabins.

Sound pressure levels generated at the mine site and rail line decrease with distance, and are expected to interact acoustically to a very minor extent with the IOC Labrador operations and Wabush Mines due to their spatial separation. No data exist which indicate the sound levels before the development of the existing mines, however, baseline studies inherently incorporate the sound levels from all nearby sources experienced by sensitive receptors. Baseline monitoring conducted for urban areas and cabin dwellings near the Project indicated daytime and nighttime sound pressure levels ranging from 39 to 47 and 32 to 40 dBA, respectively.

Noise modeling results determining the residual effects on the acoustic environment by the Project indicated a negligible increase in sound pressure for all urban sites, and a moderate increase to some nearby cabins.

In all cases, the Health Canada criteria for changes in %HA of 6.5 percent or absolute sound pressure levels of 75 dB would not be exceeded. Therefore, the cumulative effects of noise emissions from the Project on a change in the acoustic environment are found to be not significant.

Change in Vibration

Ground borne vibration propagating from the site can cause annoyance through building displacement or low-frequency noise, or cause structural damage in extreme cases. Vibrations from construction and decommissioning activities at the Project are expected to be sporadic in frequency, short in duration, and local in extent, and are therefore deemed to be not significant. Operations and maintenance activities at the mine and the rail line could generate adverse vibrations and low-frequency noise when considered in conjunction with other nearby developments or activities.

Adverse vibration effects as a result of the operation of the Project will rapidly decrease with distance, and are negligible beyond 75 m. Cabins R133, R109, and R111 are the only structures close to the 75 m limit, located at 75 m, 80 m, and 80 m from the proposed rail route respectively, and are not expected to experience significant vibrations from other projects. The predicted vibration levels at these cabins fall within the Federal Transit Administration vibration limits. Vibrations from blasting within the Rose Pit mine are also expected to be within acceptable limits, according to the United States Bureau of Mines (USBM) damage criteria, for all nearby cabins and other dwellings. Therefore, the cumulative effect on a change in vibration is deemed not significant.

Change in Lighting

Poorly designed lighting can lead to circumstances of obtrusive or hazardous light emissions, and can substantially increase the presence of light in the night sky. The night sky and unobtrusive lighting which does not impair the safety of nearby residence or sensitive receptors are to be achieved from this project and all surrounding projects.

The urban areas of Fermont, Wabush and Labrador City are categorized by a CIE rating of E3, while cabin dwellings achieve a rural E2 rating. Light emissions from IOC, Wabush Minesand Bloom Lake are not likely to interact with emissions from the Project.

Glare and light trespass emissions are extremely localized, and are unlikely to interact with other mine sites on the surrounding environment due to topographic and vegetative shielding. Careful positioning of lamps, work lighting, and building lights which avoid roadways or other pathways, and using topography and vegetation strategically will mitigate adverse light emissions.

Sky glow is the most likely interaction between the Project and the surrounding developments and urban areas. Use of high-pressure sodium lamps to reduce backscatter, and directional lighting to limit light spill are effective measures to preserve the night sky inherent to rural dwellings.

On-site monitoring will refine initial design and operations to overcome any unpredicted significant light emissions. The localized nature of glare and trespass combined with available mitigation indicate that their cumulative effects with other active or proposed projects will likely not exceed the Commission Internationale de L'Eclairage (CIE) maximum values for light trespass and glare, and will therefore be not significant. When incorporating effective technology to mitigate the cumulative effects of the project on sky glow, the cumulative effect on a change in lighting is also found to be not significant.Accidents and Malfunctions

Accidents and Malfunctions are unplanned events that could result in adverse effects on the Atmospheric Environment through increased air contaminants, noise, vibration or light emissions. Forest fires and train derailments could result in adverse effects because CAC, GHG, and noise emissions could be released to the atmospheric environment in the absence of mitigation.

Derailments could involve trains which are empty, carrying fuel for use on-site, or iron ore concentrate carried off-site. Fuel will be transported in 33,000 gallon tank cars along the rail line to the Project. The frequency of fuel transportation is expected to include three tank cars per week of No. 2 fuel oil during the 24-week heating season, and six tank cars per week of diesel fuel for mine vehicles. A worst case scenario would therefore amount to a 180,000-gallon release of diesel fuel at the derailment site.

The Project is located within a forested area, and Project activities involving the use of heat or flame could result in a fire. The extent and duration of a resulting fire would be dependent on response efforts and meteorological conditions.

Potential Environmental Effects

Air Quality and GHG Emissions

A derailment involving fuel trains could expose fuel to the open air, releasing volatile organic compounds (VOC). Clean-up of the site would employ hauling trucks and earth moving equipment which would release particulate matter and combustion gases through fuel consumption, and dust emissions from the clean-up activities. Any fire associated with fuel release would also be a source of particulate matter, CO, SO_2, NO_x, and VOCs. Derailments involving iron ore concentrate could adversely change air quality from the clean-up activities similar to those employed for a fuel train derailment. Forest fires typically release particulate matter, CO, and VOCs as vegetation is burned. A substantive source of GHG emissions may occur in the event of a forest fire.

Acoustic Emissions

A train derailment would involve a sudden and large increase in noise emissions during the actual derailment. Subsequent noise emissions would originate from heavy machinery used in the clean-up. Noise emissions would be similar in magnitude to those during the construction phase of the Project, and would last until completion of the clean-up. Potential noise emissions due to a forest fire arise from the burning of plant matter and the emergency response efforts.

Mitigation of Potential Environmental Effects

Air Quality and GHG Emissions

Mitigation of air quality effects of a train derailment would mirror measures outlined in the construction phase of the Project. If derailment were to occur near the mine, air quality affects would be at least partially offset by reduced mining activities until the rail was returned to full operations. Mitigation measures during clean-up include the use of dust suppressants and adherence to a comprehensive equipment preventative maintenance program to maintain the vehicles, and to maximize fuel efficiency and vehicle performance.

Mitigation measures to limit CAC and GHG emissions will be outlined in the Emergency Response Plan.

Noise Emissions

Noise emissions can be mitigated through regular maintenance of clean-up machinery. Expedient and coordinated fire suppression mitigation outlined for air quality and GHG emissions would mitigate the effects of fire on the acoustic environment. If derailment were to occur near the mine, noise emissions would be at least partially offset by reduced mining activities until the rail was returned to full operations.

Residual Environmental Effects

Air Quality and GHG Emissions

Changes in the air quality due to a train derailment will be local in geographic extent, affecting only the immediate vicinity of the derailment. Pollutant emissions from the clean-up will be sporadic in frequency and short in duration. The likelihood of a derailment is extremely low, and the effects on air quality will cease once the clean-up is complete. Contaminant emissions are expected to be within all pertinent standards and guidelines.

The GHG emissions from clean-up operations are expected to be much less than those from the operation of the mine itself. The emissions are predicted to be low in magnitude, local in geographic extent, short term in duration and sporadic in frequency.

Acoustic Environment

Noise emissions from clean-up will be of similar magnitude as those during construction. Emissions will be temporary, short-term in duration, local in geographic extent, and will cease at the conclusion of the clean-up.

Table 14.41 summarizes the residual environmental effects of accidental events and malfunctions on the Atmospheric Environment.

Table 14.41 Summary of Residual Environmental Effects for Atmospheric Environment – Accidents and Malfunctions

Accident / Malfunction	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	
Change in Air Quality											
Train Derailment	• Compliance with provincial and federal regulations. • Implement EPP. • Implement ERP. • Employee training.	A	L	L	ST	U	R	D	N	H	Air quality monitoring incorporated into Emergency Response Plan.
Forest Fire	• Implement EPP. • Implement ERP. • Employee training.	A	M	L	ST	U	R	U	S	H	
Change in GHG Emissions											
Train Derailment	• Compliance with provincial and federal regulations. • Implement EPP. • Implement ERP. • Employee training.	A	L	G	ST	U	R	D	N	H	

Accident / Malfunction	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	
Forest Fire	• Implement EPP. • Implement ERP. • Employee training.	A	L	G	ST	U	R	U	S	H	
Change in Acoustic Environment											
Train Derailment	• Compliance with provincial and federal regulations. • Implement EPP. • Implement ERP. • Employee training.	A	L	L	ST	U	R	D	N	H	
Forest Fire	• Implement EPP. • Implement ERP. • Employee training.	A	L	L	ST	U	R	U	N	H	

Accident / Malfunction	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	

KEY

Direction:
- P Adverse: condition of the atmospheric resources is worsening in comparison to baseline conditions and trends.
- P Positive: condition of the atmospheric resources is improving in comparison to baseline conditions and trends.
- N Neutral: no change in the condition of the atmospheric resources compared to baseline conditions and trends.

Magnitude:
- N Negligible: no measurable adverse effect anticipated.
- L Low: effect occurs that is detectable but is within normal variability of baseline conditions.
- M Moderate: effect occurs that would cause an increase with regard to baseline but is within regulatory limits and objectives.
- H High: effect occurs that would singly or as a substantial contribution in combination with other sources cause exceedances of objectives or standards beyond the Project boundaries.

Geographic Extent:
- S Site-specific: effect restricted to the Project footprint within the LSA.
- L Local: effect restricted to the LSA.
- R Regional: effect restricted to the RSA.
- G Global: Provincial, National or Global scale (GHG Emissions only).

Duration:
- ST Short-term: effect occurs for less than two years.
- MT Medium-term: effect occurs for between 2 and 15 years.
- LT Long-term: effect persists beyond 15 years.
- P Permanent – will not change back to original condition.

Frequency:
- U Unlikely.
- O Once: effect occurs once.
- S Sporadic: effect occurs at sporadic intervals.
- R Regular: effect occurs on a regular basis and at regular intervals.
- C Frequently: effect occurs continuously throughout the Project life.

Reversibility:
- R Reversible: effect ceases when Project operations cease.
- o Irreversible: effect continues after Project operations cease.

Environmental or Socio-economic Context:
- U Undisturbed: effect takes place within an area that is relatively or not adversely affected by human activity.
- D Developed: effect takes place within an area with human activity. Area has been substantially previously disturbed by human development or human development is still present.

Significance:
- S Significant.
- N Not Significant.

Prediction Confidence:

Based on scientific information and statistical analysis, and effectiveness of mitigation or effects management measure.
- L Low level of confidence.
- M Moderate level of confidence.
- H High level of confidence.

14.8 Determination of Significance of Residual Adverse Environmental Effects

14.8.1 Determination of Significance of Project Effects

The following subsections provide a concise description of why each of the potential environmental effects (change in air quality, change in greenhouse gas emissions, change in acoustic environment, change in vibration, change in lighting) on the Atmospheric Environment are or are not significant using the previously identified significance criteria (magnitude, duration, frequency, geographic extent and reversibility) and the significance definition provided in Section 14.3.

Change in Air Quality

The existing air quality surrounding the proposed Project area tends to be good, as presented in Section 14.5. During the construction of the Project, emissions of CACs (particulate matter and combustion gases) will increase slightly primarily due to the combustion of fuel in heavy construction equipment and onsite vehicles, as well as from the fugitive release of particulate through material handling and vehicle traffic on unpaved roads. Project construction will result in slight increases of CACs however this activity will be temporary in nature and limited to the LSA.

During Project operation and maintenance, emissions of CACs (particulate matter and combustion gases) will result from the operation of heavy mining equipment and onsite vehicles through the combustion of fuel and from the operation of the boilers from the combustion of No. 2 fuel oil. Fugitive releases of particulate matter will also occur as a result of, for the most part, material handling and travel on unpaved roads. To assess the effect that Project operation and maintenance would have on the Atmospheric Environment an emissions inventory was prepared and dispersion modelling conducted. The results of the air dispersion modelling were then compared to the provincial regulatory standards and the results shown that the regulations would be met within the nearest communities; however, a number of cabins located at the southern end of Long Lake would be affected by particulate matter from the operation of the Project. Alderon will implement mitigation measures to reduce significant adverse effects on properties. The residual environmental effects, after mitigation has been applied, were assessed to result in an increase in CACs above the baseline condition, but to be within provincial regulatory limits and federal objectives at the nearest communities and to be restricted to the LSA.

With the proposed mitigation, the residual adverse environmental effect on air quality is not likely to be significant. This prediction is made with a high level of confidence.

Change in Greenhouse Gas Emissions

Emissions of GHGs have been assessed in terms of their contribution to provincial and national GHG emission totals. During the construction of the Project, increases in GHG emissions will result from the combustion of fuel in various pieces of construction equipment. The residual environment effects on a change in GHG emissions during Project construction are anticipated to be low in relation to provincial and national emission totals.

During the operation of the Project GHG emissions will be released through the operation of various pieces of mining equipment, heavy trucks and onsite vehicles. To determine the magnitude of an environmental effect on a change in GHG emissions, a GHG emissions inventory for Project operation was prepared. It was determined that with mitigation the Project would not contribute substantially to provincial and national totals and would be considered a medium emitter under CEA Agency guidance (CEA Agency 2003). Therefore, the residual environmental effect on a change in greenhouse gas emissions from Project operation and maintenance was assessed to be moderate in magnitude, global in geographic extent, medium term in duration, continue for the life of the Project and reversible.

With the proposed mitigation and environmental protection measures incorporated into the assessment, the residual adverse environmental effect of a change in GHG emissions is therefore considered to be not significant.

Change in Acoustic Environment

During the construction of the Project the existing sound levels within the PDA and LSA will increase due to the operation of heavy diesel powered equipment. Although the construction of the Project will be temporary in duration, generally the cabins on Long Lake and the residential areas in Wabush may not be able to distinguish individual noises, but instead an industrial “hum”.

During the operation of the Project, noise will be emitted from the various vehicles and trucks involved in the mining process, drilling and blasting activities, ore and concentrate processing and material movement (i.e. rail and conveyors). To determine the magnitude of the effect of Project operation and maintenance on a change in the acoustic environment, sound pressure level modelling was conducted and the results were added to the existing background and compared against the Health Canada criteria for CEAA Projects. The modelling showed that the operation and maintenance of the Project will result in increased sound pressure levels at the nearest cabins on Long Lake, however, with appropriate mitigation these increases would not result in an exceedance of the Health Canada criteria. The residual environmental effects on a change in the acoustic environment was therefore assessed to be moderate in magnitude, local in geographic extent, medium term in duration, continue for the life of the Project and reversible when the Project is to end.

With the proposed mitigation and environmental protection measures incorporated into this assessment, the residual adverse environmental effect on the acoustic environment is therefore not likely to be significant.

Change in Vibration

During the construction and operation of the Project, vibration could result from the operation of heavy machinery and from blasting that may be required during site preparation. Due to the distance from the Project site to the nearest receptors vibration from the operation of equipment will generally not be of concern.

During Project operation vibration could result from the blasting within the Rose Pit mine and from the transport of concentrate along the Project's rail line. As with construction blasting, blasting during mining operations will be conducted by specialized contractors according to approved blast design plans. To determine the magnitude of the effect of Project operation and maintenance on a change in the vibration, an assessment of the potential vibration resulting from the operation of the rail line on the nearest receptors was conducted and the results were compared against the vibration criteria. The assessment showed that, by implementing the proposed Project mitigation, the estimated vibration and ground borne noise would be within the FTA and TCRP vibration and ground borne noise criteria at the identified receptors.

With the proposed mitigation and environmental protection measures incorporated into this assessment, the residual adverse environmental effect on vibration is therefore not likely to be significant.

Change in Lighting

Existing light conditions surrounding the proposed Project site are typical of a suburban environment with nighttime sky that shows modest effects of the nearby urban areas.

During Project construction portable lights may be used during site preparation and at the locations of the proposed facilities to enable construction. During Project operation, the permanent lighting fixtures for the facilities will be of the full horizontal cut-off type, as appropriate, and the effects of site lighting, given the use of these fixtures, distance and topographic shielding are expected to be minimal. However, the headlights of the haulage trucks and other onsite vehicles are needed for safe and efficient operation.

With the proposed mitigation and environmental protection measures incorporated into this assessment, the residual adverse environmental effect of a change in the lighting is therefore not likely to be significant.

14.8.2 Determination of Significance of Cumulative Effects

Change in Air Quality

Air emissions from the construction and operation of the proposed Project are expected to overlap with the operations of the existing mines and rail lines currently operating in Labrador West, however, as presented in Section 14.7 this overlap is not expected to result in exceedances of the provincial *Air Pollution Control Regulations*. Therefore, with the proposed mitigation and environmental protection measures incorporated into this assessment, the residual cumulative effect of a change in air quality is predicted to be not significant.

Change in the Acoustic Environment

Noise from Project construction and operation is expected to overlap with the noise generated from the operation of the existing nearby mines and rail lines in Labrador West to cause a cumulative environmental effect on nearby receptors. The effects from these existing facilities have been previously assessed and are not considered to be significant. Cumulative effects between the Project and other large scale noise generating activities within the assessment area are not expected to occur or would be negligible due to the separation distances involved between the Project and other local projects. Therefore, with the proposed mitigation and environmental protection measures incorporated into this assessment, the residual cumulative effect of a change in the acoustic environment is predicted to be not significant.

Change in Vibration

Vibration from Project construction and operation is also expected to overlap with vibration from the operation of the existing nearby mines and rail lines in Labrador West to cause a cumulative effect on nearby receptors. The effects from these existing facilities have been previously assessed and are not considered to be significant. Cumulative effects between the Project and other large scale vibration generating activities within the assessment area are not expected to occur or would be negligible due to the separation distances involved between the Project and other local projects. Therefore, with the proposed mitigation and environmental protection measures incorporated into this assessment, the residual cumulative effect of a change in vibration is predicted to be not significant.

Change in Lighting

There is potential for the Project to contribute to increased spillover light in the LSA cumulatively with that light emitted from other mining activities in Labrador West. However, as a result of the Project's design specifications and recommended mitigation measures, cumulative effects of additional light from the proposed Project are not expected to be substantial. Therefore with the proposed mitigation and environmental protection measures incorporated into this assessment, the residual cumulative effect of a change in lighting is predicted to be not significant.

14.8.3 Determination of Significance of Accidents and Malfunctions

Change in Air Quality and GHG Emissions

As previously stated, an accidental event involving a train derailment will result in emissions of CACs that will be low in magnitude, local in geographic extent and temporary in nature. Therefore with the proposed mitigation and environmental protection measures incorporated into this assessment, the residual adverse environmental effect on air quality and GHG emissions as a result of a train derailment is not likely to be significant.

Depending on the geographic extent and severity of a forest fire, the residual adverse effect to air quality and GHG emissions could be significant.

Change in the Acoustic Environment

An accidental event involving the derailment of a train on the Project rail line will result in increases in sound emissions during the event and cleanup; however, these sounds will be temporary in nature, limited to the PDA and low in magnitude. Therefore with the proposed mitigation and environmental protection measures incorporated into this assessment, the residual environmental effect due to an accidental event on the acoustic environment is not likely to be significant.

14.8.4 Overall Residual Effects Conclusion

In summary, given the planned mitigation, and the analyses presented in this assessment, the change in air quality, change in greenhouse gas emissions, change in the acoustic environment, change in vibration and change in lighting on the Atmospheric Environment as a result of the construction, operation and decommissioning of the Project, including cumulative effects, are not likely to be significant. With the exception of a fire, the effects of accidents and malfunctions are not likely to be significant.

14.9 Follow-Up and Monitoring

The proposed follow-up and monitoring for each environmental effect is described in the following subsections.

Change in Air Quality

Air quality monitoring will be conducted by developing an ambient air quality monitoring program for both Project construction and operation, in consultation with regulatory authorities. Fugitive emissions of dust at the site level will also be monitored. A dust complaint follow-up and response procedure will also be developed as part of the Project's EPP.

Change in Greenhouse Gas Emissions

Greenhouse gas emissions resulting from the Project will be quantified on an annual basis and reporting those emissions to Environment Canada under the GHG Emissions Reporting program.

Change in Acoustic Environment

Sound quality monitoring will be conducted by measuring sound pressure levels in specific noise-sensitive areas and/or along the site perimeter as the Project proceeds, as appropriate, particularly during construction but also on occasion during operation. A noise complaint follow-up and response procedure will also be developed as part of the Project's EPP. The noise monitoring plan will be developed in consultation with regulatory authorities prior to the start of Project construction.

Change in Vibration

Vibration monitoring will be conducted along rail route located nearest the cabins and in residential areas as appropriate.

Monitoring for vibration will be conducted on a complaint driven basis. If, upon monitoring, the levels only marginally meet or exceeds the criteria levels, further mitigation may be required.

Change in Lighting

A qualified individual will oversee general construction and other activities that could increase ambient lighting levels. An on-site Environmental Monitor will ensure that mitigative measures outlined in the Project's EPP to minimize such disruptions are adhered to. Follow-up monitoring during all phases the Project will be on a complaint driven basis so specific light trespass issues can be addressed.

14.10 Next Steps

Prior to construction, an Environmental Protection Plan will be developed. Mitigation measures for Atmospheric Environment will be incorporated.

14.11 Summary

The Project is located in an area where mining and rail activities currently occur. The proposed Project will temporarily contribute CAC and GHG emissions, noise and vibration and lighting during Project construction and longer term air and GHG emissions, noise, vibration and industrial lighting during the operation of the Project. This assessment however, indicates that there are not likely to be exceedances of the previously specified criteria (Section 14.2) with implementation of mitigation for air quality, greenhouse gas emissions, the acoustic environment, vibration and lighting.

In conclusion, residual effects of the Project on a change in air quality, change in greenhouse gas emissions, change in the acoustic environment, change in vibration and change in lighting are not likely to be significant.

15.0 LANDFORMS, SOILS, SNOW AND ICE

15.1 Valued Ecosystem Component Definition and Rationale for Selection

Landforms, Soils, Snow and Ice (LSSI) were selected as a Valued Ecosystem Component (VEC) because of their importance to Project planning and their potential to interact with Project activities. This VEC includes landforms, terrain stability, soil quality and quantity, and snow and ice. The potential for Acid Rock Drainage (ARD) and metal leaching (ML) are also assessed in this section. Aspects of this VEC (wetlands, wildlife habitat, use of lands and resources) are assessed in Chapter 17, Chapter 19, Chapter 22, and Chapter 23.

15.1.1 Approach to Assessment of Effects

Existing information was used to develop this assessment, including results from an ecological land classification (ELC), bedrock geology mapping (Wardle et al. 1997), detailed 1:5,000 scale terrain mapping along the rail line, permafrost data published by Brown (1979), and climatic data from Environment Canada (2012). In addition, colour 1:30,000-scale digital imagery from August 2011 was used in the interpretation of landforms, geomorphic processes (e.g., seepage), drainage, and soil conditions; this imagery was viewed at scales as large as 1:500 using Stantec's HD-MAPP system.

The assessment of potential ARD/ML effects is based on historical data from similar mines (Labrador Iron Mines [LIM] 2009), monitoring of existing mines (Burridge pers. comm., 2012), and testing of the geological materials collected from the site. The site geology and mining plans were based on the *Preliminary Economic Assessment Report of the Kami Iron Ore Property, Labrador* (BBA 2011).

The testing evaluated ARD/ML potential of the different lithologies and materials that will be exposed during the Project, including overburden stockpile, waste rock disposal areas, open pit, tailings, and stockpiles of ore and concentrate. Approximately 89 samples were selected from drill cores using visual descriptions. These samples included representatives of overburden, open pit walls, waste rock, and ore. The samples were submitted to a certified laboratory for Acid Base Accounting to measure the potential for ARD, and Shake Flask Extraction to measure the potential for ML. The ARD/ML potential was also measured in 12 samples of concentrate and tailings that had been generated from the Rose deposit during metallurgical testing. Process water from the metallurgical testing was analyzed for routine parameters and metals as an additional check for ML potential. Based on static tests, representative samples are being selected for kinetic testing. The ARD/ML methodology described in this chapter is consistent with the recommended guidelines for the prediction of ARD potential in geologic materials (Price 2009).

15.1.2 Issues

Alderon has engaged and consulted with a variety of stakeholders, Aboriginal groups, and members of the public throughout the EA process, and is committed to being responsive to questions and concerns that arise. Accordingly, these issues are included in the assessment of the VEC. Potential issues or concerns relating to the LSSI VEC include:

- Reclamation and rehabilitation;
- Cumulative effects;
- Snow and ice; and
- Acid rock drainage (ARD).

Details on the issues raised by stakeholders are provided in Table 15.1. The number of times each issue was raised is provided in Figure 15.1.

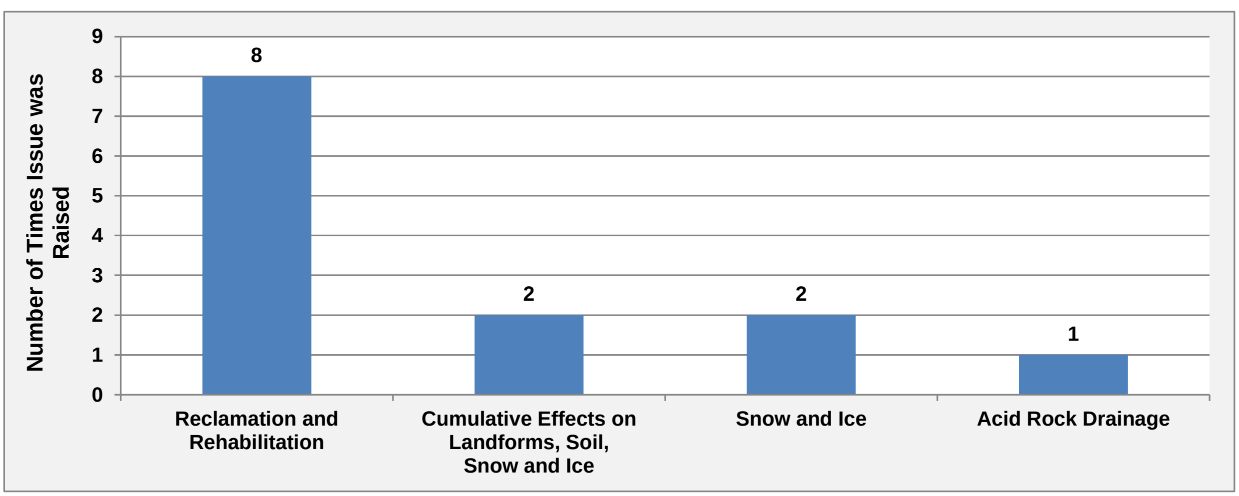
Table 15.1 Issues Raised by Aboriginal Groups and Stakeholders

Issue	Community / Organization	Summary of Comments Raised During Consultation and Engagement Activities	Response / Location in the EIS
Acid Rock Drainage and Metal Leaching	General	General	In the EIS, the potential for acid rock drainage (ARD) and metal leaching has been determined to be very low. The assessment included results from baseline sampling and the experience of nearby iron ore mine operations. There are sections of the ore deposit that contain sulphides which have the potential to generate ARD. Ongoing monitoring of tailings discharge, run-off and mine water will be conducted throughout the life of the mine to ensure that discharges meet regulatory standards. If ARD is determined to be an issue, appropriate mitigation will be identified and implemented. Details are provided in Section 15.6 and 16.6.
Snow and Ice	Le mouvement citoyen de Fermont	Are there measures taken to protect the snow from pollution from mine residues?	Control measures on-site will limit the particulate emissions to meet all regulatory standards. By controlling particulate emissions from Project activities, the deposition of dust on the snowpack will be greatly reduced. Due to the composition of the ore, no adverse residual environmental effects are expected. This assessment has been conducted based on predicted emissions during the most active period of the mine. Details on control measures are presented in Section 15.6.

Issue	Community / Organization	Summary of Comments Raised During Consultation and Engagement Activities	Response / Location in the EIS
	Fermont	What are the effects on ice on Daviault Lake during blasting?	Following the EA approval, a Blasting Plan will be developed and implemented in compliance with all applicable laws, regulations and industry best practices, and with consideration of safety, environmental and social issues as identified throughout the EIS. This issue has been addressed in Section 15.6 and information on the Blasting Plan is provided in Section 2.6.2.
Rehabilitation	Fermont	Are you required to set aside an amount of money for the rehabilitation as is the case in Québec?	Yes, a Financial Assurance, as set out in Section 10 of the *Mining Act* and addressed in Section 8 of the Mining Regulations will be set aside to cover the costs for all activities included in the Development Plan, the Rehabilitation and Closure Plan, as well as those activities required for on-going site monitoring and maintenance. Information on the Rehabilitation and Closure Plan is provided in Sections 2.6.4 and 8.1.12.
	Fermont	Do you already have a rehabilitation plan?	A Rehabilitation and Closure Plan has been prepared at a feasibility level and will be revised to a detailed design level prior to Project construction and development. Preliminary details on closure and decommissioning activities are presented in the Project Description in Section 2.6.4. Information on the Rehabilitation and Closure Plan is provided in Sections 2.6.4 and 8.1.12.
	Fermont	How will you be able to grow trees on rocks?	
	Le mouvement citoyen de Fermont	Is there a clear restoration plan for the duration of the mine with details of works undertaken?	
	Wabush	What type of vegetation will be replaced in the Project area?	The aim of the Rehabilitation and Closure Plan is to create the necessary conditions for the re-establishment and long-term propagation of indigenous native species in the areas disturbed by Alderon development and operation activities. Disturbed areas will be graded and contoured; a soil cover will be applied where it is considered necessary for vegetation growth; and vegetation will be established of similar density and diversity as that which exists in proximate areas. Further details on planned rehabilitation activities are presented in Section 2.6.4.

Issue	Community / Organization	Summary of Comments Raised During Consultation and Engagement Activities	Response / Location in the EIS
	Innu of Matimekush Lac-John	What will Alderon do with the open pit after operations? The Innu will be stuck with a large hole in their land.	The open pit will be decommissioned with the objective of long-term stability. Flooding of the pit will be allowed to occur naturally. The pit's walls will be excavated to a stable slope angle ("designing for closure") during mining operations. Pit slopes will be graded and contoured above and just below the final water surface for safety and access over portions of the pit perimeter. Further details are provided in Section 2.6.4.
Cumulative Effects	Fermont	Participant is concerned with the proximity of the proposed Project to the Town of Fermont. Fermont is already exposed to dust from operating mining sites further away from the proposed Project location. Provides example of Labrador City residue "red snow" resulting from mining activity.	As detailed in Section 14.5 (Atmospheric Environment), the prevailing winds for the area, as recorded at the Wabush Airport, are from the west and the south, with winds blowing from the northeast towards Fermont only approximately 5 percent of the time. As well, it has been shown through dispersion modelling that the air quality zone of influence for the proposed Project is limited to the Project site and a few hundred meters beyond and therefore would not likely overlap with the zones of influence of the other nearby mines to result in a cumulative effect on the Town of Fermont.

Figure 15.1 Frequency of Issue Type Related to Landforms, Soils, Snow and Ice



15.2 Environmental Assessment Boundaries

15.2.1 Spatial Boundaries

Three study areas have been identified for the assessment of LSSI and ARD/ML. These include the Project Development Area (PDA), the Local Study Area (LSA), and the Regional Study Area (RSA). Each of these is discussed below. The LSA and PDA are shown on Figure 15.2.

The PDA includes the main Project components and is where landforms, soils, snow, and ice may be directly affected by Project activities such as excavation, grading or disposal.

The LSA includes the PDA plus a 100 m buffer surrounding each component of the PDA (Figure 15.2).

The RSA is a larger area in which cumulative effects on the VEC are assessed. The RSA includes Mont Wright Mine (ArcelorMittal), Bloom Lake Mine (Cliffs Resources), Wabush Mines (Cliffs Resources), and Iron Ore Company of Canada’s (IOC) Carol Project (Figure 15.2).

15.2.2 Temporal Boundaries

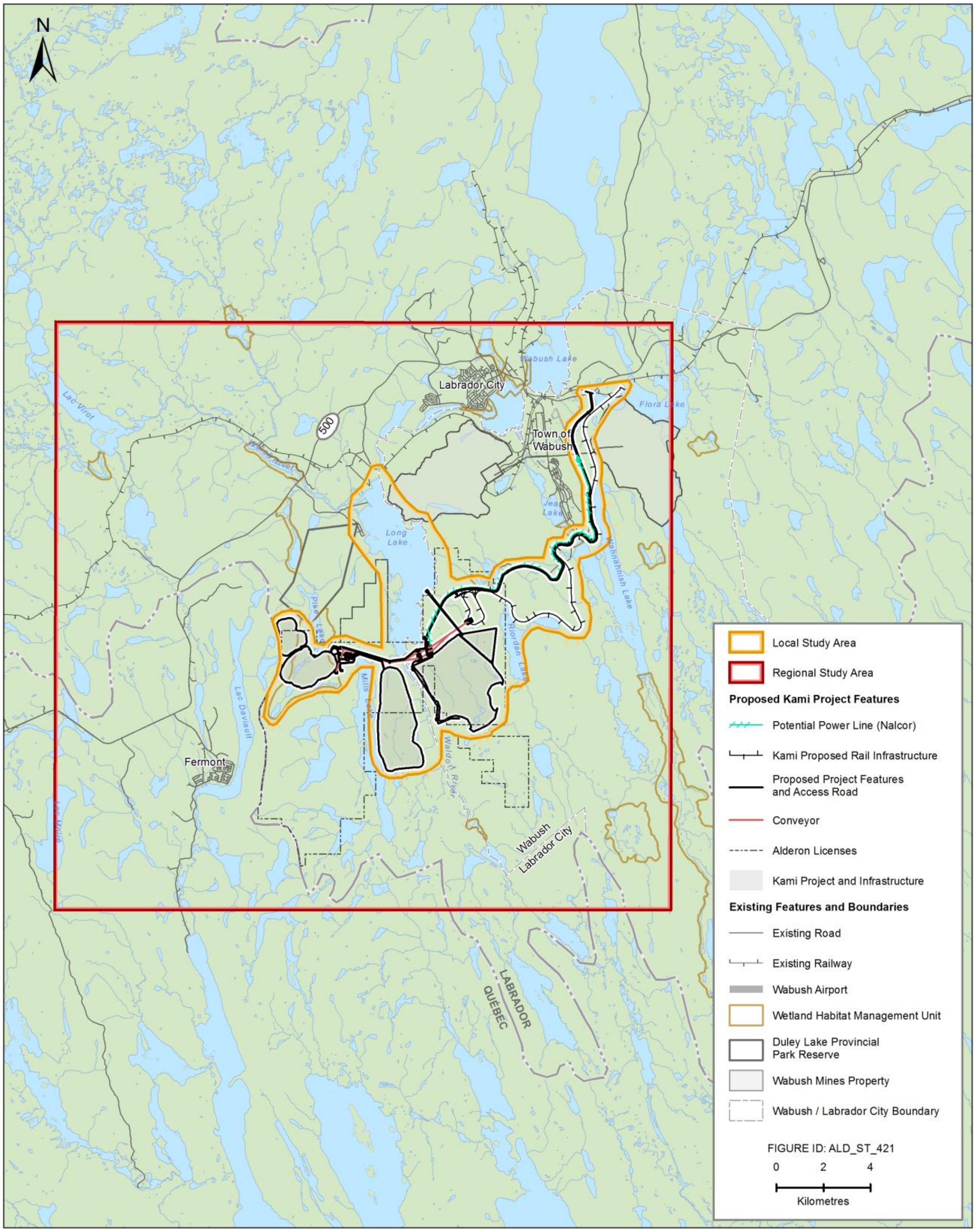
The environmental effects of the Project on LSSI will be assessed for construction (approximately two years), operation and maintenance (approximately 17 years), and decommissioning and reclamation (approximately two years).

15.2.3 Administrative Boundaries

Because no federal or provincial legislation apply specifically to landforms, soils, snow, and ice, the *MEND Report 1.20.1, Prediction Manual for drainage Chemistry from Sulphidic Geologic Materials, Version 0 – December 2009,* produced by the Mine Environment Neutral Drainage (MEND) program was used as an information source for the assessment of ARD. Direction for the inclusion of LSSI comes from the EIS guidelines, including:

- *The VECs to be considered must include: landforms, soils, snow and ice.*
- *The EIS must also describe existing geology, geochemistry, soils and terrain at the mine site and in the immediate vicinity.*
- *Potential Project-VEC interactions include:*
  - *Acid Rock Drainage/Metal Leaching airing from Project activities;*
  - *Impacts to the quality and quantity of soils;*
  - *Impacts to snow and ice; and*
  - *Impacts of landform and soils on the Project.*

Figure 15.2 Local Study and Regional Study Areas



- *The description of the existing environment in the EIS shall include:*
  - *Existing unique or valuable landforms (e.g., eskers, fragile landscapes, wetlands), including details regarding their ecological function and distribution in the LSA;*
  - *Geomorphology and topography at areas proposed for construction of major project components, including the type, thickness and distribution of soils;*
  - *Bedrock lithology, morphology, geomorphology and soils where earthworks are proposed;*
  - *Potential for ground and rock instability (e.g., slumping, landslides and potential slippage) at areas planned for Project facilities and infrastructure;*
  - *Suitability of topsoil and overburden for use in the re-vegetation of surface-disturbed areas; and*
  - *Sites of palaeontological or paleobotanical significance (addressed in Chapter 21).*
- *Specifically, the EIS shall discuss the following:*
  - *General impact on landform as a result of Project development, borrow resource extraction, with a focus on sensitive landforms, and those serving as wildlife habitat;*
  - *Implications to the Project planning and design of baseline information related to terrain conditions;*
  - *Potential impacts on the stability of terrain in the vicinity of the Project facilities and infrastructure. Discussion should focus on the potential impacts arising from surface disturbance due to construction (e.g., overburden stripping, cuts / fills), and any associated implications for Project design and management of project components, including railway embankments, access roads, watercourse crossings, ore / waste rock piles, etc.);*
  - *The potential for occurrence, frequency and distribution of terrain hazards, including snow drifts and snow banks, as a result of construction activities (e.g., cut / fill, extraction);*
  - *The potential for soil erosion, including stream bank erosion, resulting from surface disturbances associated with the construction, operation and maintenance of Project components;*
  - *Proposed commitments to preserve, store and reuse soil (including humus layers and organic soils), as applicable for site rehabilitation;*
  - *Potential contamination of soils due to the deposition of air emissions and airborne fugitive dust-fall from the Project;*

  - *Potential contamination of snow (e.g., due to runoff from tailings, emissions or other sources); and*
  - *Potential for the Project to impact ice on local lakes including Lake Daviault (e.g., potential for blasting to cause cracking).*

15.3 Establishing Standards or Thresholds for Determining the Significance of Environmental Effects

Significance of environmental effects is assessed in accordance with CEA Agency guidelines. The definitions of these terms are detailed here and appear in the summary tables used for the assessment of Project residual and cumulative effects.

- **Direction*:***
  - Positive – measurable effects benefit the terrain integrity, soil quality and quantity, and snow and ice;
  - Neutral – no measurable change; or
  - Adverse – measurable changes negatively affect LSSI.
- **Magnitude:**
  - Negligible – change of less than or equal to 1 percent;
  - Low – for landforms, minor changes to shape and stability in the LSA. For soil quality or quantity, a change of 1 percent to 5 percent in areal extent or volumetric extent relative to baseline conditions in the LSA. For ARD/ML, a change of 1 percent to 5 percent from baseline conditions;
  - Moderate – for landforms, moderate changes to shape and stability in LSA. For soil quality or quantity, a change of 6 percent to 10 percent in areal or volumetric extent relative to baseline conditions in the LSA. For ARD/ML, a change of 6 percent to 10 percent from baseline conditions; or
  - High – for landforms, major changes in terrain integrity in the LSA. For soil quality or quantity, a change greater than 10 percent in areal or volumetric extent relative to baseline conditions in the LSA. For ARD/ML, a change greater than 10 percent from baseline conditions.
- **Geographic Extent:**
  - Site – effect is confined to the PDA;
  - Local – effect is confined to the LSA; or
  - Regional – effect extends beyond the LSA but within the RSA.
- **Frequency:**
  - Once – effect occurs once;
  - Sporadic – effect occurs occasionally but not consistently throughout the life of the Project; or

    - Regular) – effect occurs at regular intervals throughout the life of the Project; or
    - Continuous – effect occurs continuously throughout the Project.
- **Duration:**
    - Short term – environmental effect lasts through the construction phase;
    - Medium term – environmental effect lasts beyond the construction phase, but not beyond the end of Project decommissioning;
    - Long term – environmental effects are measurable for up to 30 years beyond the life of the Project; or
    - Permanent – environment will not return to its original condition.
- **Reversibility:**
    - Reversible – environment will likely recover to baseline conditions after the end of Project decommissioning; or
    - Irreversible – environment is unlikely to recover to baseline conditions after the end of Project decommissioning.
- **Ecological Context:**
    - Undisturbed – area has been relatively or not adversely affected by human activity; or
    - Disturbed – area has been substantially previously disturbed by human development or human development is still present.

A significant adverse residual environmental effect on landforms is defined as an alteration of ecologically or culturally important landforms such that the function is significantly affected. Ecologically important functions include eskers, wetlands and wildlife habitat. Culturally important functions include use of land and resources. The significance of environmental effects on wetlands, wildlife habitat, and use of lands and resources are assessed in Chapter 17, Chapter 19, Chapter 22, and Chapter 23.

A significant adverse residual environmental effect on soils is defined as one where site soils are not suitable for reclamation due to either quality or quantity.

A significant adverse residual environmental effect on snow and ice is defined as an alteration in snow and ice cover such that use of snow and ice is significantly affected.

A significant adverse residual effect for ARD/ML is defined as one where effluent pH or metal concentrations exceed Metal Mining Effluent Regulation (MMER) compliance criteria and result in successive acute lethality testing failures in accordance with MMER compliance monitoring requirements.

15.4 Potential Project-VEC Interactions and Environmental Effects

The environmental assessment of LLSI is focused on the following environmental effects:

- Changes in landforms and terrain stability;
- Changes in soil quality and quantity;
- Changes in snow and ice; and
- ARD and ML.

For assessment purposes, potential interactions were identified according to Project activities. This section provides a list of Project activities and physical works (Table 15.2) and whether an interaction is expected to occur within each identified potential environmental effect. Interactions are ranked as 0, 1, or 2. Ranking includes 0 (no interaction), 1 (interaction occurs but the resulting effect can be managed through mitigation), and 2 (an interaction occurs and the resulting effect may exceed acceptable levels without implementation of specific mitigation). Project interactions with rankings of 2 are assessed in detail in Section 15.6.

Table 15.2 Potential Project Environmental Effects on Landforms, Terrain Integrity, Soils, Snow and Ice and ARD/ML

Project Activities and Physical Works	Potential Environmental Effects			
	Change in Landforms and Terrain Stability	Change in Soil Quality and Quantity	Change in Snow and Ice	ARD/ML
Construction				
Site Preparation (including clearing, excavation, material haulage, grading, removal of overburden and stockpiling)	2	2	2	2
Construction of Roads	1	2	2	2
Construction of Site Buildings and Associated Infrastructure (maintenance facilities, offices, plant, crushers, concentrator, conveyors, gatehouse, pump houses, substation, security fencing, sanitation system)	1	2	2	2
Construction of Tailings Management Facility (TMF)	1	2	2	2
Construction of Railway and Load-out Facilities (silos)	1	2	2	2
Construction of Power Line	1	0	2	0
Construction of Stream Crossings	1	0	2	1
Installation of Water Supply Infrastructure (wells, pumps, pipes)	0	0	0	0
Onsite Vehicle / Equipment Operation	0	0	0	0
Waste Management	0	0	0	0
Transportation of Personnel and Goods to Site	0	0	0	0
Expenditures	0	0	0	0
Employment	0	0	0	0

Project Activities and Physical Works	Potential Environmental Effects			
	Change in Landforms and Terrain Stability	Change in Soil Quality and Quantity	Change in Snow and Ice	ARD/ML
Operation and Maintenance				
Open Pit Mining (including drilling, blasting, ore and waste haulage, stockpiling, dewatering)	1	2	2	2
Ore Processing (including crushing, conveying, storage, grinding, screening)	0	0	2	2
Concentrator Operations (gravity and magnetic separation, tailings dewatering, tailings thickener, concentrate conveyance to load-out)	0	0	2	2
Tailings Disposal in TMF	0	0	2	2
Waste Rock Disposal on Surface	1	2	2	2
Water Treatment (including mine water and surface runoff) and Discharge	1	0	0	0
Rail Load-Out by Silo Discharge	0	0	2	0
Rail Transport	0	0	0	0
Onsite Vehicle/Equipment Operation and Maintenance	0	0	0	0
Waste Management	0	0	0	0
Transportation of Personnel and Goods to Site	0	0	0	0
Fuel Storage and Dispensing	0	0	0	0
Progressive Rehabilitation	0	1	0	0
Expenditures	0	0	0	0
Employment	0	0	0	0
Decommissioning and Reclamation				
Site Decommissioning	1	2	2	0
Site Reclamation (building demolition, grading, scarifying, hydro seeding)	0	2	2	0
Accidents and Malfunctions				
Train Derailment	0	2	1	0
Forest Fire	0	2	0	0
Polishing Pond Dyke Breach	0	2	1	0

KEY

0 No interaction.

1 Interaction occurs; however, based on past experience, the resulting environmental effect can be managed to acceptable levels through standard operating practices or through the application of best management or codified practices. No further environmental assessment is warranted.

2 Interaction occurs, and resulting environmental effect may exceed acceptable levels without implementation of specific mitigation. Further environmental assessment is warranted.

A discussion of significance is provided for interactions rated as 0 or 1, and is not considered further in the environmental effects assessment. Interactions rated as 2 are assessed in more detail.

Change in Landform and Terrain Stability

Construction

Much of the landscape in the PDA is gently undulating, with rolling to sloping topography; as no steep or unstable slopes exist, site preparation during construction was rated as 2 and deemed the only Project activity where the resulting effect may exceed acceptable levels without specific mitigation For example, the esker that parallels the Waldorf River will be affected during construction. The resulting effects and mitigation measures are described in more detail in Section 15.6.

All other activities outside of the construction phase have been rated as having either no interaction (0) or interactions that can be managed through standard operating practices or best management practices (1).

With the implementation of mitigation to maintain natural drainage patterns, the use of properly sized culverts and trenching, and wildlife habitat mitigations, as detailed in Chapters 18 and 20, significant adverse environmental effects are not likely because the landforms are not unique and the terrain is stable.

The environmental effects resulting from loss or alteration of wetlands and wildlife habitat is assessed in Chapter 17 and Chapter 19. Environmental effects on use of land and resources are assessed in Chapter 22 and Chapter 23.

Operations and Maintenance

Terrain stability is generally an issue for most mining projects. From a surficial geology perspective, no landslides or any evidence of slow mass movement were observed from an examination of the existing aerial photographs. The topography within the LSA is generally undulating and sloping, the latter being more typical of the Rose South Waste Rock Disposal Area and the TMF, where topography generally slopes from the south to the north towards Long Lake. Slopes are generally less than 10 percent. With the implementation of standard mitigation (e.g., maintenance and restoration of natural drainage patterns, especially on sloping topography), any potential for shallow landslides will be negated. Mine rock slope stability is not likely to be an issue, as standard and prescribed geotechnical and engineering design of the Rose Pit mine site will be undertaken.

Landforms will be altered by the disposal of waste rock and tailings over the existing surface, thereby masking the underlying undulating and sloping topography to the north. These waste rock sites will eventually become prominent hills in the landscape, reaching approximately 200 m in height for the Rose North Waste Rock Disposal Area and 150 m in height for the Rose South Waste Rock Disposal Area. Overburden material from the Rose Pit will be used to top these hills for reclamation purposes.

Decommissioning and Reclamation

No changes to landforms and terrain stability are anticipated during the decommissioning and reclamation phase of the Project with the implementation of proper mitigation techniques. Drainage systems will be maintained through proper culvert placement or trenching along roadsides to reduce erosion and to prevent potential for low angle slides.

Change in Soil Quality and Quantity

Interactions during construction (i.e., site preparation, construction of roads, buildings, the TMF and rail infrastructure), operation and maintenance (i.e., open pit mining, and disposal of waste rock) are rated as 2 because there is potential for admixing, erosion, compaction, and changes to moisture and nutrient status during the salvage, storage, and replacement of peat, topsoil, and upper subsoil horizons. Interactions during decommissioning and reclamation also warranted a rating of 2.

Project-soil quality interactions are rated as 1 for progressive rehabilitation because this activity will be undertaken so that soil quantity and quality are preserved to the extent possible, with associated monitoring and proper placement during storage. With the implementation of these measures, adverse environmental effects on soil quality and quantity are not likely and not significant.

See Section 15.6.2 for a detailed discussion of effects on soil quality and soil quantity for all phases of the Project.

Change in Snow and Ice

Activities through all phases of the Project (i.e., site preparation, open pit mining, ore processing, blasting, concentrator operations, tailings disposal, and waste rock disposal) will result in fugitive dust that could affect snow distribution and the timing of snowmelt as well as lake ice conditions in winter. These activities are therefore rated as 2 and are assessed in more detail in Section 15.6.

ARD/ML in the PDA

The exposure of sulfides present in overburden, waste rock, the open pit, tailings, ore, and concentrate have the potential for ARD/ML. Activities associated with exposure or production of these materials were therefore rated as 2.

Construction of stream crossings will be undertaken with non-acid generating waste rock as a standard mitigative measure for ARD/ML; therefore, significant adverse environmental effects are not likely for this activity. See Section 15.6.4 for a detailed assessment of ARD/ML for all Project phases.

Selection of Environmental Effects and Measurable Parameters

The measurable parameters used for the assessment of the environmental effects and the rationale for their selection is provided in Table 15.3.

Table 15.3 Measurable Parameters for Landforms, Soils, Snow and Ice and ARD/ML

Environmental Effect	Measurable Parameter	Rationale for Selection of the Measurable Parameter
Change in Landforms and Terrain Stability	Percentage of landforms lost (e.g., wetlands, wildlife habitat, reduction in use)	Landforms have been prescribed as part of this VEC by the EIS Guidelines. The LSA consists of very gently to gently undulating, rolling, and sloping topography, with most slopes less than 10% to 15%. The terrain is controlled by bedrock, which is overlain by coarse-textured till deposits of variable thickness. Patterned fens are common in this area as well. This topography and terrain conditions are common in the Labrador City/Wabush areas of western Labrador. The only unique landform in the LSA is an esker running parallel to the Waldorf River and east of the TMF. Eskers are important from a number of perspectives, including the provision of valuable aggregate materials for road construction, and provision of wildlife habitat for denning species.
	Increase in terrain instability	An issue raised by public stakeholders is the potential for landslides (i.e., terrain stability). The existing landscape shows no evidence of instability as the terrain is generally very gently to gently undulating, rolling, and sloping.
Change in Soil Quality and Quantity	Soil quality, as measured by reclamation suitability	The suitability of soil for reclamation purposes will determine in part the success of the reclamation program. Reclamation suitability, wind and water erosion, and soil moisture status can be altered by storage.
	Volume of soil salvaged and replaced	The availability and volume of stored soil will determine in part the success of the reclamation program. Tracking the volume and location of salvaged and replaced soils will provide valuable information for reclamation and closure planning.
	Contamination of Soil	Fugitive dusts from tailings, emissions or other sources could cause contamination of soils near the facility.
Change in Snow and Ice	Loss of snow and ice	Snow and ice are important for recreational activities (e.g., snowmobiling). Alteration of the land surface either by removal or placement of materials or construction of structures can result in changes to snow drifting. Dust from the roads, mine sites and waste rock disposal areas will land on the snow and ice surfaces immediately adjacent to these features and has the potential to alter natural albedo levels, resulting in earlier snow and ice melt in areas close to these features.
	Break up of ice	The effect of the Project on ice was raised as a concern by public stakeholders. In particular, it was asked if blasting activities will cause break up of ice on local lakes through vibration effects.

Environmental Effect	Measurable Parameter	Rationale for Selection of the Measurable Parameter
	Contamination of snow	Runoff from tailings, emissions, and other sources could cause contamination of snow, which would result in contamination of soils after melting.
ARD/ML	Neutralization Potential Ratio (NPR) =NP/AP, where NP is Neutralization Potential and AP is Acid-Generating Potential. pH, total dissolved solids (TDS), metal and sulfate concentration in contact water.	If NPR is below 2, there is potential for formation of ARD, which could affect surface and groundwater quality. Decrease in pH below 4.5, and increase in sulfate, and metals in contact water may indicate ARD/ML.

15.5 Existing Environment

This section provides a description of the terrain and soils in the Project area in relation to each Project component and also describes the local climate and unique and valuable landforms. The descriptions are based on an examination of the PDA at a scale of 1:1,000 or greater, existing background data as well as borehole data (Table 15.3) were also used.

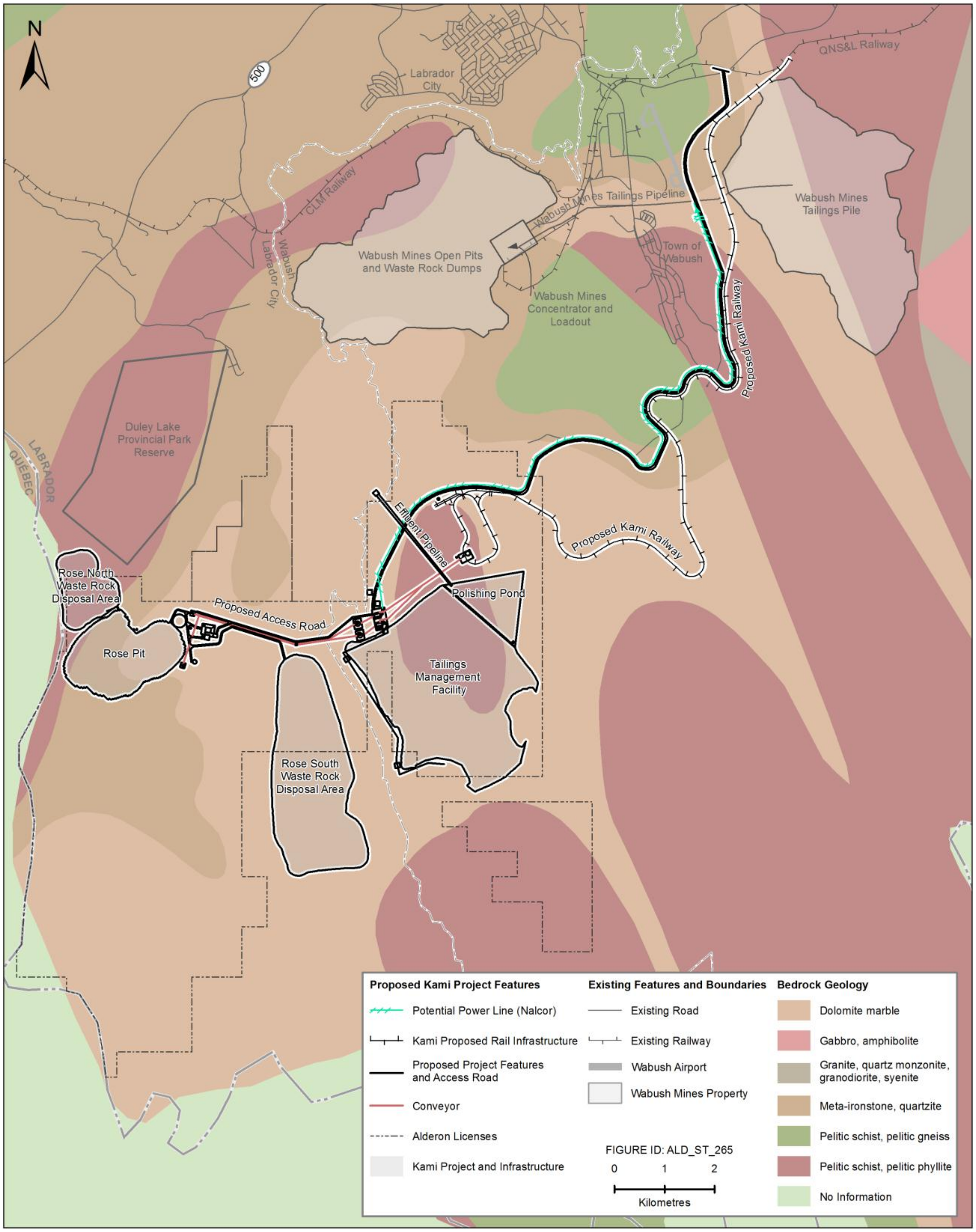
15.5.1 Rose Pit

The Rose Pit will be bordered by Pike Lake to the north and south, and Mills Lake to the east. It sits on mixed bedrock, with predominantly quartzite in the western half and dolomite marble in the eastern half. A narrow band of pelitic schist and pelitic phyllite underlies the far west boundary of the mine site (Figure 15.3).

Three substantive terrain features occur within the Rose Pit area: a 1,800 m long, bedrock-controlled ridge along the southern boundary; a wetland atop the ridge at 627 m asl; and a lake/wetland complex below the ridge at 571 m asl. Elevations within the Rose Pit range from 666 m asl atop a bedrock-controlled ridge along the south to 571 m asl at an unnamed lake north of the ridge. Topography ranges from steeply sloping (32 percent) to nearly level (less than 2 percent slope).

Like the majority of the PDA, this site is composed mainly of till, deposited directly by ice during the last glaciation, which covered most of Labrador. This surficial till layer varies in thickness across the surface, and is generally thicker in lower lying areas in comparison to the uplands. Geotechnical borehole data indicate that till thickness in this area varies between 1.6 and 52.1 m (Table 15.4). The till covering is thinnest on the upland area at the eastern margin of the mine, where the till cover does not exceed 12 m. Thicker coverings of till (46.8 m) were found at the lower lying area, at the northern margin of the mine, at the outlet from Pike Lake. Ecological mapping indicates that approximately 36 percent of the terrain in the Rose Pit is composed of organic materials; the remaining 64 percent comprises upland, well- to poorly drained materials generally comprised of sandy till materials.

Figure 15.3 Bedrock Geology



Soils from the Organic, Gleysolic and Podzolic soil orders are commonly found in the Rose Pit area. The depth of peat encountered in the boreholes drilled in organic soils ranged from 0.60 to 2.1 m. The depth of peat encountered in boreholes drilled in Gleysolic soils ranged from 0.15 to 0.60 m. Podzolic soils typically had a thin (less than 0.10 m) organic horizon (LFH or Of) overlying brown to reddish brown mineral soil. The water table was at or near the ground surface in the Organic and Gleysolic soil areas. The mineral soil underlying the peat in the Gleysolic soils ranged from gray to grayish brown in color and loamy sand to sandy clay loam in texture. Occasional cobbles and traces of gravel size stones were common.

Depth to bedrock in the PDA was determined through examination of boreholes. The minimum and maximum depth for each component is shown in Table 15.4.

Table 15.4 Borehole Data for PDA Components

PDA Component	Number of Boreholes	Depth to Bedrock	
		Minimum (m)	Maximum (m)
Rose Pit	18	1.6	52.1
Rose North Waste Rock Disposal Area	2	15.5	19.8
Rose South Waste Rock Disposal Area	-	-	-
Tailings Management Facility and Polishing Pond	3	> 9.7[1]	>11.2[1]

15.5.2 Rose North Waste Rock Disposal Area

The Rose North Waste Rock Disposal Area (136 ha) borders the northwestern edge of the Rose Pit. The local geology is composed of pelitic schist and pelitic phyllite. The area consists mainly of uplands with a minor wetland in the east. Elevations range from 674 m asl atop a subdued ridge along the western boundary to 574 m asl in the east, a difference in relief of 100 m. The topography is gently inclined (10 percent) from west to east.

Thick till deposits overlay the undulating bedrock in the area. Borehole data form the south edge of this site suggest that the till cover is approximately 19 m thick, but becomes slightly thinner towards the top of the slope, where the till cover is approximately 15 m thick. Ecological mapping suggests that approximately 74 percent of the Rose North Waste Rock Disposal Area is composed of well- to poorly drained mineral materials composed mainly of sandy tills; the remaining 26 percent in the Rose North Waste Rock Disposal Area is composed of organic materials.

Well drained soils from the Podzolic soil order are the most common in the Rose North Waste Rock Disposal Area. Poorly drained Organic and Gleysolic soils are found in the minor wetland on the east side of the area.

15.5.3 Rose South Waste Rock Disposal Area

The Rose South Waste Rock Disposal Area (595 ha) is located to the southeast of the Rose Pit, and is bordered by the Waldorf River to the east and Mills Lake to the west. This area is underlain by dolomite marble. Topography is gently undulating, with two subdued streamline bedrock ridges running north-south. Elevations range from a topographic high of 614 m asl 1,285 m south of the northern tip of the area to 573 m asl.

Surficial materials include sandy till deposit and some sloping organics and raised bogs. There are a number of small subdued ridges, most occurring adjacent to wetlands. Ecological mapping indicates that approximately 30 percent of the terrain is composed of organic materials; the remaining 70 percent comprises mainly well to poorly drained upland till deposits. Borehole data are not available for this area.

Well-drained soils from the Podzolic soil order are common. Poorly drained Organic and Gleysolic soils are found in channelized depressions oriented in the direction of drainage from south to north.

15.5.4 TMF

The TMF will be located east of the Rose Pit, just southeast of Long Lake. It is bordered by the Waldorf River to the west and Riordan Lake to the east. This area is predominantly underlain by dolomitic marble, with a band of pelitic schist and pelitic phyllite in the north. This site has gently rolling, hummocky topography, and contains landforms associated with ice stagnation.

While sandy till deposits are common, the TMF is characterized by sloping organics, many of these originating from the two small lakes found in its southern section. Borehole data from this area indicate that the till cover is over 9 m thick. Ecological mapping suggests that approximately 64 percent is comprised of well- to poorly-drained upland topography that comprises mainly of sandy till materials; the remaining 36 percent of the terrain in the TMF is comprised of organic materials.

Large, continuous areas of poorly-drained Organic and Gleysolic soils were found in the extensive lowlands in the TMF. The depth of peat encountered in the boreholes drilled in Organic soils ranged from 1.4 to 2.2 m. The depth of peat encountered in boreholes drilled in Gleysolic soils ranged from 0.15 to 0.60 m. Podzolic soils typically had a thin (less than 0.10 m) organic horizon (LFH or Of) overlying brown to reddish brown mineral soil. The water table was at or near the ground surface in the Organic and Gleysolic soil areas. The mineral soil underlying the peat in the Gleysolic soils ranged from gray to grayish brown in color and loamy sand to sandy clay loam in texture. Occasional cobbles and traces of gravel size stones were common.

The tailings will be dewatered at the mill and final tailing solids will resemble silt sand. The TMF is designed, and will operate to minimize, potential dust from the tailings deposits. Tailings will be rehabilitated with overburden cover and seeding as quickly as possible to minimize dust.

15.5.5 Existing Unique or Valuable Landforms

Only one unique or valuable landform feature has been identified within the LSA. A nearly 5-km-long esker parallels the west side of Waldorf River, from 300 to 990 m east of the Rose

South Waste Rock Disposal Area. It varies in width from 50 to 285 m, is 5 to 20 m above the Waldorf River and is about 7.5 million m^3 (5 km long x 100 m wide x 15 m high).

Although eskers are generally identified as valuable, they are not unique in this area of Labrador because they are a characteristic terrain feature of the Michikamau Ecoregion of central and western Labrador (Department of Environment and Conservation [DOEC] 2007; Bolduc 1992).

Eskers are valuable from a human and wildlife perspective. Historical, archaeological and paleontological sites are often found on eskers close to water as they represent not only a height of land from which to view the surrounding landscape, but also an area that is dry for encampments. They act as ecological connectors in the landscape providing dry ridges for wildlife movement and are often denning sites for wolves, coyotes, foxes, and black bears.

Eskers are considered a characteristic terrain feature of the Michikamau Ecoregion of central and western Labrador (DOEC 2007), the area in which the Project is proposed. Bolduc (1992) indicates that eskers are abundant on plateau areas of central and western Labrador and also suggests that the lithologies of esker ridges found in western and central Labrador are derived from up-esker till (in a corridor up to 3.5 km on either side of the ridge), which is itself derived from bedrock. This would suggest that the esker is likely composed of mainly sand, with a secondary component of gravels, cobbles and boulders. As indicated in other studies (Bolduc 1992; DOEC 2007), eskers are abundant and characteristic of this area of Labrador.

Wetlands are described in Chapter 17.

15.5.6 Climate

Table 15.5 shows climate data for the period of 1971 to 2000 for Wabush (Environment Canada 2012). Like most of Labrador, Wabush has a subarctic climate, with higher than usual precipitation due to the persistent Icelandic Low.

Table 15.5 Monthly Temperatures, Precipitation and Wind Data for Wabush, 1971 to 2000

	January	February	March	April	May	June	July	August	September	October	November	December	Total
Precipitation													
Total (mm)	54	42	57	57	56	85	112	95	96	74	68	57	852
Snowfall (cm)	66	49	65	53	17	3	0	0	7	42	75	70	445
Average Snow Depth (cm)	74	92	89	59	6	0	0	0	0	3	20	49	33
Extreme Daily Snowfall (cm)	34	36	35	32	21	10	.3	1	24	33	48	54	-

	January	February	March	April	May	June	July	August	September	October	November	December	Total
Extreme Snow Depth (cm)	218	211	193	207	164	4	0	0	10	49	122	170	-
Days with Snow Depth (cm)													
1 to 5 cm	31	28	31	29	11	0	0	0	1	13	28	31	204
5 to 10 cm	31	28	31	29	7	0	0	0	0	6	24	31	187
10 to 20 cm	31	28	31	28	5	0	0	0	0	3	20	31	176
>20 cm	31	28	31	25	3	0	0	0	0	1	13	28	160
Wind													
Speed (km/h)	14	14	16	15	14	14	14	13	15	16	15	13	14
Most Frequent Direction	W	W	W	N	N	N	S	SW	W	S	W	W	W
Maximum Hourly Speed (km/h)	72	65	59	60	61	64	56	51	55	65	80	65	-
Direction of Maximum Hourly Speed	W	NW	W	W	W	W	W	NW	SW	NW	W	W	-
Values have been rounded Values are at elevation 551.1 m Source: Environment Canada 2012													

On average, the Wabush area receives 445 cm of snow per year; July and August are the only months that do not receive measurable amounts of snowfall. Approximately 85 percent of snowfall is received from October to April.

Over the course of the year, snow depth averages 33 cm. The highest snow depths occur in February and March, when average depth is 92 and 89 cm, respectively. Extreme snowfall events range from a high of 54 cm in December to trace amounts in July and August. Extreme snow depths are associated with January and February, where 218 and 211 cm, respectively, were found on the ground. At least 1 to 5 cm of snow is on the ground for a minimum of 204 days (57 percent of the year), with more than 20 cm of snow on the ground for 160 days (45 percent of the year).

With an annual average temperature of -3.5°C at Wabush, below-freezing average temperatures are experienced for a minimum seven-month period (October [-0.4°C] to April [-4.6°C]). Ice conditions on Lac Daviault, approximately 1.5 km to the west of the Rose Pit, are on average 1.8 m (6 ft) thick, with ice conditions ranging from six to eight months (CLD 2012).

Wind speeds are fairly consistent, ranging from 13 km/h in August to 16 km/h in February and October. The most frequent wind direction is from the west. Maximum hourly wind speeds range between 51 km/h in August to 80 km/h in November; these winds are also from the west / northwest.

15.5.7 ARD/ML

The lithology of bedrock formations in Rose Pit can be summarized in stratigraphic order as follows (BBA 2011):

- Menihek (Nault) Formation consists of fine mica schists (variable muscovite and biotite with low quartz) and graphite-biotite schist with traces of pyrrhotite (sulphide), mostly developed in the basal 50 m. The schists often contain amphibole-biotite-garnet gneiss.
- Sokoman (Wabush) Iron Formation consists of metataconite (ore) and associated ankeritic marble-quartz-Feiron-silicate gneiss. Mineral grains are generally medium- to coarse-grained and interlocking, making the rock fairly coherent. Metataconite comprises generally approximately 75 percent of the Rose central stratigraphy and 35 percent of the Mills Lake stratigraphy.
- Wishart (Carol) Formation is represented by granular quartzite and mica-quartz schist with disseminated calcite, near the top.
- Denault (Duley) Formation consists of dolomitic marble with interlocking grains and generally is a competent unit. Bands of quartzite are common.

The lithology indicates that the potential for acid generation exists due to the pyrrhotite and pyrite (sulphides) found in the Menihek Formation. However, the other formations contain acid-neutralizing carbonates (calcite, dolomite, and ankerite) and no visible sulphides.

Historical monitoring records of tailings discharges showed no signs of acidification associated with two mines operating in the area (Burridge pers. comm., 2012). The water quality of the discharges complied with the *MMER*. In some occasions, the Canadian Environment Ministry of the Environment (CCME) Water Quality Guidelines for the Protection of Aquatic Life were exceeded for arsenic, aluminum, cadmium, iron ammonia and total suspended solids (TSS). The detection limits for the analytical methods which were used in the historical monitoring for cadmium and copper were generally higher than, or equal to, the current CCME Water Quality Guidelines for the Protection of Aquatic Life.

Stantec previously assessed two mine sites in the Schefferville area (western Labrador), where mining activities have occurred since the 1950s (LIM 2009). Acid Base Accounting indicated that the waste rock could be classified as non-acid generating based on Neutralization Potential Ratio (NPR) criteria.

15.6 Assessment of Project-related Environmental Effects

This section describes the interactions that will require specified mitigation measures; that is, those interactions given a rank of 2 in Table 15.2. The potential for the occurrence, mitigation, and management of the Project-related environmental effects on LSSI for each of the construction, operation and maintenance, and decommissioning and reclamation phases is assessed in this section.

15.6.1 Change in Landforms and Terrain Stability

Construction

Construction activities will result in alterations to existing landforms and existing drainage regimes within the mining and processing areas, as well as transportation and utility corridors, including roads and the rail infrastructure. These will be one-time activities.

Development of Rose Pit, waste rock disposal areas and TMF will alter existing landforms and existing drainage regimes as till materials and organics will be removed through clearing, removal of overburden, and excavation. The materials in the PDA vary from approximately 2 m to over 51 m in thickness and over time will be spread across the landscape as part of the ongoing progressive site rehabilitation. Given the relatively gently undulating, rolling, and inclined nature of the terrain, coupled with overburden of up to 51 m in depth, it is not anticipated that any landforms will be lost. Cut and fill will be minimal. This alteration represents an adverse, low, site-specific change to the landscape.

For the two waste rock disposal areas and the TMF, the landforms will be altered by the disposal of waste rock and tailings over the existing surface, thereby masking the underlying undulating and sloping topography to the north. These waste rock sites will eventually become prominent “hills” in the landscape, reaching approximately 200 m in height for the Rose North Waste Disposal Area and 150 m in height for the Rose South Waste Disposal Area. Overburden material from the Rose Pit will be used to top these hills for reclamation purposes. The changes to the two waste rock disposal areas and the TMF will result in neutral, negligible, and site-specific effects.

The esker that parallels Waldorf River will be used as a source of aggregate for the Project and will be adversely affected during construction, although it is likely that less than 20 percent of the esker will be used (see below for a discussion of mitigation measures). The construction of the roads, associated facilities and rail infrastructure will also result in alterations to the current landforms; however, given the relatively gently undulating, rolling, and inclined nature of the terrain, coupled with overburden of up to 51 m in depth, it is not anticipated that any landforms will be lost. Cut and fill will be minimal.

As described in Section 15.4, significant adverse residual environmental effects on landforms are not likely to occur as a result of activities in the operation and maintenance, or the decommissioning and reclamation phases.

The environmental effects resulting from loss or alteration of wetlands and wildlife habitat is assessed in Chapters 17 and 19. Subsequent effects on use of lands and resources are assessed in Chapters 22 and 23.

Mitigation of Project Environmental Effects

Natural drainage patterns will be maintained through the proper placement of waste rock and the use of properly sized culverts and trenching alongside roads to reduce erosion and minimize the potential for low-angle slides. In particular, the Rose South Waste Rock Disposal Area and the TMF slope to the north with well-defined linear drainage channels. Drainage of this area will be maintained to prevent alteration of the direction of flow.

The esker will be excavated preferentially in selected locations where potential for high-quality aggregate material is high. A preliminary screening test will be conducted to measure the quality of the material for aggregate use prior to excavation, and only high-quality aggregate material will be excavated. It is expected that less than 20 percent of the esker will be excavated.

Mitigation measures pertaining to wetlands, wildlife habitat and use of land and resources are presented in Chapters 17, 19, 22, and 23, respectively.

Characterization of Project Residual Environmental Effects on Landforms and Terrain Stability

Changes to landforms and terrain stability are not expected at the mining or processing areas during the construction phase with the implementation of proper mitigation techniques mentioned above. The residual environmental effects of the excavation of the esker adjacent to Waldorf River are considered to be adverse, of low to high magnitude (depending on amount of disturbance), site-specific, sporadic, of permanent duration and irreversible. The confidence level associated with these predictions is high.

15.6.2 Change in Soil Quality and Quantity

Construction

As shown in Table 15.2, construction activities are rated 2 as interacting with soil as there is potential for change in soil quality and quantity. Peat and topsoil will be salvaged and stored during the construction phase, and changes to surface and groundwater flow patterns associated with the Project may affect soil moisture conditions and alter soil quality.

Disturbances to the soil during construction could contribute to erosion, including streambank and wind erosion, and deposition of airborne sediment. Activities that disturb the surface organic horizon covering the underlying mineral soil will increase the risk of sediment transport via wind or water. The risk of wind erosion depends on soil texture and climatic factors, and risk of water erosion depends on soil texture, slope steepness and length and climatic factors. Project environmental effects on air quality (e.g., dust) are addressed in Chapter 14: Atmospheric Environment.

Compaction can degrade soil quality by changing the arrangement of aggregates and pores in disturbed and undisturbed soils. Soil will be stored in such a manner so that they retain volume and quality required for reclamation activities (see below for a discussion on mitigation of environmental effects).

Airborne deposition of dust associated with construction has the potential to change soil quality. However, because the parent geologic material contains substantial amounts of iron, the deposition of dust composed of iron particulates will not adversely affect quality of upland soils. Project environmental effects on air quality (e.g., dust) are addressed in Chapter 14.

Operation and Maintenance

Waste rock disposal on the surface has the potential to alter the soil moisture or nutrient regime and affect soil chemistry. Natural drainage patterns will be maintained through the proper placement of waste rock and the use of appropriately sized culverts and trenching. Project environmental effects on groundwater and surface water are addressed in Chapter 16: Water Resources.

Activities that disturb or compact the surface organic horizon during construction have the potential to result in the same effects discussed above throughout the operation and maintenance phase. Project environmental effects on air quality (e.g., dust) are addressed in Chapters 14 and 25. Waste rock disposal on the surface has the potential to alter the soil moisture or nutrient regime and affect soil chemistry.

Decommissioning and Reclamation

Site decommissioning and site reclamation activities will include the replacement and relocation of stored overburden and topsoil and therefore may result in a positive change in soil quality and quantity.

Mitigation of Project Environmental Effects

Peat and topsoil storage and replacement have the potential to alter soil quality through admixing, wind and water erosion, biogeochemical alterations during storage, and changes to soil moisture status. The collection and storage of soil stockpiles will be managed so that:

- The potential for mixing soil horizons is minimized;
- Erosion control protocols are followed;
- Revegetation of soil stockpiles is promoted;
- The volume of soils in each stockpile is estimated for future tracking;
- Surface drainage is designed to prevent flooding of stockpile areas;
- Signs are installed to clearly identify soils in stockpiles;
- Spill prevention and clean up protocols are followed; and
- Traffic plans are followed to minimize soil pulverization and compaction.

Revegetation of soil stockpiles will be promoted to prevent erosion and promote biological activity. Drainage patterns around stockpiles will be monitored so that the desired soil moisture conditions for the stockpile and surrounding areas are maintained. Soil salvage and stockpiling operations will be designed and monitored to minimize admixing and erosion.

The following erosion and sediment control measures will be implemented, if required and to the extent feasible:

- Progressive revegetation and direct placement of topsoil and peat will be implemented wherever possible, so that the seedbank and propagules present in recently stripped topsoil can be used;
- Soil and overburden will be stored in a manner that it is suitable for site rehabilitation;
- Wind barriers (snow fences) will be installed, as required;
- Soil handling (stripping, stockpiling, and replacement) will be suspended during and after heavy rainfall events;
- Runoff will be contained or directed in appropriately sized ditches; and
- Terracing, mulch or coarse woody debris, or matting on newly-constructed stockpiles or recently replaced soils will be used.

Discharge of treated water will be controlled through designed drainage control structures, and will therefore minimize effects on soil.

Reclamation activities will be planned and designed to minimize environmental effects resulting from compaction and erosion.

Characterization of Project Residual Environmental Effects on Soil and Soil Quality

Changes in soil quality are not likely because deposited dust will be composed of iron particulates, similar to the parent geologic material. Further details on the effects of the Project on soil quality are provided in Chapter 25. Changes in soil quantity will be minimized through the stockpiling of peat and topsoil. These stockpiled soils will be used to reclaim the site progressively and at decommissioning. Therefore, changes in soil quality and quantity will be neutral to negative in direction, local in geographic extent, low in magnitude and moderate to long term in duration. The frequency of occurrence will be discontinuous and will be reversible. The confidence level associated with these predictions is high.

15.6.3 Change in Snow and Ice

Potential Project environmental effects on snow and ice include:

- Change in snow distribution and drifting as a result of the open pit mine and the mine facilities;
- Change in the timing of snowmelt as a result of dust; and
- Change in winter ice conditions on nearby lakes resulting from blasting activities.

Although winter conditions may hinder dust dispersion, dust contamination can alter snowpack surface albedo and promote earlier than normal melting of snow. Further, finely dispersed dust released during blasting can affect runoff, erosion, and winter ice conditions on nearby lake (and thus recreational activities). These effects are discussed in detail in this section. The extent of dust dispersion is addressed in Chapter 14.

Construction

Dust emissions as a result of construction activities involving disturbance to the mineral surface could reduce snow albedo and ultimately affect the timing of snowmelt, especially during late fall, winter and early spring (October through May). Fugitive dust will be deposited to the east and southeast of the Project site, as the prevailing winds are from the west and northwest during the winter months.

Research suggests that snowmelt may occur earlier than usual near active mine sites. For example, in a study of snow melt at Schefferville, Quebec (Nicholson 1975) found that dust-covered snow near active mine sites completely melted approximately four days before the general snowpack in the area. The ability of dust to accelerate snowmelt depends on the rate of deposition, the absorbtivity of the material and other factors, and therefore direct comparison with other mines is not possible. Deposition rates of dust resulting from the Project were calculated for areas immediately north of the crusher area of the mine, and results indicate an annual deposition rate approaching 2 g/m^2 in the immediate vicinity of Project features, dropping to about a tenth of that at Lac Daviault. An annual deposition rate of 0.2 g/m^2 is not likely to be sufficient during the snow season to measurably affect the melt rate.

Construction of the mine site and associated infrastructure will also have the potential to affect snow distribution and subsequent drifting of snow. Many of these effects will be caused by changes in the microtopography, which influences wind direction and speed. These effects can be managed through proper mitigation techniques (e.g., snow fences, snow removal).

Operation and Maintenance

Operation and maintenance activities involving disturbance to the mineral surface occurring during the late fall, winter and early spring period (October to May) may result in increased dust emissions that could ultimately affect snow cover by reducing albedo levels. These activities include drilling, blasting, crushing, conveying, grinding, screening, separation, silo discharge, and disposal of rock material on the waste rock disposal areas. As noted above, the deposition rate declines from about 2 g/m^2/year in the immediate vicinity of the mine (Long Lake South) to about 0.2 g/m^2 at Lake Daviault near Fermont. The extent of dust dispersion is addressed in Chapter 14. There will be no release of effluent from the TMF outside its containment area and discharge after treatment to long lake. Therefore, snow and ice will not be contaminated.

Blasting will result in ground vibration. However, more than 90 percent of a blast's energy is consumed as it fractures the rock. The efficiency is achieved by adjusting the amount of explosives detonated per delay interval, which is also important in minimizing ground vibration. Only the remaining energy not "used up" as it breaks rock is capable of causing ground vibration. Ground vibration caused by any source rapidly decreases as the distance from the source increases (Missouri Limestone Producers 2012). In a study of maximum allowable charge size at a given location based on the distance to the nearest sensitive receptor location (commercial or residential) for the Hollinger Project open pit mine adjacent to Timmins, Ontario (Harding 2010), it was found that a 1,000 kg charge had a vibration radius of approximately 500 m; a 200 kg charge had a vibration radius of approximately 200 m. Blasting will be managed so that the vibrations will not affect ice cover of nearby lakes.

The two waste rock disposal areas will result in two new "heights of land" within the LSA, ranging from approximately 150 m at the Rose South and 200 m at the Rose North waste rock disposal areas. It is anticipated that these new "heights of land" will affect snow deposition and drifting in these areas, especially downwind areas; these effects will be localized and managed through the installation of snow fences.

Decommissioning and Reclamation

Any decommissioning and reclamation activities involving disturbance to the mineral surface during late fall, winter and early spring period (October to May) may result in increased dust emissions that could ultimately affect snow cover by reducing albedo levels.

Mitigation of Project Environmental Effects on Snow and Ice

The following mitigation measures will be implemented to minimize effects on snow:

- Use of snow fences and snow removal;
- Revegetation and implementation of progressive rehabilitation will promote windbreaks; and
- Design facilities and activities to minimize dust emissions.

To reduce potential effects on ice cover on lakes, blasting will be managed so that vibrations will not affect ice cover of nearby lakes.

Characterization of Project Residual Environmental Effects on Snow and Ice

The development of the Rose Pit, waste rock disposal areas and the TMF will affect the snow and ice conditions within the PDA. The effects on snow deposition and drifting will be mitigated through the use of snow fences to control snow drifting in critical areas. The effects of blasting on the ice in adjacent lakes will be controlled or minimized through the development of a proper blast design.

Studies have shown that dust accumulation on snowpack has resulted in the melting of snowpack four days earlier than normal (Nicholson 1975). It is anticipated that similar effects will result from the Project. A difference of four days would result in a change from 204 days a year with 1 to 5 cm of snow to 200 days. The effects of dust on snow are considered adverse, are likely low (given the four-day finding in Schefferville, Québec), are local (distributed to the east and southeast on a regular basis during the winter period), and will occur for the life of the Project; these effects are irreversible.

15.6.4 ARD/ML

Construction and Operation and Maintenance

Site preparation and construction will result in the exposure of substantial quantities of bedrock (approximately 30 Mt) and overburden. The potential for ARD/ML will extend into the operation and maintenance phase, and therefore both phases are addressed together for ease of discussion.

Tailings Management Facility, Stockpiles of Ore and Concentrate

There have been no signs of acidification associated with tailings discharges of two mines operating in the area (Burridge pers. comm., 2012). The water quality of the discharges complied with the MMER guidelines.

Static tests of concentrate and tailings samples indicated that the Neutralization Potential (NP) of these materials greatly exceeded the Acid Potential (AP). The NP/AP ratio, or NPR, is used as a criterion in the recommended guidelines for the prediction of ARD potential in geologic materials (Price 2009). Materials with NPR greater than two are considered to be potentially non-acid generating. The samples of Kami concentrate and tailings had NPR values ranging from 7.3 to 233, which indicated that tailings and concentrate would not generate ARD. In addition, process water and Shake Flask Extraction (SFE) leachates were alkaline, with the pH ranging from 8.1 to 9.1. It is concluded that the concentrate and tailings will be non-acid generating. Metal concentrations in the process water and SFE leachates from tailings and concentrates were substantially below the limits prescribed by the MMER (2002).

Over 600 Mt of metataconite ore will be mined during the Project from the Sokoman formation (BBA 2011). Acid-generating potential (AP) in the ore is low because sulfur concentrations were below the detection limit (0.01 wt%) in 14 of 15 samples. The absence of sulfur and relatively high neutralization potential (NP) resulted in high NPR values with the median calculated at 193. Other indicators such as paste pH and Net Neutralizing Potential show that ore will not generate acid. Concentrations of trace elements are below the MMER guidelines in all samples demonstrating low metal leaching potential of Kami ore.

Based on data from other mines in the area and site-specific information, no adverse environmental effects related to ARD/ML are expected from ore, tailings or concentrate during mine operation.

Waste Rock Disposal Areas and Overburden Stockpile

Stantec previously assessed two mine sites in the Schefferville area (western Labrador), where mining activities have occurred since the 1950s (LIM 2009). Acid Base Accounting indicated that the waste rock could be classified as non-acid generating based on NPR criteria.

Static tests of overburden material indicated that the values of Neutralization Potential (NP) exceeded Acid Potential (AP) in 75 percent of samples. The median NPR is 20, which indicates that the overburden stockpile will be non-acid generating, assuming that the material will be well mixed during storage. The potential for metal leaching was observed in only two of twelve SFE, indicating a low probability of metal leaching from the overburden.

Most of the waste rock will be composed of Sokoman (32 percent), Menihek (31 percent) and Whishart (28 percent) formations. Waste rock from the Sokoman and the Whishart formations are classified as non-acid generating based on median NPR values, which are 124 and 15, respectively. These formations have no acidification potential and have low potential for metal leaching based on SFE. The Menihek formation is Potentially Acid Generating (PAG) based on median NPR = 0.9 and NNP (-0.6 $CaCO_3$ kg/t), particularly in lenses of graphitic-schist. Copper, zinc and nickel are potential elements of concern associated with PAG rock.

To provide a preliminary ARD assessment for the disposal area, Total Net Neutralization Potential (TNNP) for waste rock was calculated. Median Net Neutralization Potentials for each waste rock formation was multiplied by their mass within the pit; the products were then summed to obtain the TNNP. The calculations indicate that the TNNP for the waste rock dump will be positive and high (+24 $CaCO_3$ kg/t). This result means that if waste rock in the dump is relatively well mixed it will not generate acid even without segregation of graphitic-schist lenses from the Menihek formation. Similar calculations were done for 50m elevation segments of the pit to provide a surrogate for production of waste rock units during mine operation. For each segment, the TNNP was positive, indicating that the vertical distribution of the lithology will not cause unintended enrichment of acid-generating material within large parts of the waste rock disposal areas, due to the sequential disposal of different lithologies.

Based on data from other mines in the area and site-specific information, the ARD/ML potential of waste rock is expected to be low. Therefore, no adverse environmental effects related to ARD/ML are expected from waste rock during mine operation or closure.

Rose Pit

The walls of the proposed open pit will be represented by the same formations and lithologies as the waste rock. As described above, the waste rock disposal areas are not expected to generate ARD/ML; therefore, pit/mine water will be unlikely to be acidic or contain trace elements in concentrations exceeding the MMER Guidelines. This is consistent with existing pit lakes in closed iron mines in the Schefferville area (western Labrador) which do not show any evidence for ARD/ML (LIM 2009). If further monitoring of the mine water from the pit indicates a potential for ARD/ML, the discharge (e.g., pit water quality) will be treated to meet MMER discharge criteria. No adverse environmental effects are expected from ARD/ML during the operation and maintenance phase based on currently available information.

Decommissioning and Reclamation

Based on the results presented above, ARD/ML is not expected to occur in tailings and stockpiles of ore and concentrate at closure; therefore, these components of the Project should not cause any adverse environmental effects during the decommissioning and reclamation. The same conclusion, though preliminary, can be made about waste rock disposal areas and the overburden stockpile. This conclusion is based on the historical review and will be augmented by the testing of the drillcores and overburden from the Project. Based on water quality of flooded open pits in the Schefferville Area Mine Project (LIM 2009), no ARD/ML is expected upon closure. However, if water monitoring at the Project site indicates the possibility of ARD/ML, the effluent will be treated to limit adverse effects on environmental receptors during operation and after closure.

Mitigation of Project Environmental Effects on ARD/ML

Tailings Management Facility, Ore, and Concentrate Stockpiles

Based on independent evidence, ARD/ML will unlikely occur in the tailings, ore, and concentrate stockpiles and therefore, no mitigation is considered. If monitoring and modelling of discharge (e.g., pit water quality, TMF discharge, waste rock runoff) shows potential effects from ARD/ML, the discharge from the pit will be treated to meet MMER discharge criteria.

Waste Rock and Overburden Stockpiles

Based on historical data, ARD/ML is not expected to occur in waste rock or overburden and therefore, no mitigation is proposed.

Rose Pit

Based on historical data and static tests of rock cores, mine water from the pit is not expected to be acidic or contain elevated concentrations of trace elements that exceed MMER guidelines, ARD/ML issues are not expected. Nevertheless, if monitoring and modelling of pit water quality show potential effects from ARD/ML, the discharge from the pit will be treated to meet MMER discharge criteria.

Characterization of Project Residual Environmental Effects on ARD/ML

With the implementation of mitigation, the direction of the environmental effect is neutral and the magnitude is negligible. No residual environmental effect arising from ARD/ML is likely after mitigation measures are implemented. The level of confidence in this prediction is moderate. A summary of the residual effects is presented in Table 15.6.

Table 15.6 Summary of Project Residual Environmental Effects: Landforms, Soils, Snow and Ice, and ARD/ML

Project Phase	Mitigation/Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	
Change in Landforms and Terrain Stability											
Construction	• Minimize use of esker material for aggregate use. • Maintain existing drainage to the extent possible.	A	L-H	S	M	S	I	N/A	N	H	Monitor for compliance with mitigation measures.
Operation and Maintenance		A	L	S	S	S	I	N/A	N	H	
Decommissioning and Reclamation		N	L	S	P	O	I	N/A	N	H	
Change in Soil Quality and Quantity											
Construction	• Manage the collection and storage of soil stockpiles. • Promote the vegetation of soil stockpiles to prevent erosion. • Design surface drainage to prevent flooding of stockpile areas. • Erosion control protocols will be followed. • Volumes of soil stored in stockpiles will be measured and tracked from salvage to replacement. • Progressive rehabilitation. • Fugitive dust suppression programs.	A	L	L	MT	R	R	N/A	N	H	Monitor for compliance with mitigation measures.
Operation and Maintenance		A	L	L	MT	O	R	N/A	N	H	
Decommissioning and Reclamation		N	L	L	MT	R	R	N/A	N	H	

Project Phase	Mitigation/Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	
Change in Ice and Snow											
Construction	• Design facilities and activities to minimize dust emissions. • Use of snow fences and snow removal. • Implementation of speed limits. • Manage blasting so that the vibrations will not affect ice cover at nearby lakes.	A	M	L	ST	R	R	N/A	N	M	Monitor for compliance with mitigation measures.
Operation and Maintenance		A	M	L	ST	R	R	N/A	N	M	
Decommissioning and Reclamation		A	L	L	M	R	I	N/A	N	H	
ARD/ML											
Construction	• Effluent discharge will be treated to meet MMER discharge criteria.	N	N	L	ST	C	I	U	N	M	Monitor for compliance with mitigation measures.
Operation and Maintenance		N	N	L	ST	C	I	U	N	M	
Decommissioning and Reclamation		N	N	L	ST	C	I	U	N	M	

Project Phase	Mitigation/Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	

KEY

Direction:
- P Positive.
- A Adverse.
- N Neutral.

Magnitude:
- N Negligible.
- L Low: for landforms, minor changes to shape and stability from a regional perspective; for soils, changes of less than or equal to 5 percent.
- M Moderate: for landforms, moderate changes to shape and stability from a regional perspective; for soils, changes of 5 to 10 percent.
- H High: for landforms, a major change to shape and stability in the regional area; for soils, changes of greater than 10 percent.

Geographic Extent:
- S Site: effect confined to the PDA and 200 m beyond.
- L Local: effect confined to the LSA.
- R Regional: effect extends beyond the LSA but within the RSA.

Duration:
- ST Short-term: effects last through the construction phase.
- MT Medium-term: effects last beyond the construction phase, but not beyond the end of Project decommissioning.
- LT Long-term: effects are measureable for up to 30 years beyond the life of the Project.
- P Permanent – effects will not change back to original condition.

Frequency:
- O Once: effect occurs once.
- S Sporadic: effect occurs occasionally but not consistently throughout the life of the Project.
- R Regular: effect occurs at regular intervals throughout the life of the Project.
- C Continuous: effect occurs continuously throughout the Project.

Reversibility:
- R Reversible: environment will likely recover to baseline conditions after the end of Project decommissioning.
- I Irreversible: environment is unlikely to recover to baseline conditions after the end of the Project decommissioning.

Environmental or Socio-economic Context:
- U Undisturbed: area relatively or not adversely affected by human activity.
- D Developed: area has been substantially previously disturbed by human development or human development is still present.
- N/A Not Applicable.

Significance:
- S Significant.
- N Not Significant.

Prediction Confidence:
Based on scientific information and statistical analysis, and effectiveness of mitigation or effects management measure.
- L Low level of confidence.
- M Moderate level of confidence.
- H High level of confidence.

15.7 Assessment of Cumulative Effects

An assessment of the potential cumulative effects of the Project in combination with those of other projects and activities within the RSA was conducted. The other projects and activities are described in Chapter 6. Potential cumulative effects on LSSI involve changes in landforms and increases in terrain instability, decreases in soil quality and quantity, changes in snow and ice cover, and acid rock drainage/metal leaching within the RSA.

Four iron ore mining projects and three municipalities occur within the RSA: Mont Wright Mine (ArcelorMittal), Bloom Lake Mine (Cliffs Resources); Wabush Mines (Cliffs Resources), IOC Labrador Operations, and the towns of Fermont, Labrador City, and Wabush. Development of past and current (existing) projects and activities have likely resulted in changes to Landforms, Soils, Snow and Ice within the RSA, which are reflected in current baseline conditions. The PDA consists of very gently to gently undulating, rolling, and inclined topography with anywhere from 1 to 52 m of overburden overlying the bedrock, which is very common throughout the RSA. Materials consist of mainly coarse sandy-textured till deposits with scattered organic materials of variable thickness. Soils consist of well-drained, Podzolic soils on the uplands and poorly- to very poorly-drained Gleysolic and Organic soils on the lowlands, and are of generally good quality. The only unique or valuable landform within the PDA is an approximately 5 km-long esker along the western side of Waldorf River (although eskers are common in the RSA). Average annual snowfall is 445 cm, with an average maximum snow depth of 92 cm in February. Average wind speed is 14 km/h and is mainly from the west. No ARD/ML issues currently exist naturally or are associated with other projects in the area.

As presented in Table 15.7, Project-related effects on LSSI will be limited, mitigated through the use of well established and proven mitigation measures, and are likely to be not significant. Potential adverse environmental effects of the Project on the esker landform type is low in magnitude due to the common nature of this topographical feature in the RSA. Changes to soil quantity as a result of the Project will be mitigated through stockpiling and retaining of this material for use during decommissioning and reclamation. It is not anticipated that soil quality will be adversely affected, as mining dust deposited on stockpiled soils will consist of the same parent material. In addition, the incremental change in soil metals is predicted to be low during the 17 years of operation and therefore not significant. Project effects on snow deposition and drifting will be mitigated through the use of snow fences to control snow drifting in critical areas. The effects of dust emissions on snow and ice will likely only be within a few tens of meters of the roads and the open pits, and hence the effects are very localized. Blasting will be managed so that the vibrations will not affect ice cover of nearby lakes. Based on findings from other mines in the RSA and with the implementation of mitigation, there will be no residual environmental effects arising from ARD/ML.

Other projects and activities in the RSA affecting soil quantity and quality that may act cumulatively with the Project will be required to implement similar mitigation regarding soil preservation and protection as those for the Project (e.g., control of runoff drainage, implementation of proper erosion and sediment control, stockpiling of soil by other mining operations), and are therefore not anticipated to act cumulatively with the Project.

There is the potential for cumulative effects from dust and its effects on snow cover. The effects of dust emissions on snow and ice will only be within a few tens of meters of the roads and Project features; therefore, the effects are very localized and it is unlikely that there will be any cumulative effects from dust emissions. In addition, given that the prevailing wind direction is from the west, it is not likely that the effects associated with IOC Labrador Operations (20 km to the northeast), Wabush Mines (10 km to the north) would have any effect in terms of dust emissions and snow and ice conditions.

Blasting will be managed so that the vibrations will not affect ice cover of nearby lakes. Therefore, there will be no likely adverse environmental effect resulting from the Project and no cumulative effect of the Project in combination with other projects and activities on ice cover of nearby lakes.

Based on findings from other mines within the RSA and with the implementation of mitigation, there will be no residual environmental effects arising from ARD/ML. Because there are no likely residual environmental effects resulting from the Project, there are no likely cumulative effects resulting from ARD/ML.

Future projects and activities will be required to comply with planning and regulatory processes, and therefore cumulative effects will be managed.

A summary of results is provided in Table 15.7.

15.8 Assessment of Accidents and Malfunctions

The potential environmental effects of accidents and malfunctions on LSSI are assessed for the following scenarios: train derailment; forest fire; and dyke breach. The results of the assessment of potential environmental effects of accidents and malfunctions are summarized in Table 15.8.

Landforms and Terrain Stability

Landforms and terrain stability are not likely to be affected by train derailments, forest fires, or dike breaches.

Soils

Accidents and malfunctions associated with train derailments and dyke breaches have the potential to contaminate the soil or spill concentrate or other materials on the ground. This could result in admixing, compaction, and erosion. In the event of a hazardous material or diesel spill, the soil will be remediated to meet regulatory standards and requirements. In the event of a spill of concentrate or other solid material, the area will be cleaned up through recovery activities, preventing damage to the surface organic layer.

Table 15.7 Summary of Potential Cumulative Effects on Landforms, Soil, Snow and Ice

VEC Existing Condition (Past and Ongoing Activities)	• The PDA consists of very gently to gently undulating, rolling, and inclined topography with anywhere from 1 to 52 m of overburden overlying the bedrock, which is very common throughout the RSA. Only one noteworthy landform exists within the PDA, an approximately 5 km-long esker along the western side of Waldorf River. Eskers are not unique within the RSA. • Materials consist of mainly coarse sandy-textured till deposits with scattered organic materials of variable thickness. • Soils consist of well-drained, Podzolic soils on the uplands and poorly- to very poorly-drained Gleysolic and Organic soils on the lowlands. Generally of good quality. • Average annual snowfall is 445 cm, with an average maximum snow depth of 92 cm in February. Average wind speed is 14 km/h and is mainly from the west. • No ARD/ML issues currently naturally exist or are associated with other projects in the area		
Project Residual Environmental Effects	• No significant adverse residual environmental effects on landform, terrain stability, soils, snow and ice and ARD/ML are anticipated. • While the esker along the Waldorf River is considered to be unique within the LSA, less than 20% will be excavated for aggregate materials. Eskers are abundant in western Labrador; hence, from a local and regional perspective, the partial loss of this esker is considered to be not significant. • The loss of the landforms associated with the Rose Pit, the waste rock disposal areas and the TMF are also considered to be not significant, as this terrain is common throughout western Labrador. • Changes to soil quality and quantity arising from Project activities will be neutral to negative in the medium term. The residual adverse environmental effects are considered to be not significant based on the implementation of the erosion control, surface drainage, reclamation, closure, and monitoring plans. While there may be some effect from dust emissions on snow cover, it is estimated that the effect will be very localized (tens of metres). • No significant residual environmental effect arising from ARD/ML is expected after mitigation measures are implemented.		
Other Projects / Activities	**Likely Effect Interaction (Y/N)**	**Rationale**	**Cumulative Effects**
IOC Labrador Operations	Y	• Located approximately 20 km northeast of the Project area. Potential cumulative effects from loss of landscape features and decreases in soil quality and quantity. Dust emissions from this Project may result in potential effects on snow cover duration.	• Topography at the Project site is common throughout the RSA. Eskers are common throughout the RSA. Therefore adverse environmental effects are not likely to be significant. • Potential cumulative effects on soil quality and quantity are not likely to be significant due to implementation of stockpiling, and drainage,

			erosion, sedimentation control plans, and dust suppression programs. • Potential cumulative effects on snow pack are not likely to be significant due to site-specific extent.
Wabush Mines (Cliffs Resources)	Y	• Located approximately 10 km to the north of the Project site. Potential cumulative effects from loss of landscape features and decreases in soil quality and quantity. Dust emissions from this Project may result in potential effects on snow cover duration	• Topography at the Project site is common throughout the RSA. Eskers are common throughout the RSA. Therefore, adverse environmental effects are not likely to be significant. • Potential cumulative effects on soil quality and quantity are not likely to be significant due to implementation of stockpiling, and drainage, erosion, and sedimentation control plans. • Potential cumulative effects on snow pack are not likely to be significant due to site-specific extent.
Mont Wright Mine (ArcelorMittal)	Y	• Approximately 25 km to the west of the Project. Potential cumulative effects from loss of landscape features and decreases in soil quality and quantity. Dust emissions from this Project may result in potential effects on snow cover duration	• Topography at the Project site is common throughout the RSA. Eskers are common throughout the RSA. Therefore, adverse environmental effects are not likely to be significant. • Potential cumulative effects on soil quality and quantity are not likely to be significant due to implementation of stockpiling, and drainage, erosion, and sedimentation control plans. • Potential cumulative effects on snow pack are not likely to be significant due to site-specific extent.

Bloom Lake Mine and Rail (Cliffs Resources)	Y	• Approximately 20 km to the west of the Project. Potential cumulative effects from loss of landscape features and decreases in soil quality and quantity. Dust emissions from this Project may result in potential effects on snow cover duration	• Topography at the Project site is common throughout the RSA. Eskers are common throughout the RSA. Therefore adverse environmental effects are not likely to be significant. • Potential cumulative effects on soil quality and quantity are not likely to be significant due to implementation of stockpiling, and drainage, erosion, and sedimentation control plans. • Potential cumulative effects on snow pack are not likely to be significant due to site-specific extent.
Schefferville Iron Ore Mine (LIM)	N	• Greater than 200 km north of the Project. Any dust emissions from this Project are not likely to affect the Wabush area as prevailing winds are from the west.	• None anticipated.
DSO Iron Ore Project (Tata Steel Minerals Canada)	N	• Greater than 200 km north of the Project. Any dust emissions from this Project are not likely to affect the Wabush area as prevailing winds are from the west.	• None anticipated.
Lower Churchill Generation Project (Nalcor Energy)	N	• Project is located approximately 375 km east of the Project. Interactions related to LSSI are not likely due to the distance.	• None anticipated.
Infrastructure or other projects at Port of Sept-Îles	N	• Sept-Iles is 815 km to the south of the Project. Interactions related to LSSI are not likely due to the distance.	• None anticipated.

Urbanization	Y		• The towns of Fermont, Labrador City, and Wabush are located within 15 km of the Project site. Potential cumulative effects from loss of landscape features and decreases in soil quality and quantity.			• Topography at the Project site is common throughout the RSA. Eskers are common throughout the RSA. Therefore, adverse environmental effects are not likely to be significant. • Potential cumulative effects on soil quality and quantity are not likely to be significant due to landscaping in urban areas.		
Cumulative Effects Summary (Project + All Relevant Projects/ Effects)	**Direction**	**Magnitude**	**Geographic Extent**	**Duration**	**Frequency**	**Reversibility**	**Significance**	**Confidence**
	Adverse	Low to Moderate	Site to Local	Short to Medium	Once to Regular	Irreversible	Not Significant	High

With the exception of disturbance/alteration to common landforms, there are no residual cumulative effects resulting from other projects and activities in combination with the Project.

Note: Environmental effects descriptors and their definitions are as used in the assessment of Project-related environmental effects.

Forest fires have the potential to increase the risk of erosion and change soil moisture storage levels by reducing plant consumption and increasing runoff. All fire prevention and response protocols will be followed as outlined in the Emergency Response Plan (Chapter 8: Environmental Management).

Snow and Ice

For snow and ice, the degree of interaction varies with the accidents and malfunction type. Forest fires are not likely to affect snow and ice because they will most likely occur, if at all, during the late spring, summer and perhaps fall periods, when snow and ice are likely gone. Depending on the time of year, location, and materials being transported, a train derailment may affect snow and ice resulting from a spill of concentrate or other material. A breach in the polishing pond dike during the winter period would likely result in snow and ice melt below the dike as a result of the ensuing release of warmer waters from the polishing pond.

ARD/ML

The testing of tailings and concentrate has shown that they are non-acid/metal-generating and therefore, are not expected to result in ARD/ML effects, even in a case of an accidental spill or release.

15.9 Determination of Significance of Residual Adverse Environmental Effects

15.9.1 Project-related Residual Environmental Effects

With the proposed mitigation and environmental protection measures, the environmental effect of the Project on LSSI is not likely to be significant.

The terrain within the LSA is undulating and gently sloping till with scattered organic materials. There is no evidence of any landsliding in the PDA and, with the application of standard and prescribed mitigation (e.g., maintenance of existing drainage conditions), no low-angle landslides are likely. The residual environmental effects of the excavation of the esker adjacent to Waldorf River are not likely to be significant because it is unlikely that the entire esker will be excavated and because, eskers are considered to be a characteristic terrain feature and are abundant on plateau areas of central and western Labrador (Bolduc 1992; DOEC 2007). As a result, the partial removal of this esker is considered not significant. Adverse environmental effects on wetlands and wildlife habitat are not likely to be significant (Chapters 17 and 19). The subsequent environmental effect to use of land and resources is not likely to be significant (Chapters 22 and 23). Therefore, the residual adverse effects on landforms is predicted to be not significant.

Table 15.8 Summary of Residual Environmental Effects for Landforms, Soils, Snow, and Ice – Accidents and Malfunctions

Accidents and Malfunctions	Mitigation/Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	
Change in Soil Quality and Quantity											
Dyke Breach at Polishing Pond	• EPP • ERP	A	L	S	ST	U	R	NA	N	H	Monitoring program for success of remediation.
Train Derailment	• EPP • ERP	A	L	S	MT	U	R	NA	N	H	Monitoring program for success of remediation.
Forest fire	• EPP • ERP	A	H	R	LT	U	I	NA	N	H	Not applicable.
Change in Ice and Snow											
Dyke Breach at Polishing Pond	• EPP • ERP	A	M	L	ST	U	I	NA	N	H	Monitoring program for success of remediation.
Train Derailment	• EPP • ERP	A	L	S	ST	U	I	NA	N	H	Monitoring program for success of spill remediation.

Accidents and Malfunctions	Mitigation/Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	

KEY

Direction:
- P Positive.
- A Adverse.
- N Neutral.

Magnitude:
- N Negligible.
- L Low: for landforms, minor changes to shape and stability from a regional perspective; for soils, changes of less than or equal to 5%.
- M Moderate: for landforms, moderate changes to shape and stability from a regional perspective; for soils, changes of 5 to 10%.
- H High: for landforms, a major change to shape and stability in the regional area; for soils, changes of greater than 10%.

Geographic Extent:
- S Site: effect confined to the PDA and 200 m beyond.
- L Local: effect confined to the LSA.
- R Regional: effect extends beyond the LSA but within the RSA.

Duration:
- ST Short-term: effect lasts through the construction phase.
- MT Medium-term: effects last beyond the construction phase, but not beyond the end of the Project decommissioning.
- LT Long-term: effects are measureable for up to 30 years beyond the life of the Project.
- P Permanent – effects will not change back to original condition.

Frequency:
- U Unlikely.
- O Once: effect occurs once.
- S Occurs: effect occurs occasionally but not consistently throughout the life of the Project.
- R Regular: effect occurs at regular intervals throughout the life of the Project.
- C Continuous: effect occurs continuously throughout the Project.

Reversibility:
- R Reversible: environment will likely recover to baseline conditions after the end of Project decommissioning.
- I Irreversible: environment is unlikely to recover to baseline conditions after the end of the Project decommissioning.

Environmental or Socio-economic Context:
- U Undisturbed: area relatively or not adversely affected by human activity.
- D Developed: area has been substantially previously disturbed by human development or human development is still present.
- N/A Not Applicable.

Significance:
- S Significant.
- N Not Significant.

Prediction Confidence:
Based on scientific information and statistical analysis, and effectiveness of mitigation or effects management measure.
- L Low level of confidence.
- M Moderate level of confidence.
- H High level of confidence.

The activities of the Project will result in ground disturbance, and will therefore affect soil quantity and quality within the PDA. These changes are likely to occur primarily during the construction and reclamation of the site. Peat and topsoil will be salvaged and stockpiled during construction and used for progressive and closure reclamation. The parent geologic material contains substantial amounts of iron and therefore, the deposition of dust composed of iron particulates will not adversely affect soil quality on upland soils. The stockpiled soil will be maintained throughout the operation of the Project so that the soil is suitable for reclamation purposes. Therefore, the residual adverse environmental effect on soil quantity and quality is not likely to be significant.

The ability of dust to accelerate snowmelt depends on the rate of deposition, the absorbtivity of the material and other factors. Deposition rates of dust resulting from the Project were calculated at an annual deposition rate approaching 2 g/m^2, dropping to about a tenth of that at Lac Daviault. A deposition rate of 0.2 g/m^2 on an annual basis is not likely to be sufficient during the snow season to measurably affect the melt rate. Contamination of snow through deposition of dust will be similar to the effects of deposition of dust on soil; the deposition of dust will not adversely affect snow (or soil) because the dust is composed primarily of iron particulates. Blasting will be managed so that vibrations will not affect ice cover for nearby lakes. This is predicted to result in not significant environmental effects on snowmobile use or use of the ice (Chapter 22 and Chapter 23). Therefore, the residual adverse environmental effects on snow and ice are not likely to be significant.

No residual environmental effect arising from ARD/ML is expected after mitigation measures are implemented.

15.9.2 Cumulative Effects

The landforms identified within the LSA are common throughout the RSA, and significant cumulative effects are not likely. Adverse cumulative effects on soil quantity and quality are not likely significant because the extent of effects from the Project and other projects and activities is site-specific and implementation of mitigation measures will result in soils that will be suitable both in quantity and quality for use during site rehabilitation. Cumulative effects on snow and ice are not likely because the extent of Project effects is limited to the Project site. Blasting activities relating to the development of the mine will be designed so as to not affect the ice cover of nearby lakes, and therefore there will be no cumulative effects with other projects and activities. Based on findings from other mines within the RSA where there is no ARD/ML, and with the implementation of mitigation, there will be no residual environmental effects and therefore, no cumulative effects associated with ARD/ML.

Therefore, the cumulative effects of the Project acting in combination with other past, present and planned project and activities on Landforms, Soil, Snow and Ice is likely to be not significant.

15.9.3 Accidents and Malfunctions

There are no significant residual environmental effects on LSSI as a result of accidents and malfunctions because any environmental effects will be localized and reversible. Potential accidental spills of tailings and concentrate are not expected to cause environmental effects associated with ARD/ML. Spill response measures will be implemented in the event of a spill, and soil will be remediated. Proper mitigation of any spills or contamination of the soils would be applied and properly monitored.

15.9.4 Overall Residual Effects Conclusion

The Project is not likely to result in significant adverse residual environmental effects on LSSI or ARD/ML.

15.10 Follow-Up and Monitoring

While it is unlikely that there will be any monitoring or follow-up required for landforms and terrain stability, the collection and storage of soil stockpiles will be managed. If monitoring and modelling of discharge (e.g. pit water quality, TMF discharge, waste rock runoff) shows potential effects from ARD/ML, the discharge from the pit will be treated to meet MMER discharge criteria.

15.11 Next Steps

Prior to construction, an Environmental Protection Plan will be developed. Mitigation measures for Landforms, Soils, Snow and Ice will be incorporated.

15.12 Summary

Given the proposed development plan for the Project, there are no likely significant residual environmental effects on LSSI. Mitigation will be required on a number of items. Mitigation measures for landforms include the maintenance of existing drainage courses and limiting the extraction of aggregate material from the esker paralleling Waldorf River to appropriate materials. Mitigation measures for soils include supervision of all soil stripping, stockpiling and replacement activities, implementation of erosion control programs, and monitoring to ensure vegetation is growing. Snow removal, the establishment of windrows (i.e., snow fences), and design of facilities and infrastructure to limit dust emissions will be implemented to reduce effects of the Project on snow. A Project-specific Blasting Plan will be implemented so that vibrations do not affect ice on nearby lakes.

A monitoring program for dust emissions will be implemented. In the unlikely event of an accident or malfunction, monitoring of the spill site for remediation and revegetation will be implemented.

Effects of ARD/ML are not likely based on testing to date and experience with other operations; Project effluent will be treated to comply with MMER and the Newfoundland and Labrador *Environmental Control Water and Sewage Regulations*.

16.0 WATER RESOURCES

16.1 Valued Ecosystem Component Definition and Rationale for Selection

The Water Resources VEC includes both groundwater and surface water resources. Both are integral components of the hydrologic cycle, and an effect on one component can influence the other, particularly the effect of groundwater base flow on surface water flow and quality. Water Resources interacts with other VECs such as Wetlands, Freshwater Fish, Fish Habitat, and Fisheries, Other Current Use of Lands and Resources, Health and Community Health, which are assessed in Chapters 17, 18, 23, and 25, respectively.

16.1.1 Groundwater

Groundwater is the water held beneath the earth's surface in the pores, fractures, crevasses and seams of bedrock and overlying surficial materials. Groundwater originates from the percolation of rain, snowmelt, or surface water into the ground, thence flowing from areas of high elevation (recharge areas) to areas of low elevation (discharge areas), where it exits the sub-surface as springs, streams, lakes and wetlands. This infiltrating water fills voids between individual grains in unconsolidated materials and fills fractures developed in consolidated materials, such as bedrock. The upper surface of the saturated zone is called the water table. The water table intersects the surface environment at springs, lakes, streams and wetlands, where interaction between the groundwater and the surface water environment can occur. An aquifer is a saturated formation or group of formations that can store or yield useable volumes of groundwater to wells or springs. Natural groundwater quality is directly influenced by the geochemical composition of the geological materials through which it passes, and the time the water resides within that material.

Groundwater resources refer specifically to the value and function of groundwater in maintaining streamflow for ecological habitat, and in supplying fresh water for human and light industrial or commercial uses. Groundwater availability for ecological and human uses and its susceptibility to chemical degradation or depletion by human activities is determined by the hydrogeological and hydrochemical properties of the surficial and bedrock geology in which it is found.

Groundwater resources are included as part of the Water Resources VEC because they will be used to provide potable water supply to specific components of the Project and any rural un-serviced residences adjacent to the proposed Project components. The potential for the disruption or contamination of the groundwater drinking supply for nearby residents therefore requires assessment.

Furthermore, groundwater is an integral component of the hydrologic cycle that can interact with and indirectly affect fresh water resources and fresh water ecosystems at points of discharge. There is a dynamic interaction between groundwater resources and surface water resources. Groundwater generally sustains the base flow of springs, streams, and wetlands during dry periods of the year. More rarely, surface water bodies and perched wetlands can seasonally contribute to groundwater storage under specific hydrogeological conditions.

Groundwater can be a critical water transport pathway between the various Project components (such as tailings, waste rock, petroleum or chemical storage facilities, waste water and solid waste management sites) and adjacent surface water resources. Conversely, groundwater can transmit water from surface water sources and permeable aquifers towards Project components such as open pits, and pipeline excavations.

Potential effects to groundwater, and specifically damage to domestic water supply wells, are common concerns of stakeholders. Groundwater related issues common to major mine developments can include:

- Open pit mine dewatering and associated discharge of effluents;
- Local to regional water table lowering and effects on adjacent water supply wells;
- Interception of base flow to sensitive aquatic ecosystems;
- Water quality degradation of groundwater and surface water resources (through groundwater transport) from contaminated seepages from tailings, mine dewatering, waste rock, chemical storage, and waste management sources;
- Water well damage from blasting and major site vibration sources; and
- Acidic rock drainage from exposed sulfide mineralization.

16.1.2 Surface Water

Surface water includes all water running or in storage above the ground surface. This section will expand upon the definition of surface water and its relationship to groundwater, its place in the hydrologic cycle, water quality and sediment quality.

Surface water has been selected for assessment within this VEC for the following reasons:

- Surface water related to the Project in Labrador is the freshwater habitat for fish, aquatic organisms and vegetation and both facultative and obligate wetland vegetation and therefore is critical to the life function of these biota in that it provides the habitat component of the aquatic ecosystem;
- Changes to surface water drainage patterns, quantity, quality and sediment quality arising from Project development phases, as well as the release of hazardous and deleterious substances during upset conditions, can affect the form and function of the aquatic environment and therefore directly affect the quality, nature and sustainability of aquatic ecosystems. Project effluent quality is specifically regulated through the provisions of the NL *Water Resources Act* and federal *Fisheries Act*;
- Surface water is critical in the hydrologic cycle because it is the interface for evaporation, transpiration and sublimation to provide atmospheric moisture and the outlet of the earth's groundwater regime;
- Changes to surface water quality and availability can affect infiltration, evaporation, transpiration and sublimation potential and therefore plays a critical role in preserving groundwater and evapotranspiration in the environmental water balance;

- Surface water is used locally as the public water supply for the Towns of Labrador City, Wabush and Fermont, as well as local cabin owners, and the sustainability of water supply and preservation of water quality are critical to maintain and is protected in Québec and NL public water supply regulation;
- Project effects and interactions with local surface water features used as human drinking water sources have the potential to affect water quantity and quality and therefore must be assessed to ensure the sustainability of the water supply and the preservation of water quality;
- Surface water is a VEC for its recreational value for fishing, boating, snowmobiling, bathing and other recreational uses; and
- Surface water is important to society aesthetically for its visual place within the natural environment.

16.1.3 Approach to Assessment of Effects

A baseline assessment of the water resources, both surface water and groundwater, of the area are provided in the Water Resources Baseline Study (Appendix G). The hydrological assessment was intended to characterize the baseline conditions in watersheds potentially affected by the proposed development of the Project. The hydrological study was designed to gain a better understanding of potential surface water effects arising from the Project, sources of water for mine operations and to gain a better understanding of the assimilative capacity of the various watersheds under study. This hydrological assessment included the completion of:

- A Regional Hydrological Information Review;
- A Climate and Precipitation Assessment;
- A Water Balance Assessment;
- Hydrological Monitoring; and
- Empirical Hydrological Modeling.

The aim of the groundwater investigations completed to date has been to develop a site-wide characterization of both the quality and quantity of the groundwater. The water levels, seasonal water level fluctuations, flow directions and patterns and the hydraulic properties of overburden and bedrock were all considered to help develop an understanding of how groundwater might interact with the Project, and how the Project might in turn interact with the natural hydrogeological-hydrologic cycle.

Investigation into specific groundwater characteristics focused on areas that will be developed during the Project including: main plant site, Tailings Management Facility (TMF) and effluent treatment infrastructure, waste rock disposal areas, mine access road, rail line and transmission lines and the Rose Pit Mine. Field investigations were broadly divided into two sections: the site wide areas (all areas outside the Rose Pit) which were done through the “BH-GE” borehole series, and the Rose Pit area which was investigated through the “ROB” borehole series along with selected Alderon exploration “K” borehole series.

An investigative geotechnical field program has been completed and information gathered from this work has been considered in the preparation of this EIS. Other studies that have also been conducted are a Tailings Management Study, a Waste Rock Management Study, a Hydrologic Study, and a Site Wide Geotechnical Study.

16.1.4 Issues

A major undertaking, such as a mine, has the potential to disrupt local surface water and groundwater resources during the construction, operation and decommissioning phases of the work. The identification of potential environmental effects on water resources allows the proponent to develop and implement mitigative measures, designs, and best management practices throughout the life of the Project which can eliminate or minimize effects on water resources. Upon decommissioning of the Project, a thorough understanding of the hydrological and hydrogeological processes in the Project area through baseline assessment and on-going monitoring will allow for the optimum design of decommissioning measures and stabilization of remaining components (open pit mine, tailings and waste rock disposal areas) such that the Project site is returned as closely as practical to pre-mining conditions, with any decommissioned facilities providing new habitat compatible with the area.

The following issues were raised by the public and other stakeholders, and are considered in this EIS:

- Water quality
- Water bodies;
- Water supply;
- Water management; and
- Cumulative effects

Accordingly, these issues are included in the assessment of the VEC. Details on the issues raised by stakeholders are provided in Table 16.1. The number of times each issue was raised is provided in Figure 16.1.

Table 16.1 Issues Raised by Aboriginal Groups and Stakeholders

Issue	Community / Organization	Summary of Comments Raised During Consultation and Engagement Activities	Response / Location in the EIS
Cumulative Effects on Water Resources	CRE	Lac Daviault is the head of the Moisie River watershed, what would be the dust, red water and cumulative effects on that watershed?	In the EIS, potential effects and mitigation for Water Resources have been assessed and identified. Lac Daviault is not in the same watershed as the Project, therefore there are no potential cumulative effects to the Lac Daviault/ Moisie River watershed. See Section 16.6 and 16.7 for more information about this assessment.

Issue	Community / Organization	Summary of Comments Raised During Consultation and Engagement Activities	Response / Location in the EIS
			Alderon will also implement several dust management and control measures to minimize dispersion of dust. More detail on dust management and control is provided in Section 14.6.
	Mouvement Citoyen de Fermont	Alderon should consider cumulative impacts on the entire northern region. Fermont is already surrounded by four iron mines and adding one more would contribute to additional dust and contamination of lakes and environment.	Water quality effects of the Project were reviewed in the EIS including the potential for increased sediment loading, ARD and metal leaching, ammonia contamination and red water. Effluent treatment system will be used at the TMF, and effluent will monitored for compliance with regulatory limits. No residual or cumulative water quality effects are predicted. See Section 16.6 and 16.7 for more information about this assessment.
Potential Contamination of Water Bodies	Cabin Owners	An important issue for me is potential impacts to the lakes systems.	Mine effluent will be treated in compliance with regulatory standards, minimizing impacts to lake receiving waters. There will be no surface water runoff from the Project to Lac Daviault, therefore no surface water impacts are anticipated. Lac Daviault is not in the same watershed as Project, therefore there is no potential for red water release to the Lac Daviault/Moisie River watershed. See Section 16.6 for more information about this assessment.
	Fermont	Concern that Bloom Lake project has contaminated two adjacent lakes.	
	Fermont	Will water bodies flowing into Lac Daviault be impacted?	
	Fermont	Will the Moisie River headwaters be affected?	
	CRE	Lac Daviault is the head of the Moisie River watershed, what would be the effects of dust, red water and cumulative effects on that watershed?	
	Wabush	Springs all through Daigle Point.	Lac Daigle is several kilometres to the west of the Project location in a separate watershed and will not be affected by the Project. Section 16.5 includes a description of the existing environment that may be affected by the Project.

Issue	Community / Organization	Summary of Comments Raised During Consultation and Engagement Activities	Response / Location in the EIS
	Wabush	How will tailings run off in the polishing pond affect Duley Lake / Long Lake to the north West?	The TMF will include a tailings pond followed by a polishing pond for sedimentation (settling) of fine particles. The residence time of water moving through these ponds is very long and therefore they will be able to remove particles to very small sizes. However, due to the potential for red water from the Project TMF, a flocculating red water system will be constructed at the polishing pond to further reduce particulate to extremely small sizes. This treatment system will ensure the provision of very low Total Suspended Solids concentrations to Long Lake/Duley Lake. The potential for acid rock drainage, metal leaching and ammonia contamination from TMF runoff is low and not considered a potential water quality effect. See Section 16.6 for more information about this assessment.
	Labrador City	Concern that overflow of tailings will go into Riordan Lake.	Alderon will treat all effluent to meet regulatory standards prior to release into the environment. The key characteristics and features of the TMF and effluent treatment infrastructure are described in Section 2.5.4 and 2.6.2. All discharges from the TMF and polishing pond will flow north into Long Lake and are therefore are not anticipated to affect Riordan Lake or Québec. See Section 16.6 for more information about this assessment.
	Le mouvement citoyen de Fermont	What measures are in place to contain water discharge from the mine onto the surrounding territory? In the event of contamination of waters on the Quebec territory, what measures are in place to restore/remediate contaminated areas? Are measures in place to protect Lake Perchard? How will Alderon Corp assure that groundwater is not contaminated in the region?	
	Fermont	If you add a mountain of waste over a mountain, will it modify the watershed? What about the groundwater? Is it located in the same watershed?	Surface water and groundwater divides will not be altered by the waste rock disposal areas. Disposal areas straddling two watersheds will be graded to preserve existing watershed divides to the extent feasible. See Section 16.6 for more information about this assessment.

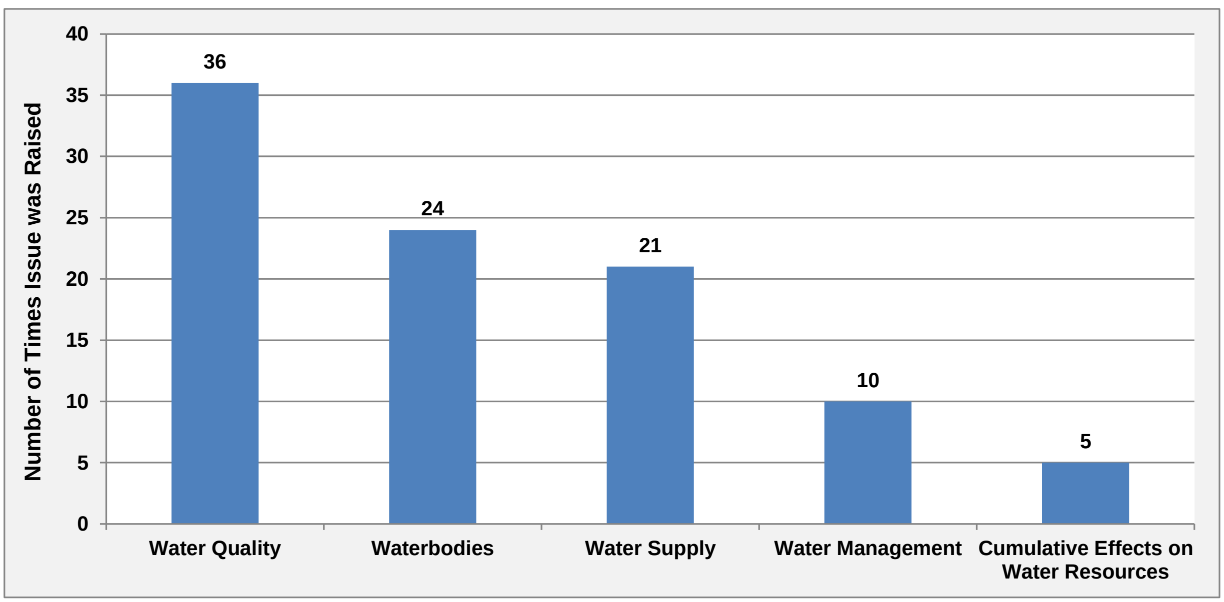
Issue	Community / Organization	Summary of Comments Raised During Consultation and Engagement Activities	Response / Location in the EIS
	Fermont	Resident likes to swim/dive amongst the ice.	Existing recreational activities are not expected to be adversely affected by the Project. See Section 23.6 for more information.
	Fermont	Will the concentration process require the use of chemicals? Is there a risk of contamination?	Alderon will treat all effluent to meet regulatory standards prior to release into the environment. Non-toxic flocculant use is expected to reduce the potential for fine particulate red water. Flocced particulate will be collected in the red water treatment system. Chemical processes would be contained in building or within mill yard, with spill containment and stormwater drainage system. The key characteristics and features of the TMF and effluent treatment infrastructure are described in Section 2.5.4 and 2.6.2.
	Labrador City	The placement of the Rose Pit in the middle of an identified stewardship management area. Look at remedial steps that can be taken to minimize habitat loss prior to construction phase.	Alderon is in the process of pursuing a Corporate Stewardship Agreement with the municipalities and the Eastern Habitat Joint Venture to mitigate loss of alternate Management Units. See Section 19.6.5 for more information about the assessment of potential effects and proposed mitigation for change in protected areas.
	Labrador City	What is the planned compensation for the water system that Rose Pit will occupy? There is quite a lot of water in the water system.	Alderon is in the process of pursuing a Corporate Stewardship Agreement with the municipalities and the Eastern Habitat Joint Venture to mitigate loss of alternate Management Units. See Section 19.6.5 for more information about the assessment of potential effects and proposed mitigation for change in protected areas. Alderon will also prepare a Compensation Plan as required under the *Fisheries Act.* See Section 18.6 for more information. Headwater areas above the Rose Pit footprint will be preserved with clean water bypass diversion around the open pit. Headwater ponds will be monitored for water level effects. For more information see Section 16.6.

Issue	Community / Organization	Summary of Comments Raised During Consultation and Engagement Activities	Response / Location in the EIS
	Labrador City	Will the bog material be removed prior to the use as tailings impoundment? If the bog material is removed, will the tailings seep into the groundwater or into the lake?	Stripping of organic soils and overburden is required to provide a structurally sound base for tailings dams and dykes. This activity also minimizes the potential for dam seepage. Tailings seepage water is not expected to have sedimentation, ARD, metal leaching, ammonia contamination or red water concerns. See Section 16.6 for more information about the assessment and mitigation of effects on water resources.
	Innu Nation	Alderon will need to be cautious of bogs and streams around the mine, to make sure they do not flow in lakes and contaminate them.	Alderon will treat all effluent to meet regulatory standards prior to release into the environment. The key characteristics and features of the TMF and effluent treatment infrastructure are described in Section 2.5.4 and 2.6.2. See Section 16.6 for more information about the assessment and mitigation of effects on water resources.
	Wabush	Will there be equipment and supplies (for containment and recovery) located immediately next the railway on site, in the event of a spill?	Alderon has developed a detailed spill management plan that will include prevention design and practices, training, spill monitoring and surveillance, spill containment, collection, remediation and reporting. Spill containment and collection equipment will be kept on site and located strategically to ensure the most expeditious spill response. See Section 16.8 for more information.
Potential Contamination Of Water Supply	Cabin Owners	An important issue to me is the potential for tailings to affect Quaniniche (our water supply).	The TMF is located primarily in the Long Lake watershed and is contained by a series of natural ridges, dams and dykes. All discharges from the TMF and polishing pond will flow north into Long Lake and are therefore are not anticipated to affect the Wabush Public Water Supply. The primary risk to the Town of Wabush water supply would be from a spill from the access road and rail infrastructure. In the case of an accident or malfunction, Alderon has developed an emergency response plan, to minimize, mitigate and remediate any effects of a potential spill to the Wabush water supply. See Sections 16.6, 16.8 and 23.8 for more information.
	Fermont / Wabush / Lab City	Concern about spills or run-off from rail, transmission or tailings potentially occurring in water supply/watershed area. There is no back up water supply for Wabush. Require a contingency to be in place. Questions include: • How you will treat the tailings so it doesn't leach into the drinking water supply? • Can surface water in the lake be affected? We take water from this lake.	

Issue	Community / Organization	Summary of Comments Raised During Consultation and Engagement Activities	Response / Location in the EIS
	Labrador City	The proposed road power line and rail line run through the Jean Lake management area and adjacent to the water supply and watershed in close proximity to residents. Consider an alternate route for rail line.	
Potential Effects on Water Quality	Cabin Owners	Will the water quality of lakes be affected? Will there be any impact on the watershed?	Alderon will treat all effluent to meet regulatory standards prior to release into the environment. The key characteristics and features of the TMF and effluent treatment infrastructure are described in Section 2.5.4 and 2.6.2. No adverse effects are anticipated to receiving water lakes or watersheds. See Section 16.6 for more information about the assessment and mitigation of effects on water resources.
	Cabin Owners / Fermont / Lab City	What will be the effects to water quality, including Long Lake, Lac Daviault and Mills Lake? Is there the potential for a spill or tailings drainage contamination of the local watershed? What will happen to the watershed if the lake is removed? Alderon should do preliminary investigation of active dewatering to reduce footprint and simplify reclamation e.g. centrifuge.	The TMF is located primarily in the Long Lake watershed and is contained by a series of natural ridges, dams and dykes. All discharges from the TMF and Polishing Pond will flow north into Long Lake and are therefore not anticipated to affect Lac Daviault or Mills Lake. Rose Lake will be removed as part of the open pit development. Headwater runoff from the Project location will be diverted around the open pit. A net increase in runoff to Pike Lake South is expected due to open pit dewatering. Alderon will treat all effluent to meet regulatory standards prior to release into the environment. The key characteristics and features of the TMF and effluent treatment infrastructure are described in Section 2.5.4 and 2.6.2. No adverse effects are anticipated to receiving water lakes, including Long Lake, or watersheds. See Section 16.6 for more information about the assessment and mitigation of effects on water resources.

Issue	Community / Organization	Summary of Comments Raised During Consultation and Engagement Activities	Response / Location in the EIS
Water Management	Fermont	What are the water sources for the Project and how will water be managed?	The water sources for the Project are: • Harvesting runoff water from the TMF; • Long Lake; • Open pit dewatering; and • Local groundwater pumping wells. A Water Management Plan is being developed to maximize the reuse of mine contact water in ore processing, dust suppression and other non-potable water uses. Further, the ore process recycles water many times to ensure that water conservation is maximized and that effluent discharge is minimized. See Section 2.6.2 and 16.6 for more information.

Figure 16.1 Frequency of Issue Type related to Water Resources



The assessment of environmental effects has been discussed with government agencies, most notably at a meeting with the Water Resources management Division of DOEC on April 19, 2012. The meeting included an outline of the Water Resources Baseline Study (Appendix G), results to date, and a presentation and discussion of the methodology for environmental effects. Issues raised with respect to Water Resources included:

- Effect of mining operation on down-stream lakes and watercourses;

- Cumulative effects of mining operation with other existing mines; and
- Potential for groundwater interactions with the Rose Pit to cross the regional watershed divide between Labrador and Québec (i.e., Lac Daviault).

Alderon subsequently developed both field and desktop work programs to assess groundwater and surface water effects. Work undertaken to address specifically raised concerns and assess effects is described below and fully documented in the Water Resources Baseline Study (Appendix G).

16.2 Environmental Assessment Boundaries

16.2.1 Spatial Boundaries

The spatial boundaries for the environmental effects assessment of Water Resources are defined below. Figure 16.2 shows the boundaries of the Local Study Area (LSA) and Regional Study Area (RSA) for the Project. For groundwater, effects are likely to be limited to the Project Development Area (PDA), which is the Project footprint, and the LSA, due to the defined hydrology drainage patterns and likely short groundwater travel pathways between potential sources and surface receiving waters. Furthermore, effects to residential water supply wells (if any) are also expected to be minimal, because of the remote location of the various Project activities, and general absence of development near Project components. No water supply wells were identified within the PDA. Surface water effects may occur within the PDA, LSA, and RSA, and include effects on flow in watercourses, watercourse and water body alterations, water levels in lakes, ponds and wetlands, as well as water and sediment quality effects in the LSA, and potential for minor down-stream water quantity changes in the RSA.

Project Development Area

The PDA is the area represented by the physical Project footprint as defined in Chapter 4. The PDA includes the area of physical disturbance for the Project, and includes the physical area planned for the open pit, waste rock disposal areas, concentrator / processing area, TMF, on-site roads, rail line, and transmission line.

Local Study Area

The LSA is the maximum area within which Project-related environmental effects can be predicted or measured with a reasonable degree of accuracy and confidence. The LSA includes the PDA and any adjacent areas where Project-related environmental effects may reasonably be expected to occur, including downstream lakes and wetlands, and portions of the power transmission line, rail line and access road. The significance of Project effects on the environment will be assessed at the receiving water (LSA) level.

Based on available information, the LSA is contained within the several local watersheds and sub-watersheds that overlap with the Project. These topography-controlled water bodies would result in relatively short runoff and groundwater travel paths between the various Project components and the closest receiving water discharge environment. The LSA is limited to and includes the approximate 8,000 hectare area bounded by the Québec-Labrador border and Rose Pit on the west, Riordan Lake on the east, Long Lake and Duly Lake Provincial Park Reserve on the north, and the Québec-Labrador border to the south, and waterbodies over which the rail line and access road cross (Figure 16.2).

Regional Study Area

The RSA is the area within which cumulative effects, and the significance of those effects, on Water Resources may occur. The RSA is the area within which the significance of Project cumulative effects is predicted.

The RSA encompasses several sub-watersheds of the headwaters of the Churchill River, including Mills Lake, Long Lake, Riordan Lake, Waldorf River, Pike Lake South, Wabush Lake, and several un-named brooks and lakes (Figure 16.2). The RSA extends from the highlands along the Québec-Labrador border, northeastward through Wabush and Labrador City along a chain of lakes including Wabush Lake and the southwestern end of Shabogamo Lake. This region hosts several mining operations which cumulatively could affect the regional groundwater and surface water resources.

16.2.2 Temporal Boundaries

The temporal boundaries are the construction phase (approximately two years), the operation and maintenance phase (approximately 17 years), and the decommissioning and reclamation phase (approximately two years).

In addition to the time required for reclamation, the decommissioning phase includes any post-decommissioning monitoring or active site management required in perpetuity to ensure that an appropriate end land use has been established. During construction and operation, Project-related effects are considered to be temporary, while effects that persist after decommissioning and reclamation (e.g., maintenance of flooded open pit mine and tailings management facilities) are considered to be permanent.

16.2.3 Administrative Boundaries

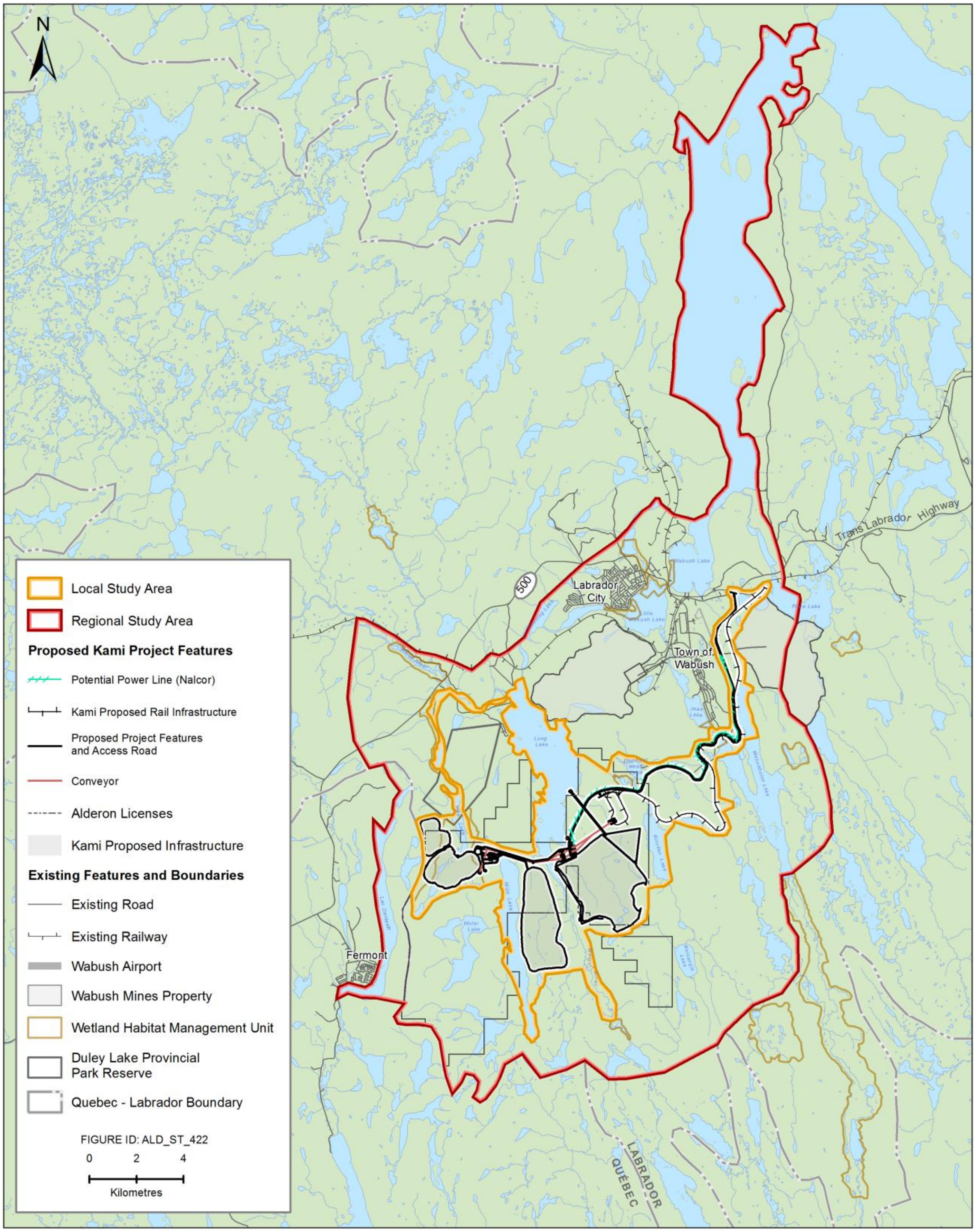
Groundwater

The *Water Resources Act* gives the Water Resources Management Division of the Newfoundland and Labrador Department of Environment and Conservation (DOEC) the responsibility and legislative power for the management of water resources including groundwater in the province. Under the *Water Resources Act*, groundwater use authorizations are required from DOEC.

Water supply well construction for various Project components is regulated under the *Well Drilling Regulations*, 2003, Newfoundland and Labrador Regulation 63/03 under the *Water Resources Act*.

Water well abandonment is regulated under Section 18. (3) of the *Well Drilling Regulations*.

Figure 16.2 Local and Regional Study Areas



Surface Water

The administrative boundaries for surface water pertain to regulatory limits, guidelines, and standards:

- Federal *Fisheries Act* (particularly Sections 32 and 35) which requires the protection of fish habitat in all watercourses that bear fish; and
- DFO (1986) Policy for the Management of Fish Habitat.

The Newfoundland and Labrador *Environmental Control Water and Sewage Regulations,* 2003 (ECWSR) pursuant to the province's *Water Resources Act* sets maximum levels for several parameters including metals, organic compounds, hydrocarbons and other potential contaminants. An amendment was enacted in 2009 that states:

> *"Schedule C - A person primarily in the Metal Mining Industry shall comply with sections 3, 19.1 and 20 and Schedule 4 of the Metal Mining Effluent Regulations (Canada) SOR/2002-222, including any changes or amendments to those sections of and that schedule to those regulations over time."*

Metal Mining Effluent Regulations (MMER) pursuant to the federal *Fisheries Act*, comes into force on the first day that a mine releases more than 50 m^3 in a single day. The MMER sets maximum allowable limits for specific metals as sampled by a prescribed schedule. MMER also sets of Environmental Effects Monitoring (EEM) criteria including operational phase surface water monitoring criteria.

Though not a regulation, the *Certificate of Approval* (C of A) issued by DOEC sets concentration limits for specific parameters in the discharged effluent. The C of A usually sets concentration limits that are the same as the MMER, when they apply to a project as they do for this Project. The C of A is issued pursuant to the *Environmental Protection Act*. The certificate grants approval for the construction and operation of a mill complex and its associated works. The C of A provides terms and conditions for satisfying various requirements for the Acts, regulations and policies under which the Project falls, including:

- *Environmental Protection Act*;
- *Water Resources Act*;
- *Environmental Control Water and Sewage Regulations*, 2003;
- *Halocarbon Regulations*, 2005;
- *Storage and Handling of Gasoline and Associated Products Regulations*, 2003;
- *Used Oil Control Regulations*; and
- Accredited and Certified Laboratory Policy.

Water use is regulated by DOEC through permitting requirements for activities within 15 m of a water body related to withdrawal of water, installation of intake structures, dams and culverts and discharge of wastewater. Water withdrawal is enshrined in Part 1 of the *Water Resources*

Act and licenses and applications are prioritized in the following manner: domestic, municipal, agricultural, commercial, institutional and industrial, water and thermal power generation, and other purposes, prescribed by regulation. Other relevant surface water regulations and local municipal bylaws relate to the management of the Town of Wabush's Wahnahnish Lake Public Water Supply Area, local watershed management units, regulations and provincial policy related to dam construction, operations, maintenance and surveillance.

The sustainability of water supply and preservation of water quality are critical to maintain and are protected in Newfoundland and Labrador and Québec public water supply regulation. In Newfoundland and Labrador, the authority to designate protected water supply areas is enshrined in Section 39 of the *Water Resources Act*. Subsection 30 (4) describes activities prohibited in a protected water supply area, as follows:

a) place, deposit, discharge or allow to remain in that area material of a kind that might impair the quality of the water;

b) fish, bathe, boat, swim or wash in, or otherwise impair the quality of the water; or

c) use or divert water that may unduly diminish the amount of water available in that area as a public water supply.

Any commission of the above prohibited activities constitutes a violation under Section 90 of the *Water Resources Act*. Subsection 39 (6) provides further direction regarding resource development activities in protected water supply areas as follows:

> *The minister shall regulate resource development and other activities to be undertaken in an area established under subsection (1) that, in the minister's opinion, may impair the quality of water, and those activities shall not be undertaken without first obtaining authorization from the minister.*

The required management of protected water supply areas is within the mandate of DOEC (2004) which describes that any development within 15 m of a water body within a protected water supply area may be subject to additional approvals such as water crossings and watercourse alterations. Provisions must address measures to control erosion and prevent sedimentation, minimize the risk of accidental spill and leaks as well as contingency plans oil spills or leaks. Bulk fuel storage is not permitted in protected water supply areas. In addition, development plans must provide information on how project derived waste material will be handled and disposed of, the environmental protection measures proposed to minimize adverse effects on water quality and proposed measures for site closure, restoration and rehabilitation.

16.3 Establishing Standards or Thresholds for Determining the Significance of Environmental Effects

The following terms will be used to characterize residual environmental effects for Water Resources: direction, magnitude, geographical extent, frequency, duration, reversibility and ecological context. The definitions of these terms are presented below.

- **Direction:**
  - Adverse: condition of Water Resources is declining in comparison to baseline conditions and trends;
  - Positive: condition of Water Resources is improving in comparison to baseline conditions and trends; or
  - Neutral: no change in the condition of Water Resources compared to baseline conditions and trends.
- **Magnitude:**
  - Negligible: no measurable adverse effect anticipated;
  - Low: effect occurs that is detectable, but is within normal variability of baseline conditions;
  - Moderate: effect occurs that would cause an increase with regard to baseline, but is within regulatory limits and objectives; or
  - High: effect occurs that would singly or as a substantial contribution in combination with other sources cause exceedances of objectives or standards within the Project RSA.
- **Geographical Extent:**
  - Site-specific: effect restricted to the Project footprint within the LSA;
  - Local: effect restricted to the LSA; or
  - Regional: effect restricted to the RSA.
- **Frequency:**
  - Occasionally: effect occurs once per month or less;
  - Sporadic: effect occurs sporadically at irregular intervals;
  - Regularly: effect occurs on a regular basis and at regular intervals; or
  - Continuous: effect occurs continuously throughout the Project life.
- **Duration:**
  - Short-term: effect occurs for less than two years;
  - Medium-term: effect occurs for between three and 20 years;
  - Long-term: effect persists beyond 20 years; or
  - Permanent: will not change back to original condition.
- **Reversibility:**
  - Reversible: effect ceases when Project operations cease; or
  - Irreversible: effect continues after Project operations cease.

- **Ecological or Socio-economic Context:**
  - Undisturbed: effect takes place within an area that is relatively or not adversely affected by human activity; or
  - Disturbed: effect takes place within an area with human activity. Area has been substantially previously disturbed by human development or human development is still present.

A significant adverse residual environmental effect on Water Resources is defined as a Project-related environmental effect that results in:

16.3.1 Groundwater

- Changes in groundwater quantity, such that the yield from an otherwise adequate water supply well decreases to the point where it is inadequate for intended use;
- Changes in groundwater quality, such that the quality of groundwater from an otherwise adequate water supply well that meets guidelines deteriorates to the point where it becomes non-potable or cannot meet the Guidelines for Canadian Drinking Water Quality (Health Canada, 2011); or
- The aquifer is physically or chemically altered to the extent that interaction with local surface water results in streamflow or surface water chemistry changes that adversely affect aquatic life or a down-stream surface water supply.

16.3.2 Surface Water

- Changes in surface water quantity, such that maintenance flow in a fish-bearing watercourse is not sustained, fish are no longer able to pass in a flowing water body, the sustainability of public water supplies are affected, changes in watercourse flow increases the erosion and sedimentation potential of a receiving water body or changes to wetland, pond and lake levels affects their ability to continue to support all the existing condition life phases of fish;
- Changes in surface water quality such that its potability is affected as defined by the Guidelines for Canadian Drinking Water Quality (Health Canada, 2011), effluent quality exceeds MMER criteria, effluent mixing zones exceed acute toxicity criteria, the boundary of effluent mixing zones exceed chronic toxicity criteria or exceed baseline or Canadian Water Quality Guidelines (CWQG) for the Protection of Aquatic Life (Freshwater), the assimilative capacity of effluent receiving waters is exceeded; or
- Sediment quality is degraded below baseline quality or the CCME Canadian Sediment Quality Guidelines, such that aquatic life is significantly affected.

16.4 Potential Project-VEC Interactions

Alterations to the land surface resulting from Project facilities (e.g., open pit and TMF) and activities affecting surface water (e.g., water withdrawal, treated effluent discharge) will be the primary drivers of effects to Water Resources. The effects assessment will include an analysis of effects on local receiving water bodies and watersheds. Surface water effects relate to potential changes in receiving water hydrology, water quality and sediment quality. Changes to flow and water quality relate to changes to the drainage, infiltration and groundwater discharge characteristics as well as Project water withdrawal and uses and how treated effluent is returned to receiving waters. Water quality effects relate to erosion and sedimentation potential and effluent quality and how effluent mixes and affects receiving waters.

The primary Project related effects on groundwater resources will include large scale pumping and dewatering during operation of the open pit mine, and localized changes to groundwater quality in the vicinity of processing facilities, petroleum storage tanks, the TMF and waste rock disposal areas. Accidental releases of hazardous substances can locally affect groundwater resources.

Each Project activity and physical work for the Project, listed in Table 16.2, is ranked as 0, 1, or 2 based on the level of interaction each will have with the VEC. A key to these rankings can be found at the bottom of the table.

Table 16.2 Potential Project Environmental Effects to Water Resources

Project Activities and Physical Works	Potential Environmental Effects			
	Change in Surface Water Quantity	Change in Surface Water Quality	Change in Surface Water Drainage Patterns	Change in Groundwater Levels or Quality
Construction				
Site Preparation (including clearing, excavation, material haulage, grading, removal of overburden and stockpiling)	2	2	2	1
Construction of Roads	2	2	2	0
Construction of Site Buildings and Associated Infrastructure (maintenance facilities, offices, plant, crushers, concentrator, conveyors, gatehouse, pump houses, substation, security fencing, sanitation system)	2	2	2	1
Construction of Rose Pit Mine; grubbing, overburden removal	2	2	2	2
Construction of Mine Tailings Management Facility (TMF)	2	2	2	1
Construction of Railway and Load-out Facilities (silos)	2	2	1	0
Construction of Power Line	1	1	1	0
Construction of Stream Crossings	1	1	1	0
Installation of Water Supply Infrastructure (wells, pumps, pipes)	1	1	1	1

Project Activities and Physical Works	Potential Environmental Effects			
	Change in Surface Water Quantity	Change in Surface Water Quality	Change in Surface Water Drainage Patterns	Change in Groundwater Levels or Quality
Onsite Vehicle / Equipment Operation	1	1	1	0
Waste Management	0	1	0	0
Transportation of Personnel and Goods to Site	0	1	0	0
Expenditures	0	0	0	0
Employment	0	0	0	0
Operation and Maintenance				
Open Pit Mining (including drilling, blasting, ore and waste haulage, stockpiling, dewatering)	2	2	2	2
Ore Processing (including crushing, conveying, storage, grinding, screening)	1	2	0	0
Concentrator Operations (gravity and magnetic separation, tailings dewatering, tailings thickener, concentrate conveyance to load-out)	2	2	0	0
Tailings Disposal in TMF	2	2	2	2
Waste Rock Disposal on Surface	2	2	2	1
Water Treatment (including mine water and surface runoff) and Discharge	2	2	2	0
Rail Load-Out by Silo Discharge	1	1	0	0
Rail Transport	1	1	2	0
Onsite Vehicle / Equipment Operation and Maintenance	1	1	0	0
Waste Management (domestic, process)	1	1	0	1
Transportation of Personnel and Goods to Site	0	1	0	0
Fuel Storage and Dispensing	0	2	0	1
Progressive Rehabilitation	1	1	1	1
Expenditures	0	0	0	0
Employment	0	0	0	0
Decommissioning and Reclamation				
Site Decommissioning	2	2	2	2
Site Reclamation (building demolition, grading, scarifying, hydroseeding)	2	2	2	1

Project Activities and Physical Works	Potential Environmental Effects			
	Change in Surface Water Quantity	Change in Surface Water Quality	Change in Surface Water Drainage Patterns	Change in Groundwater Levels or Quality
Accidents and Malfunctions				
Train Derailment	1	2	1	2
Forest Fires	1	2	1	0
Polishing Pond Dyke Breach	2	2	2	0
KEY 0 No interaction. 1 Interaction occurs; however, based on measurable or assessed effects levels and past experience, the resulting effect can be managed to acceptable levels through standard operating practices and/or through the application of best management or codified practices. No further assessment is warranted 2 Interaction occurs, and resulting effect may exceed acceptable levels without implementation of specified mitigation. Further assessment is warranted				

Those interactions that have been ranked as 0 or 1 will be assessed within this section, and those that are ranked as 2 will be further assessed and described in Section 16.6.

16.4.1 Groundwater Interactions

During the construction and operation and maintenance phases those activities rated as 0 in Table 16.2 are not expected to be a concern with respect to groundwater quality or quantity as there are no groundwater users in the immediate vicinity of the Project. During construction, these include construction of roads, rail and load-out facilities, power lines, and stream crossings, on-site vehicle operation, waste management, transportation of personnel and goods to site, employment and expenditure activities. Effects on water supply wells during construction of roads, pipelines, and power transmission ROWs are a function of distance, seismic and permeability properties of the intervening overburden and bedrock geology, degree of aggressive excavations (e.g., blasting), well type and construction integrity and local groundwater flow directions. The most common potential issues involve temporary siltation or discoloration of well water, with rare occurrences of lowered water table, reduced well yield, and very rare well collapse (very close to an activity).

Based on available information, no drilled water wells are present within several kilometers of the Project activities. Effects on residential groundwater supplies in un-serviced areas of Wabush, Labrador City or Fermont are also likely to be minimal, primarily due to the distance from Project activities, and the intervening lakes that would act as hydraulic barriers. In the event that any supply wells are identified within 200 m of a Project component, appropriate steps will be taken for the identification, inspection, and monitoring of such supply wells or springs. Specifically, the following measures will be undertaken in relation to construction of the access routes (e.g., roads, rail line, power easement):

- Conduct of a standard water supply survey to identify any well or spring water users;
- Use of mechanical excavation methods where practical;

- In unlikely event that a well is affected, mitigation measures could include:
  - Provide temporary water supply (bottled or tank);
  - Provide water treatment (silt filter, iron treatment, etc.);
  - Well deepening (in event of major excavations); and
  - Well replacement (in rare event of total well collapse or loss of supply).

During operation, activities rated as 0 include ore processing, concentrator operations, water treatment, rail load-out by silo discharge, rail transport, onsite vehicle / equipment operation and maintenance, transportation of personnel and goods to site, expenditures and employment. All process waters will originate from surface water and all site water and waste water streams will be contained within an abstraction-treatment-disposal system. Domestic solid waste will be disposed off-site, likely with local municipal waste management systems. These activities are localized, and do not involve significant excavations or hazardous chemical storage. The significance of potential effects is greatly reduced by the absence of any identified groundwater supply well users in the area.

Minor and localized groundwater effects that could be incurred during site preparation (i.e., component construction, construction of the TMF, installation of buried infrastructure, pipelines and water supply wells), and the operation of water supply wells for specific site locations have been ranked as 1. As well, during operation and maintenance, waste rock disposal, waste management, fuel storage and dispensing and progressive rehabilitation have also been ranked as 1. Effects associated with construction activities are likely to be temporary during the construction phase, and during operation, these activities are anticipated to cause only minor effects (i.e., shallow groundwater flow diversion by infrastructure, and minor localized groundwater removal by pumping wells). These interactions have been ranked as 1 because the related effects can be mitigated with best management practices.

The operation of water wells will be implemented in a manner that meets the sustainability of the host aquifer, as determined by individual constant rate pumping tests performed on each new supply well. Monitoring of supply wells for water quality, water level and nearby aquifer water level (observation well(s)), will promote safe abstraction rates that do not adversely affect aquifer water levels or stream base flows.

The waste rock disposal areas are not expected to result in a significant effect on groundwater. Due to the expected high permeability and porosity of coarse waste rock, mounding of groundwater is expected (i.e., limited driving head) to be not significant, and most seepages can be managed by perimeter drainage. Minor amounts of impacted infiltration through the base of the waste rock piles is expected to move through overburden and/or bedrock short distances to discharge points at streams and lakes where it joins the surface water system. As with the TMF, runoff from the waste rock areas is expected to be collected in perimeter ditching, and directed through drainage treatment systems.

An effluent characterization report suggests that there have been no issues with respect to waste rock disposal activities in the region. There is potential for sulfide mineralization from the basal 50 m of the Menihek Formation, which contains modest amounts of pyrrhotite (iron sulfide); however, the combination of this rock with larger volumes of the other rock types will result in a net acid neutral potential (Section 15.6*)*. Mitigation measures for waste rock disposal include:

- Perimeter groundwater monitoring wells at waste rock disposal areas;
- Toe seepage and runoff collection, and direction to treatment system (settling pond, etc.)
- Monitoring of runoff, seepage and groundwater chemistry at waste rock disposal areas; and
- Contingency to collect and direct toe seepage or groundwater back to TMF impoundment or sedimentation pond for treatment.

Site reclamation activities, including building demolition, grading, scarifying and hydroseeding are likely to be similar in scale and nature to construction and are expected to have little or no effects on groundwater resources. Any effects would likely be temporary and localized. Long-term issues associated with decommissioning of the open pit and TMF have been rated as a 2 and will be further assessed.

Accidental releases of fuel and chemicals associated with vehicle and equipment use can be mitigated with standard emergency response and clean up protocols. Forest fires and a polishing pond dyke breach are expected to have minor or no permanent effect on groundwater. The potential release of fuels or chemicals from an accidental train derailment have been rated as a 2 and are subject to further assessment. For Water Resources, the accidental event scenarios bring considered include an AST fuel tank failure, which could be significant for groundwater quality and requires further assessment.

Overall, given the nature of the Project and the proposed mitigation options, the potential environmental effects of Project-related activities that were ranked as 0 or 1 in Table 16.2 are rated not significant with a high level of confidence, and are not considered further in this EIS.

16.4.2 Surface Water Interactions

Expenditures and employment will not have any interaction with surface water during construction or operation and maintenance. During construction, power line construction, construction of stream crossings, installation of water supply infrastructure, on-site vehicle and equipment operation, waste management and the transportation of personnel and goods may interact with surface water. The potential effects of this activities are well understood and can be addressed through standard mitigation methods and do not require further assessment.

During operations and maintenance, concentrator operations, rail load-out, onsite vehicle and equipment operation, waste management, goods and personnel transport, fuel storage and dispensing will not affect drainage patterns or require watercourse alterations. During operations and maintenance, rail load-out, rail transport, vehicle and equipment operation and maintenance, waste management and progressive rehabilitation may interact with surface water quality through change in ground surface runoff characteristics, water balance and runoff / effluent quality. However, based on the implementation of conventional best practices and previous experience, these potential effects and interactions can be managed to acceptable levels. Specific additional measures are recommended to mitigate erosion and sedimentation and water quality effects.

Stormwater runoff from aggregate surfaced roads can contain high TSS concentrations, especially under high melting and intense rainfall conditions. Further TSS loading may result from road surface dust suppression watering. Water will be used for dust suppression during summer and sand used to increase tire traction of access roads during the cold season. All access roads and the rail infrastructure will incorporate roadside and railside ditches. Water management for the road and rail network is not expected to require end-of-pipe (ditch) collection for sedimentation treatment, instead the conveyance feature is expected to provide sedimentation control.

The transport of diesel fuel and lubricants via rail, as well as access vehicle traffic, increase the potential for hydrocarbon release to the environment. Road and rail design, traffic management and runoff controls will therefore require spill containment, collection and management controls to mitigate potential hydrocarbon release.

All identified accidents and malfunctions have the potential to affect surface water resources and therefore require further assessment. Train derailment may affect surface water quantity and drainage patters if watercourses are blocked by a derailment or if surface drainage must be blocked or re-routed to support remediation and mitigate downstream effects. Forest fires may also affect surface water quantity and drainage patterns by the change they produce in vegetation cover and soil stabilization; however, the deployment of a fire containment and management plan as well as burn reforestation can largely mitigate effects. As indicated above for groundwater, an AST fuel tank failure has also been considered as a relevant accident scenario for this VEC and would affect surface water quality, as would a polishing pond dyke breach.

16.4.3 Selection of Environmental Effects and Measurable Parameters

The environmental assessment of Water Resources is focused on the following environmental effects:

- Change in surface water quantity;
- Change in surface water quality;
- Change in surface water drainage patterns; and
- Change in groundwater levels and/or quality.

The measurable parameters used for the assessment of the environmental effects presented above and the rationale for their selection is provided in Table 16.3.

Table 16.3 Measurable Parameters for Water Resources

Environmental Effect	Measurable Parameter	Rationale for Selection of the Measurable Parameter
Change in Surface Water Quantity	• Surface water levels of water bodies	• Project interactions with, and uses of, surface water have the potential to alter runoff characteristics and thereby affect local streamflows and lake levels. This in turn may affect aquatic habitat quality
Change in Surface Water Quality	• TSS, pH, ammonia, metals, and colour of receiving water bodies	• The Project has the potential to affect receiving water quality through discharge of effluent high in TSS, ammonia, colour (specifically red water) and low in pH
	• Proximity of Public Water Supply Areas	• Portions of Project infrastructure pass through a Public Water Supply Area, which requires that land uses in proximity to and within the area follow specific environmental protection criteria
Change in Surface Water Drainage Patterns	• Watercourse alteration / realignment	• Project facilities and infrastructure will interfere with the existing upstream catchment area and alignment of some watercourses, potentially affecting streamflows and drainage patterns
Change in Groundwater Levels and Groundwater Quality	• Changes in water levels or water quality in monitoring wells adjacent to each major source (e.g., open pit mine, TMF)	• Changes in key indicator parameters relative to established baseline conditions could indicate an effect • Changes are expected in vicinity of open pit mine and down-gradient of various Project facilities
	• Changes in water levels, yield or water chemistry in remote monitoring wells established between the Project components and potential receptor well users	• Changes in domestic well yield or water quality during construction or operation phases could indicate an effect • Changes in water levels at distance may occur due to long term mine dewatering

16.5 Existing Environment

16.5.1 Data Collection

Groundwater

The groundwater investigations were combined with preliminary geotechnical investigations, where monitoring wells are installed in the majority of geotechnical boreholes at the Rose Pit and elsewhere throughout the Project area. The groundwater component baseline data is derived from borehole exploration drilling programs, site-specific hydrogeological testing, automated and manual groundwater level monitoring, and water quality sampling throughout the Project area. The data assessed in this EIS spans the period October 2011 through April 2012.

Information relevant to groundwater has been extracted from the various present and past groundwater studies, geotechnical investigations, mineral exploration drilling, hydrology investigations, and available government, consulting and Project exploration data sources. All of this information was compiled into electronic databases, GIS mapping, figures and tables, and used to generate a conceptual understanding of the groundwater flow conditions and baseline groundwater chemistry throughout the entire Project area, as well as the various designated Project component areas. The reader is referred to the Water Resources Baseline Study (Appendix G) for further details. The following activities have been completed:

Aquifer Description

Existing mapping, exploration drilling and well logs were used to describe each overburden and bedrock aquifer type. Mapping and cross-sections include:

- Borehole and monitoring well locations;
- Surficial geology;
- Bedrock geology;
- Groundwater flow directions, recharge and discharge areas; and
- Cross-sections for Rose Pit.

Water Levels

- Manual water level measurements collected at all available boreholes on each field trip (Nov. 2011, Jan. 2012, Mar. 2012 and Apr. 2012);
- Installed 25 automated water level data loggers; and
- Continuous records for some locations between October 2011 and present.

Groundwater Quality

- Collected 21 groundwater chemistry samples; and
- Lab analysis for general chemistry and metals.

Hydraulic Properties

- Conducted ten hydraulic response tests in accessible installed piezometers; and
- Conducted two packer injection profiles at deep inclined boreholes at Rose Pit.

Groundwater Flow Directions and Velocity

- Confirmed depth to groundwater table;
- Determined dominant directions of groundwater flow based on measured water levels and topographical mapping; and
- Determined horizontal and vertical gradients at Project component sites.

Baseline investigations are on-going.

Surface Water

A baseline surface water field monitoring program has been conducted. Seven monitoring stations were installed between October 6 and 8 of 2011 to collect water quality during seasonal sampling visits, and continuously monitor representative location streamflow and lake level measurements within the LSA (Figure 16.3).

Figure 16.3 Surface Water Monitoring Locations

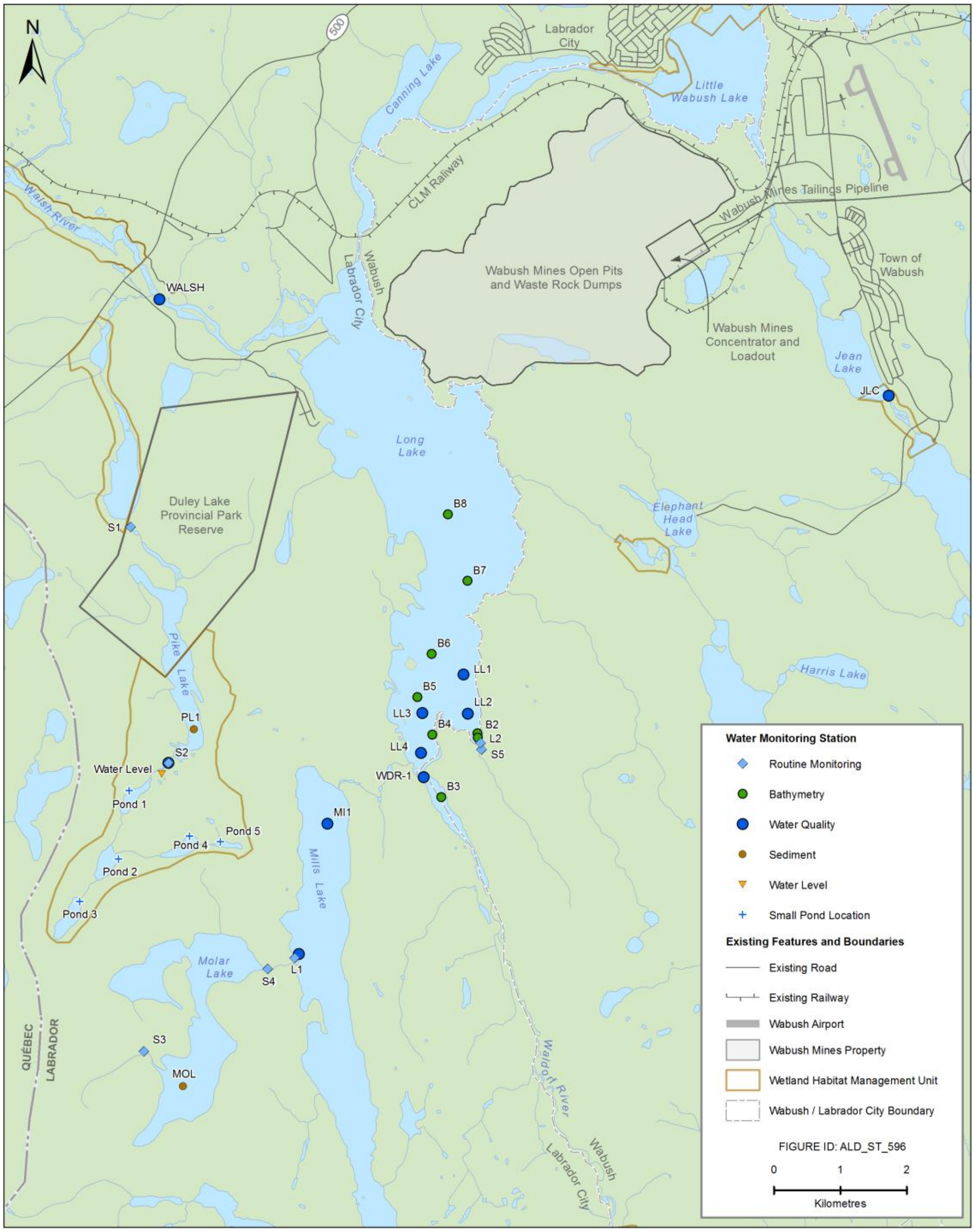


Table 16.4 presents the details of the routine monitoring stations. Additional monitoring station details, such as station photographs, the channel cross-section profiles and developed rating curves of the five stream gauging stations (*S1*, *S2*, *S3*, *S4*, *S5*), are presented in Appendix P. Manual staff gauges were also installed in five small ponds associated with the Rose Pit. Additional water quality and bathymetric data in support of the baseline study for local lakes and streams was obtained in a separate April 2012 field visit. During the May 2012 routine seasonal monitoring field visit, additional bathymetric information was obtained specifically for the south end of Long Lake. The reader is referred to the Water Resources Baseline Study (Appendix G) for further details.

Table 16.4 Monitoring Stations Details

Station ID	Location*	Function	Instrumentation
S1	5859719.7 N, 632232.1 E	Provide baseline water quality, sediment quality and flow data at the exit of the Pike Lake South watershed that contains Rose Pit and Rose North Waste Rock Disposal Area and watershed monitoring during construction, operation and decommissioning of the mine.	A Solinst Levelogger was installed in Oct 6, 2011 about 20 cm below the channel bed on the east bank in a stilling well for water depth monitoring with a 10-minute recording interval.
S2	5856173.5 N, 632802.9 E	Provide baseline water quality and flow data immediately at the exit of the Pike Lake South headwater watershed that contains Rose Pit and watershed monitoring during construction, operation and decommissioning of the mine.	A Levelogger and a Barologger were installed on Oct 7, 2011 in a stilling well for continuous water depth and atmospheric pressure monitoring with a 10-minute recording interval. The stilling well and loggers were installed on the east bank.
S3	5851833.0 N, 632431.0 E	Provide baseline water quality, sediment quality and flow data for a small headwater watershed draining into Molar Lake.	A Levelogger was installed in Oct 8, 2011 in a stilling well on the south bank for continuous water depth monitoring with a 10-minute recording interval.
S4	5853070.8 N, 634296.2 E	Provide baseline water quality, sediment quality and flow measurements at the outlet of Molar Lake upstream of its discharge point into Mills Lake.	A Levelogger was installed in Oct 7, 2011 in a stilling well on the north bank for continuous water depth monitoring with a 10-minute recording interval.
S5	5856368.7 N, 637517.1 E	Located downstream of the proposed TMF, the processing mill and other mine infrastructure to collect baseline water quality, sediment quality and flow monitoring.	A Levelogger and a Barologger were installed on Oct 8, 2011 in a stilling well for continuous water depth and atmospheric pressure monitoring with a 10-minute recording interval. The stilling well and loggers were installed on the north bank.
L1	5853238.3 N, 634702.7 E	Monitor water quality and water levels in Mills Lake which is a receiving waterbody for a portion of runoff from the proposed Rose South Waste Rock Disposal Area.	A Levelogger was installed in Oct 7, 2011 in a stilling well in the lake for continuous water depth monitoring with a 10-minute recording interval.

Station ID	Location*	Function	Instrumentation
L2	5856469.0 N, 637498.6 E	Monitor water levels in Long Lake which is the largest waterbody within the LSA and will also receive runoff from a large portion of the PDA. Due to its size and large upstream watershed catchment area, Long Lake is also proposed to be the primary raw water supply source and treated effluent discharge receiving waterbody for the Project.	A Levelogger was installed in Oct 8, 2011 in a stilling well in the lake for continuous water depth monitoring with a 10-minute recording interval.
* Location is in UTM NAD83 coordinate system.			

Hydrology

The field hydrology program included the following:

- Installation of seven representative continuous surface water monitoring stations:
    - Five LSA stream gauging stations;
    - Channel cross-section profile and flow measurements conducted during October installation and May visits;
    - Two local lake level gauging stations; and
    - Water level and temperatures recorded at 10-minute frequency since Oct 2011 to present;
- Installation of manual staff gauges in five small ponds associated with the Rose Pit including Rose Lake (RP-01 or Pond 1), Mid Lake (RP-02 or Pond 2), End Lake (RP-03 or Pond 3), Elfie Lake (RP-04 or Pond 4) and Byrd Lake (RP-05 or Pond 5), which all drain into Pike Lake South (also referred to as Narrow Lake); and
- Collection of bathymetric data for local lakes during April and May field visits.

Solinst Leveloggers™ were installed in stilling wells on direct read cables as depicted in Figure 16.4. The stilling wells were installed below the channel bed elevation and the Leveloggers were installed in latex prophylactics filled with non-toxic, residential plumbing antifreeze to protect the pressure transducers from freezing. A typical stream monitoring installation at Station *S1* is pictured in Figure 16.5.

During the April 2012 field visit, lake bathymetry was obtained through the ice.

Figure 16.4 Typical Stilling Well Installation

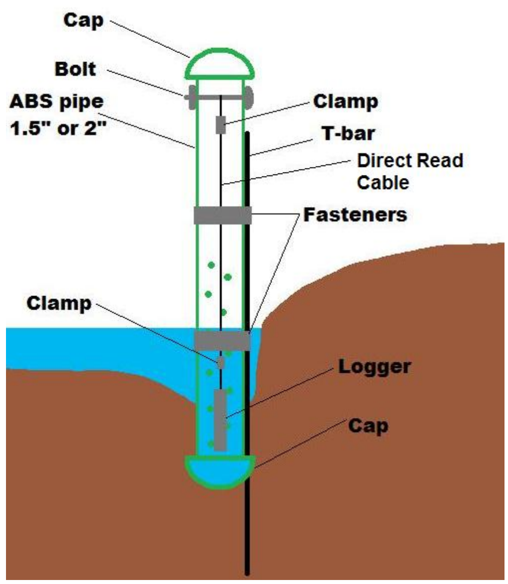
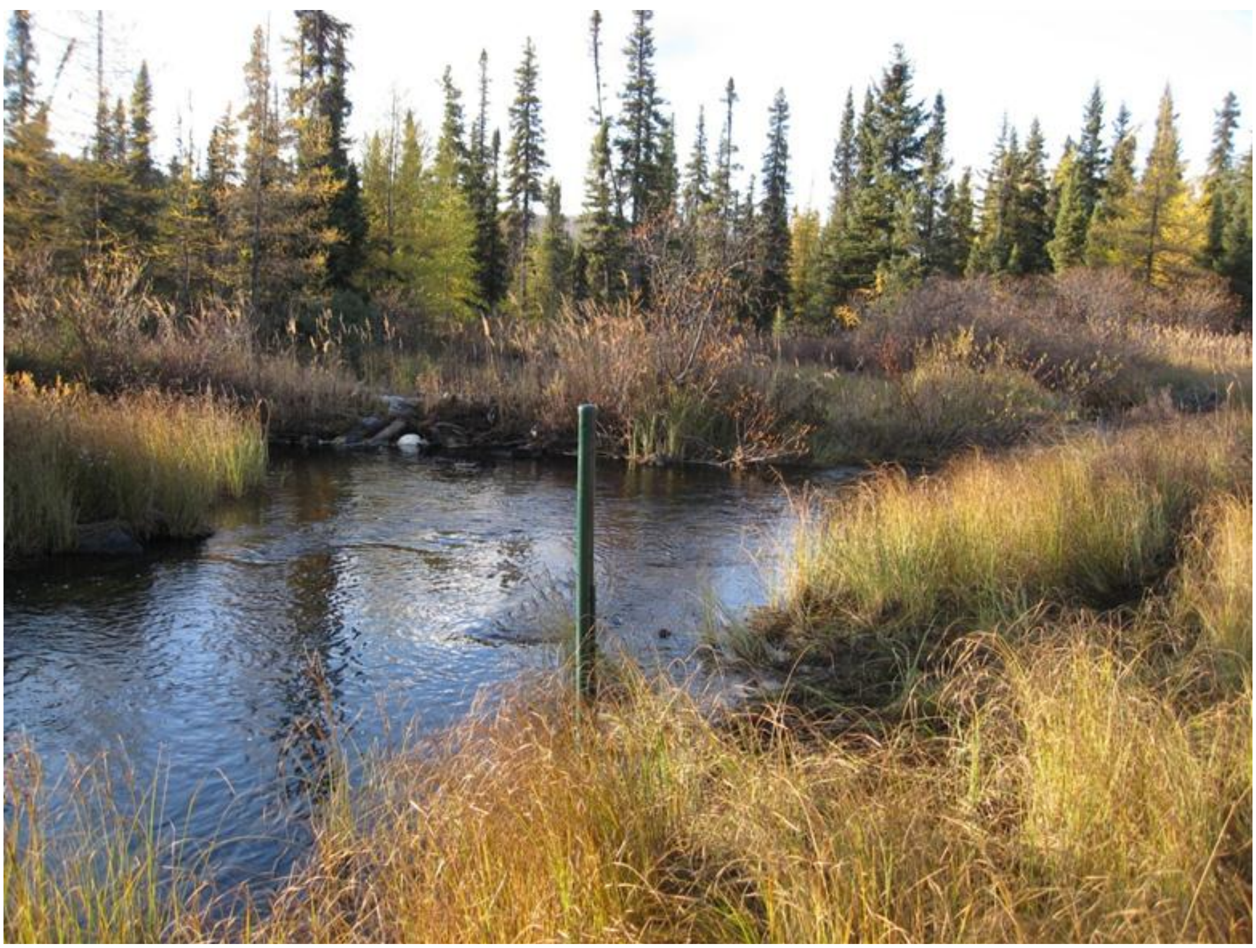


Figure 16.5 Typical Monitoring Station Installation at Station *S1*



Water Quality

Routine seasonal, spot and *in-situ* water quality monitoring was conducted as follows:

- *In-situ* water quality monitoring of general constituents, such as pH, temperature, electrical conductivity and dissolved oxygen using a multi-parameter water quality sonde at the time of water quality sample collection;
- Routine seasonal surface water quality sample collection at seven continuous monitoring stations using grab sampling;
- Additional spot water quality sampling at Long Lake, Mills Lake, Molar Lake, Pike Lake South, the Walsh River, Waldorf River and the Jean River crossing taken during an April field visit in support of the Water Resources Baseline Study (Appendix G); and
- Analysis of samples for a wide suite of general constituents, nutrients and metals by Maxxam Analytical Labs, a CALA accredited laboratory.

Sediment Quality

Sediment sampling in local lakes and streams was undertaken as follows:

- Sampling was undertaken by composite sampling;
- Sampling was undertaken at several routine seasonal and spot water quality monitoring locations;
- Sampling was undertaken during fall, winter and spring field visits; and
- Sediment samples were analyzed for a wide suite of constituents, including inorganics, petroleum hydrocarbons (PHC), polyaromatic hydrocarbons (PAH) and particle size distribution (PSD) by Maxxam Analytical Labs, a CALA accredited laboratory.

16.5.2 Summary of Existing Conditions

This section provides an overview of the environmental conditions at the Project site. Detailed baseline environmental conditions for groundwater and surface water resources are provided in the Water Resources Baseline Study (Appendix G).

Groundwater

Bedrock Geology

The various components of the Project are underlain by extremely old (1.8 to 2.5 billion years), Middle Proterozoic (Helikian) aged highly metamorphosed and deformed metasedimentary bedrock of the Knob Lake Group in the Grenville Province of the Labrador Trough. The ROB and GE-series boreholes that were drilled 3 to 4 m into the bedrock surface in 2011 and 2012 indicated strong to slightly weathered, schist and white quartz and marble bedrock of the Menihek and Wishart formations with occasional marble banding in the eastern areas (GE wells), and predominantly strong to severe weathered gray, metamorphic bedrock of the

Menihek, Wishart and Sokomon formations in the Rose Pit area. The bedrock surface elevation in the Project area exhibits considerable topographic relief (60 to 90 m) resulting in northeast trending glacial till filled bedrock depressions.

No hydraulic response tests were representative of bedrock, since most wells were sand-packed across the till-bedrock interface. Two recent 300 m deep inclined boreholes in the Rose Pit area indicated averaged K values in the order of 1.2×10^{-6} to 2.6×10^{-6} m/s, consistent with a low degree of permeability. Ancient metasedimentary and crystalline bedrock is typically considered to be a poor aquifer, with generally low bulk hydraulic conductivity in the order of 1×10^{-5} m/s or lower, and poor well development potential (typically less than 100 liters per minute).

Surficial Geology

The natural overburden material at the Kami Property can be generally classified as 'undifferentiated glacial till'. The exploration drilling to date (ROB and GE-series boreholes) indicate a lithological profile characterized by a thin (typically <0.2 m) layer of rootmat and topsoil overlying lose to very compact, brown or gray silty sand glacial till with cobbles and boulders, that increases in density with depth. Zones of sand glacial till are locally present, and up to 2 m of peat may occur in some topographically low areas. A nearly 5 km long, 5 to 20 m high glacial esker deposit runs along the west side of Waldorf River, from 300 to 990 m east of the Rose South Waste Rock Disposal Area.

Based on the approximately 62 exploration and geotechnical boreholes completed to date, the overburden thickness ranges from 0.8 m to 52.4 m and averages 10.4 m (geometric mean) across the site. The overburden thickness is greater in the vicinity of Rose Pit (mean 18.8 m) than the eastern Project areas (mean 11.5 m). It is interpreted that thicker blankets of overburden deposits are generally encountered in topographic lows and valleys thought to represent geologic structures such as rock fold depressions and faults, or possible buried glacial valleys in bedrock. Bedrock, either exposed or concealed by vegetation or thin overburden veneers, is typically found along the crests of ridges.

The overburden is described as a poorly permeable to slightly permeable, unconfined aquifer with hydraulic conductivity (K) ranging from 2.4×10^{-7} to 2.6×10^{-5} meters per second (m/s), based on 11 rising head pump-recharge tests; including sandy till K of 2.6×10^{-5} m/s and sandy silt till with a mean K of 8.8×10^{-7} m/s. There is a general decrease in K with depth in the overburden.

Conceptual Hydrogeological Setting

The Project area is characterized by rugged bedrock dominated uplands that have been incised by glacial erosion to form prominent valleys. The Rose Deposit lies within a northwest orientated drainage system which includes Elfie Lake, End Lake, Mid Lake and Rose Lake which drains into Narrow Lake.

Groundwater recharge from precipitation and runoff is largely limited to the late spring and summer when the ground is not frozen, likely extending from May through to October.

Groundwater recharge is limited between the months of November to April when the ground is frozen, and the majority of precipitation occurs as snow. Areas associated with discontinuous permafrost within the upland terrains could also locally restrict recharge and groundwater flow throughout the year.

The groundwater flow directions generally follow topography and the surface water flow patterns across the site from southwest to northeast along the Churchill River watershed. Locally, groundwater moves from the higher topography areas towards lakes, streams and wetlands distributed throughout the site.

Static groundwater elevations varied from 537 m at BH-GE-06 near the Waldorf River crossing to 646 masl (metres above sea level) at ROB-11-06 on the watershed divide west of the Rose Pit, a range of 109 m. Groundwater depths vary across the site and generally reflect the topographic relief of the area, with higher groundwater elevations occurring in wells located at higher topographic elevations. Groundwater levels varied from artesian flow 2 m or more above ground in low areas near lakes and wetlands to 5.6 m below ground in upland areas. The relatively high static water levels result in frozen well conditions during winter. Continuous monitoring shows that water levels decline through the winter months due to absence of infiltration, and recover rapidly upon the onset of the spring thaw.

Regional groundwater flow in the area generally follows topography from the upland areas toward the adjacent valleys, with generally short (typically less than a few kilometers) travel paths from point of recharge to point of discharge. Groundwater gradients ranged from gradual (in the 0.001 m/m range) near lakes and wetlands to much steeper (in the 0.07 m/m range) along the slopes of highlands. Typical horizontal hydraulic gradients of 0.005 m/m to 0.026 m/m are suggested for the mine area, averaging about 0.01 m/m (about 1%) in most construction locations. Vertical hydraulic gradients range from upward from bedrock to till in the vicinity of low lands and streams, to downwards from till to bedrock in upland areas.

Groundwater flow velocity depends on the hydraulic conductivity of the aquifer material and the hydraulic gradient, and is a measure of the rate at which groundwater moves from point of recharge to point of discharge, and also how fast a contaminant of concern released from a mine-related activity may move towards a receptor, such as surface water or well. An initial estimate of average linear groundwater flow velocity would be in the order of 1.2 to 4.2 m/year, mean 1.1 m/year for silty sand glacial till, and 22 to 2200 m/year, mean 31 m/year in fractured bedrock.

Groundwater recharge in the Project area was estimated to be 7% (dry year) to 12.1% (wet year), average 6.3% of total precipitation. Of this, about half would be expected to discharge to the surface water system as base flow and half would be returned to the atmosphere as evapotranspiration.

Groundwater Chemistry

The groundwater chemistry across the site was characterized with samples collected from 21 wells ranging in depth from 5.8 to 585 mbg (mean depth 62.52 m). The pre-construction groundwater chemistry of the site is generally characterized as a clear, moderately hard (mean hardness 71 mg/L), electrochemically neutral (mean pH 8.0, mean alkalinity 76.5 mg/L, mean Langelier calcite saturation index -0.6), calcium bicarbonate water type of low dissolved solids (mean TDS 98 mg/L). All analyzed parameters typically meet Guidelines for Canadian Drinking Water Quality (GCDWQ), Health Canada, 2010a, with the occasional exceptions of iron (mean 492 µg/L), manganese (mean 310 µg/L) and turbidity (mean 660 NTU ,attributed to method of sampling – bailing).

Groundwater Users

No groundwater users are known to exist within the PDA or LSA. Local hunting camps and cabins are believed to use surface water. The Town of Labrador City has a surface source municipal water supply tapping Beverly Lake located northeast of the Town. The Town of Wabush is served by a municipal distribution system tapping Wahnahnish Lake. The Town of Fermont, located west of Lac Daviault in Québec, has a municipal water distribution system sourced from Lac Perchard north of the Town's urban area. It is possible that there may be well users located in un-serviced areas adjacent to these municipal units.

Surface Water

The existing surface water environment includes a description and discussion of local climate, topography, surficial geology, vegetation, drainage patterns, local environmental water balance, watershed delineation, local hydrological characteristics under normal, wet and dry year scenarios, local water supplies, water quality, local receiving water assimilative capacity and sediment quality.

Climate

The climatic conditions in the LSA are sub-arctic, characterized by long cold winters and short mild summers. Climate normals for the latest 30-year period (1982 – 2011) (Table 16.5) were obtained from Environment Canada Station 8504175 (Wabush Lake Airport) located approximately 12 km to the northeast from the site. Monthly mean temperature extremes in the area can range from -22°C in the winter to 14°C in the summer, with a mean annual temperature of -3°C. The climate normal precipitation is approximately 858 mm/year, which is typical of western Labrador. The annual snowfall is estimated to be 444 cm/year occurring mainly between October and May.

The Project site is located within the zone of 'isolated patches of permafrost', near the southern extremity of the 'sporadic discontinuous permafrost' zone (NRC 1993). Snow cover is an important hydrological parameter in this area. Water stored as snow cover is released when temperatures climb above zero and is responsible for high freshet runoff flows experienced in the spring. The mean monthly snow cover peaks during February and March; from March to April, a 34% reduction can be anticipated on average. The snow cover is usually melted by the end of May and returns in November with mean a monthly value of 19 cm.

Table 16.5 Climate Normals for the Latest 30-year Period (1982 to 2011) at Wabush Lake Airport Station (Station # 8504175).

Parameter	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
Temperature (°C)	-21.8	-20.4	-13.5	-4.0	4.0	10.5	13.9	12.7	7.6	0.6	-7.7	-16.9	-2.9
Rainfall (mm)	2.5	1.3	2.6	12.4	41.8	81.5	115.9	107.5	90.4	45.1	14.0	2.8	517.9
Snowfall (cm)	66.4	51.7	68.4	49.3	13.8	1.8	0.0	0.3	4.3	37.6	77.4	72.9	443.9
Precipitation (mm)	50.0	39.0	54.2	51.9	54.1	83.3	116.1	107.7	94.4	77.3	75.5	54.5	858.1
Snow on Ground (cm)	70.2	81.7	86.6	56.8	5.8	0.0	0.0	0.0	0.0	2.4	19.0	47.2	30.8

<u>Dry Year</u>

A review of annual climate conditions observed at the Wabush Airport weather station indicated that 1993 was the driest year in the latest 30-year records. Table 16.6 presents the recorded monthly climate values for 1993. Year 1993 had 623.6 mm of total precipitation which was 27.3% less precipitation than the climate normal condition. Statistically, year 1993 is in the range of the 1:100 dry year.

Table 16.6 Climate values for 1993 (a dry year) at Wabush Lake Airport Station (8504175)

Parameter	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
Temperature (°C)	-19.4	-21.4	-14.1	-3.3	3.9	10.8	14.1	12.5	5.4	-2.9	-11.2	-17.3	-3.6
Rainfall (mm)	0.0	0.0	0.0	20.2	48.3	37.6	88.4	151.6	59.5	9.3	10.8	0.0	425.7
Snowfall (cm)	19.6	18.7	16.0	15.9	11.4	0.0	0.0	0.0	8.4	30.0	47.0	70.8	237.8
Precipitation (mm)	17.7	17.6	15.6	35.2	57.9	37.6	88.4	151.6	67.5	33.0	48.9	52.6	623.6
Snow on Ground (cm)	48.4	61.0	47.8	8.8	1.2	0.0	0.0	0.0	0.0	2.8	19.5	28.5	18.2

<u>Wet Year</u>

A review of annual climate conditions observed at the Wabush Airport weather station indicated that 1983 was the wettest year in the latest 30-year records. Table 16.7 presents the recorded monthly climate values for 1983. 1983 had 1185.1 mm of total precipitation which was 38.1% more precipitation than the climate normal condition. Statistically, 1983 is in the range of the 1:100 wet year.

The dry-wet year assessment indicates that considerable precipitation variability occurs year over year within the LSA and demonstrates the importance of assessing climatic-driven VECs such as Water Resources over a range of climate conditions in order to fully understand Project effects.

Table 16.7 Climate values for 1983 (a wet year) at Wabush Lake Airport Station (8504175)

Parameter	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
Temperature (°C)	-21.6	-21.1	-12.9	-1.4	3.1	12.1	12.8	11.8	8.0	0.2	-8.7	-20.6	-3.2
Rainfall (mm)	0.5	1.2	0.2	57.4	30.5	91.2	155.7	92.6	124.1	51.4	1.0	0.0	605.8
Snowfall (cm)	108.1	67.3	141.9	47.3	11.7	4.3	0.0	0.0	0.0	33.6	161.2	117.7	693.1
Precipitation (mm)	91.4	59.9	115.5	101.5	42.0	95.5	155.7	92.6	124.1	85.2	124.9	96.8	1185.1
Snow on Ground (cm)	69.9	100.7	114.0	100.7	10.4	0.1	0.0	0.0	0.0	0.9	29.4	112.6	44.9

Climate Change

The climate of Labrador is influenced by both atmospheric and oceanographic forces. Some of the main characteristics that shape the climate in Labrador are Labrador's latitude, geographic location, prevailing winds, elevation and relief (Bell, et al. 2008). Both the location of Labrador (between 50^o to 60^o north of the equator) and the seasonally ice covered Labrador Sea contribute to its cold weather. The direction of the prevailing winds is from the northwest to the southwest. In addition, the topography of the region with its mountains, plateaus and lakes contribute to the complexity of the climate in the region (Bell, et al. 2008). Other influences include the Labrador Current and the North Atlantic Oscillation (NAO). The NAO is defined by changes of pressure and wind patterns in the North Atlantic region. A positive NAO mode is characterized by colder and drier winters in northeastern Canada and a negative mode is characterized by warmer and wetter winters. The NAO has been in a negative mode for the past 15 years with a few exceptions (Bell, et al. 2008).

However, the inland part of Labrador exhibits more continental influences. It is characterized by temperatures ranging between above 30ºC in the summer to -30ºC in the winter. The average daily maximum temperatures are similar to the rest of Atlantic Canada (~21ºC). Labrador is the coldest region in Atlantic Canada during the winter with an average daily minimum of -22ºC. The coastal region of Labrador is milder than the inland region due to the oceanic influence. During the summer, southwesterly winds carry with them warm, moist and unstable air and severe thunderstorm sometimes develop in the western part of Labrador (Whiffen 2002).

Small changes in temperature have occurred in Labrador since 1961. A small cooling was found along the coast and a minor warming trend was observed inland (Whiffen 2002). Since the early-mid nineties, there has been a warming trend in all seasons (Bell, et al. 2008). Overall, the projected increase in annual surface air temperature along the eastern continental edge for the next century according to the Intergovernmental Panel on Climate Change (IPCC) is between 2 ºC and 3ºC and up to more than 5ºC in the northern part of the continent. The largest change is projected to occur in the northernmost part of Canada during the winter with up to 10º increase in temperature. The winter temperature in the northern part of the continent is projected to be higher by 7º in the winter and 2º in the summer. In general, the entire continent is projected to warm with the highest variations in the northern regions during the winter (Christensen, et al. 2007).

Environment Canada predicts for Newfoundland and Labrador an increase in mean temperature of 2ºC during spring, summer and fall and 4ºC increase in mean temperature during winter over the next 70 years. In the interior areas of Labrador, warmer and drier summers are predicted by Environment Canada as well as warmer winters (Vasseur and Catto 2008).

Precipitation showed an increase on average in the last 50 years throughout coastal Labrador. However, in western Labrador, precipitation remained steady (Whiffen 2002). Bell, et al. (2008) indicates that regional streamflow in Labrador has decreased since the 1970s as a result of an increase in evaporation and transpiration.

According to the IPCC, the predicted increased overall temperature will result in an increase in atmospheric moisture flux and therefore increase in precipitation. The IPCC predicts, based on its models, an increase of 20% or more in annual mean precipitation in northern North America and 30% in the winter during this century (Christensen, et al. 2007). The projections of Environment Canada agree with those of the IPCC of an overall increase in precipitation. Over the next 70 years, Environment Canada predicts an increase of almost 10% in precipitation during spring and winter and less than 5% increase in fall and summer in Newfoundland and Labrador (Vasseur and Catto 2008).

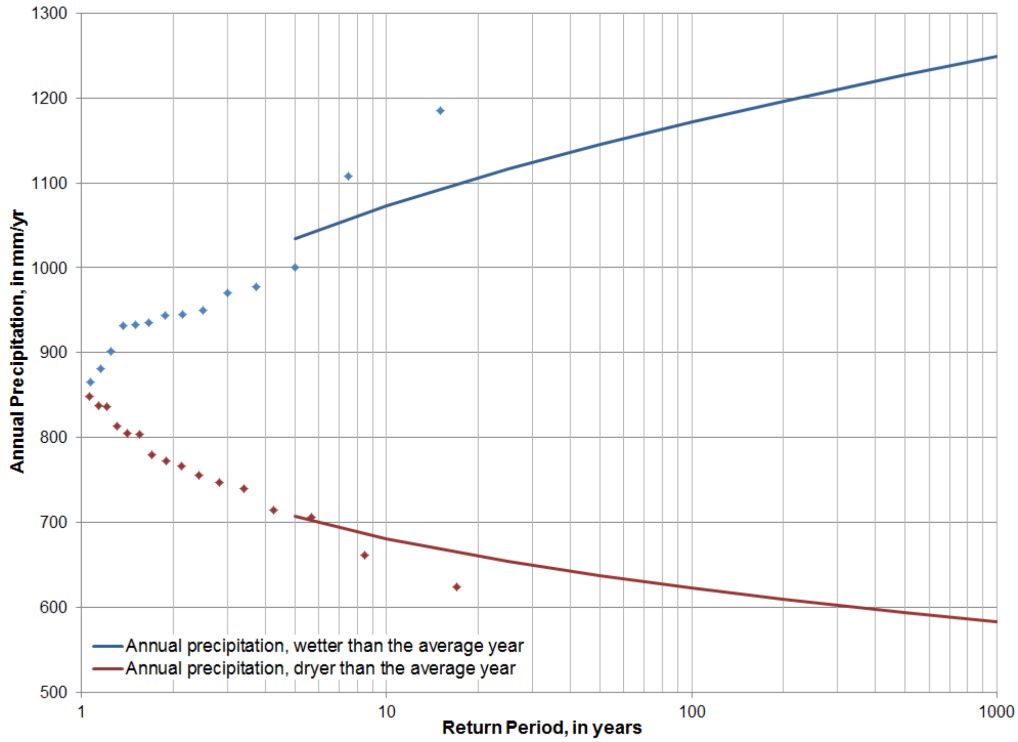
Precipitation Analysis

Table 16.8 presents precipitation analysis results for a range of return periods that are wetter or dryer than the average climate normal condition. The annual data was then ranked from greatest to smallest in order to determine the average precipitation year, the wetter year data set and the dryer year data set. Log Normal distribution was applied to develop the trends of the wetter curve and dryer curve (Figure 16.6) and predict the annual precipitation for 500-year and 1000-year return periods.

Table 16.8 Annual Precipitation Analysis for a Range of Return Periods

Annual Return Periods, in years	Precipitation Analysis	
	Wetter Years, in mm/year	Dryer Years, in mm/year
Mean	858	
5	1034	708
10	1073	681
25	1116	654
50	1145	637
100	1172	623
200	1197	609
500	1228	594
1000	1249	583

Figure 16.6 Annual Precipitation Wetter / Dryer than the Average Year



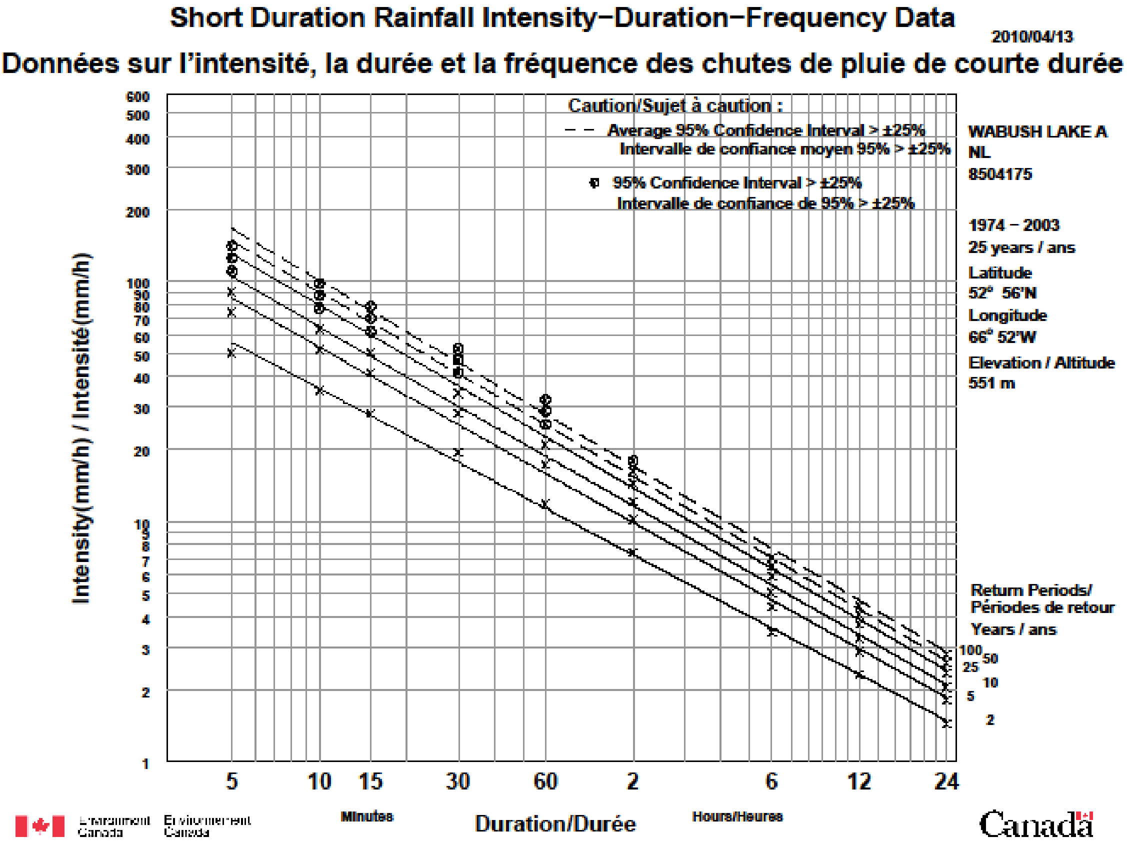
<u>Major Storm Assessment</u>

The return periods for major storm events of duration ranging from 5 minutes to 24 hours and return periods from the 2-year to 100-year events were developed by Environment Canada using the Gumbel – Method of Moments and are presented in Table 16.9. Figure 16.7 presents the Intensity-Duration-Frequency (IDF) rainfall curves for the Wabush Lake Airport weather station (Stn # 8504175).

Table 16.9 Major Storm Return Period Rainfall Amounts at the Wabush Lake Airport

Duration	Return Period (Years)					
	2	5	10	25	50	100
5 min	4.2	6.2	7.5	9.2	10.4	11.7
10 min	5.9	8.7	10.5	12.8	14.6	16.3
15 min	7.0	10.4	12.6	15.4	17.5	19.6
30 min	9.7	14.1	17.0	20.7	23.5	26.2
1 hr	11.8	17.2	20.8	25.3	28.7	32.0
2 hr	14.8	20.4	24.1	28.7	32.2	35.6
6 hr	20.7	26.5	30.4	35.3	38.9	42.5
12 hr	27.6	34.5	39.0	44.7	49.0	53.2
24 hr	34.3	43.1	48.9	56.2	61.6	67.0

Figure 16.7 Precipitation IDF Curves for Wabush Lake Airport (Environment Canada, 2012)



Topography, Vegetation and Drainage

The Kami Property is situated amidst gently rolling hills and valleys, which vary in trend from northeast-southwest to north-south. Topography across the site is relatively rugged and is governed by the underlying geological structure with elevations ranging from 580 m to over 700 m, with local slope angles of 2% to 15%.

Ground cover consists of sedges in open wetland bogs and coniferous and deciduous trees, with alder growth over those areas exposed by past forest fires.

Drainage across the site is generally directed north and east through a series of wetlands, lakes and connecting streams that form part of the headwaters of the Churchill River watershed. The west side of the Project site drains through the Pike Lake South and North watershed, north to the Walsh River, which flows into Long Lake. The center and east side of the Project site drains to Mills Lake, the Waldorf River and Long Lake. Long Lake is the largest lake in the LSA and has a large upstream drainage area. Major Project components such as the access road, power transmission line and rail line extend to the east through the Jean Lake and Flora Lake watersheds and represent the only Project components not located within the greater Long Lake watershed.

Environmental Water Balance

The environmental water balance for the Project LSA was modeled on a monthly basis using the USGS Thornthwaite Monthly Water Balance Model, hereafter referred to as Thornthwaite Model (USGS 2012). The Thornthwaite Model develops water balance estimates for a specified location among various components of the hydrologic system using a monthly accounting procedure based on the methodology originally presented by Thornthwaite (Thornthwaite 1948; Mather 1969, 1978, 1979; McCabe and Wolock 1999). In the Thornthwaite Model, the change of state of water is a function of the amount of energy available. That, in turn, is governed by the latitude, length of day and season which combine to control the amount of energy received at the earth's surface. Infiltration and vegetation factors then control the fraction of excess water that infiltrates into the ground versus the fraction that runs off to nearby streams.

The Thornthwaite Model requires input of climate normal information, local land use, geographical and environmental characteristics to further identify site specific conditions. Using climate information, aerial photography, GIS applications and regional soil data, parameters best representing the landscape surrounding the LSA are presented in Table 16.10.

Table 16.10 Site Specific Water Balance Input Parameters

	Latitude	Longitude	Elevation (masl*)
Climate Station #8504175 (Wabush)	52.93 N	66.87 W	551.1
Project Site	52.84 N	66.96 W	580 to 670
Parameter	**Value**		
Soil Storage (mm water/m soil)	125 to 142 for silty clay [a]		
Runoff Factor	50%		
Direct Runoff Factor	5%		
Maximum Melt Rate	50%		
Rain / Snow Temperature Threshold	0 degree Celsius		
Watershed Location	Headwater		

Notes:
[a] Reference: (Ball 2012).
* masl stands for Meters Above Sea Level.

The water balance was first calculated using the Thornthwaite Model and calibrated with monitored streamflow data, as well as streamflow data from the Environment Canada HYDAT database. Numerical results were then validated with previous studies (Hare 1965; Findlay 1969; Rollings 1997; Stassinu Stantec 2011). Table 16.11, 16.12 and 16.13 show the water balance results under the 30-year climate normal, wet year and dry year conditions. Previous studies of water balance estimates within the Labrador area (Hare 1965; Findlay 1969; Rollings 1997) indicate that streamflow is highly variable across small and large watersheds, ranging streamflow coefficients from 55% to 85%. The scoping level hydrology assessment report by Stassinu Stantec (2011) also estimated similarly higher total streamflow coefficients based on a review of flow gauging data from regional rivers. Since the Project site is situated within headwater areas of smaller watersheds, the streamflow estimations by the Thornthwaite Model with a total streamflow coefficient of 63% under 30-year climate normal conditions agreed with the findings in the previous studies and were chosen to estimate the mean annual total streamflow (surface runoff, interflow and groundwater discharge baseflow).

Table 16.11 Water Balance Results under the 30-year Climate Normal (Year 1982 to 2011) Conditions

Parameters	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Precipitation (mm)	50.0	39.0	54.2	51.9	54.1	83.3	116.1	107.7	94.4	77.3	75.5	54.5	858.1
Evapotranspiration (mm)	2.3	3.2	3.7	8.5	20.0	74.7	89.7	67.5	35.1	8.0	3.1	2.8	318.5
Streamflow (mm)	7.5	3.7	1.9	1.0	81.3	95.3	87.8	78.3	77.9	61.1	29.2	14.6	539.6
Surface Runoff (mm)	6.7	3.4	1.7	0.9	73.1	85.7	79.0	70.4	70.1	54.9	26.3	13.1	485.2
Infiltration (mm)	41.0	32.5	48.8	42.5	-39.0	-77.1	-52.5	-30.2	-10.7	14.4	46.2	38.6	54.4
Recharge (mm)	20.5	16.3	24.4	21.2	-19.5	-38.6	-26.3	-15.1	-5.4	7.2	23.1	19.3	27.2
Baseflow (mm)	20.5	16.3	24.4	21.2	-19.5	-38.6	-26.3	-15.1	-5.4	7.2	23.1	19.3	27.2

Table 16.12 Water Balance Results under 1:100 Year Wet Year Conditions

Parameters	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Precipitation (mm)	68.3	53.3	74.0	70.9	73.9	114.0	159.0	147.0	129.0	106.0	103.0	74.4	1172.0
Evapotranspiration (mm)	3.0	4.1	9.8	22.2	45.6	74.5	89.8	67.4	35.0	16.3	6.4	2.8	376.9
Streamflow (mm)	15.5	7.8	3.9	1.9	92.3	112.0	119.0	118.0	121.0	119.0	56.3	28.1	794.8
Surface Runoff mm)	12.7	6.4	3.2	1.6	75.8	91.8	98.1	96.9	99.1	97.7	46.2	23.1	652.6
Infiltration (mm)	52.6	42.8	61.0	47.1	-47.5	-52.6	-29.3	-17.2	-5.2	-8.5	50.5	48.5	142.2
Recharge (mm)	26.3	21.4	30.5	23.5	-23.8	-26.3	-14.7	-8.6	-2.6	-4.2	25.2	24.3	71.1
Baseflow (mm)	26.3	21.4	30.5	23.5	-23.8	-26.3	-14.7	-8.6	-2.6	-4.2	25.2	24.3	71.1

Table 16.13 Water Balance Results under 1:100 Year Dry Year Conditions

Parameters	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Precipitation (mm)	36.3	28.3	39.3	37.7	39.3	60.4	84.3	78.2	68.5	56.1	54.8	39.5	623
Evapotranspiration (mm)	3.0	4.1	9.8	22.2	45.6	74.5	89.8	67.4	35.0	16.3	6.4	2.8	376.9
Streamflow (mm)	15.4	7.8	3.9	1.9	32.1	29.7	23.0	23.2	37.1	42.3	19.5	9.7	245.7
Surface Runoff (mm)	12.7	6.4	3.2	1.6	26.4	24.4	18.9	19.1	30.5	34.8	16.0	8.0	202.0
Infiltration (mm)	20.6	17.8	26.3	13.9	-32.7	-38.5	-24.4	-8.3	3.0	5.0	32.4	28.7	43.7
Recharge (mm)	10.3	8.9	13.2	6.9	-16.4	-19.2	-12.2	-4.2	1.5	2.5	16.2	14.4	21.9
Baseflow (mm)	10.3	8.9	13.2	6.9	-16.4	-19.2	-12.2	-4.2	1.5	2.5	16.2	14.4	21.9

The annual evapotranspiration (ET) under the 30-year climate normal conditions was 318.5 mm. This value was also calculated using the Thornthwaite Model, which was based on average monthly temperatures, precipitation, soil storage and vegetation cover type. The monthly mean ET peaks between June to August. The trend is in agreement with the peak in temperature according to the climatic data in Table 16.5.

The infiltration factor for the Kami Property was calculated to be 0.5. This value represents a topographical factor of 0.1 for an average slope of 0.0987 m/m, a soil factor of 0.2 for silty clay and a vegetation factor of 0.2, representing open pasture grassland and woodland cover types. This implies that 50% of net infiltrated precipitation will be discharged to surface water via baseflow. Furthermore, the total infiltration and storage calculated for the Project site was 54 mm/year or approximately 6.3% of incident precipitation under the 30-year climate normal condition.

It is important to note that that all water recharging aquifers eventually cycle back to the surface as groundwater discharge providing baseflow to local streams and lakes. Therefore all water that infiltrates and does not get routed back to the surface as ET supports surface water baseflow and thereby total streamflow. As a result, the water balance can be further simplified into precipitation inputs and ET and total streamflow outputs.

Subwatershed Delineation

The Kami Property contains a complex system of watercourses and lakes which eventually discharge into Wabush Lake, located in the upper sections of the Churchill River watershed. The Churchill River watershed is coded as watershed #225 in the Water Resources Atlas of Newfoundland (NLDEL 1992), which ultimately discharges to the Atlantic Ocean.

The Project site was divided into 25 watersheds and sub-watersheds delineated based on basin and stream order as well as the upstream catchment area at key Project water crossing locations. Watershed surface area, perimeter and elevations were determined using GIS tools (Table 16.14) and their watershed delineations presented in Figure 16.8.

Table 16.14 Watershed and Subwatershed Details

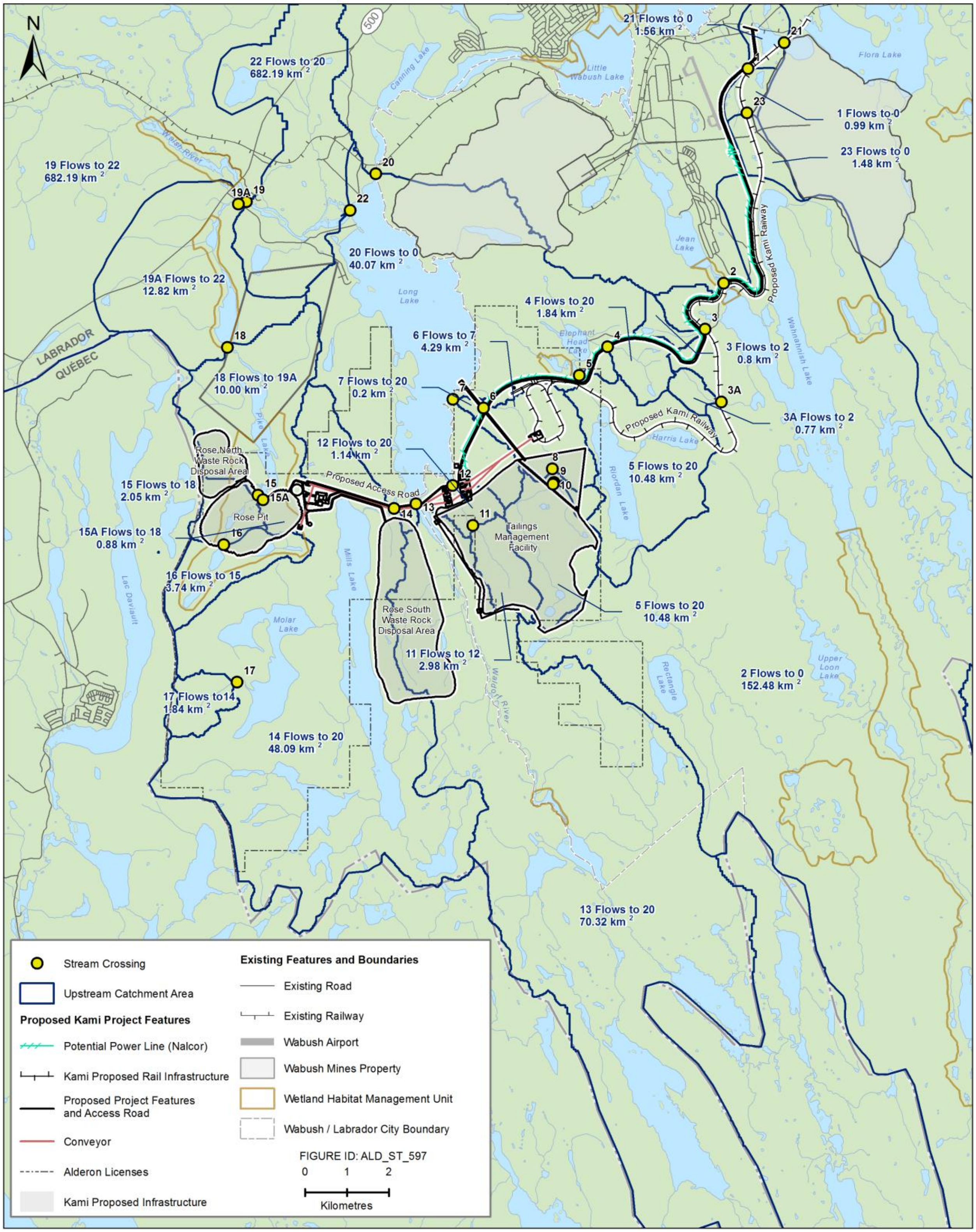
Subwatershed Code	Local Catchment Area, in km^2	Local Catchment Perimeter, in km	Cumulative Catchment Area, in km^2	Stream Order	Elevation at Headwaters, in metres	Elevation at Outlet in metres
1	0.99	4.40	0.99	1	538	516
2	152.48	97.63	154.05	4	609	538
3	0.80	6.20	0.80	1	594	560
3A	0.77	5.01	0.77	1	598	572
4	1.84	7.04	1.84	2	617	587
5	10.48	21.02	10.48	2	603	570
6	4.29	12.88	9.98	2	579	553
7	0.20	2.88	10.18	1	553	539

Subwatershed Code	Local Catchment Area, in km^2	Local Catchment Perimeter, in km	Cumulative Catchment Area, in km^2	Stream Order	Elevation at Headwaters, in metres	Elevation at Outlet in metres
8	0.11	2.16	5.69	2	582	579
9	0.51	4.41	0.51	1	582	582
10	5.07	13.75	5.07	2	613	582
11	2.38	9.72	2.38	1	590	557
12	1.14	6.32	3.52	1	557	540
13	70.32	65.48	70.32	3	579	538
14	48.09	56.15	49.93	3	597	560
15	3.37	11.93	5.83	1	579	571
16	2.46	7.94	2.46	1	631	579
17	1.84	8.08	1.84	1	669	597
18	10.79	20.50	16.62	2	571	567
19	682.19	175.54	682.19	5	635	548
19A	12.82	17.71	29.44	2	567	554
20	40.07	47.95	913.44	5	538	537
21	1.56	4.91	1.56	1	515	514
22	15.51	28.22	727.14	2	548	537
23	1.48	6.04	1.48	1	516	514

Local Hydrological Conditions

The hydrological monitoring results of all five (5) stream gauging stations (Table 16.4) were used to prepare rating curves presented in Appendix P. A rating curve is a graph of discharge versus stage for a given point on a stream. Its function is to facilitate conversions between streamflows and stages during stream and river monitoring and modeling. Manning's equation was applied in developing the rating curves. Parameters in Manning's equation were determined using the hydrological monitoring results and the channel cross section profiles. Stream flows at different stages were then calculated using Manning's equation in order to develop the discharge and stage relationship in the rating curve. Levelogger water level data was applied to the rating curve to generate continuous streamflow estimates.

Figure 16.8 LSA Watershed and Subwatershed Map



Streamflows

The rating curve developed for station *S4* is presented in Figure 16.9. Other streamflow monitoring stations rating curves are presented in Appendix P. Monitored water levels and derived flows from application of the rating curve at station *S4* are presented in Figure 16.10, with other station monitored water levels and derived flows presented in Appendix P. Baseflow continued even in the smallest monitored streams throughout the winter period. Generally, from the October 2011 to May 2012 monitored period, streamflows in local streams declined from approximately November to mid-April. These findings indicate the importance of groundwater discharge to support baseflow through winter when no overland flow occurs. From about mid-April, baseflows began to increase in local streams and peak toward the end of May. This is considered characteristic of the relatively small and headwater nature of most streams in the LSA. The observed seasonal streamflow hydrograph correlates well to the annual streamflow hydrograph presented below based on regional extrapolation. Ice thickness in local streams ranged from open water to approximately 25 cm at the time of the March 2012 field visit.

Figure 16.9 Station *S4* Rating Curve

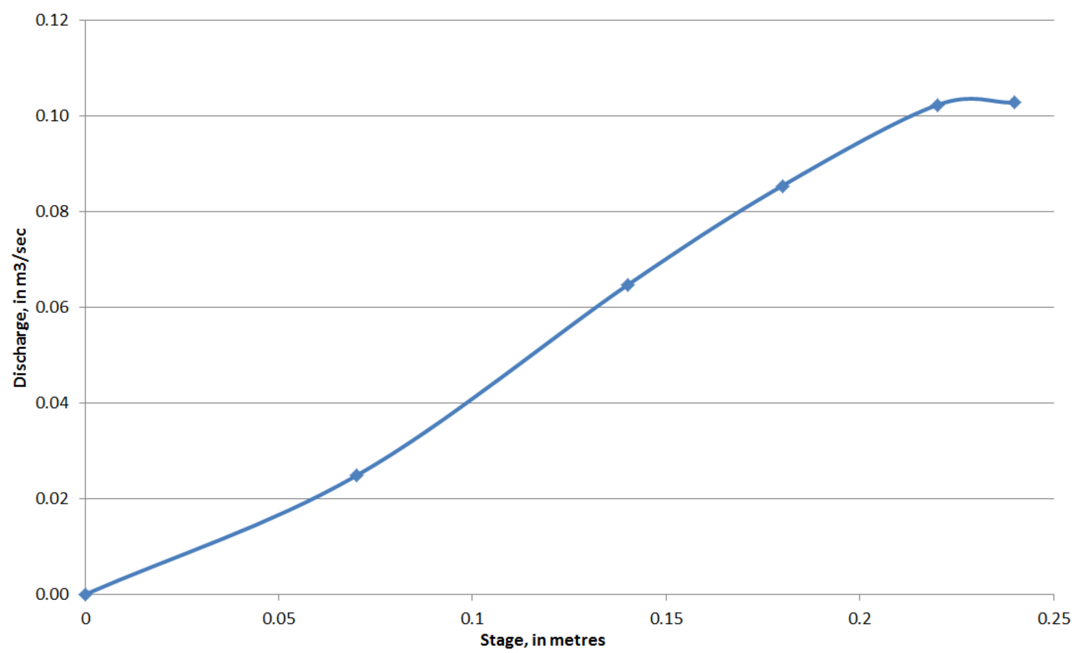
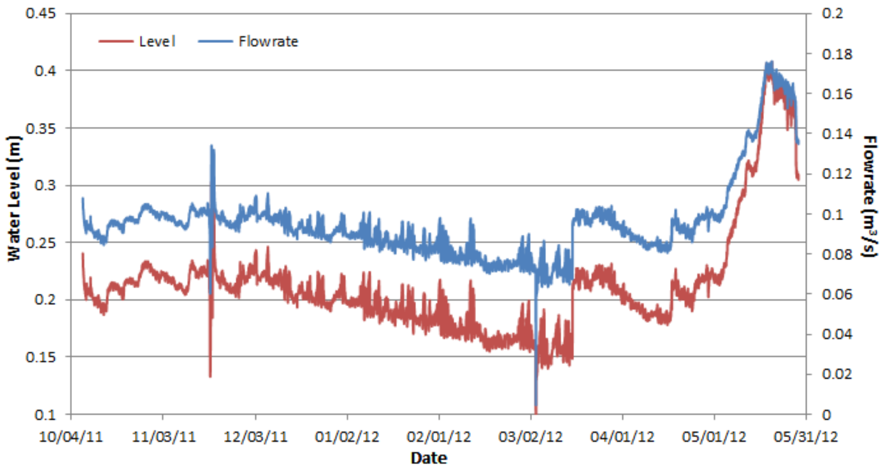


Figure 16.10 Water Level and Streamflow at Station *S4*



Lake Levels, Bathymetry and Ice Depths

In addition to streamflow monitoring, continuous lake level monitoring stations were established on Long Lake (*L2*) and Mills Lake (*L1*) (Table 16.4). The continuous water level of Mills Lake is presented in Figure 16.11. Lake level information is presented in Appendix P. Similarly to the observations for streamflows, lake levels decreased over the winter period and began increasing in mid-April as the spring freshet commenced. Similarly, local lake levels peaked toward the end of May.

Figure 16.11 Continuous Water Level Record for Mills Lake

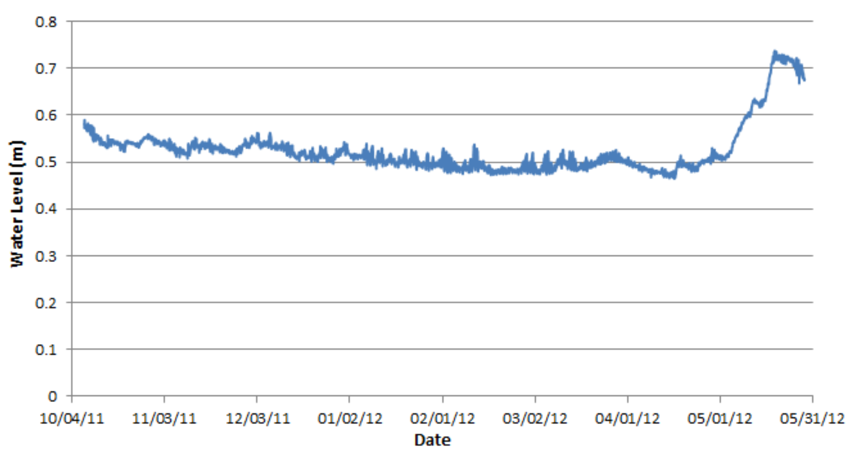
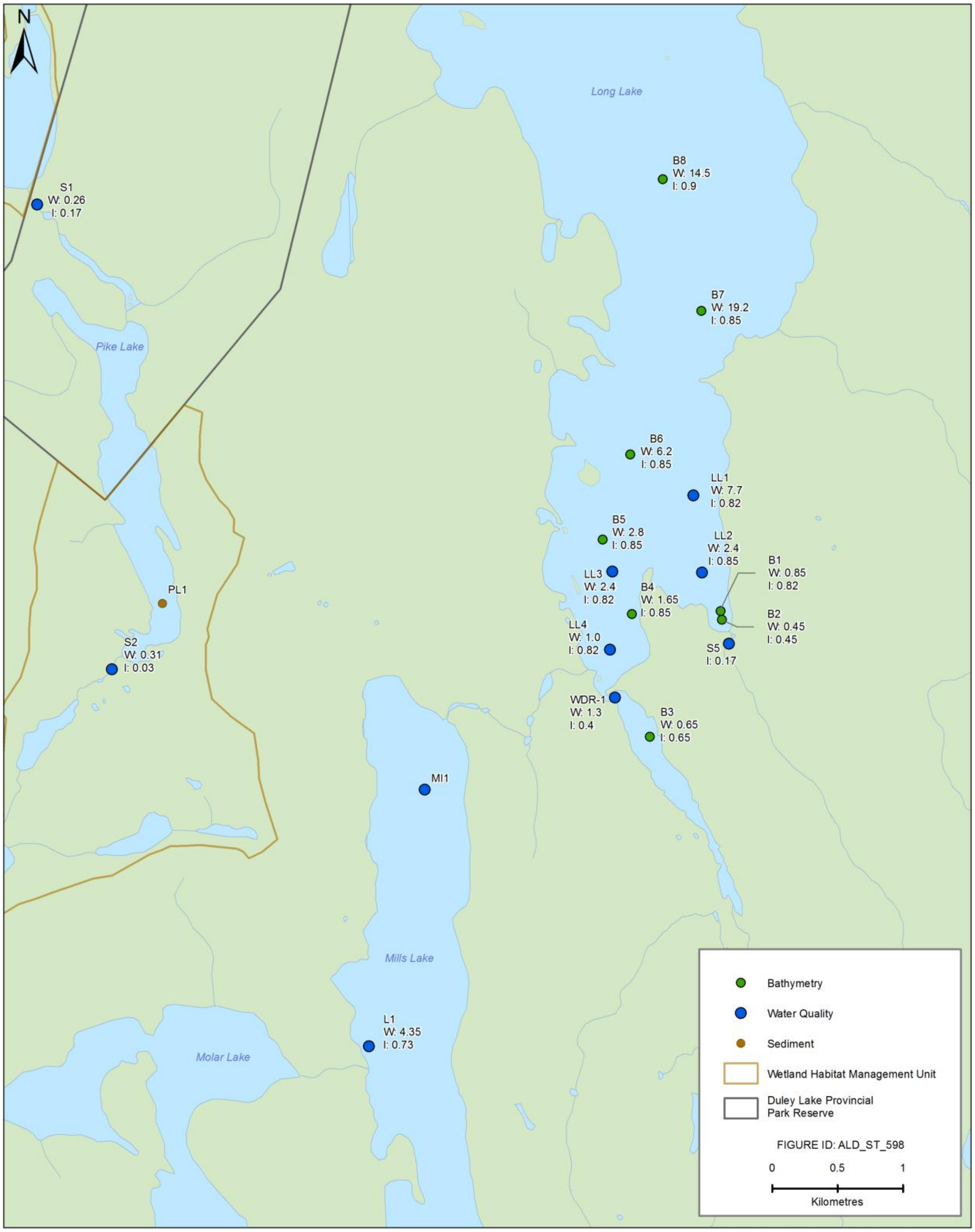


Figure 16.12 presents the bathymetric survey results for Long Lake as well as selected depth measurements for other local lakes in the LSA. Of note, the southern end of Long Lake is relatively shallow, ranging in depth from <1 m to about 3.5 m. Long Lake does deepen toward the north.

Ice thickness was measured during the March and April 2012 field visits and ranged from 0.45 to 0.85 m in local lakes.

Figure 16.12 Bathymetry Measurements of Selected Lakes in the LSA



Regional Flow Analysis

Regional flow relationships were developed using the regional Environment Canada HYDAT stations data to estimate streamflows at ungauged locations. There is no streamflow monitoring stations within the LSA boundary. Therefore, Environment Canada HYDAT stations located outside of the LSA boundary were considered for the regional flow analysis and are listed in Table 16.15. Table 16.15 summarizes the location, drainage area, period of records and regulation type. Three HYDAT stations, 03OA010, 03OA012 and 03OA005 have record less than 5 years. These stations are located below lakes and are naturally regulated by lakes. HYDAT stations with longer record, 03OA001 and 03OC006, are regulated by hydropower operations. All five HYDAT stations listed in Table 16.15 are either regulated by lakes or hydropower generation. All these HYDAT stations were included in regional flow analysis due to lack of data.

Table 16.15 Details of Environment Canada HYDAT Stations Near the LSA

Station ID	Name	Watershed Area (km^2)*	Available Years of Data	Years of Record	Distance from Project	Regulation
03OA010	Flora Creek Below Flora Lake	316.4	2002, 2003, 2007, 2008	4	18 km – NE	Natural
03OA012	Luce Brook Below Tinto Pond	43.4 *	2002, 2003, 2007, 2008	4	18 km – N	*Natural
03OA001	Ashuanipi River at Menihek Rapids	19000 *	1955 to 2009	59	178 km - N	Regulated
03OC006	Atikonak River at Gabbro Lake	21400 *	1975 to 2009	38	143 km - NE	Regulated
03OA005	Wabush Lake at Lake Outlet	1613	2007, 2008	2	35 km - S	Natural

* From Environment Canada's HYDAT database. Other watershed areas were determined using GIS tools.

As per NL hydrological guidance, regional extrapolation was used to prorate flows from large river gauging stations to local watersheds in the LSA. Regional relationships for mean monthly maximum, minimum and average daily flow rate with respect to drainage areas are developed (Appendix Q). The maximum and minimums are means of monthly minimum / maximum daily values. Flow hydrographs of all watersheds and subwatersheds (Table 16.14) within the LSA were determined from regional relationships and are presented in Appendix R. Using years when all stations were in operation enabled the development of calibrated regional extrapolation relationships. This approach accounted for the fact that larger watersheds are more hydraulically efficient and have higher total streamflow coefficients than smaller watersheds. As such, the relationships enable the accurate prorating or regional extrapolation of flow gauging records from larger watershed HYDAT stations with long record to the smaller watersheds characteristic of most of the LSA.

Using watershed #20, the outlet of Long Lake, with a cumulative drainage area of 914 km^2 as an example, Table 16.16 and Figure 16.13 present the calculated monthly maximum, minimum, and mean daily flows which were determined from the relationships in Appendix Q. By comparing the monthly runoff distribution between the prorated flows and water balance results (Table 16.11 and 16.16), both annual hydrograph estimates show a general agreement between the prorated flows and the estimated runoff from the water balance estimations. Moreover, the flow hydrographs from the outlet of Long Lake illustrate seasonal trends during a typical year with the spring freshet normally occurring between May and June and higher flow rates during the summer months when compared to the winter months. The flow hydrographs also show the attenuating influence of the lakes that are capable of storing water during late spring and releasing it gradually during the warmer months.

Table 16.16 Monthly Maximum, Minimum, and Mean Daily Flows at the Outlet of Long Lake Using the Area-Calibrated Flow Proration Method

Flow Characteristics	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Monthly Maximum Daily Flow, in m^3/sec	12.5	12.3	10.2	25.1	85.5	51.9	30.2	24.0	14.1	19.8	26.9	19.0
Monthly Minimum Daily Flow, in m^3/sec	10.1	8.5	8.0	7.2	35.3	26.8	18.5	11.7	9.1	7.3	12.3	10.7
Monthly Mean Daily Flow, in m^3/sec	11.1	10.2	9.0	11.5	63.8	35.8	24.1	17.7	11.0	12.5	17.9	14.9

Figure 16.13 Hydrograph Presentation of Monthly Maximum, Minimum, and Mean Flows at the Outlet of Long Lake Using the Area-Calibrated Flow Proration Method

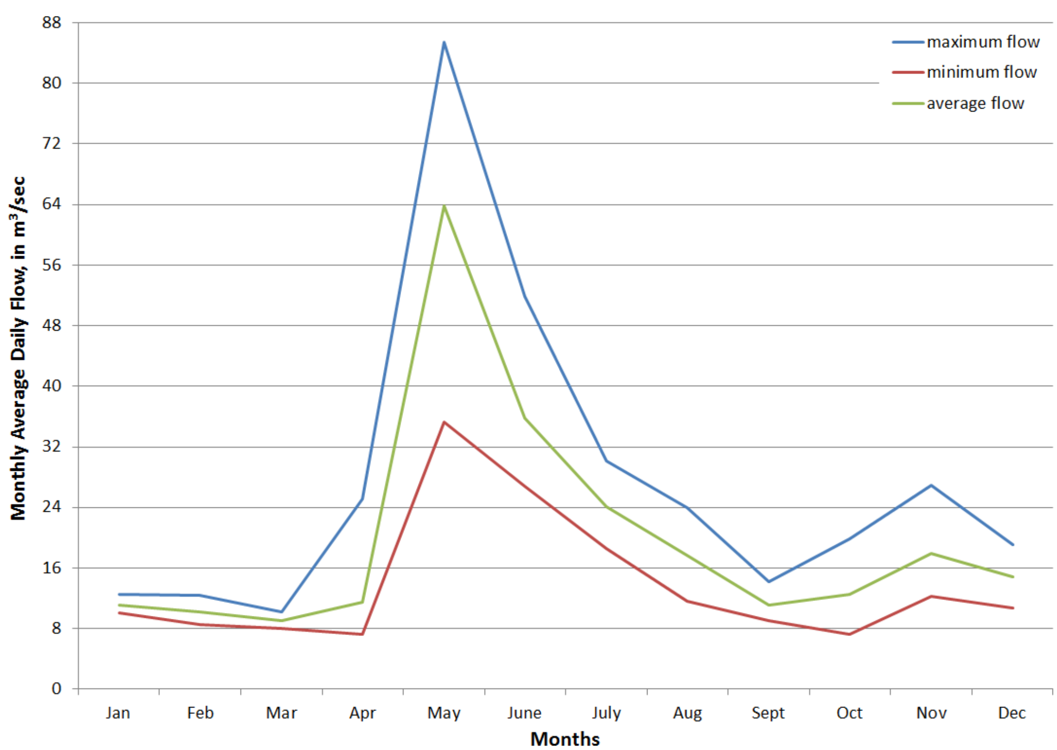
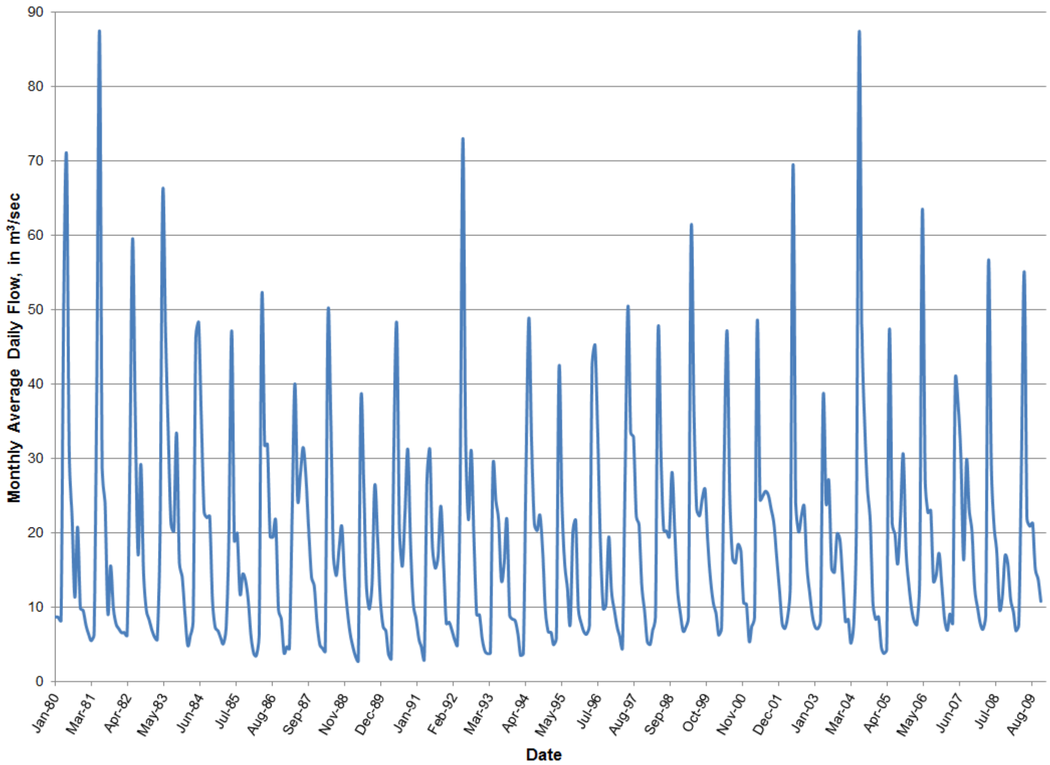


Figure 16.14 presents the area-calibrated prorated flows from the outlet of Long Lake from 1980 to 2009 flow normal records from HYDAT station 03OA001. This figure illustrates the dominance of seasonal round of high spring freshet and summer flows followed by later fall to winter low flow periods. The figure also depicts the year-to-year variability of flows, which are driven primarily by annual precipitation variability.

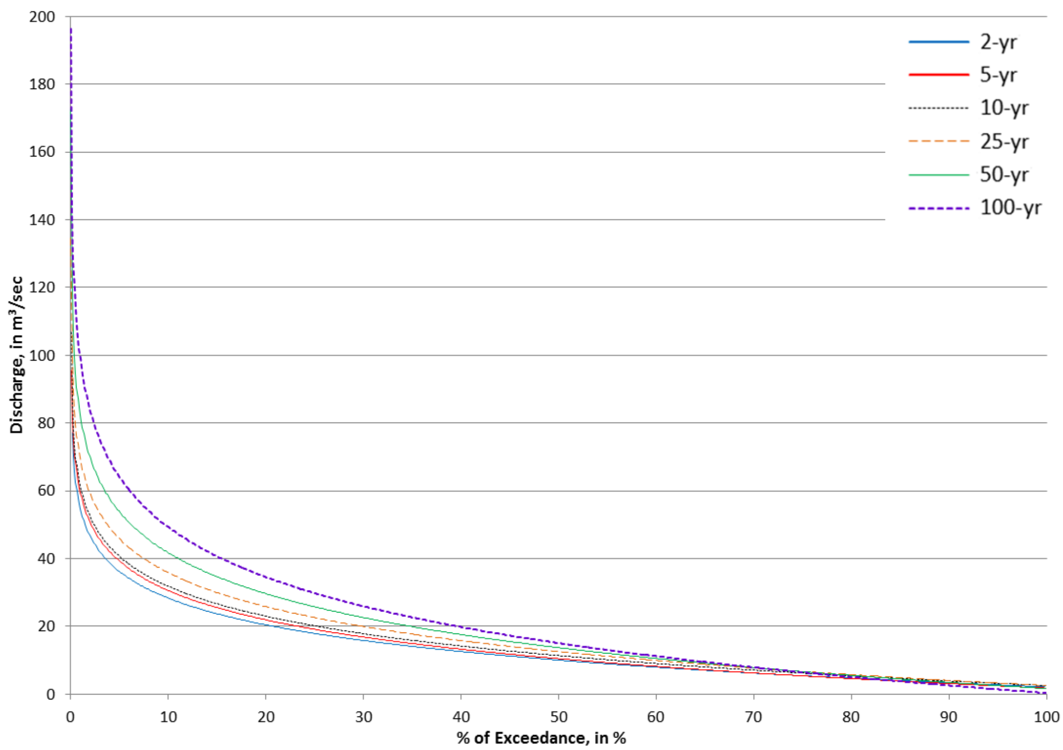
Figure 16.14 Hydrograph of 1980 – 2009 Area-Calibrated Prorated Flows at the Outlet from Long Lake



<u>Flow Duration Curves</u>

Flow duration curves (FDCs) indicate percentage of time a given flow was equaled or exceeded over a historical period. These curves are often used to aid in the determination of water allocations and to provide a measure of the magnitude of larger return period flows at specific flow nodes. The area-calibrated flow proration method was also applied to generate the FDCs from daily flows of all the watersheds and subwatersheds (Table 16.14) within the PDA and LSA. Station 03OA001 (Ashuanipi River at Menihek Rapids) was selected as the basis of FDC development since it has the longest flow monitoring records (Table 16.15). The available mean daily flow data in station 03OA001 was used to prepare FDCs up to 50-year return period, whereas the 100-year FDC was extrapolated from the shorter return period FDCs. Analyses indicated that there is a statistically significant relationship between the natural logarithm of mean annual daily flows and the natural logarithm of drainage areas. Thus, proration factors were determined using drainage areas between station 03OA001 and subwatersheds. The FDCs of station 03OA001 were then prorated down to subwatersheds level using the proration factors. Figure 16.15 illustrates the FDCs for the outlet from Long Lake. Appendix R presents the FDCs of all watersheds and subwatersheds delineated within the PDA and LSA.

Figure 16.15 Flow Duration Curves for Varying Return Periods at the Outlet from Long Lake

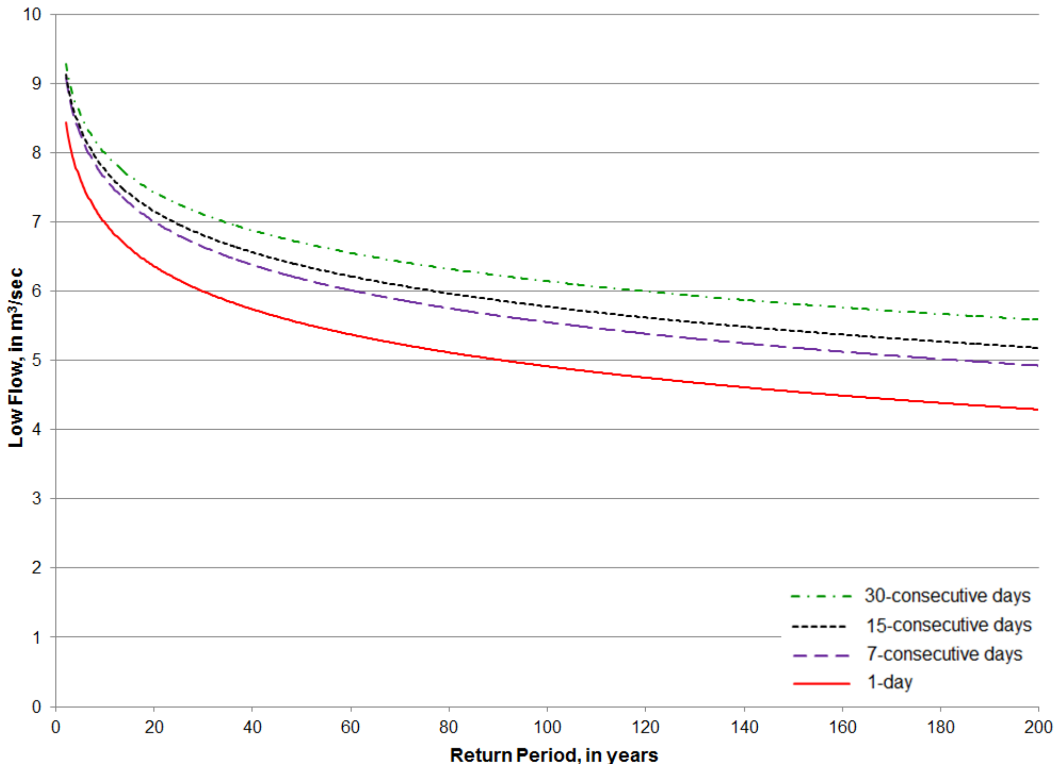


Low and Environmental Flows

A low flow analysis was conducted to provide an estimate of the water withdrawal capacity and in-stream flow needs or environmental (maintenance) flow requirements for watercourses throughout the PDA and LSA. For this study, low flows of four durations (1-day, 7-day, 15-day, and 30-day) with return periods 2-year, 5-year, 10-year, 20-year, and 50-year suggested by the Government of Newfoundland and Labrador (1991) was used for the analysis.

Station 03OA001 on the Ashuanipi River at Menihek Rapids was again used as the basis of low flow analysis due to its longest flow monitoring records (Table 16.15). The data from station 03OA001 was applied using flow analysis software DFLOW version 3.1. DFLOW uses Log-Pearson Type III frequency distribution to adjust the entire record and calculate low flows with a given recurrence interval. Figure 16.16 illustrates the low flow curves at subwatershed #20, the outlet from Long Lake. Using the 7-consecutive days curve as an example, the 7Q2 flow (the annual minimum average daily flow that is sustained during 7 consecutive days with a recurrence interval of every 2 years) at the outlet from Long Lake is 8.78 m^3/sec and the 7Q10 flow is 7.74 m^3/sec. Appendix S presents the low flow analysis of all watersheds and subwatersheds within the PDA and LSA.

Figure 16.16 Low Flow Results for the Outlet from Long Lake



Environmental flows, also referred to as maintenance flows or in-stream flow needs, describe the quantity, timing, and quality of water flows required to sustain freshwater and estuarine ecosystems. Through implementation of environmental flows, a flow regime or pattern that provides for human uses and maintains the essential processes required to support healthy river ecosystems shall be achieved (eFlowNet 2007). For this study, Tennant's method suggested by DFO was used to estimate the environmental flows of all subwatersheds throughout the PDA and LSA (Stoneman 2005; Maunder and Hindley 2005). Based on the climatic characteristics of the LSA (Table 16.5), the winter period is defined as between November 1st to April 30th and the summer period is between May 1 and October 31. The flow requirement for the summer period is 40% of the mean annual flow (MAF) and for the winter period is 20% of the MAF.

The latest 30-year flow data from HYDAT station 03OA001 was first used to determine the mean monthly flow (MMF) and MAF. The area-calibrated relationships between HYDAT station 03OA001 and the subwatersheds delineated for the PDA and LSA were then used in developing the environmental flows as shown in Table 16.17. Environmental flows at the outlet to Long Lake are estimated at 3.74 m^3/sec for the winter period and 7.47 m^3/sec for the summer period, and at Station *S2* are 0.0225 m^3/sec for the winter period and 0.0450 m^3/sec for the summer period.

Table 16.17 Environmental Flows for Subwatersheds within the PDA and LSA

Subwatershed ID	Environmental Flow, in m^3/sec	
	November to April	May to October
1	0.004	0.007
2	0.617	1.23
3	0.003	0.006
3A	0.003	0.006
4	-0.007	0.014
5	0.041	0.081
6	0.039	0.077
7	0.040	0.079
8	0.022	0.044
9	0.002	0.004
10	0.019	0.039
11	0.009	0.018
12	0.013	0.027
13	0.279	0.559
14	0.198	0.395
15	0.022	0.045
16	0.009	0.019
17	0.007	0.014
18	0.065	0.130
19	2.78	5.56
19A	0.116	0.232
20	3.74	7.47
21	0.006	0.012
22	2.97	5.93
23	0.006	0.011

Flood Flow Assessment

A flood is defined as the temporary rise of water level. In Newfoundland and Labrador, floods are caused by rainfall, snowmelt, or a combination of rainfall and snowmelt. The single station frequency analysis method with Log-Pearson Type III distribution between 2-year and 200-year return periods suggested by DOEC (Rollings 1999) was used for the flood flow assessment. Flood data in station 03OA001 was selected as the basis of the flood flow assessment due to its long monitoring records. The flood flows within the LSA and RSA were estimated by prorating the estimated flood flows at the HYDAT station 03OA001 based on drainage areas.

Figure 16.17 illustrates the flood flow at Long Lake outlet over a range of return periods. Similar flood flow curves for the watersheds and subwatersheds within the PDA and LSA are presented in Appendix T. The estimated flood flows at the Long Lake outlet were compared to flood flows estimated from the regional relationships developed by Rollings (1997) in the *Hydrology of Labrador*. The comparison indicated that single station estimates were within 10% and were generally lower than Rollings (1997). This is considered reasonable because Rollings (1997) work is based on gauging stations throughout Labrador, Newfoundland and Québec where climate, hydrology and physiography are much different from that of LSA and also as most gauged station watersheds are larger and more hydrologically efficient in comparison to the smaller headwater catchment area of the LSA and RSA.

Figure 16.17 Flood Flow Assessment for the Outlet from Long Lake

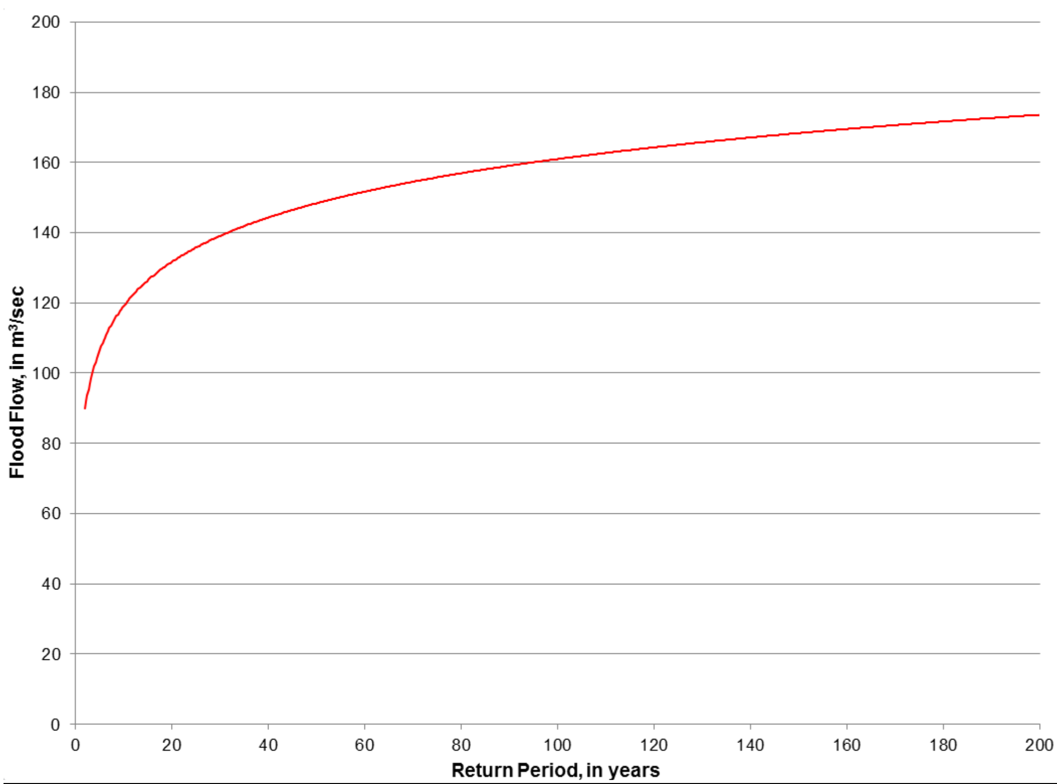


Table 16.18 Comparison of Flood Flows at Long Lake Outlet

Return Period (Year)	Flood Flows (m^3/s)	
	Single Station Analysis	Rollings 1997
10	122	137
25	138	153
50	149	164
100	160	174

Local Water Supplies

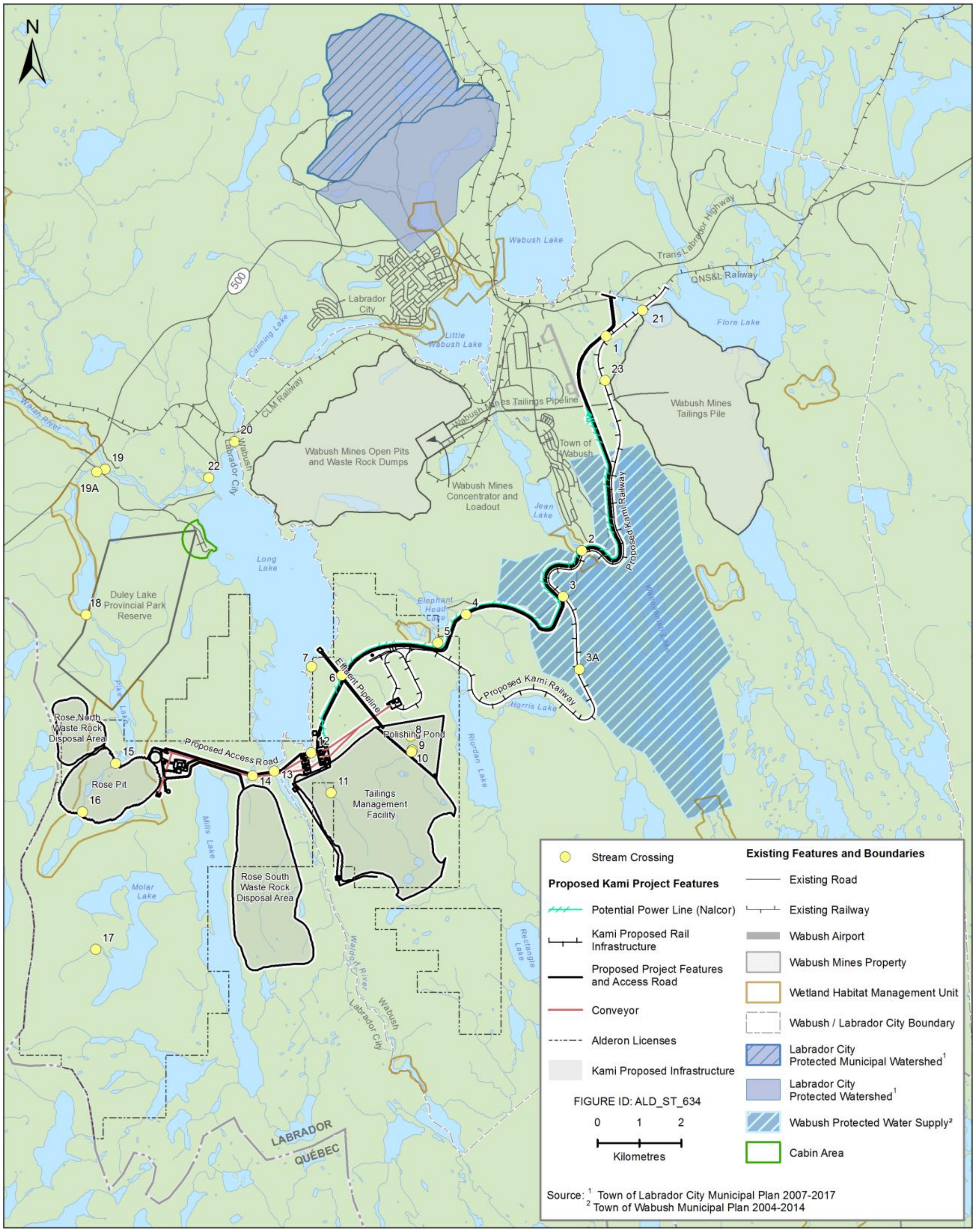
Surface water is used locally as the public water supply for Labrador City, Wabush and Fermont, as well as local cabin owners.

Labrador City manages a total area of 446 km^2, and has a surface water municipal water supply source from Beverly Lake located northeast of the Town, with a 500,000 igal reservoir, treatment plant and a grid distribution network servicing approximately 3,200 homes and businesses. Beverly Lake drains into Little Wabush Lake, via a tributary to the lake. Beverly Lake is offline from the Long Lake to Wabush Lake flow system. Labrador City's protected water supply area is depicted in Figure 16.18.

Wabush manages a total area of 428 km^2, and also is served by a municipal distribution system sourced from Wahnahnish Lake. The protected water supply area for Wabush is depicted in Figure 16.18. The Project interacts with the Wahnahnish Lake Public Water Supply Area via the proposed location of portions of the access road and rail link within the protected water supply drainage area, including the Jean River crossing at the outlet from Wahnahnish Lake and several crossings of small tributaries to the Lake. However, the Wabush protected water supply is offline from the Long Lake – Wabush Lake flow system. The Wabush drinking water intake is located in Wahnahnish Lake, approximately 175 m upstream of the lake outlet. Intake water is chlorinated at a pump house and then pumped into a 475,000 igal reservoir which supplies all of Wabush's water distribution network. A multi-barrier approach starting with water supply watershed protection, uninterrupted chlorination, annual water tower cleaning and a series of quality checks including chlorine residual monitoring, monthly bacteriological analysis and quarterly physical and chemical analysis are taken to ensure the delivery of clean, safe drinking water. The Town of Wabush follows the Standards for Bacteriological Quality of Drinking Water as provided by the Provincial Department of Environment and the Guidelines for Canadian Drinking Water Quality prepared by Health Canada.

The Town of Fermont, Québec is located west of Lac Daviault and has a municipal water distribution system that is fluoridated; the source lake is Lac Perchard north of the Town's urban area. Lac Perchard and Lac Daviault drain south toward the Gulf of St. Lawrence, whereas surface water in the PDA/LSA drains east to the Labrador Sea.

Figure 16.18 Surface Water Supply Areas within the RSA



In addition to local water extractions associated with public water supplies, Cliffs Natural Resources (Wabush Mines) and cabin owners extract surface water from the LSA/PDA for industrial and domestic purposes. Wabush Mines derives its water source from Flora Lake, which has its own large, offline upstream watershed catchment area. The IOC-Rio Tinto Carol Mine derives its water supply from Wabush Lake which is beyond the PDA/LSA scope of direct water resources effects. However, the potential residual effects of net water takings from the Project on the water supply potential of Wabush Lake will be assessed with respect to cumulative effects. Domestic surface water withdrawal by PDA/LSA cabin owners is expected to be very minimal in relation to sustainable yield of Long and Mills Lakes.

Surface Water Supply Capacity Assessment

Surface water withdrawal in NL is assessed based on the sustainability of yield, effects to downstream users, ecological effects and the hierarchy of water taking use prescribed in legislation. The sustainable yield of surface water sources is determined through estimation of several low flow statistics including the 30Q50 (NL DEL, 1992; DOEC, 2005). DOEC (2005) indicates that a surface water quantity assessment should include a review of the available yield of the water supply and should demonstrate that:

- Where possible, a minimum drought return period of one in fifty years has been used for calculating the safe yield (Q50);
- A minimum drought duration of 30 days has been used (30Q50);
- The yield is adequate to provide ample water for other legal users of the source including any required fish flows;
- The yield is adequate to meet the maximum current and future water demand including any required fish flows without significantly affecting the watercourse habitat downstream of the intake; and
- Only live storage has been used in the yield calculations.

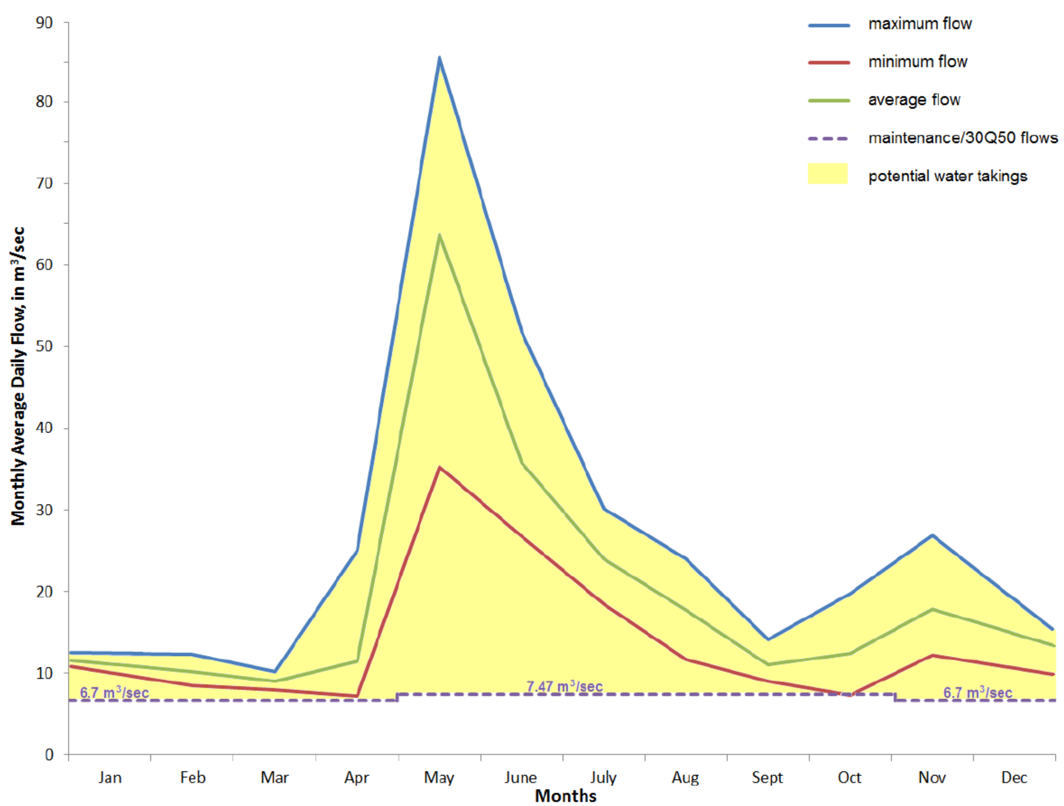
Where site-specific streamflow data is available, yield can be estimated by generated mass flow curves. The streamflow data should also be used to estimate the minimum perennial yield on record and to estimate a drought return period for that year.

Fish flows, also referred to as maintenance flow, environmental flows and in-stream flow needs are determined as per the method described previously.

The greater of these flows are considered the minimum environmental flow threshold, beyond which water extractions cannot impinge. Appendix S provided estimates of low and environmental (maintenance flows). For instance, at the outlet from Long Lake the 30Q50 low flows were estimated at 6.70 m^3/s. Maintenance flows at the outlet from Long Lake were estimated at 3.74 m^3/s during the winter period and 7.47 m^3/s during the summer period. Maintenance flows are assumed to set the lower water taking limit during summer and 30Q50 during winter. Summer and winter period withdrawal could not result in flow impingement on respective maintenance/30Q50 flow thresholds at the outlet of Long Lake meaning that when lake outflow decreases below these thresholds, water extractions should cease. For illustration purposes Figure 16.19 indicates the total portion of the Long Lake outlet annual hydrograph above the 30Q50 and maintenance flow threshold potentially available for water extraction purposes. The exact water extraction rates, duration and frequency will be subject to climate conditions and further discussions with DOEC and DFO. However, this level of water supply potential assessment indicates that surface water sustainable yield is available from Long Lake.

Based on use of the sustainable yield criteria, potential water withdrawal from Long Lake is depicted in Figure 16.19. Raw water withdrawal from local waterbodies, such as Long Lake can be offset and minimized through the construction and operation of reservoirs which collect and store mine contact waters.

Figure 16.19 Long Lake Surface Water Supply Capacity



Water Quality

As described in previous sections of this report, the proposed Project may affect the water quality in the LSA and RSA. The RSA encompasses several sub-watersheds of the Churchill River, including Mills Lake, Long Lake, Riordan Lake, Waldorf River, Pike Lake South, Wabush Lake and several un-named brooks and lakes.

As outlined above, a baseline water quality investigation was conducted in 2011-2012. Five (5) stream and two (2) lake monitoring stations were established in early October, 2011 to routinely monitor seasonal baseline water quality at representative waterbodies throughout the

LSA and address monitoring requests forwarded by regulators. *In-situ* water quality measurements were taken at each monitoring station using a YSI multi-parameter sonde. Routine seasonal grab samples of surface water quality at each of the seven monitoring stations were collected during each field visit in October 2011 and March 2012, respectively. In addition, further water quality samples were collected at a number of local lakes and streams during an additional field visit in April 2012. April sampling included grab samples from selected local rivers and lakes. A composite sample was collected on Molar Lake. April, 2012 sampling targeted specific waterbodies to support baseline study objectives and provide additional water quality information to support specific effects assessments. Samples were submitted to Maxxam Analytics, a CALA accredited laboratory, for laboratory analytical reporting. Summary statistics utilized the convention of ½ the detection limit (Clark, et al. 1998) for values which were reported as < DL.

Regional Water Quality Review

The Canada–Newfoundland Water Quality Monitoring Agreement (WQMA) facilitates the monitoring of water quality across the province. DOEC has mapped water quality concentration contours across the province. Mapping of those contours is presented in Appendix U. The results were based on average recorded values at WQMA sites for all data collected between 1985-2000. The contour regions were estimated using a geo-statistical approach known as Inverse Distance Weight (IDW), with a power of 5. Table 16.19 presents the Canadian Water Quality Guidelines (CWQG) for the Protection of Freshwater Aquatic Life, the MMER promulgated under the federal *Fisheries Act* and WQMA reference water quality in western Labrador.

Table 16.19 Summary Regulatory Criteria and Reference Water Quality in Western Labrador

Parameter	Regulatory Criteria and Reference Water Quality				
	Units	CWQG	MMER[1] (Max Monthly Mean)	MMER[1] (Max Grab)	WQMA
Alkalinity	mg/L				4.0332 – 6.5461
Colour	TCU	Narrative			18.5 – 27.7 (RU)
Conductivity	µS/cm				8.9 – 515.9
DO	mg/L	6.5 – 9.5 (cold water–life stage)			1.68 – 3.60
pH	pH	6.5 – 9.0			6.51 – 6.61
Turbidity	NTU	Narrative			0.0 – 1.98 (JTU)
Temperature	Deg C	Narrative			3.7 – 5.1
TSS	mg/L	Narrative	15	30	
Calcium	mg/L				0.81 – 1.69
Chloride	mg/L				0.15 – 30.12
Fluoride	mg/L	0.120 (inorganic F)			0.025

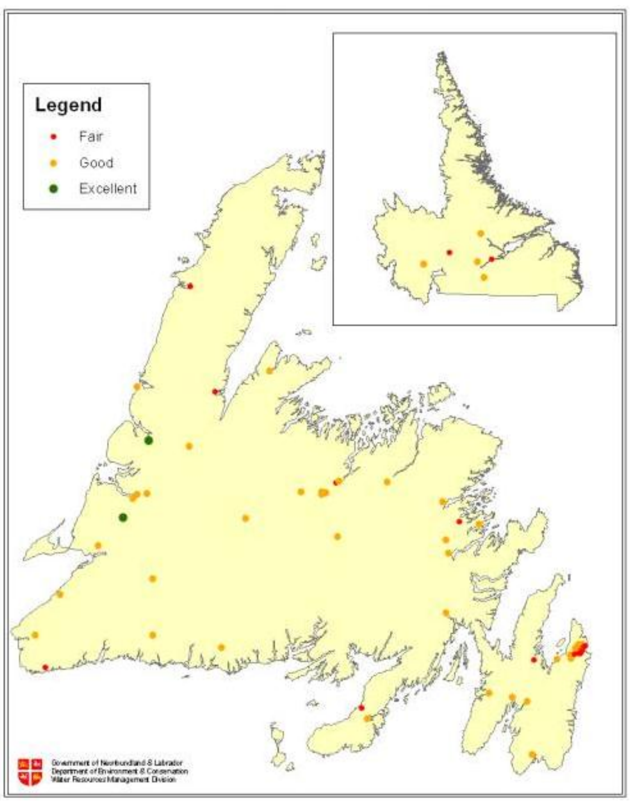
Parameter	Regulatory Criteria and Reference Water Quality				
	Units	CWQG	MMER[1]		WQMA
			(Max Monthly Mean)	(Max Grab)	
Magnesium	mg/L				0.23 – 1.43
Potassium	mg/L				0.0 – 0.80
Sodium	mg/L				0.0 – 10.55
Sulphate	mg/L				0.41 – 6.38
Cyanide	mg/L	0.005 (as free CN)	1	2	
DOC	mg/L				4.4 – 4.5
Total Ammonia - N	Mg/L	T°C and pH dependent			0.136 – 0.150
Un-ionized Ammonia	µg/L	19			
Nitrite	mg/L	0.06			
Nitrate	mg/L	13			
Phosphorus	µg/L	< 4 - >100 (trophic status)			7.12 – 11.36
Aluminum	µg/L	5 if pH <6.5, 100 if pH > 6.5			35 - 82
Arsenic	µg/L	5	500	1000	0.05 – 0.08
Boron	µg/L	1500 (Long Term)			
Cadmium	µg/L	Hardness adjusted			0.103 – 0.117
Copper	µg/L	Hardness adjusted, a minimum of 2 µg/l regardless of water hardness (Demayo and Taylor 1981)	300	600	4.35 – 4.93
Iron	µg/L	300			61.8 – 185.9
Lead	µg/L	Hardness adjusted, a minimum of 1 µg/L regardless of water hardness (CCREM 1987: Table 3-10)	200	400	0.34 – 0.42
Mercury	µg/L	0.026			0.087 – 0.103
Molybdenum	µg/L	73			0.05 – 0.062
Nickel	µg/L	Hardness adjusted, a minimum of 25 µg/L regardless of water hardness (IJC 1976)	500	1000	2.3 – 3.6
Selenium	µg/L	1			0.05 – 0.057
Silver	µg/L	0.1			

Parameter	Regulatory Criteria and Reference Water Quality				
	Units	CWQG	MMER[1] (Max Monthly Mean)	MMER[1] (Max Grab)	WQMA
Thallium	µg/L	0.8			
Uranium	µg/L	33 (short term), 15 (long term)			
Zinc	µg/L	30	500	1000	3.4 – 3.8
$Radium_{226}$	Bq/L		0.37	1.11	

Notes:
1 The MMER provides three effluent water quality limits including the maximum authorized monthly mean concentration, maximum authorized concentration in a composite sample and maximum authorized concentration in a grab sample. The Maximum Authorized Monthly Mean Concentration will be the MMER effluent criteria carried forward in Project effects assessments.

Application of the Canadian Water Quality Index to WQMA sites in Labrador indicates Good to Excellent water quality as depicted in Figure 16.20.

Figure 16.20 Water Quality Index Ranking Map for Labrador (DOEC 2011c)



LSA Water Quality Results

Laboratory analytical results are presented in Appendix V. The following presents a discussion of general constituents, nutrients and metals.

General Constituents

Table 16.20 presents summary statistics for all lab analytical general constituents.

Table 16.20 Summary of General Constituents for Routine Monitoring and April Field Samples

Parameter	Units	CWQG Guideline	Min	Mean	Max	75th
General Constituents						
Anion Sum	me/L		0.55	1.09	2.32	1.41
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		27	51	110	64
Calculated TDS	mg/L		34.0	58.1	116.0	75.8
Carb. Alkalinity (calc. as CaCO3)	mg/L		**0.5**	0.5	1.2	0.5
Cation Sum	me/L		0.630	1.064	2.220	1.280
Hardness (CaCO3)	mg/L		29	50	110	59
Ion Balance (% Difference)	%		0.54	3.26	8.33	4.66
Langelier I0.5ex (@ 20C)	N/A		-3.28	-0.97	0.15	-0.54
Langelier Index (@ 4C)	N/A		-3.53	-1.22	-0.10	-0.79
Saturation pH (@ 20C)	N/A		7.91	8.61	9.03	8.87
Saturation pH (@ 4C)	N/A		8.16	8.86	9.28	9.12
pH	pH	6.5-9	5.64	7.58	8.06	7.81
Acidity	mg/L		**2.5**	3.5	12.0	4.4
Total Alkalinity (Total as CaCO3)	mg/L		27	50	110	60
Dissolved Chloride (Cl)	mg/L		**0.5**	0.7	2.2	0.5
Color	TCU	Narrative[1]	8	14	44	14
Strong Acid Dissoc. Cyanide (CN)	mg/L	0.005 (as free CN)	**0.0010**	0.0010	**0.0010**	0.0010
Total Dissolved Solids	mg/L		27	55	110	68
Dissolved Fluoride (F-)	mg/L	0.120 (inorganic F)	**0.05**	0.05	0.11	0.05

Parameter	Units	CWQG Guideline	Min	Mean	Max	75th
Reactive Silica (SiO2)	mg/L		3.2	5.1	9.4	6.4
Total Suspended Solids	mg/L	Narrative[2]	**0.5**	1.3	5.2	1.7
Dissolved Sulphate (SO4)	mg/L		**1.0**	3.0	5.8	3.9
Turbidity	NTU	Narrative[3]	0.05	0.41	1.30	0.58
Conductivity	uS/cm		56	101	210	130

Notes:
1 **True Color -** The mean absorbance of filtered water samples at 456 nm shall not be greatly higher than the seasonally adjusted expected value for the system under consideration.
2 **Total Suspended Solids for Clear flow -** Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maximum average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).
3 **Turbidity for Clear Flow -** Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g., 24-h period). Maximum average increase of 2 NTUs from background levels for a longer term exposure (e.g., 30-d period).
Bold numbers are values under detection limits and adjusted to half values of detection limit for analytical purpose.

The lab results indicate that pH for the seven routine monitoring stations ranged from 7.5 – 8.06, demonstrating slightly alkaline conditions and no strong difference between stream and lake pH values. All routine monitoring pH results were within CWQG which is from 6.5-9.0. The April monitoring results demonstrated similar pH range to the routine seasonal monitoring results. One exception was a pH sample value of 5.64 in the composite sample on Molar Lake. However, the *in-situ* pH spot measurement in Molar Lake indicated a pH value of 7.77. The pH range observed throughout the LSA is more alkaline than the WQMA pH range for western Labrador which tends to be slightly acidic.

Total Alkalinity (as $CaCO_3$) for routine monitoring stations ranged from 27 mg/L (as $CaCO_3$) to 110 mg/L with mean concentration of 50 mg/L. Higher concentrations of 87 mg/L and 110 mg/L were observed from the samples taken in October 2011 and March 2012 for routine monitoring station *S5,* which is located in a tributary that discharges to the southeast end of Long Lake. Another higher alkalinity value of 89 mg/L from October sample was observed at routine monitoring station *L2* which is located at the southeast end of Long Lake. The April monitoring results show a similar alkalinity range to the routine monitoring stations results. Higher concentrations of 76 mg/L and 72 mg/L were observed from samples taken at the southern end of the Long Lake (LL4) and Waldorf River (WDR-1). However, alkalinity values in this range are considered to be low. Low alkalinity values suggest limited acid buffering potential in local lakes and streams.

Hardness (as $CaCO_3$) ranged from 29 mg/L (as $CaCO_3$) to 110 mg/L with mean of 52 mg/L for the routine monitoring stations. Relatively higher values of 89 mg/L, 110 mg/L as well as 90 mg/L were observed at the routine monitoring stations *S5* (October and March) and *L2*. For the April field samples, hardness values ranged from 29 mg/L to 71 mg/L with mean of 46.8 mg/L. Similarly, higher values of 67 mg/L and 71 mg/L were observed at sampling locations LL4 and WDR-1. LL4 is located at the southern end of the Long Lake, and WDR-1 is located at Waldorf River in proximity to LL4. The value range for routine monitoring stations and April monitoring locations indicated hardness ranging from soft (<60 mg/L as $CaCO_3$) to moderately hard (61 – 120 mg/L). Parameters such as copper, cadmium, lead and nickel are hardness-adjusted in the CWQG. The range of hardness values result in lower CWQG thresholds for lower hardness concentrations to higher thresholds for higher concentrations.

Langelier Saturation Index (LSI) values for most routine monitoring stations and all of the April monitoring locations are negative and indicative of pH under-saturation with calcium carbonate ($CaCO_3$). The negative LSI values indicate that the local surface waters will tend to dissolve solid $CaCO_3$ and will not be scale-forming. However, there is one exception for the result from routine monitoring station S5 for which the LSI was higher than the rest with a positive value of + 0.15 in the March 2012 sample. The positive value shows that the water is over-saturated and tends to precipitate a scale layer of $CaCO_3$. However, the October sample from the same locations shows a negative value of -0.08. The potential for scale formation is an important consideration in the selection and design of water infrastructure.

Electrical conductivity for routine monitoring stations ranged from 56 µS/cm to 210 µS/cm with mean of 106.4 µS/cm. The highest value of 210 µS/cm was observed from Station S5 in the March sample. For April monitoring results, the electrical conductivity values ranged from 66 µS/cm to 140 µS/cm. No strong lake to stream concentration trend or relationship was observed. Conductivity within the 150 µS / cm and 500 µS/cm range in freshwaters are indicative of the potential to support good mixed fisheries.

Ionic balance for routine monitoring stations and April monitoring samples were moderately positive and expected in light of the soft to moderate water hardness observations above. Concentrations of major cations, such as calcium, sodium, potassium, magnesium, manganese, ammonium, iron and aluminum, were low, as were concentrations of major anions, such as chloride, fluoride, sulphate, and nitrate, resulting in relatively weak ionic strength.

Total Dissolved Solids (TDS) concentrations were generally low for routine monitoring stations, ranging from 27 mg/L – 110 mg/L with mean of 56.6 mg/L. The maximum value of 110 mg/L was observed from the March sample at routine monitoring station *S5*. Another higher value of 100 mg/L was observed from the October sample at routine monitoring station *L2*. For April monitoring results, the TDS values ranged from 29 mg/L to 90 mg/L. The value of 90 mg/L was observed at April monitoring location LL4. However, these TDS values are much less than the TDS tolerance maxima of 1000 mg/L estimated by Boyd (1999) in mixed fish fauna aquatic ecosystems. Total suspended solids (TSS) concentrations for routine monitoring stations were low ranging from <1 mg/L (below the detection limit) to a maximum of 5.2 mg/L. The April monitoring results present a range between <1 mg/L - 2.0 mg/L, which is similar to the routine seasonal monitoring results. Turbidity levels observed are typical of very low values. Colour ranged from 7.9 – 44 TCU with mean of 14.0 TCU. The mean colour value is below the Canadian Drinking Water Quality Aesthetic Guideline of 15 TCU for colour.

Cyanide is comprised of triple bound carbon and nitrogen atoms. Most cyanide species are highly toxic. The free cyanide CWQG threshold is 5 µg/L. All cyanide samples from routine monitoring stations and April monitoring locations were below the detection limit of 2 µg/L.

Sulphate concentrations for routine monitoring stations and April monitoring stations ranged from below 2 mg/L to 5.8 mg/L, which is much lower than the maximum concentration of sulphate of 250 mg/L and the 65 mg/L 30-day average concentration proposed for the protection of aquatic life in the Draft BC ambient water quality guideline for sulphate (Meays and Nordin 2011). No CWQG exists for sulphate.

Nutrients

Table 16.21 presents summary statistics for all lab analytical nutrient results.

Table 16.21 Summary of Nutrients for Routine Monitoring and April Field Samples

Parameter	Units	CWQG Guideline	Min	Mean	Max	75th
Nutrients						
Nitrate + Nitrite	mg/L		0.03	0.06	0.27	0.08
Nitrate (N)	mg/L	13.000	**0.025**	0.062	0.270	0.086
Nitrite (N)	mg/L	0.1	**0.005**	0.005	**0.005**	0.005
Nitrogen (Ammonia Nitrogen)	mg/L	See notes[1]	**0.025**	0.038	0.160	0.025
Dissolved Organic Carbon (C)	mg/L		1.500	4.873	20.000	5.225
Total Organic Carbon (C)	mg/L		**1**	4	20	4
Orthophosphate (P)	mg/L		**0.01**	0.01	**0.01**	0.01
Total Phosphorus	mg/L	See notes[2]	0.003	0.010	0.020	0.010

Notes:
1 http://st-ts.ccme.ca/?lang=en&factsheet=5#aql_fresh_concentration.
2 Ultra-oligotrophic <4, oligotrophic 4-10, mesotrophic 10-20, meso-eutrophic 20-35, eutrophic 35-100, hyper-eutrophic >100.
Bold numbers are values under detection limits and adjusted to half values of detection limit for analytical purpose.

Total ammonia-N for routine monitoring stations and April monitoring locations ranged from below the 0.05 mg/L detection limit to 0.16 mg/L and were all consistently below the CWQG of 4.84 mg/L (Ammonia concentration at pH 7.5, temperature 5°C). Un-ionized ammonia was calculated from Total ammonia-N, pH and temperature using the formula developed by Emerson, et al. (1975). All un-ionized ammonia concentrations were well below CWQG of 19µg/L. Nitrate concentrations ranged from below 0.05mg/L to 0.27mg/L for routine monitoring stations and April monitoring locations. The results were well below the CWQG for nitrate of 13 mg/L. Similarly, all nitrite concentrations were below the detection limit of 0.01 and the CWQG of 0.06 mg/L.

Orthophosphate levels for routine monitoring stations and April monitoring locations were below the detection limit of 10 µg/L. Total Phosphorus (TP) values for routine monitoring stations fell in the range of 0.003 mg/L to 0.018 mg/L. For April monitoring locations, TP values ranged from 0.005 mg/L to 0.014 mg/L which is similar to the results for routine monitoring stations. The CWQGs indicate that TP concentrations from 0.003 – 0.018 mg/L range from ultra-oligotrophic to meso-trophic, respectively.

Metals

Table 16.22 presents summary statistics for all lab analytical metals results.

Table 16.22 Summary of Water Quality Metals for Routine Monitoring and April Field Samples

Parameter	Units	CWQG Guideline	Min	Mean	Max	75th%
Metals						
Dissolved Mercury (Hg)	µg/L	0.026	**0.010**	0.010	0.070	0.010
Dissolved Aluminum (Al)	µg/L		**3**	13	80	14
Total Aluminum (Al)	µg/L	5 if pH <6.5, 100 if pH > 6.5	**2.5**	22.7	73.6	19.9
Total Antimony (Sb)	µg/L		**0.5**	0.5	**0.5**	0.5
Total Arsenic (As)	µg/L	5.000	**0.5**	0.5	**0.5**	0.5
Total Barium (Ba)	µg/L		9	15	31	18
Total Beryllium (Be)	µg/L		**0.50**	0.50	**0.50**	0.50
Total Bismuth (Bi)	µg/L		**1.00**	1.00	**1.00**	1.00
Total Boron (B)	µg/L	1500	**25**	25	**25**	25
Total Cadmium (Cd)	µg/L	see note[1]	**0.0085**	0.0163	0.0560	0.0085
Total Calcium (Ca)	µg/L		6860	12,308	25,300	14,500
Total Chromium (Cr)	µg/L		**0.5**	0.5	**0.5**	0.5
Total Cobalt (Co)	µg/L		**0.2**	0.2	**0.2**	0.2
Total Copper (Cu)	µg/L	see note[2]	1.0	1.1	2.4	1.0
Total Iron (Fe)	µg/L	300	**25**	112	493	140
Total Lead (Pb)	µg/L	see note[3]	**0.250**	0.288	0.840	0.250
Total Magnesium (Mg)	µg/L		2,580	5,621	13,000	7,080
Total Manganese (Mn)	µg/L		**1**	33	185	45
Total Molybdenum (Mo)	µg/L	73	**1**	1	**1**	1
Total Nickel (Ni)	µg/L	see note[4]	**1**	1	**1**	1
Total Potassium (K)	µg/L		849	1,302	2,690	1,410
Total Selenium (Se)	µg/L	1	**0.5**	0.5	**0.5**	0.5
Total Silicon (Si)	µg/L		1,560	2,530	4,940	3,410
Total Silver (Ag)	µg/L	0.1	**0.05**	0.05	**0.05**	0.05
Total Sodium (Na)	µg/L		538	1,000	3,040	946
Total Strontium (Sr)	µg/L		12.4	17.9	29.9	22.5
Total Sulphur (S)	µg/L		**2,500**	2,500	**2,500**	2,500
Total Tellurium (Te)	µg/L		**1**	1	**1**	1
Total Thallium (Tl)	µg/L	0.8	**0.05**	0.05	**0.05**	0.05
Total Tin (Sn)	µg/L		**1**	1	**1**	1

Parameter	Units	CWQG Guideline	Min	Mean	Max	75th%
Total Titanium (Ti)	µg/L		**1.0**	1.2	4.1	1.0
Total Uranium (U)	µg/L		**0.05**	0.21	0.96	0.22
Total Vanadium (V)	µg/L		**1**	1	**1**	1
Total Zinc (Zn)	µg/L	30	**2.5**	6.0	30.7	5.2
$Radium_{226}$	Bq/L		**0.0025**	0.0063	0.0200	0.0070

Notes:
1 http://st-ts.ccme.ca/?lang=en&factsheet=20#aql_fresh_concentration.
2 Minimum 2 µg/L and see equation at http://st-ts.ccme.ca/?lang=en&factsheet=71#aql_fresh_concentration.
3 Minimum 1 µg/L and see equation at http://st-ts.ccme.ca/?lang=en&factsheet=124#aql_fresh_concentration.
4 Minimum 25 µg/L and see equation at http://st-ts.ccme.ca/?lang=en&factsheet=139#aql_fresh_concentration.
Bold numbers are values under detection limits and adjusted to half values of detection limit for analytical purpose.

Cadmium, copper, lead and nickel all have hardness-adjusted CWQG thresholds, however in the cases of copper, lead and nickel an arbitrary lower limit is implemented as indicated in Table 16.22. Comparison of observed analytical results for these metals was conducted by calculating the individual sample hardness-adjusted CWQG limit or lower arbitrary limit. The total cadmium values for routine monitoring stations ranged from below 0.017 µg/L RDL to 0.048 µg/L with mean of 0.011 µg/L and most analytical results indicated cadmium concentrations better than the CWQG. However, several total cadmium exceedances of the hardness-adjusted CWQG limits were observed including *S1* (downstream of Pike Lake South) in October 2011 and at the Waldorf River WDR and Long Lake LL2 and LL3 sample locations in April 2012 samples.

Copper concentration for routine and April monitoring locations are generally below the Reportable Detection Limit (RDL). The CWQG threshold for copper concentration is based on hardness-adjustment. However, the minimum CWQG threshold for copper is 2 µg/L regardless of water hardness (Demayo and Taylor 1981) Therefore, the CWQG thresholds ranged from 2 µg/L – 2.6 µg/L. Based on the ½ DL convention (Clark, et al. 1998), a slight copper exceedances was observed at *L1* on October sample with a value of 2.4 µg/L which exceeded the CWQG minimum threshold of 2 µg/L.

The minimum CWQG threshold for lead is 1 µg/L regardless of water hardness (CCREM 1987). Similarly, the minimum threshold for nickel is 25 µg/L (IJC 1976). The concentrations for lead and nickel at all locations were below values of the CWQG thresholds. Total iron concentrations were all below the CWQG with the single exception of station *S2* in March sampling. Arsenic, uranium and $radium_{226}$ concentrations were well below their respective CWQG and/or MMER criteria.

Local Receiving Water Assimilative Capacity

<u>Existing Water Uses</u>

Existing water taking uses important to assimilative capacity assessments include extractive uses, effluent discharge uses, recreational uses, and water quality and ecological sensitivities.

In the PDA/LSA, no surface water discharges are known to occur. Local cabin domestic sewage effluent is expected to be routed through septic leaching beds, pits or to holding tanks for periodic effluent pump-out. No direct surface water effluent discharges are known to occur within the PDA/LSA.

The larger lakes in the Project site likely have the greatest potential as water supply sources for the Project. The approximate surface area of both the Long and Mills Lakes are 1150 ha and 510 ha respectively. The surface water field program was able to collect some bathymetric information for Long Lake, Mills Lake, Pike Lake South and Molar Lake which has been presented above.

Existing Net Assimilative Capacity

DOEC (2005) provides guidance on the development of receiving water quality objectives through the conduct of a receiving water study (RWS). The typical level of effluent treatment required for a new wastewater treatment plant (WWTP) in NL is secondary treatment with disinfection. The assimilative capacity is the water quality attenuation capacity between the baseline water quality of the receiver and the Canadian Environmental Quality Guidelines (CEQGs), of which the applicable guidelines in this case is the CWQG for the protection of freshwater aquatic life. Dilution ratios should be based on receiver flows at the 7Q20 low flow threshold and the peak hourly effluent discharge rate.

DOEC (2005) indicates the following mixing zone criteria.

No conditions within the mixing zone should be permitted which:

- Are rapidly lethal to important aquatic life (resulting in conditions which result in sudden fish kills and mortality of organisms passing through the mixing zones);
- Cause irreversible responses which could result in detrimental post-exposure effects;
- Result in bioconcentration of toxic materials which are harmful to the organism or its consumer; or
- Attract organisms to the mixing zones, resulting in a prolonged and lethal exposure period.

The mixing zone should be designed to satisfy the following conditions:

- Shall allow an adequate zone of passage for the movement or drift of all stages of aquatic life (specific portions of a cross-section of flow or volume may be arbitrarily allocated for this purpose);
- Shall not interfere with the migratory routes, natural movements, survival, reproduction (spawning and nursery areas), growth, or increase the vulnerability to predation, of any representative aquatic species, or endangered species;
- Eliminate rapid changes in the water quality, which could kill organisms by shock effects;

- Total loading from all mixing zones within a waterbody must not exceed the acceptable loadings from all point source discharges required to maintain satisfactory water quality; and
- Mixing zones should not result in contamination of natural sediments so as to cause or contribute to exceedances of the water quality objectives outside the mixing zone.

The mixing zone shall be:

- Free from substances in concentrations or combinations which may be harmful to human, animal or aquatic life;
- Free from substances that will settle to form putrescent or otherwise objectionable sludge deposits, or that will adversely affect aquatic life or waterfowl;
- Free from debris, oil, grease, scum or other materials in amounts sufficient to be noticeable in the receiving water;
- Located so as not to interfere with fish spawning and nursery areas;
- Free from colour, turbidity or odour-producing materials that would:
    - Adversely affect aquatic life or waterfowl;
    - Measureably alter the natural colour of the receiving water;
    - Directly or through interaction among themselves or with chemicals used in water treatment, result in undesirable taste or odour in treated water; and,
    - Free from nutrients in concentrations that create nuisance growths of aquatic weeds or algae or that results in an unacceptable degree of eutrophication of the receiving water.

Based on the work undertaken in this study, the Long Lake watershed is considered to have the greatest assimilative capacity for mine effluent discharge as illustrated in Table 16.23, however assimilative capacity is generally assessed on an individual parameter basis. As such the assimilative capacity of one parameter may be different from another. The full extent or boundary of the effluent mixing zone is therefore viewed as the dilution / assimilation zone required by the most conservative parameter to return to either baseline or CWQG conditions, whichever is greater. More detailed assessments of local receiving waterbody assimilative capacity are provided in Section 16.6, however Table 16.23 provides the instantaneous assimilative load capacity for Long Lake, Mills Lake, and Pike Lake South as measured by estimated 7Q20 outlet flow, for several selected MMER metal parameters based on the 75th% water quality presented in Table 16.22.

Table 16.23 Instantaneous Assimilative Capacity Load of Selected LSA Lakes (kg/s)

Parameter	Units	CWQG Guideline	75^{th}%	Long Lake	Mills Lake	Pike Lake South	Waldorf River
7Q20 flow	**m^3/sec**	**-----**	**-----**	**7.01**	**0.367**	**0.120**	**0.518**
Instantaneous Load				**kg/sec**			
Arsenic	µg/L	5	0.5	3.15×10^{-5}	1.65×10^{-6}	5.42×10^{-7}	2.33×10^{-6}
Copper	µg/L	2	1	7.01×10^{-6}	3.67×10^{-7}	1.20×10^{-7}	5.18×10^{-7}
Iron	µg/L	300	140	1.12×10^{-3}	5.86×10^{-5}	1.93×10^{-5}	8.29×10^{-5}
Lead	µg/L	1	0.25	5.25×10^{-6}	2.75×10^{-7}	9.04×10^{-8}	3.89×10^{-7}
Nickel	µg/L	25	1.0	1.68×10^{-4}	8.80×10^{-6}	2.89×10^{-6}	1.24×10^{-5}
Zinc	µg/L	30	5.2	1.74×10^{-4}	9.09×10^{-6}	2.99×10^{-6}	1.29×10^{-5}

Sediment Quality

Sediment quality is used to indicate long-term water quality conditions, potential historic contaminant releases, aquatic / benthic community potential and health, as well as the sensitivity of aquatic sediment to environmental changes. Sediment quality of Project-related sites is discussed in the following section.

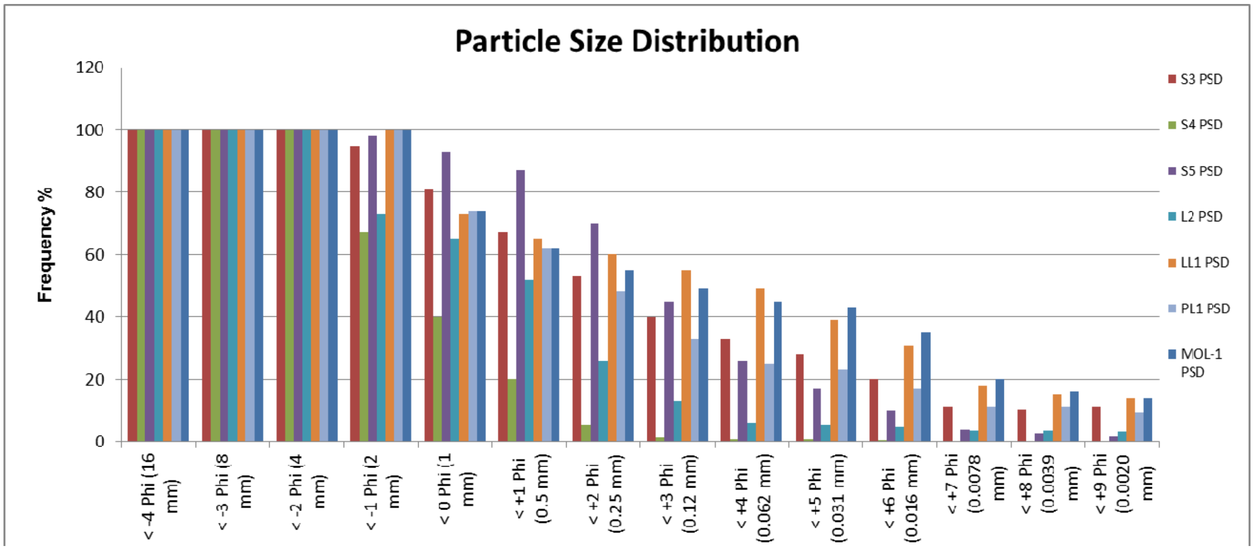
An initial sediment collection field visit was conducted in later November 2011. However, due to remote monitoring site transportation constrains which arose, only one sediment sample was collected at monitoring station *L2* on Long Lake. During the March 2012 field visit, three samples were collected from routine monitoring station *S3, S4* and *S5* (*S3* is at the small tributary upstream of Molar Lake, *S4* is at the stream connecting Molar Lake to Mills Lake and *S5* is located at the tributary that discharges to the southeast end of Long Lake). Another three samples from Long Lake, Pike Lake and Molar Lake were collected during an additional field visit in April 2012.

Sediment was sampled in accordance with CCME Canadian Sediment Quality Guideline (CSQG) for the Protection of Aquatic Life. Samples were submitted to Maxxam Analytics for laboratory analytical reporting. Laboratory analytical results for sediment samples are presented in Appendix V. Particle Size Distribution (PSD), inorganics, petroleum hydrocarbons (PHCs), and polycyclic aromatic hydrocarbons (PAHs) were analyzed for the sediment samples. Data were discussed with comparison to CSQG limits.

Particle Size Distributions

Sediment from routine monitoring station *S3* is described as silty sand with trace gravel and clay having grain sizes of 5.2% gravel, 61% sand, 23% silt as well as 10% clay. The PSD is plotted in Figure 16.21. The observed sand dominance was also observed at the rest of the six other sampling locations, including the southern end of Long Lake (*L2*), Long Lake (LL1), Molar Lake (MOL1), and Pike Lake (PL1), as well as the stream connecting Molar Lake and Mills Lake (*S4*) and the small tributary to Long Lake (*S5*). Note however that cobble and boulder class materials were also observed in all of the stream sampling locations. Stream monitoring station *S1* (outlet channel of Pike Lake South)and *S2* (inlet channel to Pike Lake South and channel draining Pike Lake South headwaters) were all visually observed to have a mix of gravel-cobble-boulder class materials in their channel beds. Finally, routine monitoring station *L1* on Mills Lake had a sand, gravel and cobble bed.

Figure 16.21 Particle Size Distributions for Routine Monitoring and April Field Visit Samples



<u>Metals</u>

Most metals concentrations from all sediment samples were below their respective CSQG Interim Sediment Quality Guideline (ISQG) and the Probable Effect Level (PEL). However, exceedances for the chromium ISQG value of 37.3 mg/kg were observed in samples from S3 in March, as well as LL1 and MOL1 in April. The chromium value for S3 in March sample is 48 mg/kg. As for LL1 and MOL1 April samples, the values are 65 mg/kg and 71 mg/kg, respectively. These values exceed the ISQG value of 37.3 mg/kg, but are still below the PEL value of 90 mg/kg. The sample from Molar Lake (MOL1) has slightly higher values for cadmium (0.65 mg/kg) and copper (37 mg/kg), which exceeded the ISQG values of 0.6 mg/kg (cadmium) and 35.7 mg/kg (copper), but well below the PEL values of 3.5 mg/kg (cadmium) and 197 mg/kg (copper). A summary of the metal concentrations for routine monitoring station and April field visit samples are presented in Table 16.24.

Table 16.24 Summary of Metal Concentrations for Routine Monitoring and April Field Visit Samples

Parameter	Units	CWQG Guidelines		Min	Mean	Max	75th
		ISQG	PEL				
Available Aluminum (Al)	mg/kg			1,500	7,880	23,000	12,250
Available Antimony (Sb)	mg/kg			**1**	1	**1**	1
Available Arsenic (As)	mg/kg	5.9	17.0	**1.0**	1.4	2.6	1.9
Available Barium (Ba)	mg/kg			17	213	860	278
Available Beryllium (Be)	mg/kg			**1**	1	**1**	1
Available Bismuth (Bi)	mg/kg			**1**	1	**1**	1
Available Boron (B)	mg/kg			**2.5**	2.5	**2.5**	2.5
Available Cadmium (Cd)	mg/kg	0.60	3.50	0.15	0.32	0.65	0.46
Available Chromium (Cr)	mg/kg	37.3	90.0	9.0	31.0	71.0	44.0
Available Cobalt (Co)	mg/kg			1.7	7.0	17	10.7
Available Copper (Cu)	mg/kg	35.7	197.0	**1.0**	11.6	37.0	15.5
Available Iron (Fe)	mg/kg			5,500	33,290	71,000	50,000
Available Lead (Pb)	mg/kg	35.0	91.3	1.1	4.1	16.0	4.6
Available Lithium (Li)	mg/kg			**1.0**	6.5	16.0	10.2
Available Manganese (Mn)	mg/kg			110	5,397	16,000	12,275
Available Mercury (Hg)	mg/kg	0.170	0.486	0.050	0.080	0.170	0.100
Available Molybdenum (Mo)	mg/kg			**1**	7	14	14
Available Nickel (Ni)	mg/kg			4.0	20.1	49.0	31.3
Available Rubidium (Rb)	mg/kg			**1.0**	6.0	19.0	5.0
Available Selenium (Se)	mg/kg			**1**	1	**1**	1
Available Silver (Ag)	mg/kg			**0.25**	0.25	**0.25**	0.25
Available Strontium (Sr)	mg/kg			5.0	15.8	39.0	21.8
Available Thallium (Tl)	mg/kg			**0.05**	0.33	0.81	0.47
Available Tin (Sn)	mg/kg			**1**	1	**1**	1
Available Uranium (U)	mg/kg			0.23	7.46	28.00	10.68
Available Vanadium (V)	mg/kg			7	20	42	28
Available Zinc (Zn)	mg/kg	123	315	8	54	130	86
Notes: **Bold** numbers are values under detection limits and adjusted to half values of detection limit for analytical purpose.							

Hydrocarbons

All BTEX constituent concentrations were below the detection level. PHC C1-C4 were at background level and reached baseline at C50. All PAH parameter concentrations were below the detection limit and CSQG threshold concentrations. Sediment quality results for all the sampling locations are presented in Table 16.25.

Table 16.25 Summary of Hydrocarbon Concentrations for Routine Monitoring and April Field Visit Samples

Parameter	Units	CCME Guidelines		Min	Mean	Max	75th
		ISQG	PEL				
Polyaromatic Hydrocarbons							
1-Methylnaphthalene	mg/kg			**0.0025**	0.0025	**0.0025**	0.0025
2-Methylnaphthalene	mg/kg	0.0202	0.2010	**0.0025**	0.0025	**0.0025**	0.0025
Acenaphthene	mg/kg	0.0067	0.0889	**0.0025**	0.0025	**0.0025**	0.0025
Acenaphthylene	mg/kg	0.0059	0.1280	**0.0025**	0.0025	**0.0025**	0.0025
Anthracene	mg/kg	0.0469	0.2450	**0.0025**	0.0025	**0.0025**	0.0025
Benzo(a)anthracene	mg/kg	0.0317	0.3850	**0.0025**	0.0025	**0.0025**	0.0025
Benzo(a)pyrene	mg/kg	0.0319	0.7820	**0.0025**	0.0025	**0.0025**	0.0025
Benzo(b)fluoranthene	mg/kg			**0.0025**	0.0025	**0.0025**	0.0025
Benzo(g,h,i)perylene	mg/kg			**0.0025**	0.0025	**0.0025**	0.0025
Benzo(j)fluoranthene	mg/kg			**0.0025**	0.0025	**0.0025**	0.0025
Benzo(k)fluoranthene	mg/kg			**0.0025**	0.0025	**0.0025**	0.0025
Chrysene	mg/kg	0.0571	0.8620	**0.0025**	0.0025	**0.0025**	0.0025
Dibenz(a,h)anthracene	mg/kg	0.0062	0.1350	**0.0025**	0.0025	**0.0025**	0.0025
Fluoranthene	mg/kg	0.1110	2.3550	**0.0025**	0.0025	**0.0025**	0.0025
Fluorene	mg/kg	0.0212	0.1440	**0.0025**	0.0025	**0.0025**	0.0025
Indeno(1,2,3-cd)pyrene	mg/kg			**0.0025**	0.0025	**0.0025**	0.0025
Naphthalene	mg/kg	0.0346	0.3910	**0.0025**	0.0025	**0.0025**	0.0025
Perylene	mg/kg			**0.0025**	0.7691	2.3000	1.4500
Phenanthrene	mg/kg	0.0419	0.5150	**0.0025**	0.0025	**0.0025**	0.0025
Pyrene	mg/kg	0.0530	0.8750	**0.0025**	0.0052	0.0200	0.0025
Surrogate Recovery (%)							
D10-Anthracene	%			79	84	92	86
D14-Terphenyl	%			91	102	130	105
D8-Acenaphthylene	%			76	79	82	80
BTEX & F1 Hydrocarbons							
Benzene	µg/g			**0.010**	0.049	**0.100**	0.100
Toluene	µg/g			**0.010**	0.049	**0.100**	0.100
Ethylbenzene	µg/g			**0.010**	0.049	**0.100**	0.100
o-Xylene	µg/g			**0.010**	0.049	**0.100**	0.100
p+m-Xylene	µg/g			**0.020**	0.097	**0.200**	0.200
Total Xylenes	µg/g			**0.020**	0.097	**0.200**	0.200
F1 (C6-C10)	µg/g			**5**	24	**50**	50
F1 (C6-C10) - BTEX	µg/g			**5**	24	**50**	50

Parameter	Units	CCME Guidelines		Min	Mean	Max	75th
		ISQG	PEL				
F2-F4 Hydrocarbons							
F4G-sg (Grav. Heavy Hydrocarbons)				440	743	1200	895
F2 (C10-C16 Hydrocarbons)	µg/g			**5**	28	50	50
F3 (C16-C34 Hydrocarbons)	µg/g			**5**	143	720	140
F4 (C34-C50 Hydrocarbons)	µg/g			**5**	48	240	50
Surrogate Recovery (%)							
1,4-Difluorobenzene	%			97	100	103	102
4-Bromofluorobenzene	%			85	101	109	108
D10-Ethylbenzene	%			87	98	110	99
D4-1,2-Dichloroethane	%			92	95	98	96
o-Terphenyl	%			84	104	127	115
Notes: **Bold** numbers are values under detection limits and adjusted to half values of detection limit for analytical purpose.							

Summary of Sediment Quality Conditions

Based on the analytical assessment, sediment qualities at routine monitoring stations (including *S3*, *S4*, *S5* and *L2*) and April sampling locations (including Long Lake, Pike Lake) are considered to be good and unimpaired. Only a few exceedances of ISQG for chromium, cadmium and copper values were observed from the Molar Lake April sample. Also samples from S3 and LL1 exceeded the chromium ISQG. However, the exceedances from Molar Lake, S3 and LL1 sample were well below the PEL values.

16.6 Assessment of Project-related Environmental Effects

Activities identified in Table 16.2 with a rating of 2 are considered to have the potential to affect local or regional groundwater or surface water resources either temporarily or permanently, and are further assessed in detail below.

16.6.1 Construction

16.6.1.1 Potential Environmental Effects

Groundwater - Changes in Quantity and Quality

As indicated in Table 16.2, the only Project activity during construction rated as a 2 for groundwater, and therefore requiring further assessment, is construction of the Rose Pit mine. The primary construction-related environmental effects on groundwater resources from this activity include short term to long term effects on local groundwater quantity and groundwater quality.

Groundwater quantity effects can include potential lowering of local water levels, with consequent reduction in water supply well levels within 500 m of the open pit mine, reduction in domestic well yield in proximity to Project activities due to blasting, and reduction in local streamflows due to shallow groundwater diversion caused by site excavation and construction activities. A related concern is the potential for diversion of surface water towards the Rose Pit or associated underground mine components in the event that intervening permeable overburden or bedrock structures are encountered, with consequent increase in dewatering requirements, and possible reduction in streamflow during the summer period.

Construction of the open pit mine, including overburden removal will involve ground disturbance, with the potential to cause changes in groundwater recharge, flow directions, or water quality.

Construction of the open pit mine is anticipated to result in the greatest degree of local groundwater disruption. This will include the removal and stock-piling of large volumes of silty sand glacial till overburden, with consequent dewatering of the overburden in the immediate vicinity of the pit head.

The open pit mine area will be isolated from overland drainage and shallow groundwater seepage through the overburden with trenches, collection ponds and other water management measures. During the pre-stripping activities, particular care will be taken to ensure that water collected within the open pit mine is pumped into a settling basin which will be built in advance of the construction work for the open pit mine site. This basin will also be used during operations to receive water pumped from the open pit to allow for settling of suspended solids prior to discharge to the environment. Part of this water will also be used for dust suppression where required and possible. As the mine development progresses, the degree of groundwater table decline within several hundred meters of the open pit mine will gradually increase in both overburden and bedrock.

Acid drainage and associated metal leaching from ore, waste rock or tailings is not expected to be an issue in the Project (Sections 15.4 and 15.6). Sulphide minerals are generally not prevalent in the geology of the Kami deposit (0.01 wt%) in 14 of 15 samples from the Sokoman Formation (BBA 2011), and the surrounding host rock (waste rock). While sulfide mineralization in the form of pyrrhotite identified by Project geologists within the Menihek formation in the Rose Pit area poses a small acid drainage risk; the acid neutralizing properties of the other rock types will mitigate this potential (Chapter 15). There have been no reported instances of acid generation by nearby mining operations in the past 40 years. Based on this, the risk of acid rock drainage is extremely low.

Surface Water – Changes to Quantity, Quality, and Drainage Patterns

The primary potential adverse effects to surface water during the Project construction phase include:

- Increased runoff from disturbed ground surfaces;
- Increased TSS from disturbed ground surfaces and potential for spills during construction;

- Increased erosion scour and sediment in watercourses;
- Water extractions for dust suppression, and construction activities and
- Watercourse alterations / realignments.

Surface water effects may include potential drainage pattern watercourse and waterbody alteration and realignment, flow reductions arising from water withdrawal or increases due to increases in imperviousness, reduction of vegetative cover, and dewatering of watercourses, and changes in water and sediment quality.

The potential effects resulting from Project construction to surface water quality, quantity and/or drainage patterns are summarized in Table 16.26.

Table 16.26 Construction Phase Potential Project Environmental Effects to Surface Water

Project Activities and Physical Works	Potential Environmental Effects		
	Change in Surface Water Quantity	Change in Surface Water Quality	Change in Surface Water Drainage Patterns
Construction			
Site Preparation (including clearing, excavation, material haulage, grading, removal of overburden and stockpiling).	These activities may increase runoff potential and reduce evapotranspiration and infiltration potential through increases in surface slope and surface hardening and compaction, surface disturbance and instability and vegetation removal. This is applicable to all Project site preparation areas. Water extractions for dust suppression, and construction could affect water quantity.	Site preparation and construction may increase erosion and sedimentation and the potential for spills and thereby degrade surface water quality. This is applicable to all Project site preparation areas.	Watercourse alterations, as well as changes to drainage patterns required at the start of operations, will be undertaken during construction. This includes alterations to two watercourses within the TMF and in the area of the processing mill, several watercourses within the Rose South Waste Rock Disposal Area and the headwater watercourse draining into Pike Lake South from the open pit.
Construction of Site Buildings and Associated Infrastructure (maintenance facilities, offices, plant, crushers, concentrator, conveyors, gatehouse, pump houses, substation, security fencing, sanitation system).			
Construction of Rose Pit Mine; grubbing, overburden removal.	Open pit mine construction will include tree removal and overburden stripping, which may affect evapotranspiration, infiltration and runoff potential, thereby affecting open pit mine area runoff as well as groundwater flow which may affect groundwater discharge (baseflow) to surface water features. Dewatering of overburden to facilitate stripping may reduce baseflows and overland flow.	Tree removal, overburden stripping and construction of a dam on Mid Lake may increase erosion and sedimentation and affect baseflow quality.	The watercourse connecting Mid Lake to Rose Lake and Rose Lake to Pike Lake South will require pipeline diversion to route headwater flows through the open pit mine footprint to Pike Lake South. Anticipated overburden trenching to dewater soils for stripping may change drainage patterns in the open pit mine footprint. Perimeter drains and ditches installed

Project Activities and Physical Works	Potential Environmental Effects		
	Change in Surface Water Quantity	Change in Surface Water Quality	Change in Surface Water Drainage Patterns
			around the open pit mine will route runoff around the open pit mine. A dam is proposed on Mid Lake to attenuate headwater flows through the diversion pipeline which will alter and attenuate natural headwater peak flow and baseflow characteristics.
Construction of Mine Tailings Management Facility	TMF construction will include tree removal and dam / dyke construction which may affect evapotranspiration potential, thereby affecting TMF area runoff as well as groundwater flow which may affect groundwater discharge (baseflow) to surface water features. Water extractions are required to initially charge the tailings and polishing ponds and fill the process water system during commissioning.	Tree removal and dam construction activities may increase erosion and sedimentation and affect baseflow quality.	The mine process water reclaim system is designed to reduce raw water withdrawal from Long Lake by maximizing runoff harvesting from the TMF. To do so, all runoff from the TMF watershed will be diverted to the tailings and polishing ponds which comprise the main process water supply reservoir system. Flows to TMF watercourse will be reduced by the loss of contributing flow.
Construction of Roads and Railway and Load-out Facilities	These activities include vegetation and overburden removal which may increase local runoff and affect groundwater baseflow discharge.	Linear infrastructure construction may increase erosion and sedimentation.	Linear infrastructure may alter overland flow patterns, baseflow discharge locations and watercourse alignment and flooding characteristics at stream crossings.

16.6.1.2 Mitigation of Project Environmental Effects

Groundwater

The following mitigation measures are proposed to minimize and mitigate Project-related effects on groundwater resources during the Project construction phase:

- Maintain natural drainage, where possible;
- Inspection of rock excavations for sulfide mineralization and implementation of ARD abatement measures if required; and
- Conduct perimeter and off-site water level monitoring (open pit mine, TMF site).

Surface Water

The following mitigation measures are proposed to minimize and mitigate Project-related effects on surface water during the site preparation and Project construction phase:

- Minimize construction footprint (i.e., PDA) to the extent possible;
- Implement erosion and sedimentation control (ESC) including installation of silt fencing and construction drainage ditches and sedimentation ponds to address construction phase watercourse erosion and water quality concerns;
- Design fill lines and general earthworks platform levels at elevations above the 100-year return period flood elevation;
- Construct the sedimentation ponds early in the construction phase to enable initial pond filling from runoff, construction phase sedimentation and use pond water for construction uses, such as dust suppression and cement batching;
- Prioritize consumptive raw water extraction sources to Long Lake for most construction phase uses, with lesser extractions subsequently from the Waldorf River and Mills Lake;
- Construct open pit mine and waste rock disposal area perimeter ditches; and
- Establish a site for equipment maintenance, repair, and cleaning that is at least 100 m from any lake, river, stream, or wetland.

In addition, the following measures will be followed in relation to access routes (e.g., roads, rail line, power easement):

- Avoid chemical, lubricant and fuel storage and fueling within the Protected Water Supply Area for Wabush;
- Fugitive dust suppression programs;
- Develop emergency response for spills;
- Maintain existing hydrological inflow to receiving waterbodies;
- Minimize drainage interactions and alterations; and
- Construct access roads and rail line cross drainage.

16.6.1.3 Characterization of Residual Effects

Groundwater

During initial stages of the open pit mine construction, dewatering following removal of overburden and waste rock will cause a decrease in the groundwater levels in the area immediately surrounding the mine. However, this is not expected to have any effect on any groundwater supply potential in the area. Therefore since no measurable or adverse effect is anticipated, the residual effects would be negligible.

Surface Water

Changes to surface water quantity during construction activities arise from Project alterations to the environmental water balance, such as tree removal reduction in evapotranspiration and surface hardening increases in runoff. These residual effects persist into operation and maintenance and are discussed further in Section 16.6.2. However, environmental water balance changes to the Long Lake ultimate receiving water system are relatively small and within the natural range of flow and water level conditions experienced in the system. Therefore since the effect is within the normal variability of baseline conditions, the residual effect is expected to be low.

Changes to surface water quality during construction are expected to be mitigated by the implementation of erosion and sedimentation measures. Water quality effects are expected to be contained and assimilated to either baseline or CWQG threshold criteria at the edge of effluent mixing zones within the LSA. Therefore, no net residual surface water quality effects are expected.

Changes to drainage patterns and watercourse alterations will be restricted primarily to the PDA with only minor effects extending into the LSA. No effects are expected to extend beyond the LSA. Therefore no net residual drainage pattern and watercourse alteration effects are expected.

16.6.2 Operation and Maintenance

16.6.2.1 Potential Environmental Effects

The main potential adverse effects to groundwater resources during mine operation and maintenance include potential dewatering of the overburden and bedrock aquifer surrounding the open pit, and potential release of contaminated seepages from the TMF.

Seepage from the TMF will migrate through overburden and shallow bedrock towards discharge points at the closest streams, lakes or wetlands. Based on the topography and drainage characteristics of the Project site, groundwater transport pathways from a source (such as the TMF) and a receptor stream or lake are likely to be short (less than a few 100 meters) and, in the absence of identified well users, the primary receptor of contaminated seepages from the TMF or waste rock areas is the surface water resource.

Effects on residential groundwater supplies during operations in the vicinity of Wabush, Labrador City or Fermont are likely to be negligible, primarily due to the absence of water supply wells located within close proximity to Project components, distance between the Project and potential well users, and the intervening lakes and watershed divides that would act as hydraulic as barriers.

It is anticipated that some water supply wells may be installed on the Project site to service specific components of the Project (e.g., offices, small facilities, etc.). While these wells would be more likely to be affected by Project activities, it is expected that they will be integrated into the Project groundwater monitoring system, and appropriate remediation (water treatment or well replacement) can be applied once an effect is detected.

During the operation and maintenance phase, potential adverse effects to surface water resources include changes to drainage patterns, changes to flow regimes, and water and sediment quality. The primary Project activities that will affect surface water are open pit mining, ore processing and water treatment, operation of the TMF, waste rock disposal areas and fuel storage and dispensing.

Water quantity effects may result from hydrological regime or water balance effects in major Project component areas arising from changes to runoff characteristics and Project water demands over a range of operating conditions and environmental conditions. Project water demands are expected to include:

- Process water uses;
- Sanitary water uses; and
- Dust suppression water uses.

Sanitary water uses are non-consumptive meaning that all the water taken for sanitary uses is cycled back to the environment after treatment. Sanitary water uses are generally continuous throughout the year. Most water used for dust suppression is non-consumptive, with the consumptive portion being lost to evaporation. Dust suppression water use peaks during the warmer snow-free season, with little need for dust suppression during the snow-cover season. Process water demand is the largest water demand of the Project and is proportionally related to annual ore production. Most water used in the process is mixed with tailings to produce a pumpable slurry that will freely drain from the TMF back to the tailings pond and polishing pond. However, a portion of the tailings slurry water is expected to be retained in the pore space of the tailings matrix and for the purposes of the Project water balance is considered to be a loss. Additional process water losses include concentrate moisture. As long as non-consumptive losses do not undergo a large time lag between the surface water taking and the return to the surface water environment, they can be viewed as not impinging on sustainable yield thresholds. However, consumptive losses occur as those portions of water withdrawal are not expected to be cycled back to the local surface water environment. These consumptive losses will be the focus of the surface water supply assessment.

Water quality may be affected as a result of:

- Increased TSS loading from disturbed and unstabilized ground surfaces and active work zones and its subsequent effects on sediment quality;
- The potential for ARD/ML to affect water quality;
- The potential for ammonia contamination from incomplete combustion of explosives materials; and
- The potential for red water generation.

Changes to drainage pattern and watercourse alterations will continue beyond the construction stage into operations and maintenance stage. Specifically, this is expected to occur as the open pit mine, TMF and waste rock disposal areas are expanded to their ultimate extent over the life of mine. Therefore this category of surface water effects are assessed in the following sections.

Effects Associated with the Open Pit Mine

Groundwater Effects

The main issues with respect to the open pit mine on groundwater resources include the potential for lowering of the water table in overburden and bedrock due to mine dewatering, blasting effects on any nearby drilled water wells, and interactions with nearby surface water sources.

Preliminary assessment suggests that the effects of mine dewatering will be limited to the watershed hosting the open pit. Drawdown effects are not expected to extend more than 1500 m from the open pit mine or into Québec. For example, the presence of Gleeson Lake, the small lake adjacent to the watershed divide west of the open pit mine, and large topographic elevation between the open pit mine and Lac Daviault (Water Resources Baseline Study [Appendix G]) mitigates this concern. Additional lakes (Mills, Long and Pike Lakes) within 1 km east and north of the open pit mine are expected to act as hydraulic boundaries for open pit mine dewatering effects.

It is likely that the water table in overburden and bedrock will be lowered substantively in the immediate vicinity of the open pit mine, declining in effect magnitude with distance from the mine. Because of distance, no existing well users are likely to be affected by the open pit mine. Proposed on-site operations wells may be affected by water table decline; however, these wells would be located and designed in consideration of this possibility, and they become part of the groundwater monitoring system. Any reductions in yield will be remediated with standard procedures (e.g., treatment, rehabilitation, deepening and replacement).

Blasting will be a necessary component of the open pit mining operation. Again, since no domestic supply wells are known to be located within a kilometer or more of the pit, blasting effects on wells are likely to be negligible. Effects, if any, are more likely to be experienced by on-site wells, which will be readily remediated through provision of silt filters, monitoring, maintenance, rehabilitation or replacement.

There is potential for local streams and lakes to positively affect the groundwater inflow of the open pit mine. Pending the completion of site specific hydrogeological investigations, the overburden could be the primary pathway between the open pit mine and the surface water bodies. The placement of a ring dyke system to redirect overland runoff away from the pit area, or a ring diversion trench at the base of the overburden cut at the high wall to intercept and redirect groundwater seepages emanating from the overburden are currently being considered.

Rose Pit Inflow Prediction

A preliminary estimate of potential open pit mine inflows from groundwater was made using the range of hydraulic conductivities provided for overburden and bedrock in the open pit area (Table 16.27). Table 16.27 summarizes estimated potential pit inflows from overburden and bedrock using the range of K available to date.

Table 16.27 Estimated Rose Pit Inflow

Overburden (Silty Sandy Till)	Hydraulic Conductivity m/s	Pit Perimeter m	Seepage Face m	Gradient	Flow (Q) m^3/hr	Flow (Q) m^3/day
Min	5.06E-07	8627	10	0.5	78.6	1,886
Max	1.81E-06	8627	10	0.5	298.1	7,156
Average	1.41E-06	8627	10	0.5	219.3	5,262
Min	3.17E-08	8627	10	0.5	4.9	118
Max	2.58E-06	8627	10	0.5	400.6	9,615
Average	1.01E-06	8627	10	0.5	156.8	3,764

Assuming a pit perimeter of 8,627 m, an average seepage face height of 10 m during operations and a conservative hydraulic gradient of 0.5 m/m towards the pit wall, the estimated inflow to the pit through the silty sand glacial till overburden material ranges from 1,886 m^3/day to 7,156 m^3/day with an average of 5,262 m^3/day. Using similar pit morphology assumptions and the K values from two packer tests and three wells crossing the till-bedrock interface (representative of deep till and bedrock), the estimated inflow to the pit through bedrock could range from 118 m^3/day to 9,615 m^3/day with an average of 3,764 m^3/day (575 igpm). It is assumed that the overburden inflows will be controlled by perimeter dykes and sumps, and that the bedrock inflows will be controlled by a sump system located within the open pit as it advances in depth.

A second estimate of potential mine inflow was generated using the Darcian approach: $Q = TiL$, where Q = inflow in m^3/day, T = transmissivity in m^2/day (hydraulic conductivity / aquifer thickness, or the mine depth), i = average regional hydraulic gradient in m/m, and L = effective width of the pit (i.e., 2750 m pit width plus about 35 %) in meters perpendicular to the dominant direction of regional groundwater flow. A preliminary estimate of inflow is: $Q=TiL$ = 41.5 m^2/d (assuming mean K of 1.2 x 10^{-6} m/s x 400 m bedrock mine depth) x 0.025 m/m estimated regional gradient x 3,700 m effective pit capture width = about 3,838 m^3/day (586 igpm), which is in the same order of magnitude as the preliminary seepage estimates above.

The above estimates should be considered as very preliminary, pending on-going hydraulic testing of the bedrock (packer tests and pumping tests). Only two bedrock packer tests with very consistent results have been done to date, and the bedrock seepage estimates can be further refined as new data becomes available over the ensuing year. A more accurate estimation could also be possible from a calibrated groundwater flow model.

Based on the above preliminary groundwater inflow estimates, it can be seen that groundwater seepage could average about 42% of the total expected mine sump inflow (i.e., rainfall plus groundwater seepage). Assuming a mean annual rainfall of 850 mm/year less 200 mm/year evaporation potential = 650 mm/year, and a pit capture area of approximately 3 km^2 (e.g., inside any perimeter water diversion measures), the rainfall component or total pit discharge could be the dominant water input requiring management (e.g., averaging 1.95×10^6 m^3/year).

An estimate of potential short term pumping requirements is also provided. Assuming a major storm event of 75 mm in 24 hours, a rainfall input of 225,000 m^3 (50 million imperial gallons) is theoretically possible within the proposed final pit footprint, which needs to be stored, managed and discharged over the ensuing few days to weeks. Daily groundwater seepage would add less than 2 percent to this theoretical volume.

Assuming that the seepage face would be similar as the mine depth progresses, and the pit perimeter increases gradually as mining progresses, additional estimates of potential pit dewatering requirements can be made for each phase of the mine development by pro-rating the above maximum with the open pit area at each stage.

Regional Effect of Rose Pit Pumping

An assessment of the potential for the open pit mine to affect Lac Daviault or residential wells farther southwest of the open pit mine on the opposite side of Lac Daviault in Fermont was performed.

One of the potential effects of a major open pit mining operation is the potential for regional water table lowering around the mining operation. This is usually an issue when residential or commercial water supply wells are present within the area contributing groundwater inflow to the open pit (usually about one kilometer from the pit wall). In the case of the Project, no residential wells (other than the proposed site wells) would be affected by this mine.

A secondary potential issue is the possibility of hydraulic interaction between the open pit mine and adjacent surface water bodies, including Pike, Rose, Mills, Long, Gleeson and Daviault Lakes. A potential also exists for water table lowering west of the Québec-Labrador border.

A conceptual cross-section through the open pit mine from west of Lac Daviault in Québec to east of Mills Lake in Labrador is illustrated in the Water Resources Baseline Study (Appendix G). This profile shows the original grade topography, the bedrock surface and the pre-mining (non-pumping) static water level. The maximum mining profile and a preliminary estimation of likely water levels is also shown.

Two aquifer dewatering effects are observed. In the silty sand glacial till overburden, the water table drawdown will likely describe an asymptotic curve that extends several 10s to 100s of meters from the pit wall as excavation proceeds; most of the indicated overburden will be removed. Seepage from proximal overburden will be collected in interception ditching to be diverted from the open pit mine, and discharged into the receiving water environment. The bedrock water table profile is expected to be much steeper than in overburden, attributed to the expected lower K of the rock mass, and could extend one to two kilometers east and west of the open pit mine. Based on this preliminary assessment, it is anticipated that Mills Lake on the east, Pike Lake on the North and Gleeson Lake on the west will act as hydraulic barriers to further development of water table drawdown. In the unlikely event that the bedrock drawdown extends beyond Gleeson Lake into Québec, Lac Daviault is also positioned between potential wells in the Fremont area and the open pit mine.

Surface Water Effects

The open pit mine will potentially affect surface water resources in the following ways:

- Surface water generation from the open pit mine footprint will be increased due to high runoff production, groundwater seepage and the need to collect and manage surface water runoff and groundwater seepage into the open pit;
- Potential excess dewater capacity can be used to provide dust suppression water and offset mine water demand;
- Full development of the open pit mine will require the removal of RP-01 (Rose Pond) a small local pond within the open pit mine footprint;
- Dewatering of the open pit mine may affect the water levels in local ponds RP-02 to RP-05 (referred to locally as Mid, Byrd, Elfie, Mid and End Ponds, respectively);
- Groundwater extraction (drawdown) wells around the perimeter of the open pit mine constructed to reduce groundwater seepage into the open pit mine can be used to offset potential water level effects on small local ponds RP - 02 to RP -05;
- The development of the western portion of the open pit mine will affect the location of the watercourse that connects RP-01 – RP – 05 to Pike Lake South. Upstream drainage can be provided through construction of a watercourse diversion along an open pit mine slope bench, or construction of a conveyance pipe along an open pit mine bench. To avoid open pit mine flooding effects, runoff attenuation facilities, such as a stormwater pond, may be required to provide temporary storage for RP-02 – RP-04 streamflow upstream of the open pit mine;
- Watercourse diversion or bypass piping will ensure that flooding and erosion and sedimentation are minimized;
- Open pit mine runoff and groundwater seepage management will accommodate the 1:100 year flood event through provision of appropriately sized sedimentation pond(s) near the open pit mine perimeter;
- Open pit mine water quality concerns relate to potential ARD/ML, red water production, ammonia from uncombusted explosives and general sedimentation requirements;
- Open pit mine sediment quality concerns relate to potential deposition of suspended sediment from open pit mine dewatering, increased overall surface water discharge rates from the open pit mine footprint resulting in erosion and scour or reduction in discharge flows due to mine water use limiting receiving watercourse potential to provide self-flushing and existing condition sediment transport; and
- Use of appropriately sized sedimentation ditches and ponds.

Changes in Surface Water Quantity

Section 16.5.2 presented the existing condition water balance for the PDA representing the open pit mine. Based on climate normal conditions, the annual average streamflow generated by the open pit mine footprint is estimated at approximately 172.3 m^3/h. Under operations and maintenance conditions, the water balance for the open pit mine will change in that the streamflow coefficient will increase from approximately 63% in the existing condition to 100%. This increase in streamflow within the open pit mine arises from several factors, including:

- Removal of vegetation;
- Removal of most overburden;
- Steep overburden sloping to bedrock increasing runoff coefficient;
- Open pit mine requirement to collect and dewater surface runoff to the 1:100 year storm level to avoid pit and pit equipment flooding, maintain mining operations and ensure human safety;
- Minimization of time duration between runoff generation in the open pit mine and dewatering thus minimizing the potential for evaporation; and
- Snow sublimation on open pit mine slopes, however sublimation effects will be minimal in light of the annual water balance based on existing conditions and will be further minimized in the open pit mine due to shading and open pit mine cold thermal capture.

Therefore, the use of a 100% streamflow runoff coefficient for the open pit mine is considered conservative and appropriate and will contribute 273.4 m^3/h under climate normal conditions.

In addition to surface runoff from precipitation, groundwater seepage to the open pit mine will require dewatering as indicated above. Development of the open pit will commence with overburden removal to bedrock in the construction and early years of operation. Based on the proposed mine plan of operating at 8 Mtpa during years 1 – 4 and 16 Mtpa for years 5 – 17, overburden removal is expected to continue until year 9 of operations at which point the open pit is expected to have reached its ultimate surficial extent. Vertical development of the open pit will continue into bedrock over the entire life-of-mine.

Baseline groundwater information from empirical testing indicates that seepage through overburden may range from 1886 – 7156 m^3/d with an average of 5262 m^3/d and seepage through till / bedrock faces in the open pit may range from 118 – 9615 m^3/d with an average of 3764 m^3/d. Open pit seepage assessment based on the Darcian approach indicates that groundwater seepage to the pit may be approximately 3838 m^3/d. Therefore, for the purposes of including groundwater seepage into the open pit water balance the Darcian estimate is assumed at 3838 m^3/d (160 m^3/h).

Water in the ore is considered in the process water balance and is estimated at 41 m^3/h and 82 m^3/h in the 8 and 16 Mtpa concentrate production levels. However, as ore water represents about 10% *in-situ* water content it is not considered in the open pit mine water balance.

The total operational case open pit mine water balance is estimated to require an average dewatering rate of 433.9 m^3/h under climate normal conditions. Comparing the existing condition climate normal total streamflow of 172.3 m^3/h to the operational case climate normal total open pit mine dewatering rate of 433.9 m^3/h represents an increase in streamflow to Pike Lake South of 261.6 m^3/h. The watershed catchment area upstream of the open pit mine watercourse (Sub-watershed Node #15 in Table 16.14) is estimated at 583 ha and the existing condition climate normal mean annual streamflow is estimated at 359.7 m^3/h (10 L/s). Typical open pit mine dewatering will increase flow to Pike Lake South to 621.3 m^3/h (17.3 L/s) or approximately 73%.

The design case wet and dry conditions are the 1:100 wet and dry years derived by log-normal statistical determination of return period annual precipitation and distributed proportionally to the climate normal year. The 1:100 wet and dry years are presented in Table 16.12 and 16.13. Under design wet and dry year conditions, the surface runoff would be an average of 374.1 m^3/h and 198.7 m^3/h, respectively. Groundwater seepage would be relatively constant in a wet, normal or dry year due to the low groundwater recharge potential. Therefore, during design wet and dry year conditions, groundwater seepage is expected to be 3838 m^3/d. Therefore, the design wet and dry year total dewatering of the open pit mine for collected surface water and groundwater is expected to be 539.9 m^3/h and 358.6 m^3/h, respectively. Table 16.28 presents the operational case water balance for the open pit mine. Appendix W presents monthly water balance tables for the design wet and dry years.

Table 16.28 Monthly Runoff and Dewatering Pumping Rate Estimation from Rose Pit During Climate Normal Conditions

Month	Existing Condition	Operational Condition			
	Runoff Volume (m^3)	Runoff Volume (m^3)	Seepage Volume (m^3)	Total Volume (m^3)	Pumping Rate (m^3/hr)
Jan	20,848	33,156	118,978	152,134	205
Feb	10,419	16,570	107,464	124,034	185
Mar	5,204	8,277	118,978	127,255	171
Apr	2,892	4,600	115,140	119,740	166
May	227,227	361,370	118,978	480,348	646
June	266,519	423,857	115,140	538,997	749
July	245,546	390,503	118,978	509,481	685
Aug	218,965	348,230	118,978	467,208	628
Sept	217,949	346,614	115,140	461,754	641
Oct	170,840	271,695	118,978	390,673	525
Nov	81,652	129,855	115,140	244,995	340
Dec	40,836	64,944	118,978	183,922	247
Annual	1,508,898	2,399,671	1,400,870	3,800,541	434

The design storm event used for sizing surface runoff management facilities is the 1:100 year, 24-hour storm event. The Wabush Airport (Stn. 8504175) IDF tables indicate that 1:100 year, 24-hour storm to be 67 mm of precipitation (Table 16.9). Again, conservatively assuming a 100% runoff coefficient and minimal initial abstraction, the total volume of surface runoff generated by the 1:100 year storm is estimated at 186,930 m^3. The groundwater seepage contribution during the 1:100 year storm is estimated at 160 m^3/h and would add approximately 3838 m^3 to the total volume of runoff generated from the storm event. The total runoff and seepage volume generated by the 1:100 years, 24-hour event is therefore, estimated at 190,768 m^3. The 1:100 year peak runoff rate is estimated by the Rational Method to be 1.6 m^3/s. The peak groundwater seepage rate is estimated as the peak hourly rate resolved to be 0.044 m^3/s.

Changes in Surface Water Quality

There are four potential effects from the open pit that may adversely affect surface water quality and aesthetic conditions in the LSA. These include:

- Sedimentation;
- Acid Rock Drainage / Metal Leaching;
- Ammonia contamination; and
- Red water.

Other potential water contamination vectors exist, such as hydrocarbon contamination from oil spills, and are considered in Section 16.8 under Accidents and Malfunctions.

Sedimentation

Within the open pit mine, sedimentation is caused primarily from runoff over exposed overburden and freshly exposed bedrock. Small rock particles are also generated from the open pit mine blasting and excavation processes as well as the rock pulverization arising from equipment movement along the floor of the open pit mine. Other factors such as freeze-thaw action will mechanically degrade bedrock to finer rock particles. Sedimentation arises from the entrainment of mostly inorganic rock and overburden soil particles in the dewatering process. High sediment or TSS load in mine effluent is considered a deleterious substance and when suspended in the water column can inhibit the ability of fish to forage, decrease water column light penetration and inhibit the growth of submerged aquatic plants. When high sediment loads settle out they can affect sediment quality, inhibit fish egg incubation and degrade benthic habitat.

The design criteria for TSS in mine effluent is 15 mg/L derived from MMER. The open pit mine will generate TSS from mine dewatering in excess of 15 mg/L. The TSS concentration will be a function of the proportion of surface water: groundwater being dewatered. Groundwater seepage is generally low in TSS, whereas surface runoff, especially during and after high intensity rainfall / runoff events, can be quite high in TSS. Therefore, if groundwater seepage collection is managed to avoid the potential to entrain surface particles, TSS sedimentation becomes largely an intermittent activity focused on settling after rainfall and melting events. The design peak TSS concentration expected from the open pit mine is expected to be approximately 300 mg/L, based on experience at other open pit mining operations.

Acid Rock Drainage / Metal Leaching

ARD/ML usually occur through reactions of oxygen and water with metal sulphides which form naturally at elevated concentrations in many types of deposits. However, ARD will not occur if host geologic materials contain enough carbonate minerals to neutralize the acid as it is generated. Thus, both acid generating and acid neutralizing components must be considered in determining the ARD potential.

To estimate the ARD potential, lithology of the Rose Lake deposit was examined (BBA 2011) and historical information was reviewed (Stantec 2009). Process water from the metallurgical testing was analyzed for routine parameters and metals. A phased ARD/ML testing (MMER 2002; CCME 1999; Price 2009) of geologic materials from the site was also undertaken. Twelve (12) samples of concentrate and tailings that had been generated from the Rose Lake deposit during metallurgical testing were tested for ARD/ML potential. The samples were submitted to a certified laboratory for Acid-Base Accounting (ABA) to measure the potential for ARD and Shake Flask Extraction (SFE) to measure the potential for ML. Eighty samples including representatives of overburden, open pit walls, waste rock and ore will be selected for ARD/ML testing from drill cores using visual descriptions.

The Rose Pit lithology is comprised of the following formations, including Menihek, Sokoman (Wabush) Iron, Wishart (Carol) and Denault (Duley). As indicated in Chapter 15, the Menehek formation contains very small and isolated amounts of acid-generating sulphidic material, including pyrrohite and pyrite. Pyrrhotite is of particular concern in the open pit mine because although it may only yield about 10% of the acid-generating potential that the more common pyrite generates, it can do so up to 100 times faster and therefore is important in the open pit mine context where ore and waste rock will be blasted out and exposed for short periods prior to removal. However, based on the limited and isolated extent of sulphidic materials and the fact that other formations contain large amounts of acid-neutralizing materials, such as calcite, dolomite and ankerite, the potential for ARD is considered to be low.

As indicated in Chapter 15, pit lakes in closed iron ore mines in the Schefferville area did not show any evidence of ARD/ML, nor did historical monitoring records from two local iron ore mines. Therefore, the open pit mine component of the Project is not expected to generate any adverse environmental effects associated with ARD/ML. From the historical review, the same conclusion can be made about waste rock disposal areas, overburden stockpile and the open pit mine. These findings will be supported by ongoing tests of the drill cores and overburden from the Project. Chapter 15 provides a complete overview of the ARD/ML assessment undertaken for the Project.

Ammonia Contamination

Incomplete combustion of explosives used in open pit mining may result in contamination of open pit mine surface runoff and groundwater. The following discussion describes the methodology and assumptions used to estimate average monthly concentrations of nitrogen species in the discharges from the open pit mine during the operational phase.

Two cases of mine operation are considered in nitrogen species estimates. They reflect a base case with 8 Mtpa of concentrate production capacity and a case with an increase in production up to 16 Mtpa after year 5. Ore and waste rock production rates for these cases are shown in Table 16.29. Explosive application rates used for waste rock and ore are expected to be 0.18 kg/tonne and ore 0.23 kg/tonne, respectively (Fitch 2012, pers. comm.). Section 16.6.2 presents the finding of a similar nitrogen species assessment for the waste rock disposal areas.

Table 16.29 Average Monthly Production of Ore for 8 Mtpa and 16 Mtpa

Year	Scenarios 1 and 2, 8 Mtpa		Scenarios 3 and 4, 16 Mtpa after fifth year	
	Waste rock	Ore	Waste rock	Ore
Pre-Prod	2,566,173	365,198	2,566,173	365,198
1	5,750,000	1,447,098	5,750,000	1,447,098
2	7,560,970	1,829,398	7,560,970	1,829,398
3	6,829,110	1,806,684	6,829,110	1,806,684
4	6,745,192	1,805,507	6,745,192	1,805,507
5	5,771,898	1,821,155	11,624,254	3,642,309
6	4,953,763	1,813,414	10,383,871	3,642,309
7	4,283,425	1,814,650	7,829,344	3,642,309
8	3,722,761	1,802,748	6,615,534	3,642,309
9	3,545,490	1,808,771	6,257,429	3,642,309
10	2,794,448	1,808,771	4,965,875	3,642,309
11	2,183,312	1,804,078	3,879,855	3,642,309
12	1,267,060	1,810,349	2,573,291	3,642,309
13	816,651	1,810,342	2,549,617	3,642,309
14	357,669	1,860,151	2,549,617	3,642,309
15	142,434	1,860,151	728,462	3,642,309
16	30,707	769,028	364,231	3,642,309
17	no production		285,507	2,855,070

The potential for contamination of open pit mine water with residual nitrogen species was evaluated using the empirical method of Ferguson and Leask (1988). The method is based on the ratio of ANFO (Ammonium Nitrate with Fuel Oil) / slurry in explosives. In the Project, no slurry will be used according to BBA (Pers. Comm. 2012a). Therefore, the nitrogen loss from the explosives was conservatively assumed to be equal 0.2%, which was set by Ferguson and Leask (1988) for use of 100% AFNO. Currently proposed explosives are an emulsion (100%), which should result in even lower nitrogen loss than ANFO (Fitch 2012, pers. comm.). Nevertheless, the 0.2% value was conservatively used in the calculations of nitrogen loss from the mass of the explosives.

Nitrogen release from the open pit mine site was shown to be dependent on the annual hydrological cycle. For climatic conditions similar to Kootenay, B.C., Ferguson and Leask (1988) recommended quarterly distribution of annual nitrogen load in effluent as shown in Table 16.30. These values were slightly modified to match the hydrological cycle observed at the Project site. The modified values for each season were used to calculate the nitrogen release rate coefficient for each month (Table 16.30).

Table 16.30 Nitrogen Release Rates

<table>
<tr><th rowspan="2">Month</th><th>Ferguson and Leask (1988)</th><th colspan="2">This Study</th></tr>
<tr><th colspan="2">Release in % Annual Nitrogen Load</th><th>Rate coefficient (r)</th></tr>
<tr><td>Jan</td><td rowspan="3">5</td><td rowspan="4">5</td><td>0.15</td></tr>
<tr><td>Feb</td><td>0.15</td></tr>
<tr><td>Mar</td><td>0.15</td></tr>
<tr><td>Apr</td><td rowspan="3">77.5</td><td>0.15</td></tr>
<tr><td>May</td><td rowspan="4">75</td><td>2.25</td></tr>
<tr><td>Jun</td><td>2.25</td></tr>
<tr><td>Jul</td><td rowspan="3">7.5</td><td>2.25</td></tr>
<tr><td>Aug</td><td>2.25</td></tr>
<tr><td>Sep</td><td rowspan="4">20</td><td>0.6</td></tr>
<tr><td>Oct</td><td rowspan="3">10</td><td>0.6</td></tr>
<tr><td>Nov</td><td>0.6</td></tr>
<tr><td>Dec</td><td>0.6</td></tr>
</table>

Equation [1] was used to calculate monthly nitrogen losses associated with ore and waste rock blasting residual nitrogen for the open pit mine and waste rock disposal areas:

$$M_N = (R_{WR} \times M_{WR} + R_O \times M_O) \times L_N \times P_E \times F \times r \qquad \text{Eqn [1]}$$

Where:

M_N – monthly nitrogen release (kg);

M_{WR} and M_O – monthly production of waste rock and ore (tonnes; Copeland 2012, pers. comm. ,);

R_{WR} and R_O – explosive application rate used for waste rock (0.18 kg/tonne) and ore (0.23 kg/tonne), respectively (Fitch 2012, pers. comm.);

L_N – 0.002 nitrogen loss as 0.2% of total N used, dimensionless;

P_E – mass portion of nitrogen assumed to be 1/3 of the explosive (emulsion) mass (Bailey, et al. 2012). Dimensionless;

F – fraction of nitrogen leached either in pit or in disposal area assumed to be, 2/3 and 1/3, respectively. Usually, higher nitrogen loadings are associated with mine water than with runoff from waste rock due to fast dissolution of blasting residues (Matts, et al. 2007). Therefore, it was arbitrary assumed that 2/3 of lost nitrogen would leach into mine water, while a third of nitrogen lost in waste rock (no contribution from ore) would be released from the disposal areas. Dimensionless; and

r – monthly nitrogen release rate coefficient (Table 16.30), dimensionless.

Monthly nitrogen losses were used as an input for calculation of total nitrogen concentrations in mine water and the effluents from waste rock disposal areas. Taking into account assumptions discussed above, total concentrations of nitrogen in effluents were calculated as follows:

$$C_N = M_N\, 1000/V_i \times D_{WR} \qquad \text{Eqn [2]}$$

Where:

C_N – average monthly concentration associated with mine water or discharge from ether disposal area or the pit, mg/L;

M_N – monthly nitrogen release from either waste rock disposal area or the pit (kg);

1000 – conversion factor from kg/m3 to mg/L;

V_i – average monthly volume of runoff from disposal area or mine water from the pit; and

D_{WR} – multiplier used to account for waste rock deposition scenarios as shown in Table 16.31.

Table 16.31 Multiplier Used to Account for Waste Rock Deposition Scenarios at Different Nitrogen Sources

Deposition Scenario[1]	Nitrogen Source		
	Rose North Waste Rock Disposal Area	Rose South Waste Rock Disposal Area	Pit
Waste rock in Rose North and Rose South Waste Rock Disposal Areas	122/(537+122)	537/(537+122)	1
	0.185	0.815	1.000

Note:
[1] In addition to the expected proportional deposition of overburden and waste rock to the north and south waste rock disposal areas, a second deposition scenario was assessed in which all overburden would be deposited in the Rose North Waste Rock Disposal Area and all waste rock deposited in the Rose South Waste Rock Disposal Area.

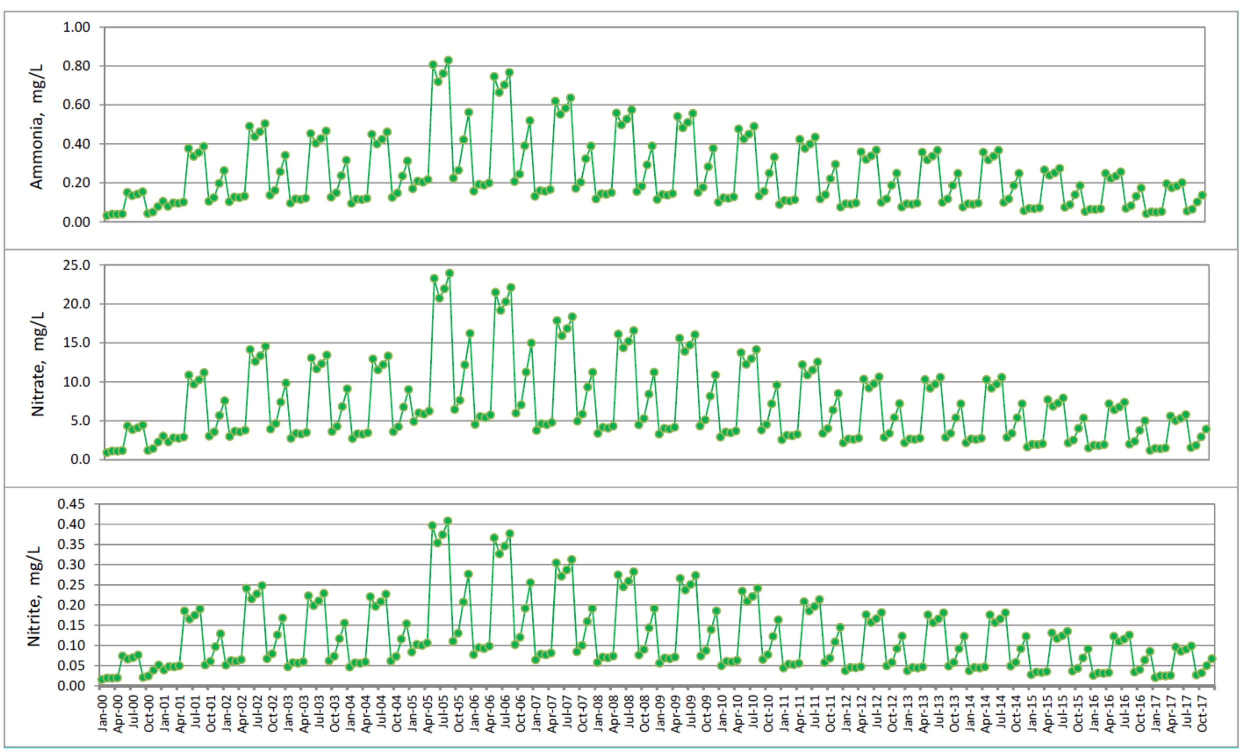
In order to speciate nitrogen, the proportions nitrate (87%), ammonia (11%), and nitrite (2%) recommended for effluents by Ferguson and Leask (1988) were used. The spectated nitrogen concentrations were converted into the final concentrations of species according to their molecular mass.

Regulatory criteria for nitrogen species effluent is indicated in Table 16.32. There are no MMER criteria for nitrogen species release, therefore the CWQG is used as a mixing zone boundary condition and the Newfoundland and Labrador Environmental Control Water and Sewerage Regulation 65/03 Schedule A is used as the effluent criteria. Monthly concentrations of nitrogen species in discharges from the open pit mine, and the disposal areas were calculated for the years 1 - 4, 8 Mtpa and years 5 – 17, 16 Mtpa operational cases with results discussed below and presented in Figure 16.22. Section 16.6.2 presents the results of nitrogen assessment for the waste rock disposal area.

Table 16.32 Regulatory Criteria for Nitrogen Species in Mine Effluent

Nitrogen Species	Regulatory Criteria (mg/L)	
	CWQG	NL Reg. 65/03, Schedule A
Ammonia	1.916 – 0.855 (Temp. 0 – 10 ºC)	2
Nitrate	13	10
Nitrite	0.197	Not Indicated

Figure 16.22 Estimated Average Monthly Concentrations of Nitrogen Species in Open Pit Mine Dewater



The nitrogen assessment indicates that nitrogen species release to mine dewater peaks in operational year 5 and 6. Ammonia concentrations are well below regulatory effluent criteria in all years. Nitrate concentrations are expected to exceed NL Reg. 65/03 Schedule A effluent criterion during the May – August period annually from year 1 through to year 13 of operations. Nitrate concentrations are expected to peak at up to 25 mg/L in operational year 4, and nitrite concentrations may exceed CWQG from operation years 2 – 11 with expected nitrite peaks of 0.40 mg/L occurring in operational year 5. This will be mitigated through an ammonia contamination program.

Red Water

Red water is a tailings effluent condition associated with iron ore mining and processing. When iron ore tailings come in contact with water, the iron precipitation and staining processes occur and results in the red discoloration of water due to very fine particulate suspension. At other iron ore mining operations in the Labrador City, Wabush, NL and Fermont, Québec area, the red water condition is associated with tailings effluent and is not an issue associated with waste rock or open pit runoff. The red water condition is not associated with acid rock drainage and is associated with very fine colloidal reddish iron mineral or iron stained quartz / silica particles in suspension. As a result, red water is not considered to be a potential concern at the open pit mine. It is further discussed under the assessment of effects associated with the TMF.

<u>Change in Surface Water Drainage Patterns</u>

Development of the Rose Pit over the life-of-mine will alter local drainage patterns, require a watercourse alteration, and will require mitigation.

Drainage patterns in the open pit mine catchment area will be altered through the lateral development of the open pit mine. This will include two components including the collection and dewatering of all incident precipitation – runoff within the open pit mine footprint and the construction and maintenance of open pit mine perimeter ditching to prevent overland flow into the open pit mine. The hydrological effects will be related to the change in water balance described previously due to the increase in runoff coefficient and reduction in evapotranspiration associated with open pit mine development. Drainage patterns in the headwater area upstream of the open pit mine are not expected to change.

Watercourse alteration will take several forms, including lake removal, watercourse diversion, as well as potential change in baseflow and water level characteristics. Development of the open pit mine will require the removal of Rose Lake. A watercourse alteration is planned to convey the existing watercourse connecting Mid Lake to Rose Lake to Pike Lake South around the inside pit perimeter to prevent external drainage into the open pit mine. Also associated with the proposed watercourse diversion will be a small dam proposed at the south end of Mid Lake to attenuate design storm runoff events to be conveyed around the open pit mine in the downstream watercourse diversion. Open pit mine groundwater seepage collection and dewatering may alter upstream headwater watercourse baseflows within the open pit mine's hydrogeologic zone of influence. The existing condition assessment indicated that baseflow was an important contributor to the annual hydrograph for watercourses in the LSA. Similarly, there is potential for open pit mine surface and groundwater dewatering to affect the water levels in the small headwater lakes referred to as Mid Lake, Elfie lake, End Lake and Byrde Lake.

Effects Associated with the Tailings Management Facility and Effluent Treatment Infrastructure

The TMF is situated between Riordan Lake on the east, Waldorf River on the west, and Long Lake to the north (Figure 16.23). An effluent characterization report indicates that tailings from mines in the local area were generally non-toxic and non-acidic, and no effects on freshwater ecology were known. The main issue is red-discoloration, which is typically treated with a flocculent to remove iron in settling ponds.

The TMF is proposed to cover an area south of the processing and concentrator facilities of approximately 948 ha at its ultimate extent. The TMF will include dams, dykes, tailings impoundments, a tailings pond and a polishing pond. The progressive phases of the TMF development are depicted in Figure 16.23. The TMF will include a starter phase to accommodate tailings disposal for years 1 - 3 at a tailings area of 282 ha and then an ultimate expansion for years 4 - 17 to a tailings footprint of 763 ha. The tailings will be discharged via spigots into the TMF and allowed to drain naturally.

Tailings will initially be dewatered at the mill via a dewatering cyclone, which will separate the coarse and fine tailings. The coarse tailings resemble a silty sand, range in size between 150 to 200 µm and upon dewatering, will be deposited, whereas, fine tailings are less than 100 µm. Fine tailings will move to the cyclone overflow and will be directed to the plant thickener for further dewatering. A flocculant and coagulant will be used for thickening the fine tailings, resulting in 45% solids by weight, before pumping to the TMF. Under the 8 and 16 Mtpa production regimes, process water content in tailings slurry accounts for 2041 and 4083 m^3/h, respectively. Tailings specific gravity is estimated at 2.9 and a void ratio of 1 is used for TMF design purposes. Tailings water that will remain in pore spaces is expected to account for approximately 28.2% of the total water content of tailings slurry. The residual tailings water is assumed to be a consumptive water demand. The primary source of process make up water to offset the tailings water consumptive demand is runoff harvesting from the TMF area. Long Lake will provide a secondary source and will also be used to supply make up water for specific process clean water requirements. Figure 16.24 and 16.25 present the process water balances for 8 Mtpa and 16 Mtpa operational cases, respectively. Integration of the environmental water balance into the process water balance is discussed later in this section.

Two alternatives are currently being considered with respect to the polishing pond. Both alternatives for red water treatment are detailed in Section 2.5. Other treatment alternatives may also be investigated in the course of feasibility level and detailed design engineering.

Figure 16.23 Starter and Final TMF Layout

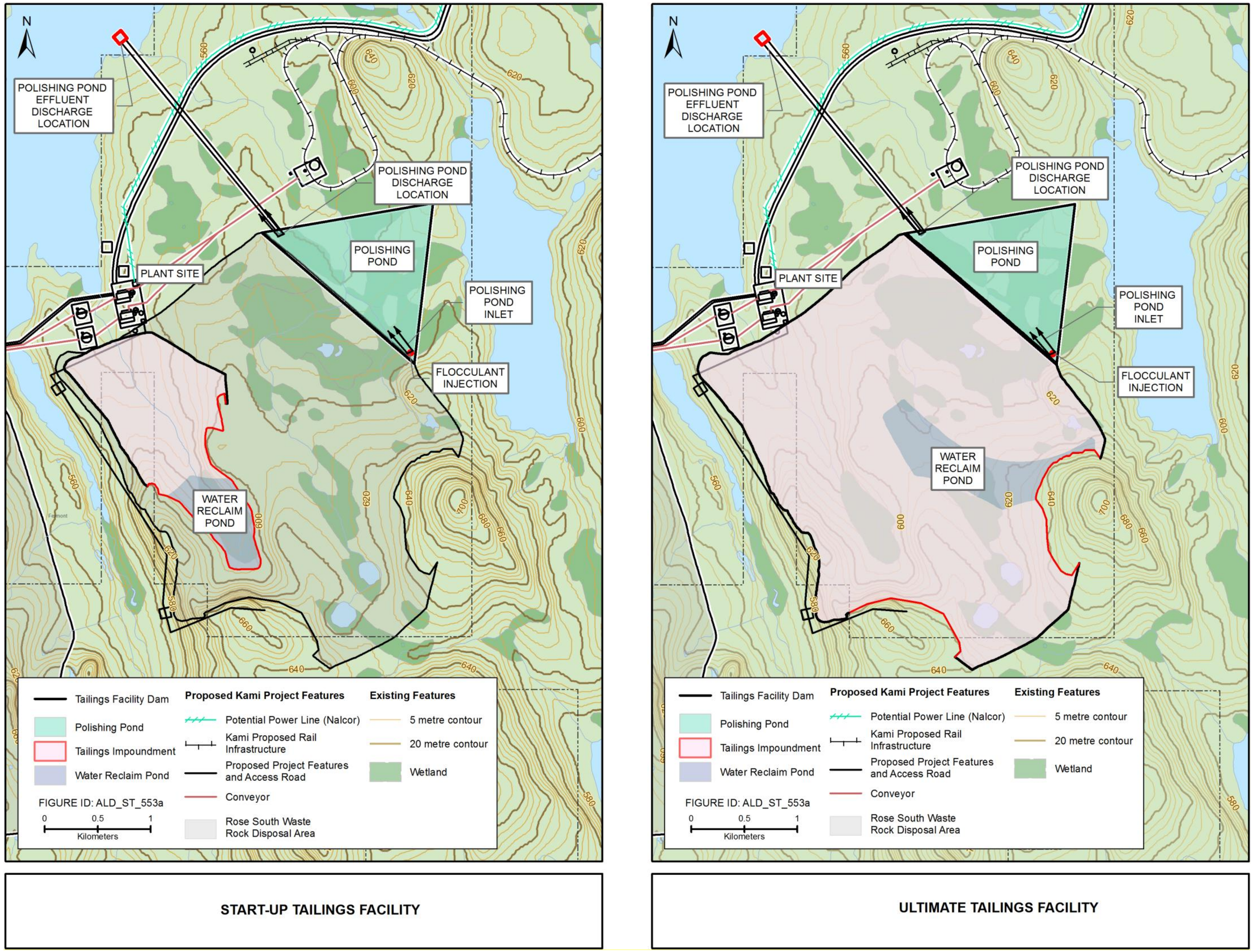
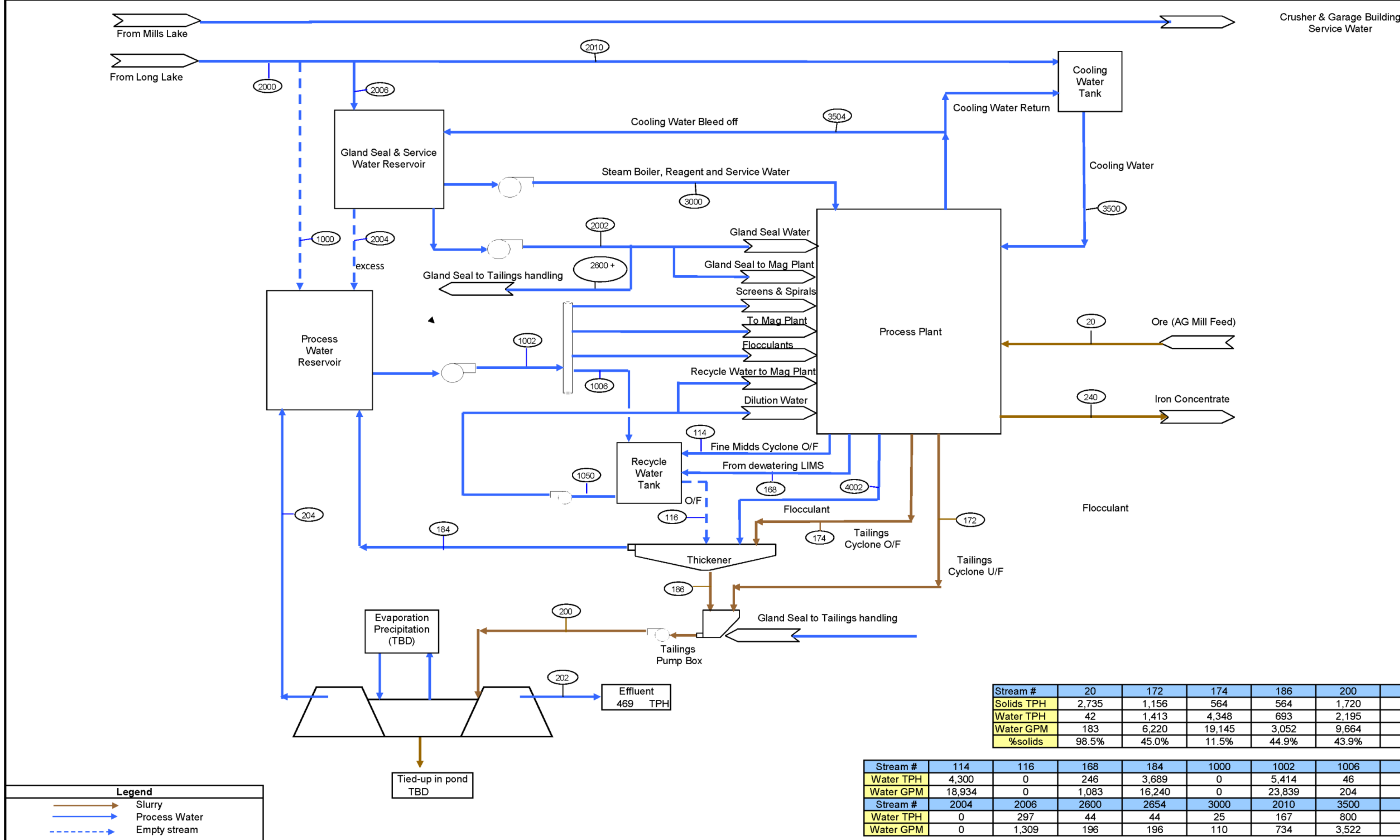


Figure 16.24 Process Water Balance at 8 Mtpa Production

KAMI Iron Ore Project - Feasibility Study	Design by BBA		Project # 3054001				
Preliminary Water Balance		Rev.	Description	Date	By	Reviewed by	Approved by
(based on 2850 tph fresh feed for 8.00 MT/y concentrate and at mill utilization 90%)		RA	For information	29/11/2011	FL	FL	AG
3054001-0000000-49-D12-0002-R03		...	...	...	..		
		R2	For Information	18/07/2012	JB	FL	AG
		R3	Effluent stream adjusted	26/07/2012	JB	FL	AG



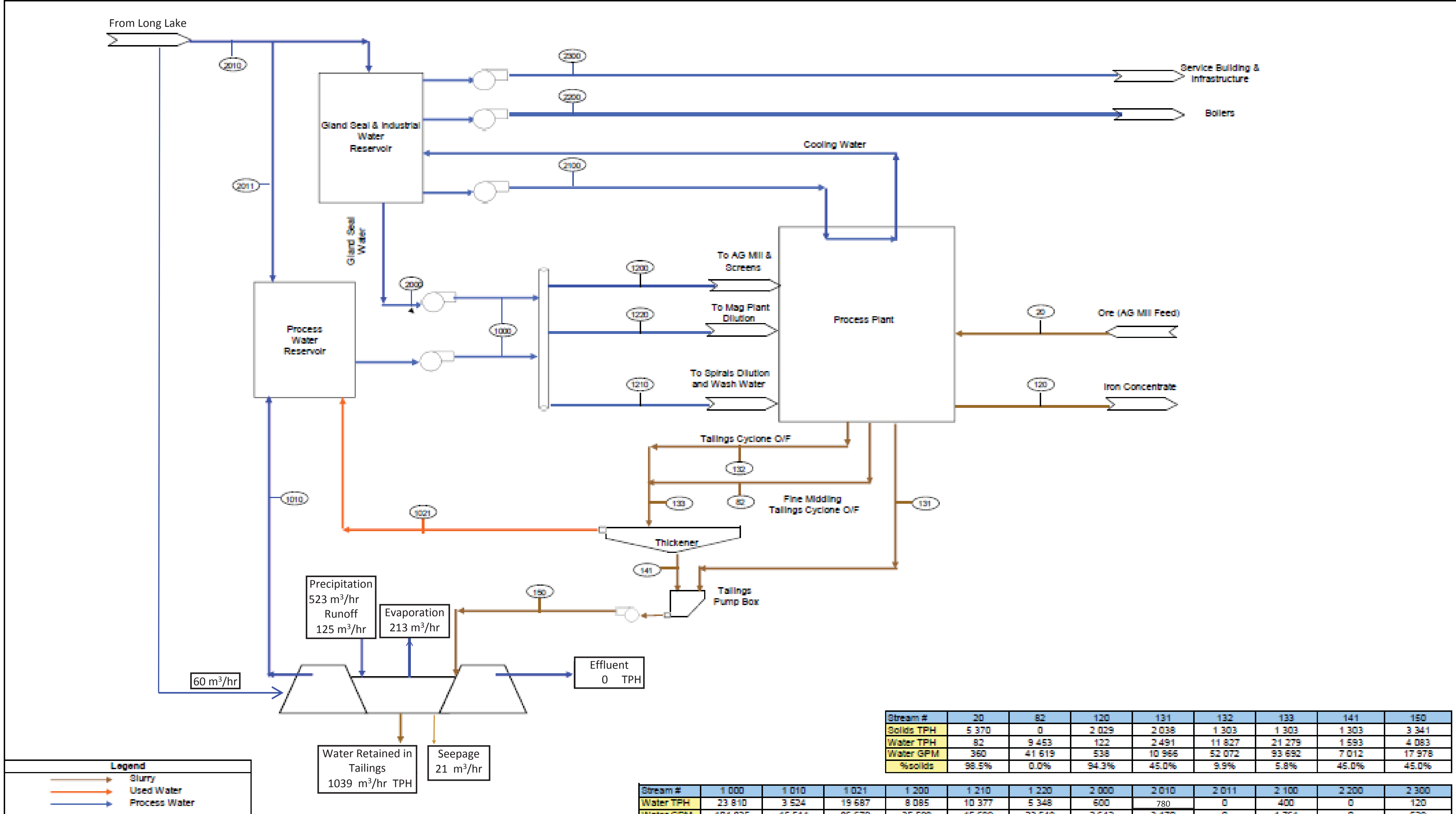
Stream #	20	172	174	186	200	202	204	240
Solids TPH	2,735	1,156	564	564	1,720	0	0	1,015
Water TPH	42	1,413	4,348	693	2,195	469	1,726	36
Water GPM	183	6,220	19,145	3,052	9,664	2,064	7,599	157
%solids	98.5%	45.0%	11.5%	44.9%	43.9%	0.0%	0.0%	96.6%

Stream #	114	116	168	184	1000	1002	1006	1050	2000	2002
Water TPH	4,300	0	246	3,689	0	5,414	46	4,593	464	439
Water GPM	18,934	0	1,083	16,240	0	23,839	204	20,220	2,042	1,932
Stream #	2004	2006	2600	2654	3000	2010	3500	3504	4002	4102
Water TPH	0	297	44	44	25	167	800	167	22	11
Water GPM	0	1,309	196	196	110	734	3,522	734	98	49

Figure 16.25 Process Water Balance (Operations Phase)

KAMI Iron Ore Project - Feasibility Study	BBA Design by	Rev.	Description	Date	By	Reviewed by	Approved by
Preliminary Water Balance		RA	For information	2011-11-29	FL	FL	AG
(based on 4833 tph fresh feed for 16.00 MT/y concentrate and at mill utilization 90%)							

Project # 3054001



Stream #	20	82	120	131	132	133	141	150
Solids TPH	5 370	0	2 029	2 038	1 303	1 303	1 303	3 341
Water TPH	82	9 453	122	2 491	11 827	21 279	1 593	4 083
Water GPM	360	41 619	538	10 966	52 072	93 692	7 012	17 978
%solids	98.5%	0.0%	94.3%	45.0%	9.9%	5.8%	45.0%	45.0%

Stream #	1 000	1 010	1 021	1 200	1 210	1 220	2 000	2 010	2 011	2 100	2 200	2 300
Water TPH	23 810	3 524	19 687	8 085	10 377	5 348	600	780	0	400	0	120
Water GPM	104 835	15 514	86 679	35 598	45 689	23 548	2 642	3 170	0	1 761	0	528

Groundwater Effects

The main effect to groundwater from the TMF is potential change in groundwater chemistry due to seepage of tailings pore water, either through the tailings dam into overburden and shallow fractured bedrock, or through the bottom of the TMF into deeper groundwater pathways. The seepage force is created by the elevation of fluids within the TMF, typically from elevated treatment pond and polishing pond levels, or large thickness of fine-grained (consistency of silty sand) tailings mounds where the water table tends to mound up. The severity of effect to groundwater quality resulting from this Project is expected to be less than from a sulfide tailings facility; however, some variance from ambient groundwater conditions can be expected. The main potential water quality issues identified in an effluent characterization study include: red water (suspended iron), nitrogen from incomplete combustion of explosives, trace metal leaching (e.g., Cr, Mn, etc.) and a minor possibility of acidity (FeS mineralization).

The primary receptor from tailings seepage through expected short groundwater flow pathways would be the surface water environment. The chemistry of the groundwater seepage "plume" could affect surface water chemistry, depending on its seepage rate and chemistry. The seepage chemistry could include components from the tailings and reaction products (e.g., ion exchange or redox reactions) along the flow path through glacial till. The effect on groundwater users from tailings seepage is anticipated to be negligible, due to distance to identify off-site well users, and the presence of numerous intervening surface water boundaries.

Surface Water Effects

The main potential effects to surface water related to the TMF during operation and maintenance include:

- Changes to existing surface water drainage patterns within the TMF footprint affecting the hydrological regime and potentially the watercourse locations of two existing watercourses, TDA -01 and TDA -02;
- Potential net changes to flow out of Long Lake, as well as changes in Long Lake water quality arising from Project effects on hydrology, water withdrawal and effluent discharges in the LSA;
- Changes to the hydrological regime of Long Lake arising from Project consumptive water losses which may affect the Long Lake hydrological regime;
- Changes to water quality in Long Lake and the Pike Lake system, to be determined via effluent receiving water assessment; and
- Habitat, Alteration, Disruption and Destruction (HADD) condition for the watercourses and waterbodies within the TMF and downstream of the TMF due to reductions in upstream flow contribution.

An assessment of these potential effects is provided in the following sections. A water management plan will be implemented to provide for process water supply to the mill, effluent discharge to the environment and to document the changes associated with water management planning from existing case conditions. A portion of mine water demand will be supplied through TMF area runoff harvesting.

Change in Surface Water Quantity

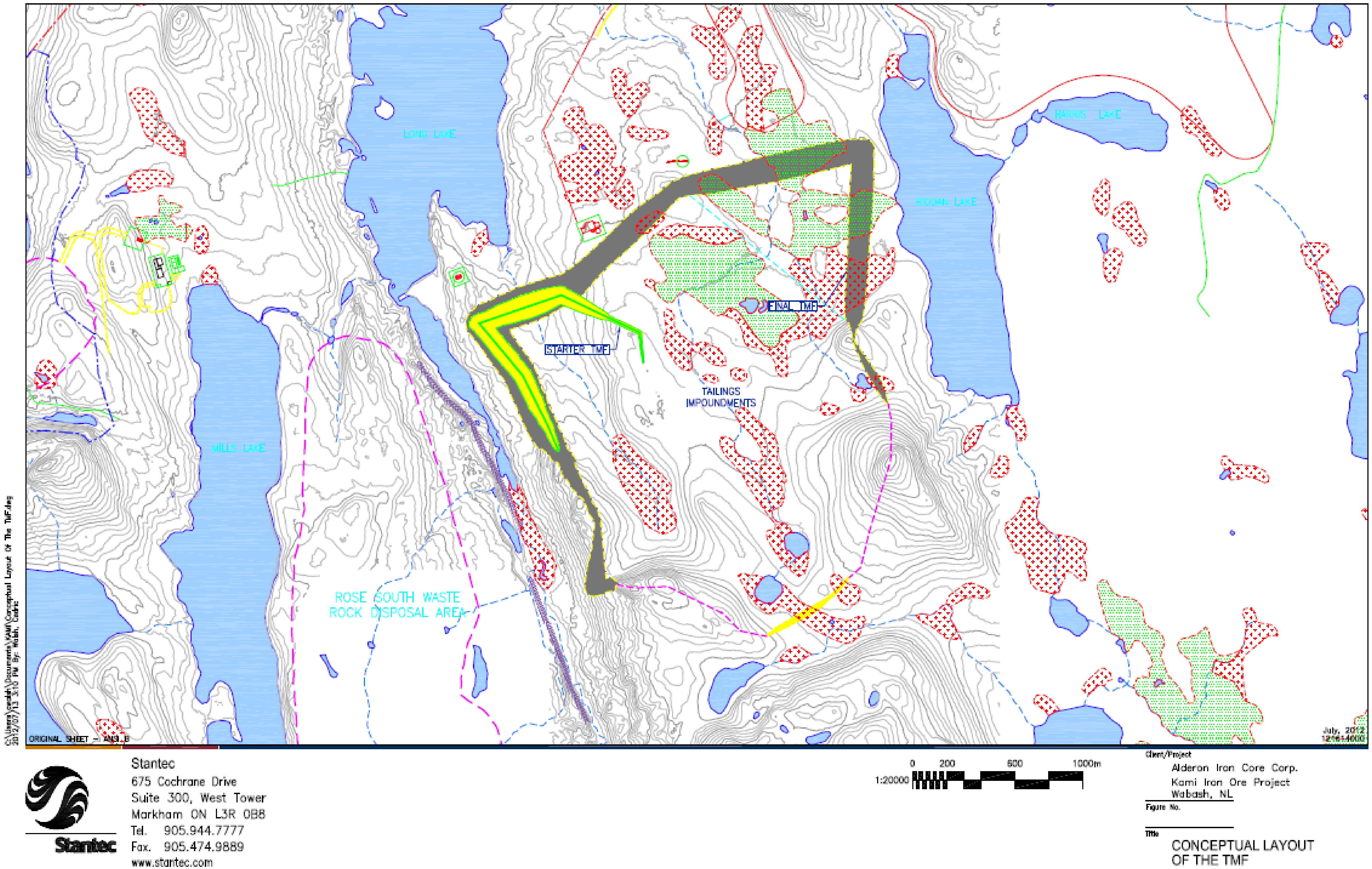
Tailings water reclaim and runoff harvesting from the TMF is the primary source of process water supply, with water takings from Long Lake providing a secondary source. Therefore, water management at the TMF is integrated with process water demand. The design process water demand, as well as other water demands, are presented in schematic form in Figures 16.24 and 16.25 as the process water balance under the 8 Mtpa and 16 Mtpa production cases.

To assess water withdrawal from the environment over the life-of-mine, a TMF water balance model has been developed for the Project. Climate data obtained from regional analysis, and site specific data collected at the proposed Project site were used to develop the water balance model. The model has been developed for monthly time steps and provides estimates on the surplus and deficit water in the TMF under the two mine ore production rates and climate normal and 1:100 year wet / dry climatic conditions.

Climate normal and 1:100 wet / dry hydrologic conditions for the Project site were considered for the TMF water balance analysis. Table 16.112 and 16.13 provide average monthly precipitation and evapotranspiration for the climate normal and 1:100 wet / dry year conditions. The precipitation, infiltration and evapotranspiration conditions have been applied to the TMF catchment areas to estimate the runoff to the tailings pond. Figure 16.26 shows the details of the TMF and associated catchment areas. The following assumptions were considered in the integration of climatic and hydrologic conditions and the TMF catchment areas:

- Runoff coefficient for natural ground is 0.68;
- Runoff coefficient for the wet tailings zone is 1.00;
- Runoff coefficients for the dry tailings beach zone is 0.40;
- Tailings void ratio is conservatively estimated to be 1, and approximately 28.2% of all tailings slurry water will be retained in the tailings matrix as tailings water;
- Annual estimated seepage from the TMF is182,500 m^3;
- Water input sources into the TMF include direct precipitation and tailings slurry water; and
- Outputs from the TMF include evaporation, infiltration (seepage), runoff and reclaim to the processing plant. Excess runoff overflow will be discharged to the Polishing Pond and from there to Long Lake.

Figure 16.26 Conceptual Layout of the TMF Starter and Ultimate Configurations



Over the life of the mine, various aspects of the mining operation will change including the ore production rate, tailings pond containment and polishing pond volumes. As a result, the tailings delivered to the TMF will change as follows:

- Year 1 to Year 4 : Annual concentrate production = 8 Mtpa; Nominal tailings water deposition = 1,841 m^3/hr; and Reclaim water requirement rate = 1,502 m^3/hr; and
- Year 5 to Year 17: Annual concentrate production = 16 Mtpa; Nominal tailings water deposition = 3,683 m^3/hr; and Reclaim water requirement rate = 3,359 m^3/hr.

The design process water balance schematics presented in Figures 16.27 to 16.29 indicate that under the 8 and 16 Mtpa production cases, the water content of tailings slurry will be 2042 and 4083 m^3/h, respectively. These estimates are conservative, incorporate factors of safety and represent a worse case design condition. The nominal tailings water is a less conservative estimate of tailings slurry water content based on operational experience and is considered more representative of actual water demand.

Figure 16.27 Schematics of Annual TMF Water Balance for 8 Mtpa for Average Climatic Conditions – Starter TMF

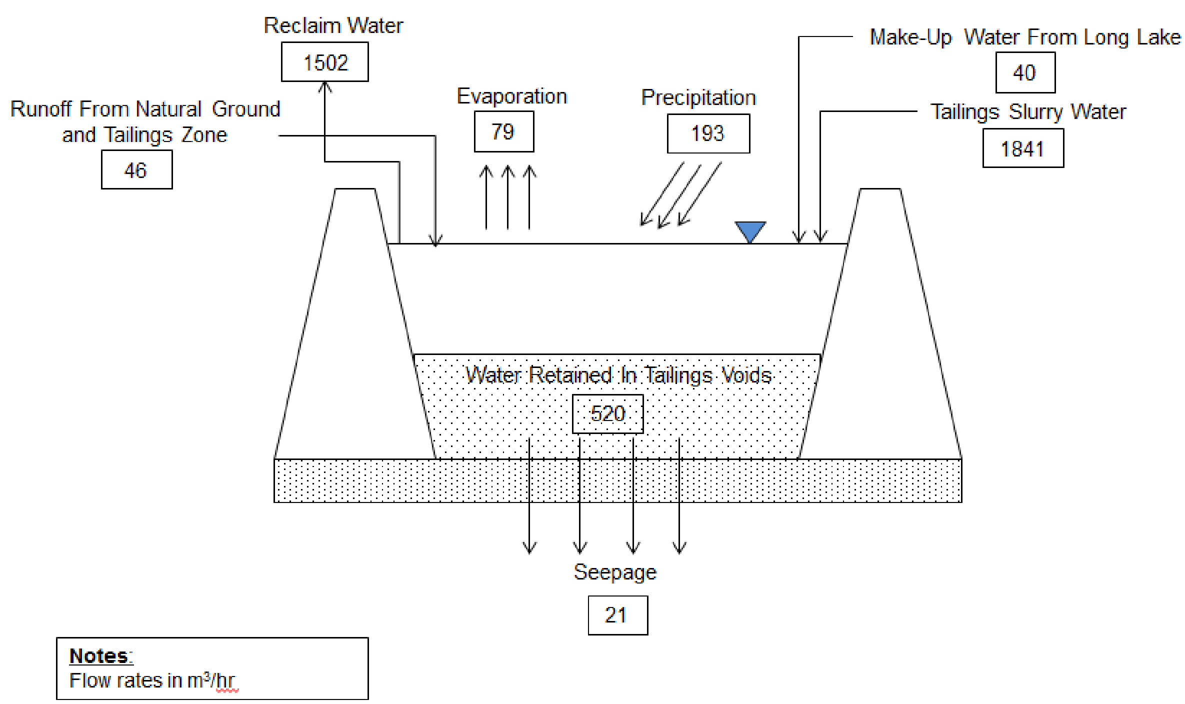


Figure 16.28 Schematics of Annual TMF Water Balance for 8 Mtpa for Average Climatic Conditions – Final TMF

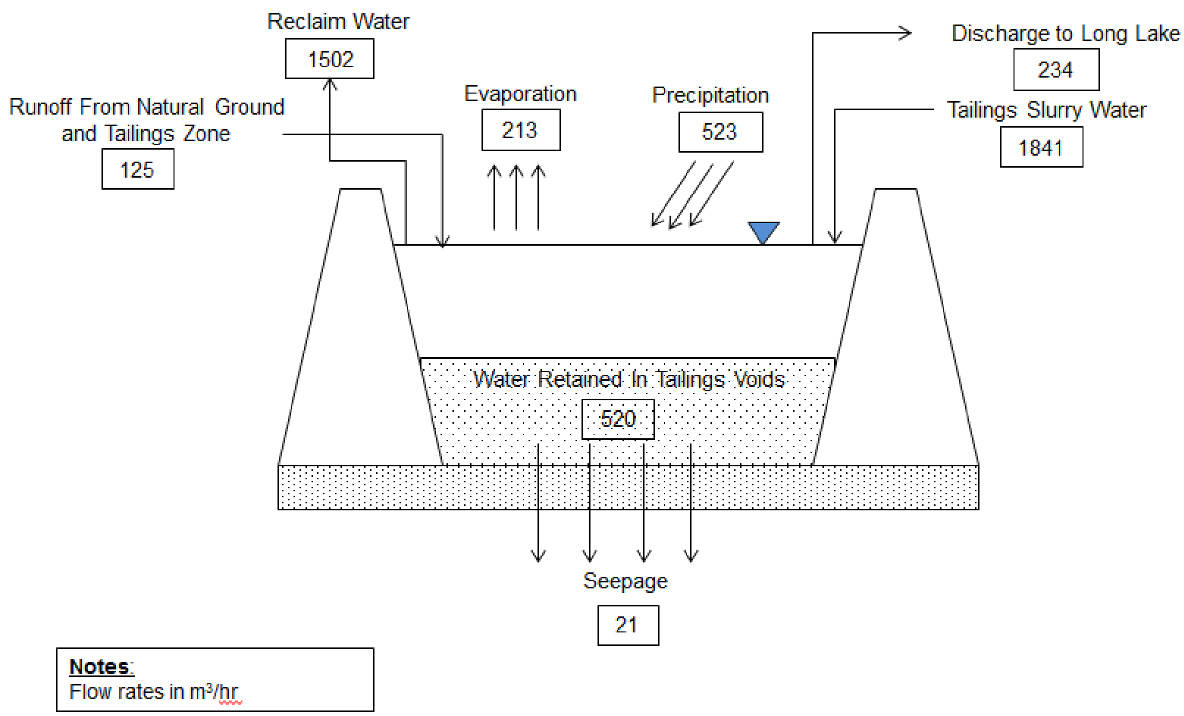
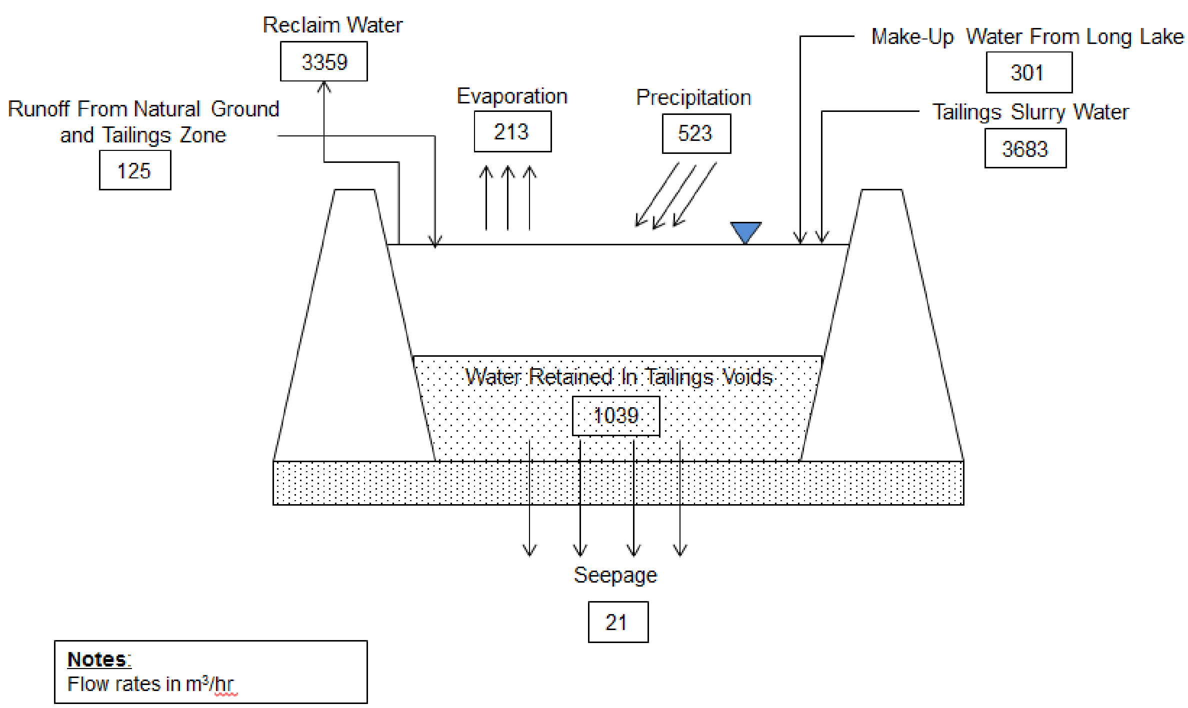


Figure 16.29 Schematics of Annual TMF Water Balance for 16 Mtpa for Average Climatic Conditions – Final TMF



The water balance analysis is carried out over the life-of-mine considering the ore production rates, and climatic conditions as follows:

- Average climatic conditions with 8 Mtpa for the starter TMF;
- 1:100 wet year climatic conditions with 8 Mtpa for starter TMF;
- 1:100 dry year climatic conditions with 8 Mtpa for starter TMF;
- Average climatic conditions with 8 Mtpa for final TMF;
- 1:100 wet year climatic conditions with 8 Mtpa - for final TMF;
- 1:100 dry year climatic conditions with 8 Mtpa - for final TMF;
- Average climatic conditions with 16 Mtpa for final TMF;
- 1:100 wet year climatic conditions with 16 Mtpa for final TMF; and
- 1:100 dry year climatic conditions with 16 Mtpa - for final TMF.

The water balance results for the nine scenarios are summarized in Table 16.33. The results indicate that the TMF would generate surplus water during operational years 1 to 3 under the 1:100 wet year hydrologic conditions and operational years 4 to 17 under the average and 1:100 wet / dry year conditions. Maximum annual water surplus occurs for the 8 Mtpa production rate during the 1:100 wet year hydrologic condition for final TMF and the maximum annual deficit occurs for 16 Mtpa ore production rate during the 1:100 dry year hydrologic conditions. Minimum annual water deficit occurs for the 8 Mtpa production rate during the average normal hydrologic conditions for the starter TMF.

Table 16.34 provides monthly water balance details for 8 Mtpa and 16 Mtpa production rates. Appendix W presents monthly water balance flows for climate normal, 1:100 year wet and dry conditions for the starter TMF and the ultimate TMF under 8 Mtpa and 16 Mtpa operational cases.

Table 16.33 Summary of Water Balance Results

Operation Year	Hydrologic Conditions	Annual Surplus (Deficit), in m^3
Years 1 to 3 (8 Mtpa)	Normal	(353,074)
	1:100 Wet Year	570,993
	1:100 Dry Year	(961,500)
Years 4 to 17 (8 Mtpa)	Normal	2,048,478
	1:100 Wet Year	4,548,703
	1:100 Dry Year	402,277
Years 4 to 17 (16 Mtpa)	Normal	(2,640,479)
	1:100 Wet Year	(140,253)
	1:100 Dry Year	(4,286,682)

Table 16.34 Summary of Monthly Water Balance Results for Climate Normal Conditions

Month	Monthly Surplus (Deficit)		
	Starter TMF	Final TMF	
	8 Mtpa	8 Mtpa	16 Mtpa
October	22,862	312,669	(78,077)
November	(53,930)	104,042	(288,704)
December	(147,046)	(147,046)	(537,793)
January	(147,046)	(147,046)	(537,793)
February	(145,546)	(145,546)	(536,293)
March	(147,046)	(147,046)	(537,793)
April	202,877	798,879	408,133
May	295,626	1,050,681	659,934
June	(129,708)	(100,988)	(491,734)
July	(59,607)	89,537	(301,209)
August	(40,735)	140,597	(250,149)
September	(3,775)	239,745	(151,001)

The proposed tailings pond within the TMF will be a dynamic water storage feature that changes in volume and size based on tailings geometry and, during the early years of TMF development, on the topography of existing ground. The tailings pond will be the primary TMF process reclaim water harvesting and collection point. The maximization of the storage capacity of the tailings pond will affect the TMF runoff harvesting potential, minimize the required water withdrawal from Long Lake and minimize the volume of tailings pond bypass to the polishing pond where it will be treated for discharge to the environment. Optimization of tailings pond design is ongoing in feasibility level design and will continue into detailed design. The following discussion of expected water withdrawal from Long Lake does not take into account the effect of the tailings pond active storage volume on the water balance and is therefore conservative. When tailing pond optimization in confirmed and active storage integrated into the TMF water balance, the amount of water taken from runoff harvesting can be maximized against water withdrawal directly from Long Lake. Tailings pond optimization will therefore result in reduction in water withdrawal from Long Lake and effluent discharge into Long Lake.

The maximum estimated annual water intake from Long Lake occurs during the ore production rate of 16 Mtpa and is listed in Table 16.35. Annual runoff volumes into Long Lake are also presented in Table 16.35. Maximum annual water intake from Long Lake is estimated at 1.20% of annual runoff volume into Long Lake from its large catchment area. Typical water withdrawal will account for approximately 0.535% of Long Lake inflow. Some Project water demands require clean make up water with water quality requirements much more stringent than that of process feedwater and will be extracted directly from Long Lake on a continuous basis. Therefore, even under conditions of TMF water surplus, some water demands require water to be taken from Long Lake.

Table 16.35 Maximum Annual Water Intake from Long Lake and Annual Runoff Volume into Long Lake

Climatic Conditions	Water Intake (M m^3)	Annual Runoff Volume (M m^3)	Water Intake (% of Annual Runoff Volume)
Average	2.64	493	0.535
1:100 Year Dry	4.29	358	1.20
1:100 Year Wet	0.140	673	0.021

The primary consumptive water demand for the Project is the tailings water that is retained in the tailings pore spaces. The worst case climate normal consumptive water taking condition would occur under operational years 4 – 17, 16 Mtpa production rate and would generate an annualized hourly water deficit of 301.4 m^3/h, implying that all TMF runoff harvesting is consumed and an additional 301.4 m^3/h of process make up water demand is required directly from Long Lake.

Changes in Surface Water Quality

Mine effluent quality is regulated by the NL *Water Resources Act* and regulations which for metal mining operations use the effluent discharge criteria found in the federal MMER promulgated under the *Fisheries Act*. Mine effluents must meet the water quality requirements of the MMER which are presented in Table 16.36. These effluent criteria were used as a worst case TMF polishing pond effluent condition to assess the mixing zone characteristics of mine process effluent into Long Lake.

Table 16.36 *Metal Mining Effluent Regulations* Discharge Concentration Limits

Parameter	Units	Maximum Monthly Mean Concentration	Maximum Concentration in a Composite Sample	Maximum Concentration in a Grab Sample
Arsenic	mg/L	0.50	0.75	1.00
Copper	mg/L	0.30	0.45	0.60
Cyanide	mg/L	1.00	1.50	2.00
Lead	mg/L	0.20	0.30	0.40
Nickel	mg/L	0.50	0.75	1.00
Zinc	mg/L	0.50	0.75	1.00
Total Suspended Solids	mg/L	15.0	22.5	30.0
Radium 226	Bq/L	0.37	0.74	1.11

Four areas of potential water quality degradation were assessed for the TMF, including sedimentation, ARD/ML, ammonia contamination and red water, and are presented in the following sections.

Sedimentation

Due to the fine to coarse sand class distribution of Project tailings, the potential for high TSS concentrations in TMF runoff is considered to be high. The regulatory criteria for TSS in mine effluent is 15 mg/L.

The Universal Soil Loss Equation (USLE) was used to estimate average and peak TSS concentrations from the TMF to the polishing pond. The tailings surface will have an average slope of approximately 1%. To estimate the erodibility of tailings from the tailings beach slopes, the USLE was used as follows:

$$A = R \times K \times LS \times C \times P \qquad \text{Eqn [3]}$$

Where:

- A – long-term average soil loss (tons/ac/year);
- R – rainfall factor (assumed to be 90);
- K – soil erodibility factor (0.03 for sand class and slopes <2%);
- LS – slope-length gradient factor (1% slope at 500 m slope run is 0.2964);
- C – vegetation and management factor (1 assuming no vegetation management); and
- P – support practice factor (1, assuming up / down slope).

The long-term average material loss anticipated from tailings beach slopes is estimated at 0.8 tons/ac/year (1793 kg/ha/year). This equates to an average TSS concentration in tailings runoff to the tailings pond of approximately 300 mg/L, with higher peak TSS concentrations during periods of intense rainfall and runoff events. The maximum TSS concentration requirements of process water reclaim are 100 mg/L and the maximum environmental discharge requirement is 15 mg/L. Sedimentation of TSS in both the TMF tailings pond and in the polishing pond will be required to comply with both process and regulatory TSS concentration requirements.

ARD/ML

The potential for ARD/ML in ore is considered to be low. Static tests of concentrate and tailings samples indicated that the Neutralization Potential (NP) of these materials greatly exceeded the Acid Potential (AP). The NP/AP ratio, or NPR, is used as a criterion in the recommended guidelines for the prediction of ARD potential in geologic materials (Price 2009). Materials with NPR greater than four are considered to be potentially non-acid generating. The samples of concentrate and tailings had NPR values ranging from 7.3 to 233, which indicated that tailings and concentrate would not generate ARD. In addition, process water and Shake Flask Extraction leachates were alkaline, with the pH ranging from 8.1 to 9.1. The conclusion is that the concentrate and tailings will be non-acid generating.

Metal concentrations in the process water and Shake Flask Extraction leachates from tailings and concentrates were substantially below parameters prescribed by the MMER (2002) and most parameters regulated by the CCME Water Quality Guidelines for the Protection of Aquatic Life). Exceedances of the CCME Water Quality Guidelines for the Protection of Aquatic Life were observed for copper, iron, aluminum, and cadmium. Elevated copper (approximately 0.006 mg/L) was observed only in the process water, but was likely related to contamination from copper pipes rather than from the materials, because no exceedances were observed in the leachates extracted with deionized water from tailings and concentrates. Therefore, copper exceedances were not related to the leaching. Iron and aluminum were generally present in the suspended or colloidal fraction passing through a 0.45 µm filter and were unrelated to metal leaching by acid. Exceedances for total cadmium in the process water was likely related to high concentrations of TSS. Therefore, concentrations of iron, aluminum, and cadmium would likely be lowered by the removal of most suspended solids prior to discharge, which is a standard practice used on iron ore mines in the area.

Historical monitoring records of direct tailings discharges to surface waterbodies showed no signs of acidification associated with two mines operating in the area. The water quality of the discharges complied with the MMER. On some occasions tailings effluent exceeded CWQG for arsenic, aluminum, cadmium, iron, ammonia and TSS. The local mines assessed discharge tailings directly to natural waterbodies listed under Schedule 2 of MMER.

Ammonia Contamination

The potential for ammonia and other nitrogen species contamination is addressed under the open pit mine and waste rock disposal areas discussions. Potential nitrogen contamination of ore is expected to be mostly released at the open pit mine due to nitrogen leaching to groundwater seepage and surface runoff. As a result the potential for nitrogen species contamination of TMF runoff is considered to be low.

Red Water

Red water is a tailings effluent condition associated with iron ore mining and processing. When iron ore tailings come in contact with water, the iron precipitation and staining processes occur and results in the red discoloration of water. At other iron ore mining operations in the Labrador City and Wabush, NL and Fermont, Québec areas, the red water condition is associated with tailings effluent and is not an issue associated with waste rock or open pit runoff. The red water condition is not associated with acid rock drainage and is associated with very fine colloidal reddish iron mineral or iron stained quartz / silica particles in suspension.

The assessment of the red water potential and effects for the Project is stipulated in Section 4.18.4.2 of the EIS Guidelines (Appendix B), which states:

> *“Describe the potential for the phenomenon known locally as “Red Water” to be associated with tailings management and associated impacts to water”*

Schedule 4 of the federal MMER define the total suspended solids and total iron concentrations permitted in metal mining effluent. The concern is that iron ore mining and processing operations can be in compliance with MMER limits, yet still produce red water tailings effluent.

Red water is caused from suspended particles of ferric oxides (Fe_2O_3 - hematite), oxyhydroxide (FeOOH – goethite) and hydroxides ($Fe(OH)_3$. These ferric solids are reddish-brown in colour. Ferric oxide-hydroxide precipitates also cause reddish staining on quartz and silica particles found in iron ore tailings. A portion of red water particles are considered to be colloidal. The term colloidal refers to a state of particle subdivision, implying that the molecules or polymolecular particles dispersed in a medium have at least in one direction a dimension roughly between 1 nm and 1µm (1 micron). Various types of colloids are recognized: inorganic colloids (i.e., clay particles, silicates, iron oxy-hydroxides), and organic colloids (humic and fulvic substances). The colloidal particles that result in the red water condition at local iron ore mining operations are inorganic.

Colloidal suspension, or 'red water' as it is known in the iron ore producing region of Labrador West is mainly treated via settling ponds and the addition of flocculants. Publicly available information presented in the Canada Gazette, Part II, Vol. 143, indicated that tailings deposited into Wabush Lake and Flora Lake for the RioTinto IOC Carol and Cliffs Natural Resources Scully iron ore mines in Labrador respectively, were non-toxic and non-acid generating. Discharged tailings historically result in "red water" in the lakes. Since there is no evidence of adverse effects on fish and fish habitat, there are no regulatory requirements related to the colour of effluent discharged to the receiving environment. The main concern with red water is aesthetic.

To address aesthetic concerns, the Carol Mine adds a non-toxic chemical clarifying agent known as flocculent (Magnafloc 10) to the tailings prior to discharge. The flocculent causes the materials in the tailings to aggregate into heavier, faster settling particles. The flocculating agent utilized by the Carol Mine is non-toxic and helps reduce turbidity, as well as the red coloration of the lake.

Similarly, the ArcelorMittal S.A. Mont Wright iron ore mine located 17 km from Fermont, Québec discharges its tailings directly into Lake Hessé. The effluent treatment system was upgraded in the early 1980s to address concerns associated with red water. This red water was caused by the presence of fine particles in the water column of iron minerals and iron stained quartz. It was not related to acid rock drainage. As a result of releases of red water from the mine, fish, including salmon, in the downstream Pékans and Moise rivers were tainted and water and sediment quality were degraded. Since the implementation of the effluent treatment system, red water has been effectively managed. The treated effluent is discharged from the southern outlet of the lake, and it has consistently been in compliance with the effluent discharge limits specified in the MMER.

The tailings grinding, processing and management process proposed for this Project is not dissimilar to the processes currently deployed at the RioTinto IOC Carol Lake mine, Cliff Natural Resources Wabush Mines Scully Mine and ArcelorMittal S.A. Mont Wright Mine. Therefore, it is assumed that iron-rich sub-micron class particles will produce red water in tailings effluent from the TMF.

As indicated above, there are no regulatory effluent criteria specifically for red water. The Canada Gazette issue referenced above indicated that red water environmental issues are minimal and mostly aesthetic in nature. However, red water is associated with red discoloration of fish flesh. Settling of red suspension particles may affect sediment quality. Red suspension may affect light penetration in the water column and the ability of fish to forage by sight.

EIS guidance has directed Alderon to address red water potential from Project tailings management and its associated effects to water. Red water will be controlled as per the options outlined in Chapter 2. Based on regulatory direction to other iron ore mining operations in the area, it is expected that regulators will require red water from Project tailings effluent to be treated and two polishing pond treatment alternatives with use of a flocculant are presented in Chapter 2. It is expected that consultation with regulators during the EIS review, feasibility-level, detailed design and permitting phases of the Project will further define the red water issue and its remedial approach as well as determine if specific red water effluent criteria may be applied in the Project Certificate of Approval. If specific quantitative effluent criteria are applied, it is expected that they will take the form of a measurable colour or turbidity criteria.

Change in Drainage Patterns and Watercourse Alterations

TMF development over the life-of-mine will alter local drainage patterns, require a watercourse alteration and will require mitigation.

Drainage patterns in the TMF catchment area will be altered through the development of the TMF and the Project plan to harvest runoff from the entire ultimate tailings area footprint from the commencement of operations to offset water withdrawal from Long Lake. The TMF will be constructed at the headwater catchment of two watercourses which drain the TMF footprint to Long Lake. Therefore, no TMF perimeter ditches are proposed. The western watercourse (also referred to as TDA-01) drains the western portion of the TMF and the eastern watercourse (also referred to a TDA-02) drains the eastern portion of the TMF footprint. To maximize TMF runoff harvesting, all TMF drainage will route to the tailings pond in the ultimate TMF extent case. In the starter TMF case, which is contained in the catchment area of the western watercourse, starter TMF drainage will be routed to the starter tailings pond. The drainage from the eastern watercourse will naturally drain toward the TMF dam adjacent to the polishing pond where excess water required for process needs above that provided by the starter tailings pond reclaim will be extracted. During starter phase operations (years 1 – 3), the TMF climate normal condition runs mostly in water deficit, meaning that for most months, all TMF runoff will be harvested and re-used in the process. To meet regulatory compliance point requirements, it is expected that during periods of TMF water surplus, excess water will be pumped to the polishing pond for discharge to the environment.

Watercourse alteration will take two forms, including lake and watercourse removal and reduction in flow to downstream reaches of the eastern and western watercourses.

Waste Rock Disposal Areas

Table 16.37 presents the area, shape and storage characteristics of the waste rock disposal areas.

Table 16.37 Waste Rock Disposal Area Characteristics

Characteristic	Rose North Waste Rock Disposal Area	Rose South Waste Rock Disposal Area
Total Area (ha)	136	595
Total Volume Capacity (Mm^3)	122	537
Crest Elevation (m ASL)	800	730
Maximum Stockpile Height (m)	205	150
Maximum inter-bench slope angle	36º	
Overall slope angle	30º	
Bench Height (m)	30	
Bench Width (m)	10	
Crest sloping grade	0.5%	
Total Waste Rock (Mt)	1081	
Total Overburden (Mt)	151	
Total Stripping (Mt)	1232	

Two overburden and waste rock storage alternatives were considered in the following assessment, one where a relative proportional distribution of overburden and waste rock will be routed to each waste rock disposal area and a second where all overburden will be stored in the Rose North Waste Rock Disposal Area and all waste rock stored in the Rose South Waste Rock Disposal Area.

The Rose North Waste Rock Disposal Area is located in the Pike Lake watershed, west of Pike Lake South and will drain entirely to Pike Lake South. The Rose South Waste Rock Disposal Area is located across a ridge between the Waldorf River and Mills Lake watersheds and will drain proportionally to each watershed.

Groundwater Effects

Waste rock disposal was rated as a 1 in Table 16.2 because there are no likely effects to groundwater associated with surficial deposition of waste rock, given the standard mitigations and operating procedures that will be applied; this activity is not further assessed here with respect to groundwater quality or quantity.

Surface Water Effects

The main potential effects of the waste rock disposal areas associated with surface water are the following:

- Changes to existing surface water runoff quantity arising from water balance alteration due to vegetation removal and waste rock and overburden filling;
- Changes to existing surface water quality due to increased sediment loading in waste rock disposal area runoff and the potential for ARD/ML, ammonia contamination and red water; and
- Changes to drainage patterns within the waste rock disposal area footprints affecting the hydrological regime of adjacent receiving waterbodies, including Mills Lake and the Waldorf River.

Change in Surface Water Quantity

Section 16.5.2 presented the existing condition water balance for the LSA representing the waste rock disposal areas. Based on climate normal conditions, the annual average streamflow generated by the waste rock disposal area footprint is estimated at approximately 83.9 and 366.3 m^3/h for Rose North and Rose South respectively. Under operations and maintenance conditions, the water balance for the waste rock disposal areas will change in that the streamflow coefficient will increase from approximately 63% in the existing condition to 75%. This increase in streamflow within the waste rock disposal areas arises from several factors, including:

- Removal of vegetation resulting in less evapotranspiration;
- Increase in soil compaction from the waste rock and overburden dumping process;
- Surficial grading reducing surface depression storage; and
- Increase in slope angle at the waste rock disposal areas perimeter.

Therefore, the use of a 75% streamflow runoff coefficient for the waste rock disposal areas is considered appropriate and will contribute 100.1 and 436.9 m^3/h for Rose North and Rose South under climate normal conditions accounting for an approximate increase in total streamflow of 19.3% from existing conditions.

Appendix W presents similar monthly water balance tables for the 1:100 year dry year and the 1:100 year dry year conditions. Table 16.38 and 16.39 present the monthly existing and operations and maintenance phase case water balance runoff conditions for the Rose North Waste Rock Disposal Area and Rose South Waste Rock Disposal Area under climate normal conditions.

Table 16.38 Monthly Runoff Estimation from the Rose North Waste Rock Disposal Area under Climate Normal Conditions

Month	Runoff Volume (m^3)		% Change
	Existing Condition	Operational Condition	
Jan	10,219	12,188	19.3
Feb	5,041	6,013	19.3
Mar	2,589	3,088	19.3
Apr	1,363	1,625	19.3
May	110,775	132,122	19.3
June	129,850	154,874	19.3
July	119,631	142,686	19.3
Aug	106,687	127,247	19.3
Sept	106,142	126,597	19.3
Oct	83,251	99,295	19.3
Nov	39,786	47,454	19.3
Dec	19,893	23,727	19.3
Annual	735,228	876,915	19.3

Table 16.39 Monthly Runoff Estimation from Rose South Waste Rock Disposal Area under Climate Normal Conditions

Month	Runoff Volume (m^3)		% Change
	Existing Condition	Operational Condition	
Jan	44,605	53,200	19.3
Feb	22,005	26,246	19.3
Mar	11,300	13,477	19.3
Apr	5,947	7,093	19.3
May	483,513	576,692	19.3
June	566,775	676,000	19.3
July	522,171	622,799	19.3
Aug	465,672	555,412	19.3
Sept	463,293	552,575	19.3
Oct	363,378	433,406	19.3
Nov	173,660	207,127	19.3
Dec	86,830	103,563	19.3
Annual	3,209,149	3,827,591	19.3

Change in Surface Water Quality

Potential water quality effects associated with the waste rock disposal areas during the operations and maintenance phase include sedimentation, ARD/ML, ammonia contamination and red water and are assessed in the following sections.

Sedimentation

The Universal Soil Loss Equation (USLE) was used to predict the long term average annual rate of erosion and TSS concentration from the waste rock disposal areas as follows:

$$A = R \times K \times LS \times C \times P \qquad \text{Eqn [4]}$$

Where:

A – long-term average soil loss (tons/ac/year);

R – rainfall factor (assumed to be 90);

K – soil erodibility factor (0.26 for silty clay);

LS – slope-length gradient factor (for 36º and 51 m slope run on waste rock slopes and 0.5% at 500 m slope run on the waste rock plateau is 0.2026);

C – vegetation and management factor (Construction Phase: 0.5 for seasonal crops x 0.60 for mulch tillage, Progressive Rehabilitation: 0.10 for trees x 0.25 for no-till); and

P – support practice factor.

The Modified Universal Soil Loss Equation (MUSLE) was used to predict the erosion rates and TSS concentrations associated with storm events as follows:

$$Y = 11.8\ (Q \times q_p)^{0.56} \times K \times LS \times C \times P \qquad \text{Eqn [5]}$$

Where:

Y – sediment yield (metric tonne);

Q – runoff volume (m^3); and

Q_p – peak runoff rate (m^3/sec).

The predicted sediment concentrations for average and storm events are presented during the construction and operations and maintenance phases. Progressive rehabilitation of the waste rock disposal areas will be undertaken over the course of the operations and maintenance phases. Therefore, the predicted TSS concentrations take into account progressive rehabilitation effects. The results presented in the Table 16.40 are represented annual and storm event average TSS concentrations for the storm durations of 24 hours. It is expected that the peak TSS concentrations would be higher than the average values and dependence on antecedent moisture and precipitation intensity conditions.

Table 16.40 Predicted TSS Concentrations from the Waste Rock Disposal Areas

	Estimated TSS Concentration (mg/L)			
	Rose South Waste Rock Disposal Area		Rose North Waste Rock Disposal Area	
	Construction Phase	Operational Phase	Construction Phase	Operational Phase
Long-term Average	136	11	136	11
1:10 Year	216	18	161	13
1:25 Year	219	18	183	15
1:50 Year	222	18	199	17
1:100 Year	224	19	202	17

ARD/ML

ARD/ML potential is addressed in Chapter 15 and in Section 16.6 The ARD/ML potential of waste rock and overburden was evaluated through review of historical records of ARD/ML potential, as well as testing of drill cores of lithologies representing overburden and waste rock. Samples were submitted to an accredited laboratory for Acid Base Accounting (ABA) to measure ARD potential and Shake Flask Extraction (SFE) to measure ML potential consistent with ARD/ML guidelines (Price 2009).

Stantec previously assessed two mine sites in the Schefferville area (western Labrador), where mining activities have occurred since the 1950s. Acid Base Accounting indicated that the waste rock could be classified as non-acid generating based on NPR criteria. Surface drainage, including flooded open pits, did not show any evidence for ARD/ML. Observed iron exceedances of the CCME Water Quality Guidelines for the Protection of Aquatic Life were related to the suspended forms of the metal and to annual redox stratification of water bodies. The ongoing ARD/ML characterization of the materials from the site will augment the observations historical data. The ARD/ML potential in runoff from the waste rock and overburden is considered to be low.

Ammonia Contamination

The approach and methodology used to assess nitrogen species contamination in the open pit and waste rock disposal areas is presented in Table 16.30 which describes the nitrogen species distribution in the case where waste rock and overburden are segregated and distributed between the two waste rock disposal areas proportionally.

Figure 16.30 presents the nitrogen species concentrations in runoff from the Rose South Waste Rock Disposal Area under the deposition condition wherein all waste rock is diverted to the Rose South Waste Rock Disposal Area. Figure 16.31 presents nitrogen species concentrations in runoff from the Rose North Waste Rock Disposal Area and Rose South Waste Rock Disposal Area when waste rock and overburden are distributed to each area proportionally. Nitrogen species regulatory criteria is presented in Table 16.32.

Ammonia concentrations are expected to be below regulatory criteria, however the concentrations of both nitrate and nitrite are expected to exceed regulatory criteria under both depositional alternatives. Exceedances of nitrate and nitrite criteria are expected from year 1 to year 10 of operations and occur during the March and April period prior to spring freshet, when the modeling predicted the highest concentration of nitrogen would be released from waste rock disposal areas. Modeling results indicate that mitigation of nitrate and nitrite will be required at the Rose South Waste Rock Disposal Area when waste rock is exclusively diverted to it and both the Rose North Waste Rock Disposal Area and Rose South Waste Rock Disposal Area when waste rock is proportionally distributed to each waste rock disposal area. Ammonia contamaination will be managed.

Figure 16.30 Nitrogen Species Runoff Concentration when all Waste Rock is Diverted to the Rose South Waste Rock Disposal Area

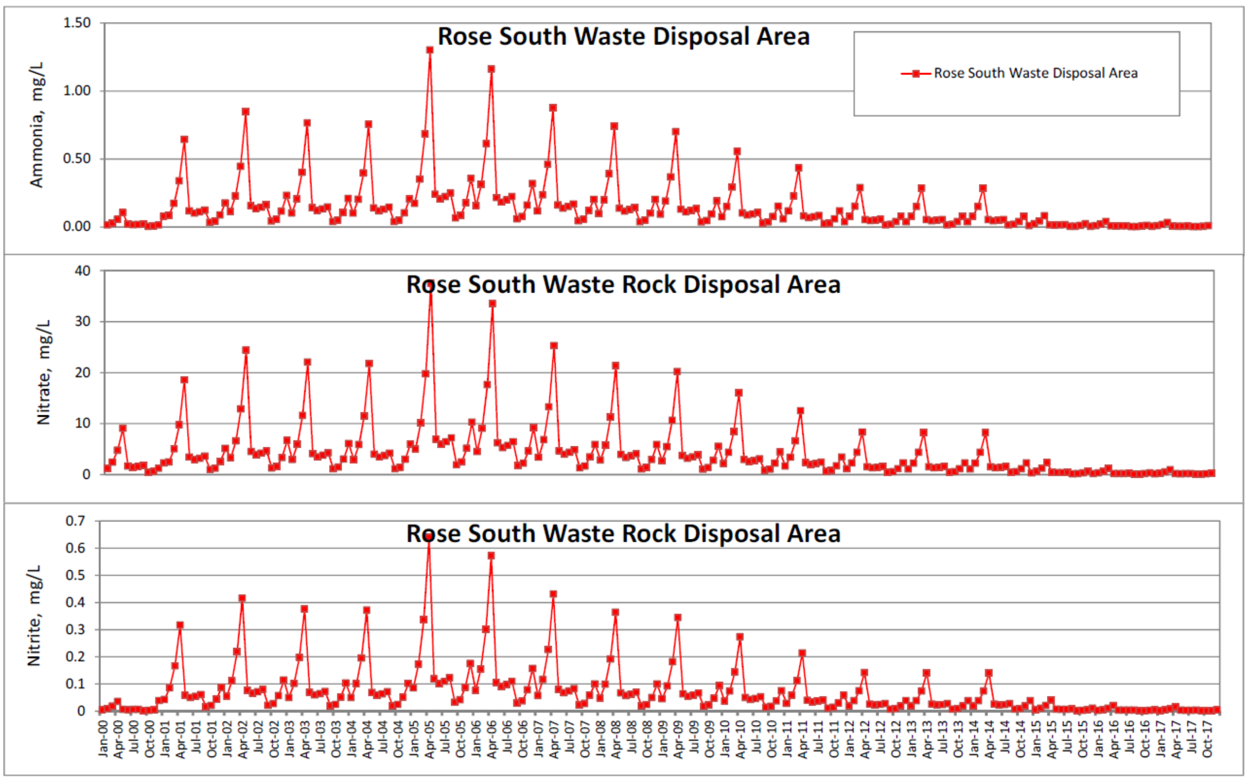
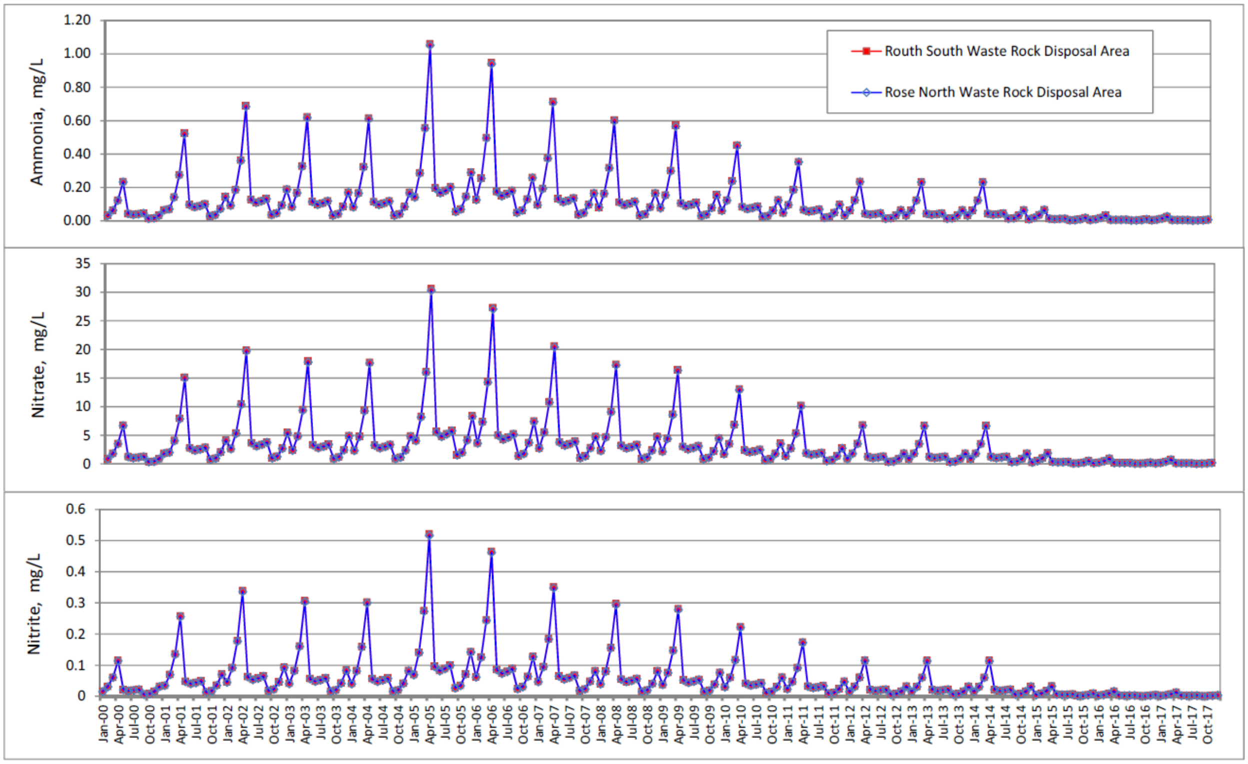


Figure 16.31 Nitrogen Species Runoff Concentrations when Waste and Overburden are Distributed Proportionally to the Rose North Waste Rock Disposal Area and Rose South Waste Rock Disposal Area



Red Water

Red water is a tailings effluent condition associated with iron ore mining and processing. When iron ore tailings come in contact with water, the iron precipitation and staining processes occur and results in the red discoloration of water. At other iron ore mining operations in the Labrador City, Wabush, NL and Fermont, Québec area, the red water condition is associated with tailings effluent and is not an issue associated with waste rock or open pit runoff. The red water condition is not associated with acid rock drainage and is associated with very fine colloidal reddish iron mineral or iron stained quartz / silica particles in suspension.

<u>Change in Surface Water Drainage Patterns</u>

The development of the waste rock disposal areas will affect drainage patterns within their footprint areas; however, due to their headwater locations in their catchment areas, they will have minimal effect on external drainage. Both the Rose North Waste Rock Disposal Area and Rose South Waste Rock Disposal Area will both continue to drain to their respective existing receiving waters of Pike Lake South, Mills Lake and the Waldorf River.

Perimeter ditches are proposed to convey side slope runoff to collection points at sedimentation ponds which will discharge at low topographic points, to existing ponds or watercourses at the waste rock disposal area perimeter. The main change in drainage patterns will be that waste rock disposal area water management will route runoff to specific sedimentation pond locations prior to discharge to receiving waters.

Concentrator / Ore Processing Facilities

The concentrator and processing facilities are comprised of three main facility blocks, including:

- Crusher Yard;
- Process Plant Area; and
- Mine Services and Infrastructure Area.

The crusher yard is where run of mine (ROM) ore is temporarily stored after haulage out of the open pit mine and will be located east of the open pit mine. ROM ore subsequently runs through the primary crusher from which it will be hoppered onto the conveyor which will take it to the ore stockpile in the processing plant area. The mine service and infrastructure area will also be located east of the open pit mine and will include mine offices and other operational infrastructure buildings to service the mine operation, including the vehicle fuel tank farm, wash bay and truck stop, small and large vehicle parking areas, mine service building warehouse and employee facilities. The process plant area will include crushed ore stockpile, Long Lake raw water pump house, process plant, tailings thickener unit, concentrator, concentrator services building, administration and maintenance offices, warehouse area, employee facilities, boiler fuel tank farm and parking areas. The process plant facility will be located north of the TMF and south of Long Lake and east of the open pit mine, crusher yard and mine service infrastructure areas.

Groundwater Effects

Under normal operating conditions, effects to groundwater are not anticipated from ore processing or concentrator operations and these activities were ranked as 0 in Table 6.2, indicating that no further assessment is required. The concentration process is one of mechanical crushing, autogenous grinding, screening, gravity concentration, and magnetic separation. Static tests of concentrate samples indicated that the Neutralization Potential (NP) of these materials greatly exceeded the Acid Potential (Chapter 15); therefore, no acid drainage issues are anticipated.

Surface Water Effects

The main potential effects to surface water at the concentrator / process facilities are expected to include the following:

- Drainage and flooding controls associated with mine site facility stormwater management may after facility area water balance;
- Facility runoff and dust suppression activities may increase TSS runoff concentrations;

- Sanitary sewage effluent from worker facilities may affect receiving water quality; and
- Facility grading and stormwater management may alter drainage patterns and require watercourse alteration.

These potential effects are assessed in further detail in the following sections.

<u>Change in Surface Water Quantity</u>

All of the surface disturbances associated with the Project are located within the Long Lake watershed except some disturbances, such as access roads, the rail line and power lines, which also traverse portions of the Flora Lake and Wahnahnish Lake watersheds.

The estimated surface disturbance due to the Project facilities in the Long Lake watershed is 0.20 km^3, which is 0.02% of the total drainage area of the Long Lake watershed. These facilities have the potential to affect the flows and water levels in the receiving streams lakes, ponds and wetlands.

The compacted and paved surfaces of the Project facilities will be less permeable than natural surfaces, and result in reductions in evapotranspiration, higher volumes of surface runoff and lesser potential of infiltration than under existing conditions. Hydraulic stream characteristics determine the magnitude of the effect of flow change on streamflow depths, velocities and wetted perimeters. In narrow confined streams, water levels and velocities can change dramatically in response to change in flow. On the other hand, water levels and velocities change little in response to flow changes in streams with wide floodplain. Sustained high or low flows and volumes are required to raise or lower lake levels with small lakes responding more quickly to flow changes than large lakes. Stormwater management facilities will discharge to nearby lakes and watercourses via discharge ditches. 2011 water level monitoring data indicates that there is a 1.2 m natural variation in Long Lake levels and 0.25 m natural variation Mills Lake levels. The primary change in surface water quantity will arise from water balance alteration from facility development and the increase in total streamflow coefficient from approximately 63% in the existing case to 90% in the operational and maintenance case.

Estimated monthly runoff volumes are presented in Table 16.41 to 16.43 for the crusher yard, mine service building and processing plant area for existing and operational conditions. It is expected that crusher yard runoff would be drained to Pike Lake South, the mine service and infrastructure area would drain to Mills Lake and the processing plant area to Long Lake. Runoff increases to Pike Lake South, Mills Lake and Long Lake are expected to amount to approximately 1.7 m^3/h, 1.87 m^3/h, and 4.44 m^3/h, respectively. Likely effects on water levels and flow velocities in receiving lakes will not be detectable due to increase in runoff volumes in operational conditions.

Table 16.41 Estimated Existing and Operational Monthly Runoff Volumes for Crusher Yard

Month	Runoff Volume (m^3)	
	Existing Condition	Operational Condition
Jan	478	685
Feb	239	342
Mar	119	171
Apr	66	95
May	5,214	7,463
June	6,115	8,753
July	5,634	8,064
Aug	5,024	7,161
Sept	5,001	7,158
Oct	3,920	5,611
Nov	1,874	2,682
Dec	937	1,341
Annual	34,623	49,556

Table 16.42 Estimated Existing and Operational Monthly Runoff Volumes for Mine Service Area

Month	Runoff Volume (m^3)	
	Existing Condition	Operational Condition
Jan	525	751
Feb	262	375
Mar	131	187
Apr	73	104
May	5,719	8,186
June	6,708	9,602
July	6,180	8,846
Aug	5,511	7,888
Sept	5,486	7,852
Oct	4,300	6,155
Nov	2,055	2,942
Dec	1,028	1,471
Annual	37,979	54,359

Table 16.43 Estimated Existing and Operational Monthly Runoff Volumes for Processing Plant Area

Month	Runoff Volume (m^3)	
	Existing Condition	Operational Condition
Jan	1,246	1,783
Feb	622	891
Mar	311	445
Apr	173	247
May	13,576	19,431
June	15,923	22,791
July	14,670	20,998
Aug	13,082	18,725
Sept	13,021	18,638
Oct	10,207	14,609
Nov	4,878	6,982
Dec	2,440	3,492
Annual	90,149	129,032

Change in Surface Water Quality

At the concentrator / processing facilities the potential for ARD/ML, ammonia contamination and red water are considered to be low. Potential changes in surface water quality associated with the concentrator / processing facilities arise from the following: sedimentation, hydrocarbon release and sanitary effluent. These are assessed in further detail in the following sections.

Sedimentation

Stormwater runoff from industrial yards can contain high TSS concentrations especially under high melting and intense rainfall conditions where event TSS concentrations can exceed 300 mg/L. Further TSS loading may result from facility yard and road area dust suppression watering. Stormwater management will be implemented at facility yard areas and internal roads in the form of grading controls, and appropriately sized sedimentation ponds.

Hydrocarbon Release

The concentrator / processing facilities will include fuel storage tank farms, fueling stations, lubricant storage and mechanic shops, parking areas and most of the mine's fixed mechanical equipment, all of which will require regular lubricant. These facilities and their associated activities increase the potential for hydrocarbon release to the environment either through infiltration into the ground and potential groundwater contamination or entrainment in stormwater runoff and contamination of receiving surface waters. Concentrator / processing facilities areas will therefore be equipped with spill containment, collection and management controls to mitigate potential hydrocarbon release. Any used lubricants or solvents will be handled and stored in compliance with all applicable regulatory requirements and industry best practices.

Sanitary Effluent

The concentrator / processing areas will provide the workspace for most workers. One or more wastewater treatment plants (WWTP) are proposed for the mine. Sanitary effluent criteria is not covered under MMER, however it is covered under Schedule A of NL Regulation 65/03. All sanitary effluent will be treated to regulatory effluent criteria before discharge to the receiving environment.

<u>Change in Surface Water Drainage Patterns</u>

Vegetation removal, surface grading, soil compaction and the institution of stormwater runoff controls will affect drainage patterns within the concentrator / processing facility footprints. Although likely not required at the crusher yard and mine service and infrastructure facilities, perimeter ditching around the processing facility may be required to divert external overland flow around the facility. Effects to drainage patterns will be localized to the facility footprint and expected to be negligible.

Watercourse alteration may be required for the western TMF tributary (also referred to as TDA-01) to facilitate processing facility construction. The capture and reclaim of upstream runoff contribution to TDA-01 will alter watercourse flows. Stormwater discharge from the processing yard is expected to be routed via ditches to the TDA-01 stream.

Access Roads and Rail Line

Access to the Project will be via an access road from the Trans Labrador Highway east of Labrador City, running south and east of Wabush and crossing west to the PDA over the Jean River Rapids. Access road length is approximately 12 km, with and nominal road width of 6.8 m. Approximately 10 water crossings are associated with the access road. The main service road connects the open pit and crushers to the processing plant and associated facilities and will be approximately 4 km in length. Other roads will be required to access the fuel unloading area, the TMF and tailings pumping system, raw water pumphouse, load-out silo and concentrate conveyor system and the explosives magazine.

A rail line will also be constructed adjacent to the main access road from the QNS&L line east of Labrador City to the Jean River crossing where the rail line will route south toward Riordan Lake and then northwest to a turning loop east of the processing facility. The loop track will be designed to hold a minimum of 240 ore cars plus locomotives, which will allow the train loading operation to be completely contained within the loop track. Approximately eight streams or drainages water crossings are associated with the rail line.

Groundwater Effects

Access roads and rail infrastructure are not expected to interact with groundwater quantity or quality and were ranked as 0 in Table 16.2.

Surface Water Effects

Change in Surface Water Quantity

During periods when dust suppression on access roads is required, up to 100 m^3/d of water may be applied. Due to the relatively narrow and linear nature of the access road and rail line their minor effect on the drainage characteristics of their footprints will be distributed over their lengths. Therefore changes to surface water quantity are considered to be negligible.

Change in Surface Water Quality

The potential for ARD/ML, ammonia contamination and red water are considered to be low for the access roads and rail line. Potential changes in surface water quality associated with the access roads and rail line arise from the following: sedimentation, and hydrocarbon releases, but with standard mitigation in place, these interactions were rated as a 1 in Table 16.2.

Change in Drainage Patterns

The rail line and access roads are expected to require similar drainage works. The rail line and road will require side ditches and culverts to convey cross-drainage. Intermittent and perennial watercourse crossings will require large steel pipe or arch-type culverts. The 100 year return period flow will be used to size culvert conveyance capacity without rail line inundation. Rail line drainage works will be designed in accordance with the American Railway Engineering and Maintenance-of-Way Association (AREMA) and QNS&L railway design guidelines. Watercourse alterations may be required at some water crossings to minimize crossing angle and culvert length.

Project-Wide Water Balance

The above sections of this VEC chapter have presented the water balance effects of the major Project components from existing conditions to the operations and maintenance phase. This section examines the Project-wide water balance to assess potential net effects of water extractions (deficits) and discharges (surpluses) at the PDA and LSA scale.

Table 16.44 presents the existing case and operations and maintenance phase water balance based on climate normal conditions. Figures 16.32 and 16.33 present the existing condition and operational and maintenance conditions in flow chart format. Total expected Project consumptive water demands under climate normal conditions are 1,039 m^3/h associated with tailing water retention and at their highest in years 4 – 17 at the 16 Mtpa production rate. However, runoff rates are expected to increase at all other major Project component areas by 356 m^3/h. All Project discharges route to Long Lake either via direct discharge or via Pike Lake discharge to the Walsh River which discharges to Long Lake. Therefore, the net consumptive demand for the Project is 683 m^3/h. As Long Lake is the ultimate water receiver for Project flows and water withdrawal, the consumptive loss of 683 m^3/h will result in Long Lake outlet flow reduction of 190 L/s, which equates to a 0.95% reduction in the mean annual flow from Long Lake of 20.05 m^3/h (refer to flow node #20 in Table 16.14). Even under minimum annual flow conditions, this magnitude of taking would not impinge on environmental flows from Long Lake and therefore are viewed to be within the range of natural flows. Based on the small proportion of consumptive water losses in relation to Long Lake flows, offsetting effects of increased flow discharges from other major Project component areas and that water withdrawal will not impinge on environmental flow from Long Lake, the net effects are considered to be negligible.

Table 16.44 Project-Wide Water Balance Runoff Flows Based on Climate Normal Conditions

Watershed	Project Component	Runoff Volume (m^3/h)		
		Existing Condition	Operational Condition	Change
Pike Lake	Open Pit	172.2	433.4	+261.2
	Rose North Waste Rock Disposal Area	83.9	100.1	+16.2
	Crusher Yard	3.95	5.66	+1.71
Mills Lake / Waldorf River	Rose South Waste Rock Disposal Area	366.3	436.9	+70.6
	Mine Service and Infrastructure Facility	4.34	6.21	+1.87
Long Lake	Processing Facility	10.29	14.73	+4.44
	Tailing Management Facility	471	-568	-1,039
	Total	1,112	429	-683

Figure 16.32 Water Balance for Climate Normal Existing Conditions

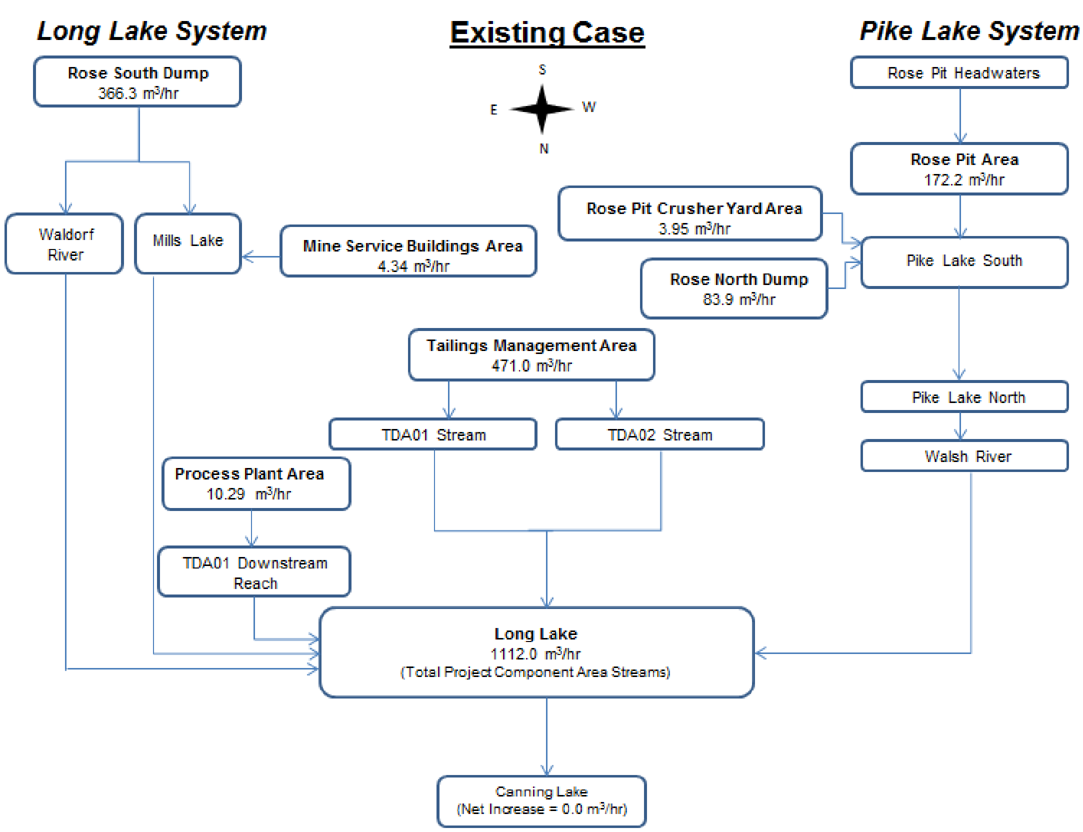
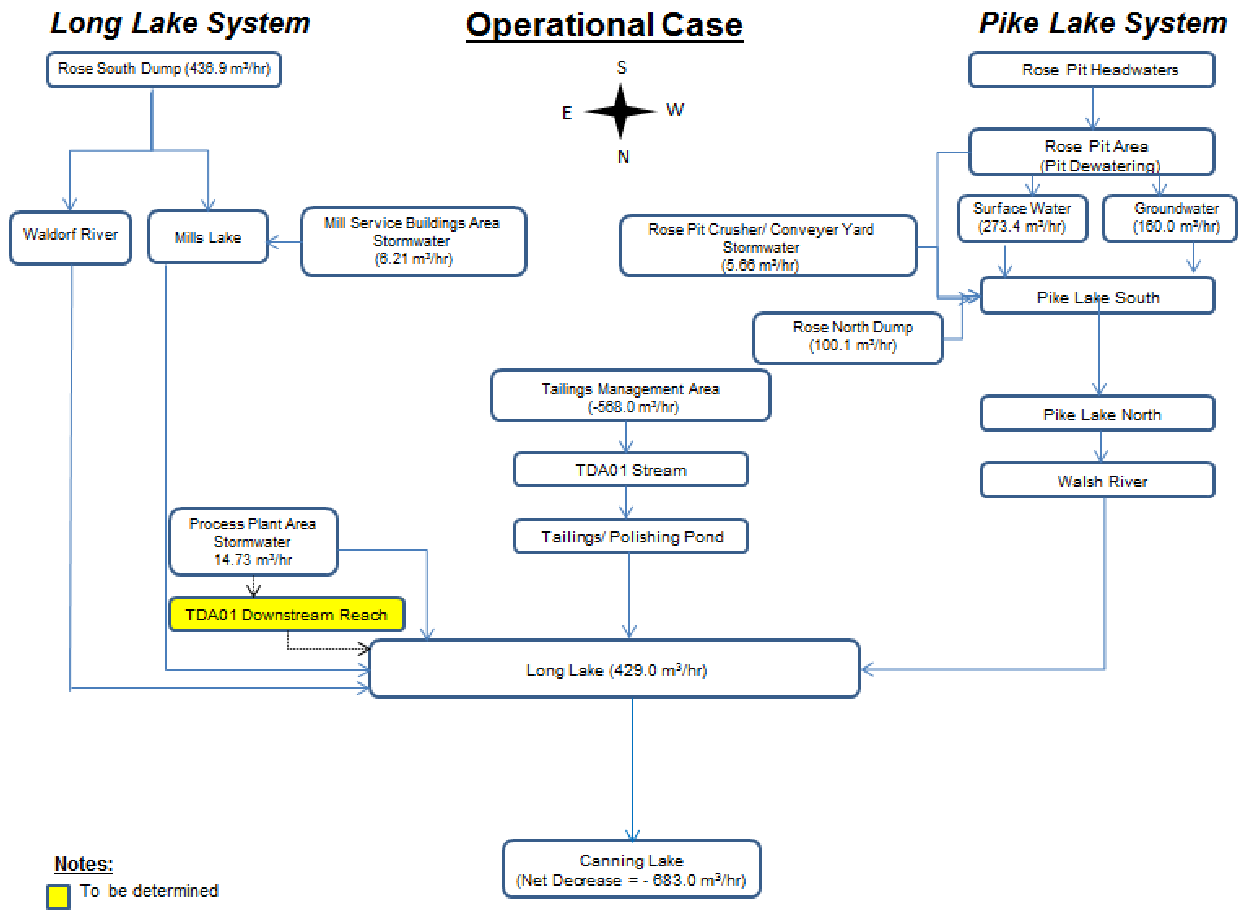


Figure 16.33 Water Balance for Climate Normal Operational and Maintenance Conditions (16 Mtpa)



During summer up to an additional 100 m^3/d may be used for access road dust suppression and further water withdrawal for dust suppression may be deployed at the waste rock disposal areas and the TMF. Dust suppression in the open pit mine is expected to be accomplished through aerial dust collection fans, but water may also be used, in which case it would reuse open pit mine dewater collection.

In the 8 Mtpa production case, the net consumptive loss of water is estimated at approximately 520 m^3/h, and the total hourly usage of water for processing, operations, sanitary / potable uses and dust suppression total up to approximately 12,500 m^3/h. Therefore, the net water recycling conservation rate is 96%. Similarly, in the 16 Mtpa case, the total hourly water usage rate is estimated at up to 25,000 m^3/h and the consumptive water losses are estimated at 1039 m^3/h, yield a 96% water reuse or conservation rate.

The public water supplies draw water from sources offline from the Long Lake – Wabush Lake flow system and therefore are not expected to be adversely affected by water withdrawals from Long Lake or other waterbodies near the PDA. Wabush Mines derives it water source from Flora Lake, which has its own large, offline upstream watershed catchment area and would not be adversely affected by Project water extractions. The IOC-Rio Tinto Carol Mine derives its water supply from Wabush Lake which is beyond the PDA/LSA scope of direct water resources effects. However, the potential residual effects of net water takings from the Project on the water supply potential of Wabush Lake will be assessed in the cumulative effects assessment. Domestic surface water withdrawal by PDA/LSA cabin owners is expected to be minimal in relation to sustainable yield and Project water demands and extraction points located in the near-shore zone of Long and Mills Lakes.

Assessment of Effluent Discharge

This section presents a summary of the methodology and results of a preliminary diffuser design for the proposed Project's process discharges into Long Lake. An effluent mixing analysis of the mine process into Long Lake was conducted to identify a preliminary diffuser configuration that achieves good dilution at the boundary of an initial mixing zone in Long Lake. Project design continues to be refined including the ultimate treatment and discharge plan for sanitary effluent discharges. As stated above, sanitary effluent will be treated to meet regulatory effluent criteria prior to discharge. Sanitary effluent is a small waste water load in comparison to other Project effluent streams, but as a conservative approach, sanitary effluent discharge was added to the mixing zone analysis for Long Lake. Note that this may not represent the final design selection.

Effluent Conditions

A TMF water balance analysis was carried out over the life of the mine for annual average and 1:100 wet / dry year hydrologic conditions by Golder Associates (P. Merry, pers. Comm. 2012). Water balance results indicate that excess water in the TMF is in the range of 737 m^3/d to 50,071 m^3/d and is expected to occur between April and November. This excess water will be directed to the polishing pond to provide required water quality treatment to meet end of pipe water quality as per the MMER. Therefore, the process effluent discharge into Long Lake is projected to meet MMER water quality at end of pipe, which are presented in Table 16.19 and Appendix X. The mine process effluent discharge rate to Long Lake will depend on tailings and polishing pond storage and operating requirements and is expected to be lower than the excess water in the TMF.

For the purposes of the mixing zone assessment, it was assumed that 720 m^3/d of sanitary effluent could be discharged to Long Lake. Sanitary effluent will be treated to meet the Newfoundland and Labrador ECWSR water quality criteria at end of pipe. The criteria are provided in Appendix X. As both mine process and sanitary effluent would be discharged as a combined effluent, the combined effluent will have to meet the more stringent of MMER and ECWSR water quality criteria. The projected water quality at end of pipe for the combined mine process and sanitary effluent discharges are provided in Table 16.45. Water temperature of the process mine water is assumed to be approximately 10.0 ^{o}C during open-water conditions and 1.0 ^{o}C during ice-cover conditions.

Long Lake Ambient Conditions, Constraints and Diffuser Location

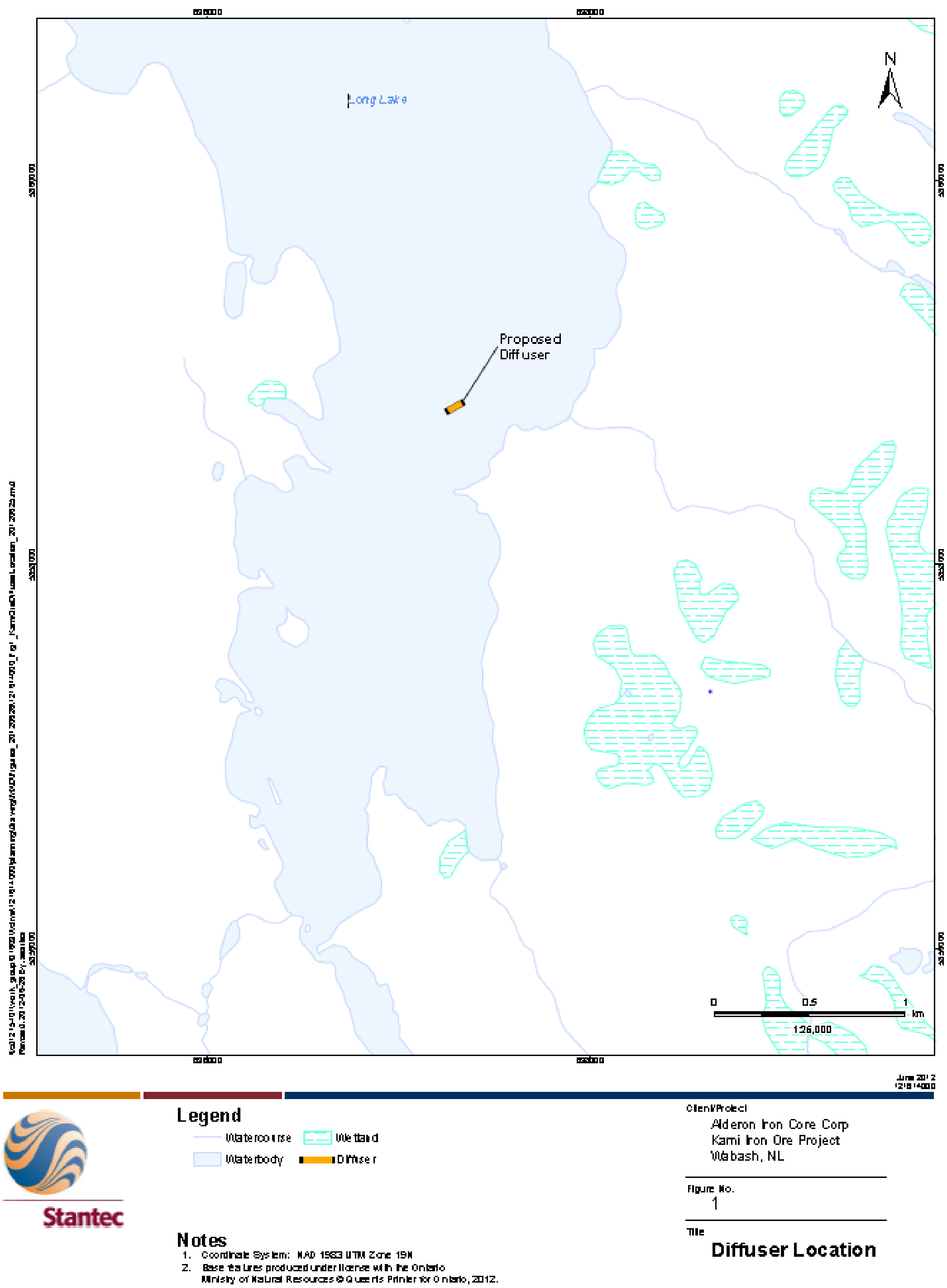
Design of the effluent discharge into Long Lake takes into consideration some key local surface water effluent discharge constraints:

- Avoidance of the near-shore zone in the effluent mixing zone and the adoption of a near-shore zone buffer zone to avoid domestic water takings. The protected water supply area guidance on buffer areas from water supply intakes (150 m buffer) can be applied in this instance. As the domestic surface water intakes are near-shore, the use of the 150 m shoreline buffer is applied as a physical constraint;
- In addition to the shoreline buffer, avoidance of areas with large shallow zones, such as the southeast embayment of Long Lake near station *L2,* due to ice cover depth and limited vertical mixing potential;
- Avoidance of shallow zones to also address ecological concerns for areas utilized by fish for red development and juvenile rearing;
- Placement and configuring of effluent discharge points in locations deep enough and at discharge orientations to avoid or minimize the potential for:
    - Outfall / diffuser jetting effects causing bottom scour;
    - Outfall / diffuser discharge related reductions in local ice cover;
    - Outfall / diffuser interference with the navigability of the receiving waterbody; and
    - Surface breakout of the mixing zone.
- To avoid residual effects in PDA/LSA effluent receivers, and to the extent feasible, preferential selection of receiving waterbodies with the largest assimilative capacity;
- Minimization of effluent mixing zones to the point where the mixing zone does not extend beyond the boundary of the receiver and definitely not beyond the boundary of the LSA; and
- Containing any Project water quality effects on local receivers to within the LSA boundary, thereby minimizing the potential for water quality residual and downstream cumulative effects.

The proposed location of the diffuser is shown in Figure 16.34. This location is estimated to be 625 m from shore with a local water depth of 14 m. This location was selected to ensure enough water column depth is available for effective dilution of effluent discharges and to minimize the length and cost of an outfall pipe. During the months of October through May, water depths are reduced by up to 1.0 m due to ice-cover. Water temperature data in Long Lake indicate that a uniform vertical temperature distribution can be assumed. The ambient vertically averaged water temperature at the proposed diffuser location is estimated to be approximately 1.0°C during the ice-cover period and 10.0°C during the open-water season. There are no lake current measurements within Long Lake. It is assumed that wind-generated currents will be much greater than the lake inflow-outflow generated currents. Wind-generated surface current velocities are estimated as 2% to 3% of wind speed. The average current velocities near the proposed diffuser location are estimated to be in the range of 4 cm/s to 6 cm/s during the open-water period, based on wind speed recorded at the Wabush Environment Canada Climate Station. The lake current is assumed to be minimal during ice-cover conditions.

Stream and lake water quality samples were collected at the Project site from October 2011 to April 2012 and the results are summarized in Appendix X for constituents listed in MMER and ECWSR guidelines.

Figure 16.34 Diffuser Location



Long Lake Mixing Zone

The water quality criteria to be satisfied at the mixing zone boundary is selected as the higher of background water quality of Long Lake or water quality criteria recommended by Canadian Water Quality Guidelines for the Protection of Aquatic Life presented in Table 16.19 and Appendix X. The selected water quality criteria for Long Lake are presented in Table 16.45 based on background water quality data and CWQGs. Table 16.45 also shows the combined process mine water and sanitary effluent concentration at end of pipe and the required dilution of effluent to achieve water quality criteria. The required dilution factor varies between 2 and 300 depending on constituents. Therefore, the mixing zone boundary also varies with constituents. Hence, the mixing zone boundary was defined as a boundary where the dilution factor is 300. At the mixing zone boundary, effluent water quality will meet either the CWQGs or background water quality of Long Lake.

Table 16.45 Long Lake Water Quality Criteria

Constituents	Unit	Effluent Water Quality at End of the Pipe	Water Quality Criteria at Mixing Zone Boundary	Required Dilution at Mixing Zone Boundary
Solids (Dissolved)	mg/L	1000	55 [b]	18
Solids (Suspended)	mg/L	15	6.2	2
Arsenic	mg/L	0.5	0.005	100
Barium	mg/L	4.5 [a]	0.015 [b]	300
Boron	mg/L	5	1.5	4
Cadmium	µg/L	4.2 [a]	0.014	300
Chlorine	mg/L	0.15 [a]	0.0005	300
Chromium (hexavalent)	mg/L	0.05	0.001	50
Chromium (trivalent)	mg/L	1	0.009	112
Copper	mg/L	0.3	0.002	150
Cyanide	mg/L	0.025	0.005	5
Iron (total)	mg/L	10	0.30	33
Lead	mg/L	0.2	0.003 [b]	69
Mercury	µg/L	5	0.026	192
Nickel	mg/L	0.5	0.044	11
Nitrates	mg/L	10	13	0
Nitrogen (ammoniacal)	mg/L	2	0.038 [b]	53
Phenol	mg/L	0.1	0.004	25
Phosphates (total as P2O5)	mg/L	1		
Phosphorus (elemental)	mg/L	0.005	0.01	0
Radium $_{226}$	Bq/L	0.37	0.006 [b]	
Selenium	mg/L	0.01	0.001	10

Constituents	Unit	Effluent Water Quality at End of the Pipe	Water Quality Criteria at Mixing Zone Boundary	Required Dilution at Mixing Zone Boundary
Sulfides	mg/L	0.5		
Silver	mg/L	0.03 [a]	0.0001	300
Zinc	mg/L	0.5	0.03	17

Notes:
[a] Waste Water Treatment Plant (WWTP) will be designed to provide the end of the pipe Cadmium and Chlorine concentrations as indicated which is much lower than ECWSR criteria
[b] Background water quality values

Long Lake Mixing Analysis

The Cornell Mixing (CORMIX™) Model was used to simulate the mixing zone of combined mine process and sanitary effluent discharges into Long Lake. This model is one of the most extensively used for predicting mixing behaviour in surface waterbodies. The CORMIX™ model assumes steady-state ambient conditions and effluent discharges, and predicts the plume geometry and dilution characteristics required for assessment of regulatory mixing zone compliance. The model has separate sub-systems for analyzing single port (CORMIX 1), multi-port diffuser (CORMIX 2), and buoyant surface discharges (CORMIX 3). The CORMIX 2 sub-system was used in the present study to analyze the multi-port diffuser performance under various effluent and ambient conditions.

<u>Input Data</u>

Ambient Data

The required model input for the ambient conditions includes lake water temperature, current, and depth of water. Water temperature affects ambient density. Lake current affects the far-field transport and shape of the resulting jets or plumes from the diffuser discharge. Water depth defines the boundary ambient conditions.

Ambient environment data at the proposed diffuser location in Long Lake is summarized in Table 16.46 for the open-water and ice-cover period. The ice-cover season was identified as the most critical period for diffuser performance in achieving good dilution. Generally, during the open-water season, winds generate stronger currents within the lake than those produced during the ice-cover period when wind effects are absent. Strong currents would effectively increase dispersion due to a high turbulence within the lake. Therefore, a diffuser configuration based on ice-cover conditions is expected to produce better dilution during the open-water period.

Table 16.46 Ambient Conditions at the Proposed Diffuser Location

Parameter	Open-Water	Ice-Cover
Water Depth (m)	12	11
Mean Lake Currents (cm/s)	5	0.05
Temperature (^oC)	10	1
Manning's Coefficient	0.025	0.025
Wind Speed (m/s)	4.0	0.0

Water depth was selected based on conditions in the local area surrounding the proposed diffuser location. For the ice-cover period, the simulated water depth was reduced by 1.0 m to account for the thickness of the ice-cover.

Generally, mixing simulations within the "near-field" depend more on the momentum and buoyancy of the discharge and are not sensitive to Manning's resistance coefficient, therefore, a typical Manning's coefficient for lakes is used.

Effluent Data

Process mine water discharge information is summarized in Table 16.47. The discharge rate was estimated based on mine process and sanitary effluent discharges as discussed above. The other data are based on expected process mine water characteristics prior to discharge into Long Lake.

Table 16.47 Combined Mine Process and Sanitary Effluent Conditions

Parameter	Open-Water	Ice-Cover
Discharge Rate (m^3/d)	720 – 50,000	720 – 50,000
Temperature (^oC)	10	1
Density (kg/m^3)	999.702	999.902
Concentration (%)	100	100

Diffuser Data

For a given ambient and effluent condition, the potential dilution that can be achieved by a diffuser depends on diffuser port diameter, port exit velocity, port height, port orientation, diffuser orientation and port spacing. Several scenarios of port exit velocity and diameter were analyzed to select a practical diffuser configuration that achieves good dilution at the boundary of a mixing zone. The selected diffuser configuration is summarized in Table 16.48 and shown in Figure 16.35.

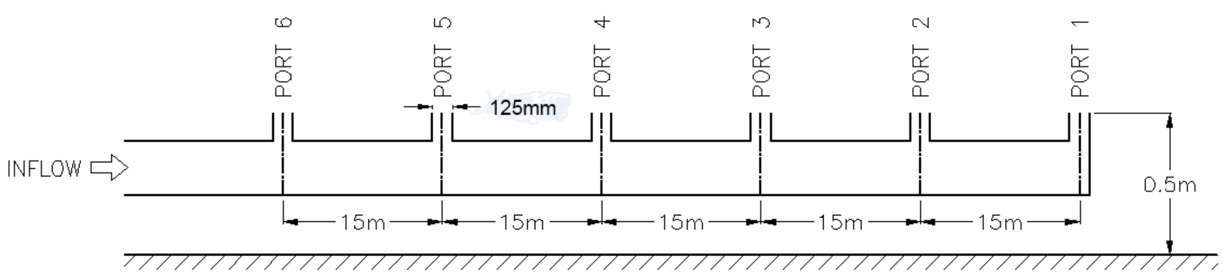
Table 16.48 Summary of Diffuser Parameters

Parameter	Values
Port Diameter (mm)	125
Port Exit Velocity (m/s)	0.978-7.9
No. of Ports	6
Length of the Diffuser (m)	75
Port Spacing (m)	15
Port Height (m)	1.0
Vertical Angle of Port (Deg)	30

For practical considerations, it was necessary to use a diffuser with a port diameter larger than 50 mm to reduce the risk of clogging within the ports, minimize head losses, and to avoid the use of a large number of ports. A maximum port diameter was selected to optimize the number of ports required to enhance dilution over a range of flow rates. The multiple ports will include valves or other flow control arrangements to adjust the number of active ports to achieve consistent mixing for a range of flow rates.

The exit velocity should be high enough to create vigorous turbulent mixing, but an upper limit is necessary to avoid problems of cavitation and foaming. A minimum value of port height was selected to minimize the risk of sediment entrainment from high port exit velocities. Diffuser length and port spacing were selected to reduce plume interaction from adjacent ports.

Figure 16.35 Diffuser Configuration



Results

The predicted mixing zone boundary corresponding to various average dilution factors are presented in Table 16.49 and 16.50 for open-water and ice-cover conditions. The predicted mixing zone boundary for the open-water condition is smaller than that of ice-cover season. During open-water conditions, the dilution factors are expected to be much greater than those predicted for the ice-cover period. The better dilution expected during the open-water period is due to generally stronger currents produced by winds, which induce more mixing than what would occur during ice-cover conditions. Figure 16.36 and 16.37 show the mixing zone boundary for the selected diffuser design under open-water and ice-cover conditions for the discharge of 50,000 m^3/d.

Table 16.49 Predicted Mixing Zone Boundary at Various Dilutions– Open Water Season

Discharge (m^3/d)	Port Diameter (mm)	No. of Ports	Port Exit Velocity (m/s)	Mixing Zone Boundary (m)		
				S=100	S=200	S=300
1000	125	1	0.98	45	116	124
10,000	125	3	3.1	5	44	119
20,000	125	4	4.7	12	84	197
30,000	125	5	5.7	17	154	311
40,000	125	6	6.3	23	162	341
50,000	125	6	7.9	29	260	480

Table 16.50 Predicted Mixing Zone Boundary at Various Dilutions – Ice-Cover Season

Discharge (m^3/d)	Port Diameter (mm)	No. of Ports	Port Exit Velocity (m/s)	Mixing Zone Boundary (m)		
				S=100	S=200	S=300
1000	125	1	0.98	94	185	384
10,000	125	3	3.2	157	815	1,914
20,000	125	4	4.7	240	1,112	2,577
30,000	125	5	5.7	278	1,345	3,175
40,000	125	6	6.3	303	1,607	3,801
50,000	125	6	7.9	386	1,643	3,867

Conclusions

The mixing zone analysis of proposed process mine water discharge into Long Lake indicates that:

- The ice-cover period is the most limiting period for diffuser design and better dilution can be attained during open-water conditions;
- The mixing zone extents are approximately 300 m for open-water conditions and 4,000 m for ice-cover conditions; and
- Under worse-case ice cover conditions, the mixing zone boundary, meaning the point at which boundary conditions return to baseline or CWQG background conditions, is completely enclosed within Long Lake and therefore within the boundary of the LSA.

These results are preliminary and detailed studies such as Long Lake circulation patterns, additional bathymetry data, temperature profiles, etc. are needed to improve the mixing zone predictions during the detailed design stage.

Figure 16.36 Dilution Isolines for Open-Water Season

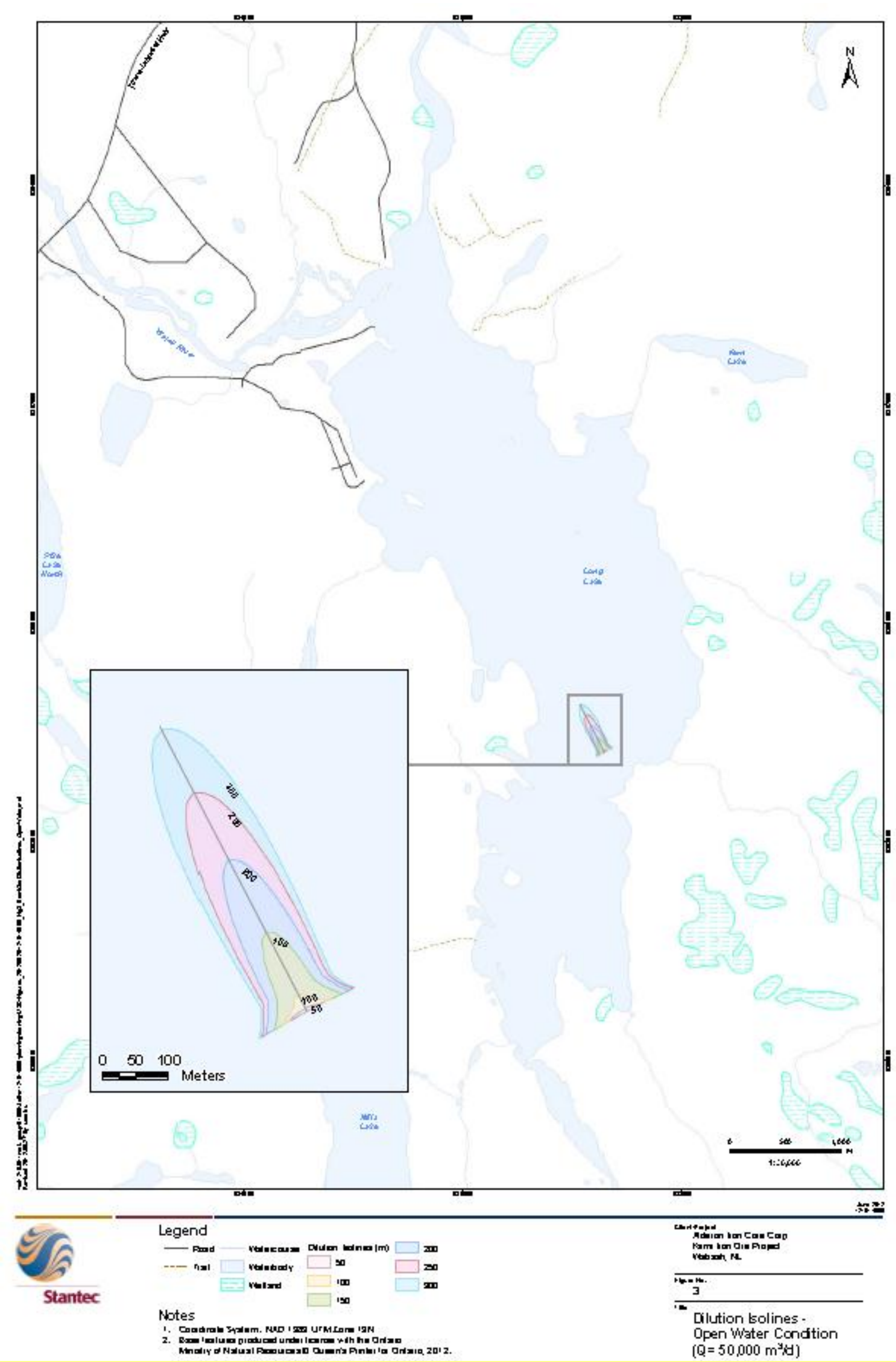
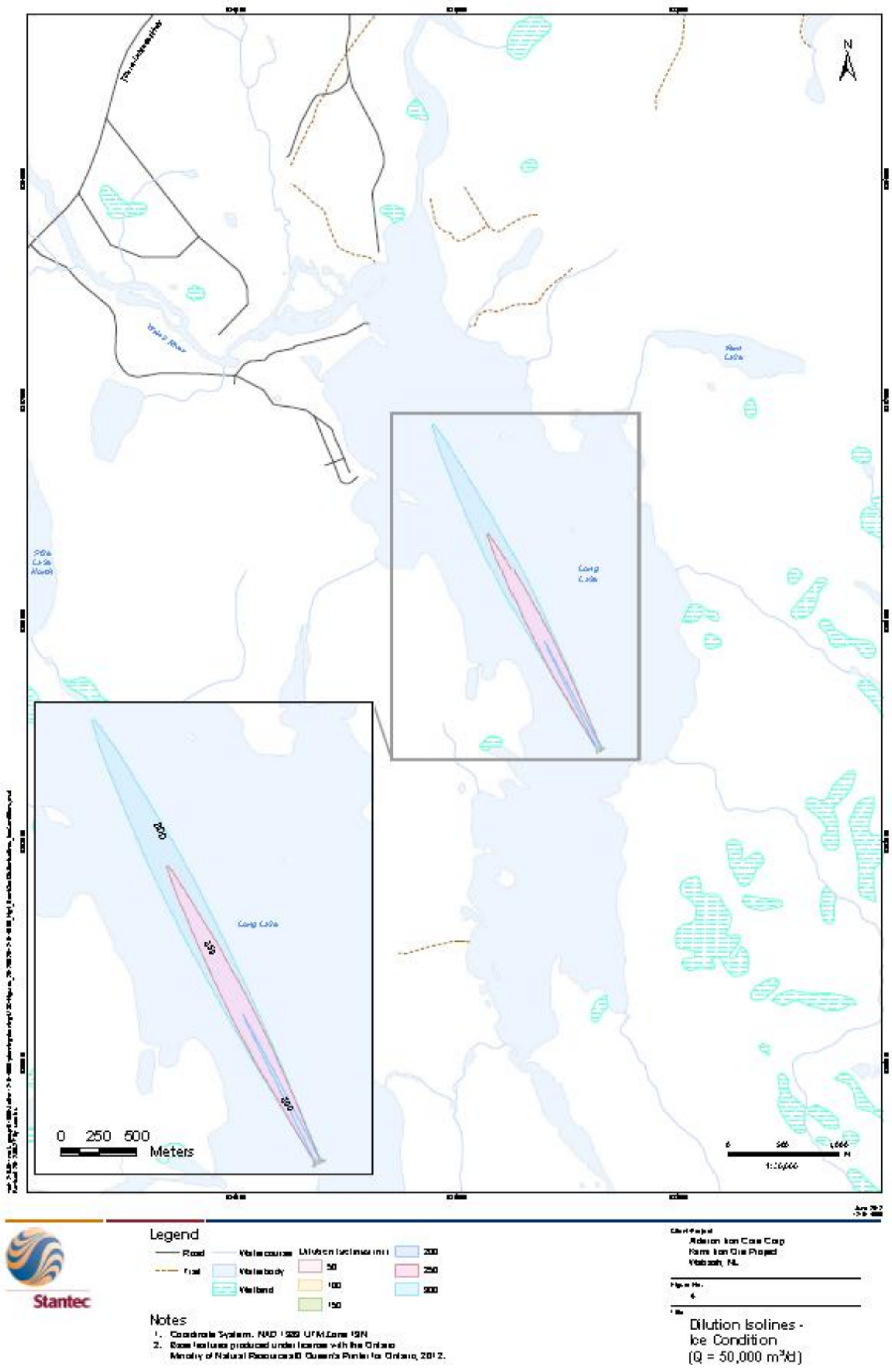


Figure 16.37 Dilution Isolines for Ice-Cover Conditions



16.6.2.2 Operation and Maintenance - Mitigation of Project Environmental Effects

Groundwater Mitigation

Effects Associated with Open Pit Mine

The primary mitigating factor limiting effects on groundwater users in Fremont, Québec and Wabush and Labrador City in Labrador is the natural topography and drainage patterns in the region. Potential effects from mine dewatering on Lac Daviault and Fermont, Québec to the west is naturally mitigated by the presence of a 675 m high watershed divide and a lake (Gleeson Lake) situated between the Rose Pit and Lac Daviault, which should limit the western extent of drawdown effects from the open pit mine. Potential wells in the vicinity of Fremont are further separated from the Project by an additional major lake (Lac Daviault). The areas within 2 kilometers or more of the open pit mine or other components of the Project are unpopulated, and no municipal or domestic groundwater users are known to be present. The Towns of Wabush and Labrador City located further to the east are serviced by surface water municipal systems.

Proposed mitigations involve the placement of a ring dyke system to redirect overland runoff away from the pit area, and a ring diversion trench at the base of the overburden cut at the high wall to intercept and redirect groundwater seepages emanating from the overburden. Mitigation of effects caused by open pit mine operations on groundwater during operations would include:

- Inspection of quarry wall rock for sulfide mineralization and implementation of standard ARD abatement procedures if warranted;
- Management of sulfide waste rock; and
- Management of groundwater inflows from pit walls.

In the unlikely event that a residential or on-site water supply wells are adversely affected by aspects of the mine construction or operation, they will be inspected, assessed, and if warranted remediated to the satisfaction of the owner. Options include:

- Provision of bottled water (temporary) due to effects from equipment vibration or blasting during road, mine or infrastructure development;
- Provision of silt filters (temporary to permanent);
- Well deepening (water level lowering leading to yield loss); or
- Well replacement (well collapse, loss of yield).

Effects Associated with Tailings Management Facility and Effluent Treatment Infrastructure

Mitigation strategies to limit the degree of seepage from the TMF include:

- Tailings dam design;
- Upper seepage collection ditch to divert seepage into polishing pond;

- Tailings dam toe seepage collection, with diversion into polishing pond;
- Conduct perimeter and off-site water level monitoring (open pit mine, TMF, site);
- Contingency to collect and direct toe seepage or groundwater back to TMF or sedimentation pond for treatment; and
- Annual review of water levels, chemistry and dam integrity.

Surface Water Mitigation

There are several general design features including the sedimentation ponds that serve to mitigate potential Project effects on surface water. This is discussed individually below, followed by a detailed listing of proposed mitigation to address each of the surface water effects identified through the assessment.

Water Management Plan

A Water Management Plan is being developed for the Project, and will be implemented and followed. This plan outlines water management in and around the major Project component areas (i.e., waste rock disposal areas, open pit, tailings impoundment, mine service and mill yard areas, and roads, rail yards, and water crossings). Water on the Project site requires careful management for several reasons, including:

- The proximity of the Project to several lakes and other watercourses poses the potential for contamination and/or sedimentation if site runoff is not carefully managed;
- Run-off from waste rock storage may be high in TSS and therefore requires treatment;
- Potential for red water;
- Water will collect in the open pit and will need to be removed by in-pit sumps to allow for excavation and removal of rock; and
- Run-off from parking lots and other service areas may come into contact with hydrocarbons and/or other solids.

The Water Management Plan will describe how water on site will be diverted, collected, treated, and/or stored so as to avoid adverse environmental effects and maximize Project efficiencies through water conservation.

Stormwater management facilities (e.g., local retention ponds, berms, drainage ditches, pumps) will be utilized to collect and contain surface water runoff from Rose Pit, waste rock disposal areas, processing plant Area, crusher yard, mine service building, and ore stockpile area. These will be designed to provide on-site storage of local runoff with slow controlled releases permitted after appropriate settling and water quality sampling indicates the water is suitable for release.

Where feasible, natural buffers around waterbodies will be maintained to minimize potential disturbance to riparian conditions and effects on local flow patterns. This will also provide an area for dispersion of stormwater runoff releases before entering any natural watercourses.

Newfoundland and Labrador uses a "two zone" approach to flood design (DOEC 2012e). The "designated floodway" is defined as the 1:20 year flood zone and the area subject to the most frequent flooding. The "designated floodway fringe" is defined as the 1:100 year flood zone and constitutes the remainder of the flood risk area. While no building or structure should be erected in the "designated floodway", it may be acceptable to use land in the designated floodway for agricultural or recreational purposes. Development within the floodway fringe may be acceptable provided that the structure is flood proofed.

Stormwater control and sedimentation facilities associated with the Project will use the 1:100 year storm as the primary quantity control design criteria. However, this criterion may be augmented by water quality control criteria to ensure that mine contact-water will be in compliance with MMER effluent limits.

Outlet structures and discharge channels associated with stormwater control and sedimentation facilities would ensure post- to pre-peak flow attenuation to avoid erosion, scour and flooding in receiving watercourses and waterbodies. Therefore, the flooding criterion for stormwater control and sedimentation features discharge channels is containment of the attenuated 1:100 year discharge peak from the respective facility. This criterion will avoid potential flooding of downstream mine infrastructure.

The design criteria for the sediment ponds for the Project area are described below:

- Water quality control: Settle particles greater than 5 µm size during 1:10 year storm event;
- Water quantity control: Contain and convey flows up to 1:100 year storm event;
- Provide at least 2 m depth (1 m for sediment accumulation and 1 m for water quality flow);
- Pond length to width ratio should be at least 5 to minimize short circuiting;
- Pond area shall be sufficient to settle particles greater than 5 µm based on the following formula

  $$\text{Pond Area } (m^2) = (Q_{10\ Outflow}/V_s) \times 1.2 \quad \text{Eqn [6]}$$

  Where :

  $Q_{10\ Outflow}$ = 10 year storm outflow rate (m^3/s);

  V_s = settling velocity of 5 µm particle (m/s); and

  1.2 = Factor of Safety.
- Pond freeboard shall be 0.5 m during the 100 year storm event;
- Inlet section of the pond should incorporate energy dissipation to spread out the flow and reduce the velocity of incoming water;

- The low flow outlet should intake from below the permanent pool so that sedimentation ponds can also act as hydrocarbon and Light Non-Aqueous Phase Liquids (LNAPL) containment features and well as mitigate discharge thermal effects; and
- An emergency spillway may be required to convey storm event larger than the 1:100 year event.

A conceptual design of a typical sediment pond is shown in Figure 16.38. Figure 16.39 shows the proposed sediment pond locations for the Project.

Figure 16.38 Conceptual Design of Sediment Pond

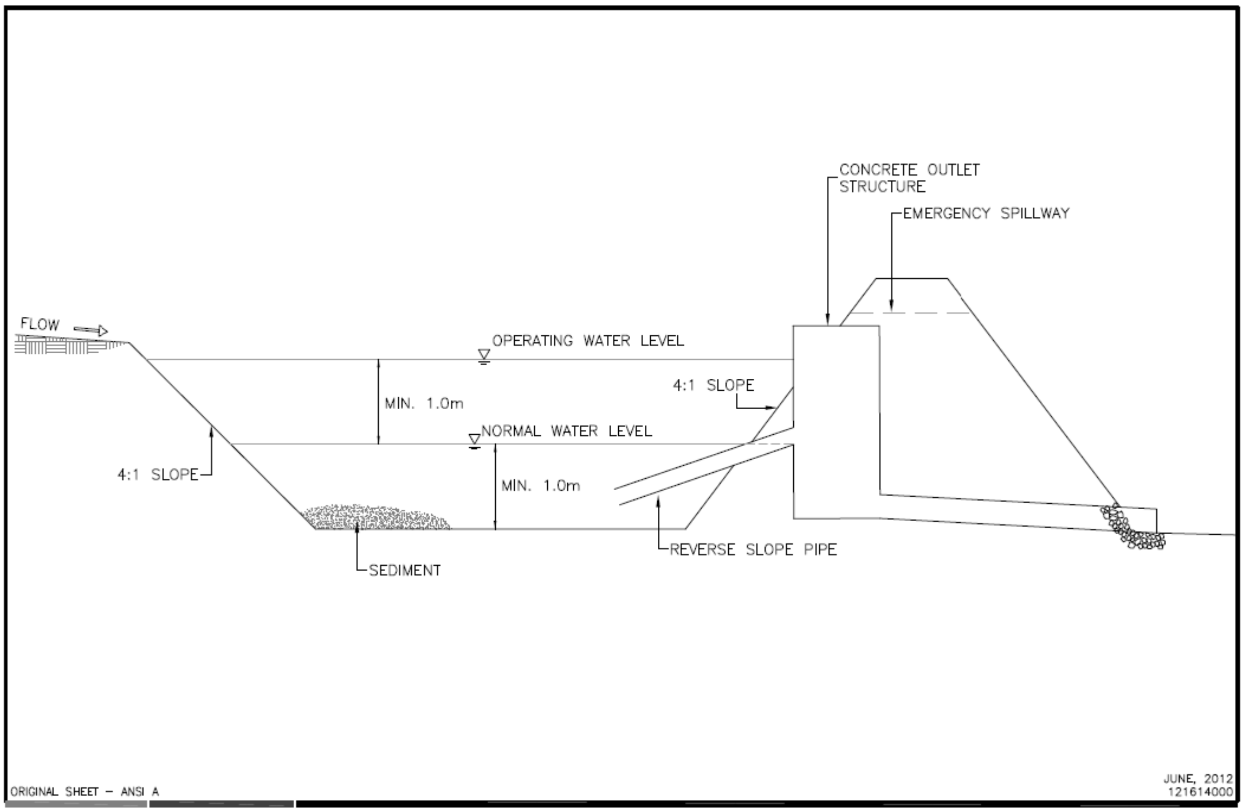
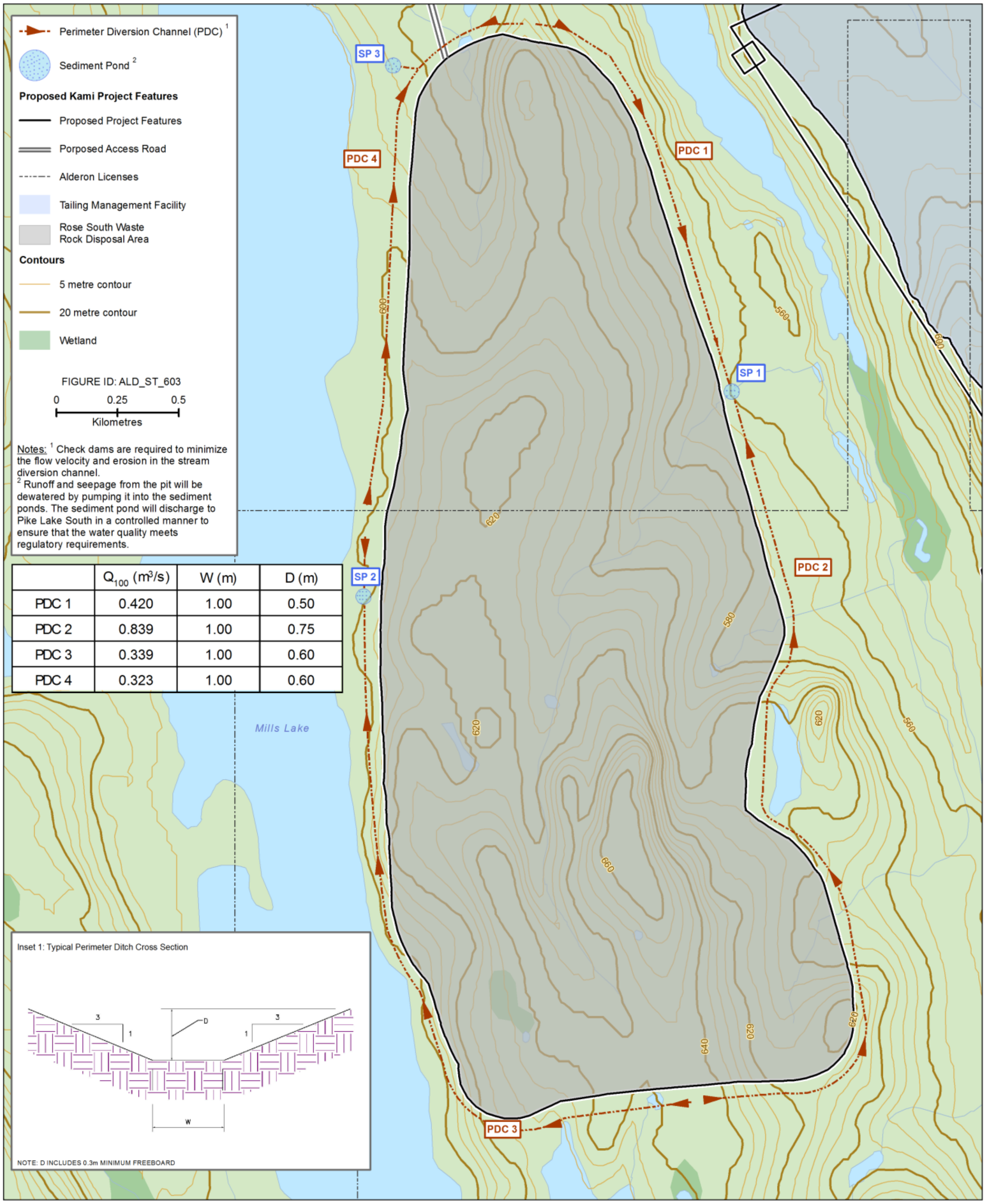


Figure 16.39 Proposed Sediment Pond Locations

The runoff from Rose South Waste Rock Disposal Area will be collected in three sediment ponds (SP1, SP2, and SP3) via perimeter collection channels as shown in Figure 16.40. Sediment Pond, SP1 will collect runoff from 389 ha of Rose South Waste Rock Disposal Area and will discharge to the Waldorf River via an existing creek. The sediment ponds, SP2 and SP3, will collect runoff from 105 ha and 100 ha of Rose South Waste Rock Disposal Area respectively and will discharge to Mills Lake via a trapezoidal channel. This drainage scheme will help to maintain the existing drainage boundaries for Rose South Waste Rock Disposal Area. The runoff from 136 ha of Rose North Waste Rock Disposal Area will be collected in a sediment pond, SP4 via perimeter collection channels and will discharge into Pike Lake South via an existing creek (Figure 16.41).

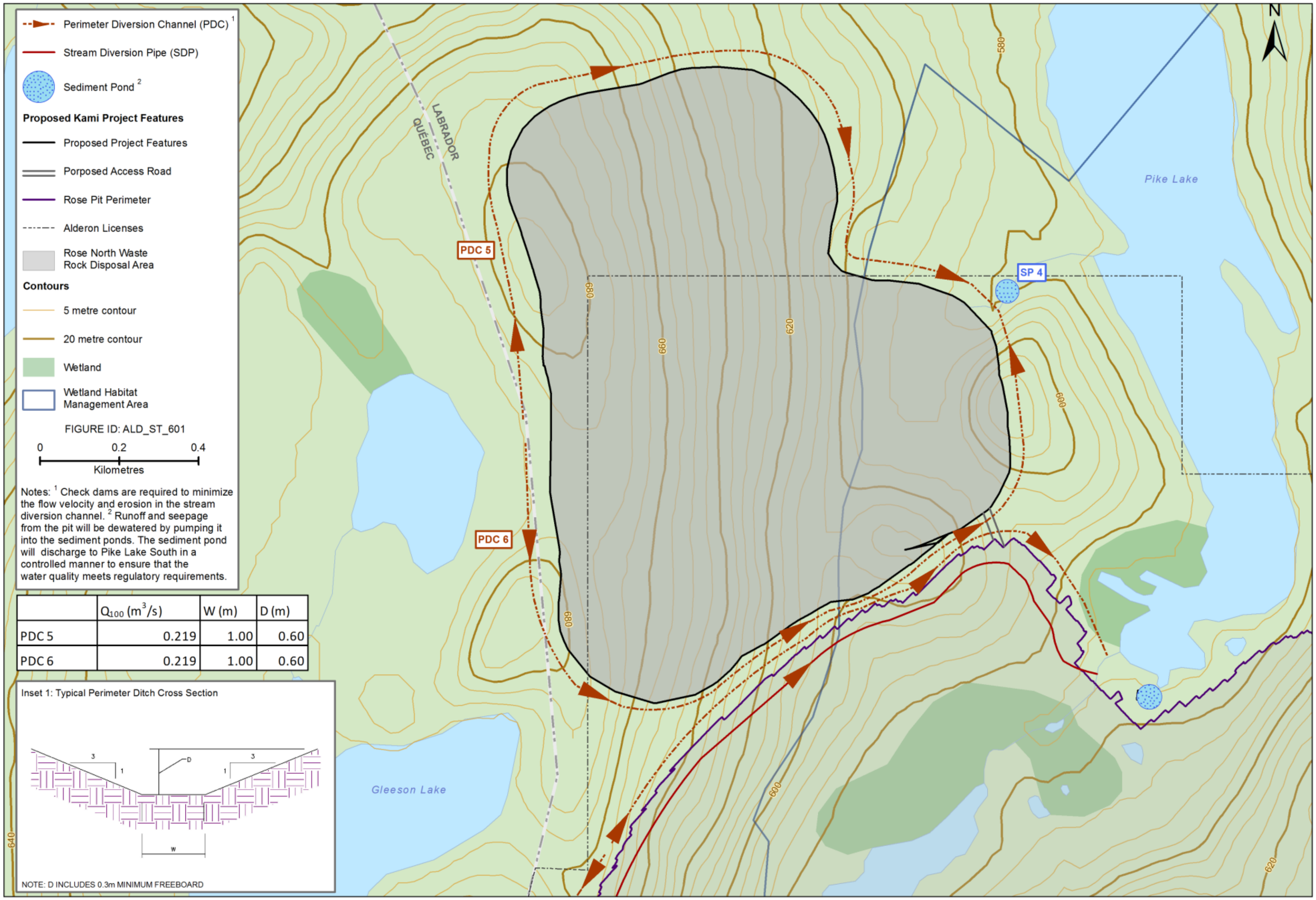
Rose Pit runoff and seepage will be pumped into sediment pond SP5 and eventually discharge into the Pike Lake South (Figure 16.42). The area of the Rose Pit is approximately 279 ha. The runoff from 0.92 ha crusher yard area will be collected in the sediment pond SP6 and will discharge into the natural areas north of the crusher yard. The runoff from 7 ha of mine service area will be collected in the sediment pond SP7 and will discharge into Mills Lake. The runoff from 10.6 ha of processing plant area will be collected in the sediment pond SP8 and will discharge into Long Lake via overland flow or a newly constructed outlet ditch.

Figure 16.40 Rose South Waste Disposal Area Water Management Plan



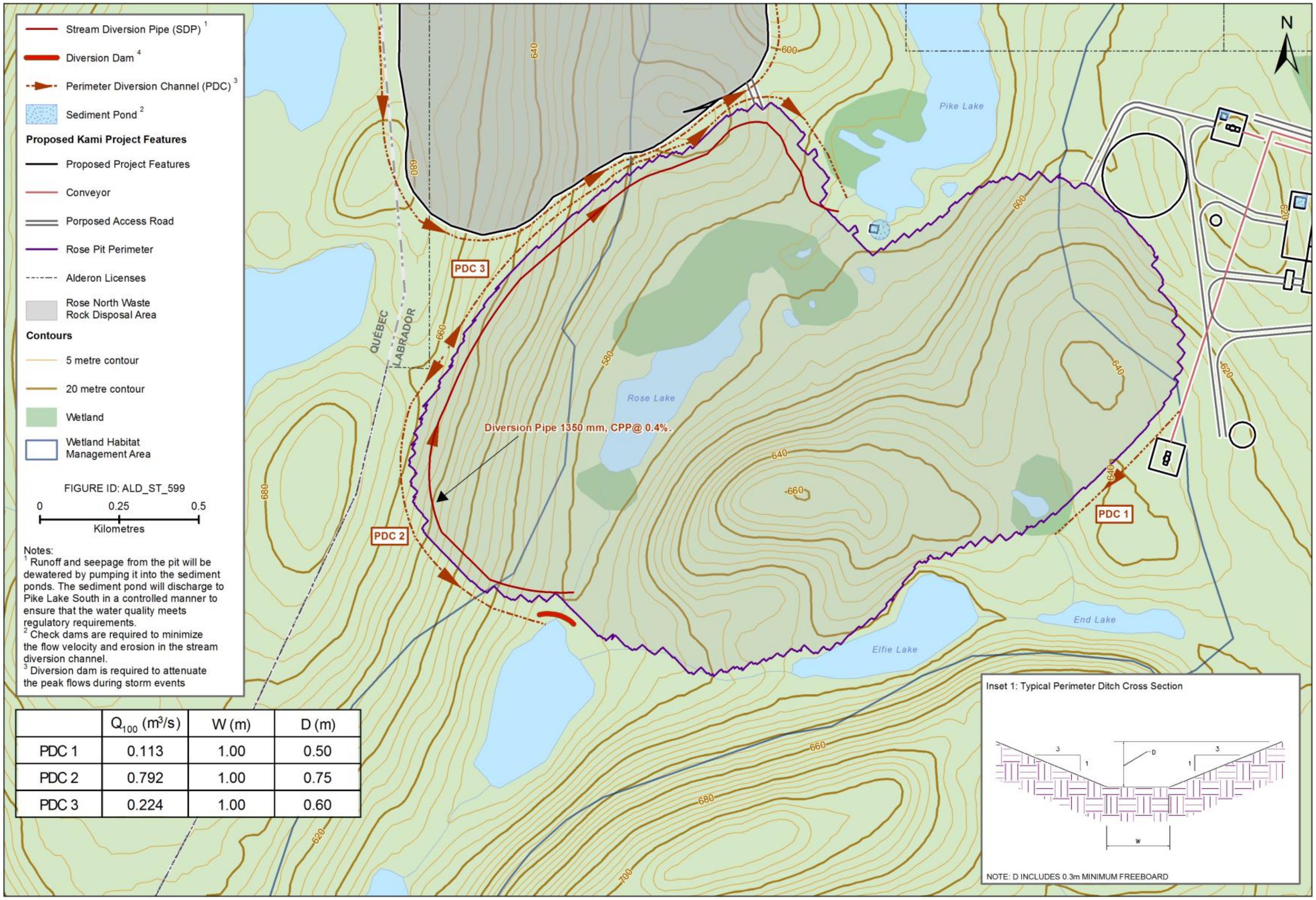
	Q_{100} (m^3/s)	W (m)	D (m)
PDC 1	0.420	1.00	0.50
PDC 2	0.839	1.00	0.75
PDC 3	0.339	1.00	0.60
PDC 4	0.323	1.00	0.60

Figure 16.41 Rose North Waste Disposal Area Water Management Plan



	Q_{100} (m^3/s)	W (m)	D (m)
PDC 5	0.219	1.00	0.60
PDC 6	0.219	1.00	0.60

Figure 16.42 Rose Pit Water Management Plan



	Q_{100} (m^3/s)	W (m)	D (m)
PDC 1	0.113	1.00	0.50
PDC 2	0.792	1.00	0.75
PDC 3	0.224	1.00	0.60

Table 16.51 lists the location of sediment ponds, receiving waterbodies, and estimated sizes of various sediment ponds proposed for the Project. Each sediment pond was sized to capture 5 micron size settleable particles during the 10-year design storm event. The sizes of sediment ponds indicated in Table 16.51 are preliminary and detailed design will require optimization of pond sizing.

Table 16.51 Estimated Sediment Pond Sizes

Sediment Pond ID	Location	Pond Sizes		Receiving Water Body
		Surface Area (ha)	Depth (m)	
SP1	Rose South Waste Rock Disposal Area	7.7	4.0	Waldorf River
SP2	Rose South Waste Rock Disposal Area	2.8	3.0	Mills Lake
SP3	Rose South Waste Rock Disposal Area	2.8	3.0	Mills Lake
SP4	Rose North Waste Rock Disposal Area	3.6	3.0	Pike Lake South
SP5	Rose Pit	5.4	4.0	Pike Lake South
SP6	Crusher Yard	0.10	2.5	Pike Lake South
SP7	Mine Service Area	0.30	3.0	Mills Lake
SP8	Processing Plant Area	0.5	3.5	Long Lake

Mitigation Specific to Identified Environmental Effects

Table 16.52 provides a detailed listing of the proposed mitigation measures to be implemented during Project operation and maintenance in order to address the identified effects on surface water resources.

Table 16.52 Mitigation Measures for Surface Water During Operation and Maintenance

Surface Water Effect	Project Component	Proposed Mitigation
Changes to Surface Water Quantity and Quality: • Increase in streamflow discharge from existing conditions. • Increase in TSS loading and sedimentation in open pit mine dewater discharge.	Open Pit Mine Waste Rock Disposal Areas Concentrator / Process Facilities	• Prepare and implement Water Management Plan. • Ensure that channel relocations / realignments are designed to minimize erosion and sedimentation, follow the two-zone approach to mitigate flooding effects and avoid ice-jamming effects. • Capture and reuse of groundwater to augment upstream pond water levels. • Dewater reuse for dust suppression within the open pit mine and for mine access roads and crushing facilities. • Reuse of groundwater collected for potable / sanitary water uses at the mine service and infrastructure facility. • Reuse of excess surface water and groundwater in the process to offset tailings water consumptive demand. • Optimized water harvesting and re-use.

Surface Water Effect	Project Component	Proposed Mitigation
		• Manage effluent treatment to meet the MMER and NL ECWSR discharge limits.
Changes to Surface Water Quantity: • Decrease in TMF streamflow discharge from existing conditions.	Tailings Management Facility	• Optimized water harvesting and re-use.
Changes to Surface Water Quality: • Increase in TSS loading and sedimentation in TMF discharge.	Tailings Management Facility	• Manage effluent treatment to meet the MMER and NL ECWSR discharge limits. • Conduct effluent treatment, including red water control, as per options outlined in the Project Description. • Initial TMF runoff capture, detention and TSS sedimentation in the TMF tailings pond to a minimum TSS concentration threshold of 100 mg/L. • Tailings pond excess water pumping to the polishing pond where it will undergo further detention and sedimentation to a target 5 µm particle size threshold and TSS concentration not exceeding 15 mg/L prior to discharge to Long Lake as per MMER regulatory effluent criteria.
Changes to Surface Water Quality • Increase in TSS loading and sedimentation from facility area runoff.	Concentrator / Process Facilities	• Fugitive dust suppression programs. • Use of appropriately sized sedimentation ponds.
Changes to Surface Water Quality • Increase in TSS loading and sedimentation to local receiving waters from gravel road surfaces and ditch conveyance erosion.	Access Roads and Rail Line	• Fugitive dust suppression programs. • Use of appropriately sized sedimentation ditches and ponds. • Implementation of erosion and sedimentation controls.
Changes to Surface Water Quality: • Nitrogen species contamination of open pit mine dewater discharge particularly for nitrate and nitrite	Open Pit Mine Waste Rock Disposal Areas	• Conduct ammonia contamination management. • Manage effluent treatment to meet the MMER and NL ECWSR discharge limits. • Use of appropriately sized sedimentation ditches and ponds. • Investigation of nitrogen species contamination mitigation strategies at other similar open pit mining operations. • Explosives selection and management to reduce unexploded ordnance quantities and nitrogen species content.

Surface Water Effect	Project Component	Proposed Mitigation
during the May – August high flow period.		• Open pit mine dewater control to reduce unexploded ordnance contact with water. • Nitrogen species release concentration monitoring to confirm existing assessment assumptions. • Nitrogen species treatment at the open pit mine and waste rock disposal area sedimentation ponds which could take the form of sedimentation pond construction as a constructed or engineered wetland or the installation of a mechanical / biological nitrogen treatment facility at the open pit mine and waste rock development area.
Changes to Surface Water Quality: • Red water aesthetic discolouration of TMF effluent.	Tailings Management Facility	The Project red water strategy includes the following: • Red water treatability testing will be completed on samples of simulated drainage from iron ore tailings obtained in conjunction with the mine preliminary engineering design. • Feasibility-level alternative investigation, evaluation and selection; and design of red water treatment concept. • Effluent treatment, including red water control, as per options outlined in the Project Description.
Changes to Surface Water Quality • Potential for hydrocarbon release.	Concentrator / Process Facilities Access Roads and Rail Line	• Storage tanks for petroleum or other hazardous materials will comply with regulations and have secondary containment. • Implementation of an Emergency Response Plan to address accidental spill events. • Installation of oil-water separator devices downstream of areas with high risk of hydrocarbon release. • Use of bottom-draw, reverse slope outlet pipes at facility sedimentation ponds to capture LNAPLs. • Employee training in spill detection and management. • Availability of spill containment and clean up supplies and materials. • Routine spill / hydrocarbon monitoring and surveillance.
Changes to Surface Water Quality • Potential receiving water contamination from sanitary effluent.	Concentrator / Process Facilities	• Manage effluent treatment to meet the MMER and NL ECWSR discharge limits. • Construction and operation of WWTP(s) to treat sanitary wastewater to regulatory effluent criteria. • WWTP effluent design and factor of safety criteria targeting effluent quality in the range of 1/10 to ½ the regulatory effluent design criteria. • Use of effluent diffuser technology in Long Lake to minimize the size and extent of the effluent mixing zone and ensure the mixing zone boundaries are maintained within the LSA.
Changes to Drainage Patterns: • Development would affect local drainage patterns.	Open Pit Mine Tailings Management Facility Waste Rock Development Areas	• Minimize drainage interactions and alterations. • Construct open pit mine and waste rock disposal area perimeter ditches. • Monitoring of water levels in upstream lakes.

Surface Water Effect	Project Component	Proposed Mitigation
	Concentrator / Process Facilities	
Changes to Drainage Patterns • Development of the access roads and rail line would affect local drainage patterns.	Access Roads and Rail Line	• Construct access roads and rail line cross drainage. • Restore natural drainage patterns, to the extent feasible.
Watercourse Alterations: • Development of the open pit mine will require watercourse diversion and removal of Rose Lake.	Open Pit Mine	• Construction of a dam across the downstream end of RP-02 to store and attenuate high flow events to at least the 1:100 year, 24-hour design event. • Development of one of the open pit mine pit slope benches as a flow conveyance bench from RP-02 to the existing watercourse outlet from the open pit mine footprint. • Installation of a diversion pipeline to convey upstream flows around the pit wall to the open pit mine watercourse outlet.
Watercourse Alterations: • Development of the TMF will require watercourse diversion and removal.	Tailings Management Facility	• Maintaining vegetated buffer zones around watercourses.
Watercourse Alterations: • Development will require watercourse alteration, diversion and/or removal.	Waste Rock Disposal Areas Concentrator / Process Facilities	• Maintenance of proportional watershed runoff through the waste rock disposal areas to their existing condition watershed areas. • Minimize sub-watershed catchment drainage pattern alteration by following existing drainage patterns and provision of adequate culvert water crossing capacity.
Watercourse Alterations: • Development of the access roads and rail line will require watercourse alterations.	Access Roads and Rail Line	• Water crossing conveyance design for the access road should adopt the AREMA and QNS&L water crossing criteria. • The AREMA / QNS&L water crossing criteria provide for adequate conveyance to account for passage of the 1:100 year flood without flooding of the rail line or access road. • In addition, due to the large size of the spring freshet and the attenuated length of the freshet hydrograph falling limb, flood flow design should account for snow-melt from snow-on-ground and/or elevated antecedent flows in local streams. • DFO guidance on culvert embedment and fish passage should be followed to ensure that water crossings do not constitute a barrier to fish passage.

Surface Water Effect	Project Component	Proposed Mitigation
		• Design of water crossings should minimize headwater and tailwater effects and minimize potential erosion, scour and sedimentation and potential flooding conditions. • A minimum culvert size of 600 mm is recommended, although larger may be required in many instances. This reduces the potential for blockage due to ice, sediment, beaver activities and vegetation. • Channel realignments / alterations should account for low flows under ice cover as well as mitigate ice jamming effects. • Any channel hardening required to accommodate bypass realignments / alterations should not inhibit groundwater discharge to the watercourse. • Where the water table is close to the ground in areas of peat / culvert will be installed to maintain equal water levels and natural recharge on both sides of the road to minimize excessive ponding or drying of peat areas and wetland areas on either side of the road.

16.6.2.3 Characterization of Residual Effects

Groundwater Residual Effects

Based on available information, no drilled water wells are present within several kilometers of the Project activities. Effects on residential groundwater supplies in un-serviced areas of Wabush, Labrador City or Fermont are also likely to be minimal, primarily due to the distance from Project activities, and the intervening lakes that would act as hydraulic barriers. In the event that any supply wells are identified within 200 m of a Project component, appropriate steps will be taken for the identification, inspection, monitoring of such supply wells or springs.

Based on the topography and drainage characteristics of the Project site, groundwater transport pathways from a source (such as the TMF) and a receptor stream or lake are likely to be short (less than a few 100 meters) and, in the absence of identified well users, the primary receptor of contaminated seepages from the TMF or waste rock areas is the surface water resource. The seepages from the TMF are expected to be of low environmental risk, local in extent, and will be contained with the local surface water regime.

Surface Water Residual Effects

Changes to Surface Water Quantity

Changes to surface water quantity can occur in association with the open pit mine and waste rock disposal areas as a result of increase in streamflow discharge from existing conditions; the TMF as a result of decrease in TMF streamflow discharge from existing conditions; and from the access roads and rail lines as water used to control dust from access roads will be withdrawn from on-site sedimentation ponds. The Project water balance effects are presented in the

Project-wide water balance assessment and when viewed together are considered to be negligible.

Process, sanitary and dust suppression water reuse have the potential to balance Project water consumptive losses with Project water discharge increases, in which case there would be a net null effect. While process water reuse may be continuous, potential process and dust suppression reuse would be seasonal in nature and may not be economically feasible. Therefore, the effect of no reuse of excess water from the open pit mine would increase mean annual flows to the Pike Lake watershed by 7.3 L/s from 504.8 L/s (at flow node #19A in Table 16.14) to 512.1 L/s, thereby increasing mean annual flows by 1.5% or a negligible amount. The effect of no reuse of excess water from the Rose North Waste Rock Disposal Area would increase mean annual flows to the Pike Lake watershed by 4.5 L/s from 504.8 L/s (at flow node #19A in Table 16.14) to 509.3 L/s, thereby increasing mean annual flows by 0.9% or a negligible amount and therefore a negligible effect. The effect of no reuse of excess water from the Rose South Waste Rock Disposal Area would increase mean annual flows to the Waldorf River and Mills Lake watersheds (at flow nodes #13 and #14 in Table 16.14) by 19.6 L/s and increase combined watershed mean annual flows by 1% from 2030 L/s to 2049.6 L/s and therefore a negligible effect. Facility area runoff increases from the crusher yard, the mine service and infrastructure area and the processing facility to Pike Lake South, Mills Lake and Long Lake are expected to amount to approximately 1.7 m^3/h, 1.87 m^3/h, and 4.44 m^3/h, respectively. Likely effects on water levels and flow velocities in receiving lakes will not be detectable due to increase in runoff volumes in operational conditions.

Reuse of excess open pit mine dewater for process make up required from TMF consumptive losses would reduce net consumptive demand, however cannot fully offset it and may not be an economically feasible alternative due to water pumping / piping infrastructure costs. When operating in water deficit conditions, all TMF runoff is being used for process reuse purposes. The maximum starter TMF, 8 Mtpa and ultimate TMF, 16 Mtpa water demands under climate normal conditions are 100% of TMF mean annual flow of 471 m^3/h and corresponding Long Lake water withdrawal would be 40.3 m^3/h and 301.4 m^3/h. Maximum annual water intake from Long Lake is estimated at 1.20% of annual runoff volume into Long Lake from its large catchment area. Typical water withdrawal will account for approximately 0.535% of Long Lake inflow. Therefore, the water taking effects on Long Lake, even without considering the net Project water balance, are considered to be negligible.

Water used to control dust from access roads will be withdrawn from on-site sedimentation ponds where dust suppression is accounted for as a seasonal influence on the facility water balance discussed further in the Project-wide water balance. Changes in surface water quantity associated with the access roads and rail line are considered to be negligible.

Changes to Surface Water Quality

Changes to surface water quality can results from increase in TSS loading and sedimentation in open pit mine dewater discharge, TMF discharge, waste rock disposal area effluent discharge and facility area runoff. Process, sanitary and dust suppression water reuse may reduce effluent discharges, however will not eliminate them. Therefore, open pit mine and waste rock disposal area discharges will be routed to sedimentation ponds, where TSS concentrations will be reduced to below regulatory criteria, as will be detailed in the Project Water Management Plan. The proposed sedimentation pond approach and conceptual design will also ensure stormwater discharge meets regulatory effluent criteria and results in negligible effects. TMF effluent TSS concentrations will be below regulatory effluent criteria and net effects will be negligible. Treated sanitary effluent may be discharged into Long Lake. To be conservative, an effluent mixing analysis of the mine process and sanitary effluent discharges into Long Lake was conducted to assess mixing zone extent within the LSA under a variety of effluent discharge and climate conditions. With respect to the access road and rail line, use of appropriately sized and vegetated roadside and railside ditches will prevent TSS loading to local receiving waterbodies resulting in negligible effects.

Surface water quality can also be affected by nitrogen species contamination of open pit mine and waste rock disposal area dewater discharge particularly for nitrate and nitrite during the May – August high flow period. Ammonia contamination will be managed, and effluent will be treated for nitrates, if required, to meet regulatory effluent criteria where there would be negligible effect. Options for treatment (e.g. constructed or engineered wetland, mechanical / biological treatment facility, managing effluent discharge to coincide with the spring freshet) will be considered, as and if required.

TMF effluent can result in a red water aesthetic discolouration of TMF effluent. These aesthetic conditions will be mitigated to effluent criteria developed with regulatory input; and net red water effects will be negligible.

With respect to any changes in water quality as a result of hydrocarbon releases in relation to the concentrator / processing facilities, deployment of comprehensive spill / hydrocarbon release reduction strategies, collection and separation controls and spill management, monitoring and surveillance is expected to result in negligible hydrocarbon release effects. With respect to the access roads and rail line, deployment of hydrocarbon release management strategies to minimize the potential for accidents and malfunctions, education of workers in spill detection; maintaining regular spill surveillance and maintaining a comprehensive hydrocarbon spill management plan will mitigate against the potential for hydrocarbon release to the environment. Net effects are expected to be negligible.

Changes to Drainage Patterns and Watercourse Alterations

Development of the open pit mine, TMF, waste rock disposal areas, concentrator / process facilities and access road and rail line all have the potential to affect local drainage patterns; however in all cases, effects will be localized in nature and are likely to be negligible.

Development of the various Project components will also result in alteration, diversion or removal of various watercourses and waterbodies. Development of the open pit mine will require watercourse diversion and removal of Rose Lake. Hydrological effects are considered to be negligible with a pipeline reducing conveyance water losses and mitigating against slope instability concerns. Fish passage effects are addressed in Chapter 18. With respect to the access roads and rail lines, watercourse alterations are expected to be minimal and related to minor channel realignment to minimize culvert / bridge length. Watercourse alteration effects will be localized in extent and negligible.

16.6.3 Decommissioning and Reclamation

Closure rehabilitation involves measures undertaken after mining operations, in order to restore or reclaim the property as close as reasonably possible to its pre-mining condition. This could include demolition and removal of site infrastructure, re-vegetation, and any other activities required to achieve the requirements and goals detailed in the Rehabilitation and Closure Plan.

Decommissioning would involve the removal of site structures, infilling and/or flooding of the open pit mine and stabilization of the TMF and waste rock piles (residual not used in pit decommissioning). Decommissioning of the TMF would involve stabilization of dams, berms and drainage pathways, possible grading and vegetation of the tailings, and establishment of post-decommissioning surface water and groundwater monitoring systems. Details on the open pit mine and TMF decommissioning are presented below.

16.6.3.1 Groundwater

No adverse effects on groundwater are anticipated during the site reclamation works. Immediately upon the cessation of open pit mine operations, the open pit mine would begin to flood with rainwater and groundwater seepage. During this period, the local groundwater movement would continue to be towards the open pit mine; however, as the water level rises in the open pit mine, the degree of distant drawdown will gradually recover to pre-mining levels. Once the open pit mine has flooded to equilibrium, no further effects on groundwater quality or water levels are anticipated.

Using the preliminary estimations of groundwater seepage and rainfall, it is estimated that it could take 150 years for the open pit mine to flood to equilibrium if no fill is placed. The actual rate at which the open pit mine will flood will be dependent on the final groundwater seepage rates (to be determined as mining progresses), rainfall, the volumes of waste rock, tailings and stock-piled overburden returned to the open pit mine, seasonal rainfall, and whether or not other options, such as seasonal diversion of surface water into the pit are used. The flooded pit would ultimately become part of the local surface water environment, draining naturally to Pike Lake South.

After mine site decommissioning has been completed, the main on-going potential groundwater effect would be continued seepage from the TMF through the overburden and bedrock. A short distance of travel is expected, with seepage ultimately discharging to adjacent wetlands, streams or lakes.

Mitigation may include on-going post-decommissioning monitoring of water quality and water levels in selected monitoring, and adaptive management as required. The post-closure monitoring program will continue for an anticipated period of five years after final closure activities are completed, or earlier should Alderon and the appropriate regulatory bodies be satisfied that all physical and chemical characteristics are stable.

With the possible exception of on-going relatively low strength (iron) seepage from the TMF after reclamation, the residual environmental effect on groundwater quantity or quality or domestic supply wells are expected to be negligible after decommissioning of the Project and implementation of any mitigative actions, of low magnitude, limited to 1000 m from the site in extent, short term in duration, occasional in frequency, and reversible. The Project is occurring in an undeveloped area with no water supply users identified within 1 km or more of any of the Project components. The dewatered open pit mine will be allowed to flood to equilibrium, resulting in return of local groundwater flow pathways to pre-mining conditions. The seepages from the TMF are expected to be of low environmental risk, local in extent, and will be contained with the local surface water regime.

16.6.3.2 Surface Water

The environmental effects of the decommissioning and reclamation phase will bear many similarities to the construction phase. Buildings will be demolished and removed, developed areas will be regraded, the waste rock areas and TMF tailings area rehabilitation with soil cover and vegetation planting will be completed. As such the following general environmental protection measures will be implemented, including:

- Work zone isolation with appropriate silt fencing;
- Erosion and sedimentation controls similar to the site preparation and construction phase;
- If required, maintenance of sedimentation ponds / facilities during the decommissioning and reclamation phases until disturbed ground surfaces are re-stabilized, and drainage works such as the construction of watercourse alterations are installed and stabilized; and
- Restore natural drainage patterns.

Open Pit Mine

As indicated in Section 16.6.3, after operation and maintenance works cease in the open pit mine groundwater seepage and surface water runoff collection and dewatering will cease to allow refilling of the open pit mine. Based on surface runoff and seepage estimates, it may take as much as 150 years for the open pit mine to fill to the elevation that it would drain from its current footprint outlet to Pike Lake South. The details for decommissioning will be provided in the Rehabilitation and Closure Plan that will be prepared under the Newfoundland and Labrador *Mining Act*. The post-closure monitoring program will continue for an anticipated period of five years after final closure activities are completed, or earlier should Alderon and the appropriate regulatory bodies be satisfied that all physical and chemical characteristics are stable.

Tailings Management Facility and Effluent Treatment Infrastructure

Decommissioning and reclamation of the TMF will include cover with soil material and vegetation cover. To the extent feasible, the TMF will be graded to restore drainage patterns to existing conditions.

After the vegetation cover is established and the tailings surface is stabilized, the following activities related to surface water will be investigated:

- Dykes and dams will remain in-place to contain the tailings, although dams will be breached to avoid the impoundment of water and to lower the risk of wet weather dam breach;
- The tailings pond may naturally dewater over time as groundwater levels in the tailings mass attenuate and establish a new phreatic surface and capillary frine to the vadose zone. The breaching of dams at the two existing watercourse outlet points from the tailings area footprint will allow groundwater impoundment in the tailings to attain its natural long term level and establish a new groundwater directional movement regime within the tailings zone;
- Grading through the TMF should re-establish new watercourse alignments and slopes to the watercourses and watercourse will be designed using natural channel design concepts;
- The tailings pond may naturally dewater or at least lower in water surface elevation and as such should naturalize into a wetland feature over time;
- The polishing pond will be dewatered prior to dam breach, red sediment removed and the polishing pond dam breached to allow restoration of the existing condition watercourse; and
- With the tailings surface stabilized, there is no expected need for closure sedimentation facilities. Surface runoff should be free of potential red water concerns. Groundwater will move through the tailings and have red water potential; however, groundwater is typically very low in TSS and therefore red water in groundwater seepage beyond the TMF footprint is not expected. However the potential for tailings groundwater seepage routing through the dam breaches to have red water content will be monitored and if confirmed then an appropriately sized and graded aggregate filter installed to prevent red water TSS migration, but allow groundwater passage.

Waste Rock Areas

Waste rock areas will be progressively rehabilitated over the operations and maintenance phase and rehabilitation completed during decommissioning and reclamation. The details for decommissioning will be provided in the Closure and Rehabilitation Plan that will be prepared under the Newfoundland and Labrador *Mining Act*. The post-closure monitoring program will continue for an anticipated period of five years after final closure activities are completed, or earlier should Alderon and the appropriate regulatory bodies be satisfied that all physical and chemical characteristics are stable.

Concentrator / Processing Facilities

Site rehabilitation will grade the ground surface with soils and revegetate to restore existing drainage patterns to the extent feasible. Stormwater ponds will be dewatered, sediment will be removed if required, any dams breached and permitted to naturalize into small open water or wetland features. The existing watercourse through the mill yard may require re-establishment to convey reconnected upstream catchment in the TMF.

Access Roads and Rail Line

The main site access road will remain intact for post-decommissioning activities and emergency situations. The roads will be scarified to loosen the surface structure and promote re-vegetation, and the existing drainage ditches will be infilled by grading, and the cross section contour will be shaped to match the adjacent ground. All cross contour ditching will be filled, any culverts and bridges will be removed and disposed of off-site, and the roads will be assessed for re-vegetation opportunities where practical.

16.6.4 Summary of Project Residual Effects

The residual environmental effects of the Project on Water Resources are summarized in Table 16.53. The residual environmental effects on Water Resources for construction and operation of the Project are characterized by the following descriptors: direction; magnitude; geographic extent; duration and frequency; reversibility; ecological / socio-economic context, significance, and prediction confidence.

16.6.4.1 Groundwater

Several potential residual effects related to groundwater quantity and quality were assessed. The primary effects of mine operation include dewatering of the open pit mine and seepage from the TMF. With the possible exception of minor seepages of low level leachate from the TMF, and residual effects of accidental petroleum spills, no residual effects of mining are anticipated after implementation of mitigative and remedial actions.

During the construction stage, some degree of water level decline will occur as the overburden is removed. The effects are expected to be limited to the LSA, and effluent treatment will be controlled with the proposed surface water measures. During the operations and maintenance stage, the open pit mine will induce a degree of water level decline in bedrock and overburden extending with lessening magnitude about one kilometer from the mine. Since there are no known groundwater users located within several kilometers of the mine, no adverse effects are anticipated. Small base flow reductions in nearby streams due to theoretical water level lowering should be balanced by the open pit mine discharge back to the hydrologic system. Upon closure and reclamation, the pit will be partially filled with waste rock and tailings, and allowed to flood to equilibrium, resulting in a pre-mine water table condition.

It is expected that seepage from the TMF will be returned to the surface water regime within a few hundred meters of transport. The tailings facility runoff and intercepted groundwater seepage quality will be controlled by the main sedimentation pond during operations and post closure. In consideration of the low probability of acid drainage, and expected seepage chemistry, no residual effects from mine operations are anticipated.

Changes in groundwater levels are expected to be PDA to LSA in scale during operations, and should be non-existent after closure. Changes to groundwater quality are expected to be PDA in scale during both operations and post closure. Based on the distances between the various mine components and the nearest groundwater users, the proposed open pit mine reclamation and the predicted leachate chemistry, no residual effects are anticipated on groundwater resources after mine decommissioning.

16.6.4.2 Surface Water

Several residual effects are predicted related to surface water quantity, quality and drainage patterns. Surface water quantity effects related to the net consumptive demands of tailings water retention within the tailings area and its effects on the Long Lake flow. Based on the assessment of effects under a range of climate and operational conditions, mitigation offered by offsetting increases in flows from other Project components, the fact that water withdrawal will not impinge upon environmental flows, the reduction in Long Lake outflows will account for < 1% of flows. During operations and maintenance, the Pike Lake system will see an increase in outflows due to the increase in open pit mine surface and groundwater collection. The increase in flows did not discount the potential reduction in groundwater discharge which may ensue to Pike Lake South, therefore nullifying the increased groundwater discharge effect. The increase in flows are within the natural range of flows experienced in the Pike Lake system and are expected to primarily result in an increase in baseflows. Subsequently, during decommissioning and reclamation, flows to the Pike Lake system will be decreased for the period required to fill the open pit mine. The reduction in flows are also within the natural range of flows experienced in the Pike Lake system.

Surface water quality effects relate to the mixing zones required in Long Lake to attenuate effluent quality back to baseline or CWQG thresholds. The assessment has demonstrated that mixing zones would be contained within the LSA and that baseline or CWQG background conditions would be achieved at the boundary of the LSA. Therefore, no residual effect for surface water quality is predicted.

Changes in drainage patterns and watercourse alterations are PDA in scale and result in no residual effects.

Table 16.53 Summary of Project Residual Environmental Effects: Water Resources

Project Phase	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	
Change in Surface Water Quantity											
Construction	• Implement progressive rehabilitation. • Optimize water harvesting and re-use . • Restore existing water balance conditions, to the extent feasible. • Refer to Table 16.52 for detailed mitigation list.	A	L	S	ST	R	R	U	N	H	Surface water quantity (water level) monitoring during construction, operations and closure.
Operation and Maintenance		A	L	L	MT	R	R	U	N	H	
Decommissioning and Reclamation		P	L	S	ST	O	R	U	N	H	

Project Phase	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	
Change in Surface Water Quality											
Construction	• Implement erosion and sedimentation controls. • Use of appropriately sized sedimentation ditches and ponds. • Ammonia contamination management. • Implement effluent treatment, including red water control as per options outlined in the Project Description. • Restore natural drainage patterns and maintain or restore existing water balance condition, to the extent feasible. • Manage effluent treatment to meet MMER and NL ECWSR discharge limits. • Refer to Table 16.52 for detailed mitigation list.	A	L	S	ST	S	R	U	N	H	Surface water quality monitoring during construction, operations and closure.
Operation and Maintenance		A	L	L	MT	R	R	U	N	H	
Decommissioning and Reclamation		P	L	S	ST	O	R	U	N	H	

Project Phase	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	
Change in Surface Water Drainage Patterns											
Construction	• Minimize drainage interactions and alterations. • Construct open pit mine headwater pipeline. • Construct open pit mine and waste rock disposal area perimeter ditches. • Construct access roads and rail line cross drainage. • Restore natural drainage patterns and maintain or restore existing water balance conditions, to the extent feasible. • Refer to Table 16.52 for detailed mitigation list.	A	L	S	ST	R	R	U	N	H	Monitor for compliance with mitigation measures.
Operation and Maintenance		A	L	S	MT	R	R	U	N	H	
Decommissioning and Reclamation		P	L	S	ST	S	R	U	N	H	
Change in Groundwater Quality or Quantity											
Construction	• Best management practices. • Blast monitoring.	A	L	S	ST	S	R	U	N	H	Groundwater monitoring wells to monitor water levels, flows and chemistry.
Operation and Maintenance	• Implement best management practices. • Refer to proposed monitoring.	A	L	L	MT	R	R	U	N	H	
Decommissioning and Reclamation	• Open pit mine flooding.	P	L	S	ST	O	R	U	N	H	

Project Phase	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	

KEY

Direction:
- P Positive: condition of Water Resources is improving in comparison to baseline conditions and trends.
- A Adverse: condition of Water Resources is declining in comparison to baseline conditions and trends.
- N Neutral: no change in the condition of Water Resources compared to baseline conditions and trends.

Magnitude:
- N Negligible: no measurable effect anticipated.
- L Low: effect occurs that is detectable but is within normal variability of baseline conditions.
- M Moderate: effect occurs that would cause an increase with regard to baseline but is within regulatory limits and objectives.
- H High: effect occurs that would singly or as a substantial contribution in combination with other sources cause exceedances or objectives or standards within the Project RSA.

Geographic Extent:
- S Site-specific: effect restricted to the Project footprint within the LSA.
- L Local: effect restricted to the LSA.
- R Regional: effect restricted to the RSA.

Duration:
- ST Short-term: effect occurs for less than two years.
- MT Medium-term: effect occurs for between three and 20 years.
- LT Long-term: effect persists beyond 20 years.
- P Permanent: will not change back to original condition.

Frequency:
- O Occasionally: effect occurs once per month or less.
- S Sporadic: effect occurs sporadically at irregular intervals.
- R Rarely: effect occurs on a regular basis and at regular intervals.
- C Continuous: effect occurs continuously throughout the Project life.

Reversibility:
- R Reversible: effect ceases when Project operations cease.
- I Irreversible: effect continues after Project operations cease.

Ecological or Socio-economic Context:
- U Undisturbed: effect takes place within an area that is relatively or not adversely affected by human activity.
- D Developed: effect takes place within an area with human activity. Area has been substantially previously disturbed by human development or human development is still present.
- N/A Not Applicable.

Significance:
- S Significant.
- N Not Significant.

Prediction Confidence:

Based on scientific information and statistical analysis, and effectiveness of mitigation or effects management measure
- L Low level of confidence.
- M Moderate level of confidence.
- H High level of confidence.

16.7 Assessment of Cumulative Effects

Potential cumulative effects to Water Resources relate to changes in groundwater and surface water quantity and quality, as well as changes in surface water drainage patterns, as a result of Project activities in combination with those of other past, present, and future projects and activities in the RSA. In association with the Project environmental effects discussed above, an assessment of the potential cumulative effects was conducted for other projects and activities that have potential to interact with the Project. The potential for overlap between Project activities and cumulative effects of other projects and activities conducted or to be conducted in the RSA is identified in Table 16.54.

IOC Labrador Operations, Wabush Mines, and urbanization have the potential for cumulative effects with those of the Project, although they do not overlap spatially with the Project. Baseline conditions reflect the effects of these mines and urbanization within the RSA. Other identified projects are either located in a different watershed or outside the RSA; beyond which Project residual effects are not measureable for Water Resources.

16.7.1 Groundwater

As discussed previously, groundwater effects are expected to be limited to the PDA, and a short distance from Project activities (e.g., typically < 1000 m) in the case of open pit mine dewatering effects. The Project is occurring in an undeveloped area with no identified water supply users within 1 km or more of any of the Project components. The residual environmental effects on groundwater quantity, quality, and domestic supply wells are expected to be negligible after decommissioning of the Project mine site and implementation of mitigation, with the possible exception of on-going relatively low strength (iron) seepage from the TMF after reclamation. Other projects and activities will not overlap the physical footprint of this Project.

Cumulative residual effects on groundwater quantity from the Project are judged to be not significant. Groundwater abstraction for the Rose Pit dewatering is returned to the Churchill River watershed thorough the mine water management facilities. Upon decommissioning, the pit will be flooded, and no further groundwater pumping would occur.

The cumulative effect on groundwater quality is also judged to be not significant. Groundwater low pathways are anticipated to be short between mine components and the surface water regime; groundwater seepages are collected within the mine water management system, and treated as surface water. The effect of multiple mines on the overall watershed is judged to be negligible.

Therefore there will be no cumulative effects to groundwater resulting from other projects and activities in combination with this Project. The adverse cumulative effect is, therefore, not significant.

Table 16.54 Summary of Potential Cumulative Effects to Water Resources

VEC Existing Condition (Past & On-Going Activities)	• Surface water from the PDA and LSA flows downstream to Wabush Lake and eventually to the Churchill River.		
Project Residual Environmental Effects	• Net reduction in outlet flow from Long Lake. • Outlet flow reductions can be further mitigated by increased water re-use, and implementation of less water-intensive processes. Cumulative effects downstream are naturally mitigated by the increase in watershed area downstream at potential points of interaction resulting in the dampening of PDA/LSA water quantity reductions.		
Other Projects and Activities	**Likely Effect Interaction (Y/N)**	**Rationale**	**Cumulative Effects**
IOC Labrador Operations	N	• Reduction in outlet flows from Long Lake which flows to Wabush Lake.	• Net reduction of <1% in flows from Long Lake may affect water levels and flows in Wabush Lake which is the tailings management facility of IOCC Carol Lake project.
Wabush Mines (Cliffs Resources)	N	• Located outside of likely effects boundary. Wabush mines withdraws from and discharges water to the Flora Lake system which is upstream (tributary to) the Long Lake to Wabush Lake flow system.	• Effects of Rose Pit drawdown unlikely to exceed 1 km. • Effects of TMF seepage contained within LSA Drainage patterns. • Effects of Long Lake mixing zone contained within LSA. • Effects of consumptive water withdrawal from Long Lake watershed <1%. • Effects of drainage pattern alterations confined to within the PDA.
Mont Wright Mine (ArcelorMittal)	N	• Located outside of likely effects boundary.	
Bloom Lake Mine and Rail Spur (Cliffs Resources)	N	• Located outside of likely effects boundary.	
Schefferville Iron Ore Mine (Labrador Iron Mines)	N	• Located outside of likely effects boundary.	
DSO Iron Ore Project (Tata Steel Minerals Canada)	N	• Located outside of likely effects boundary.	
Lower Churchill Generation Project (Nalcor Energy)	N	• Located outside of likely effects boundary.	
Infrastructure or other projects at Port of Sept-Îles	N	• Located outside of likely effects boundary.	
Urbanization	N	• Urbanization will likely have effects on surface water quality and quantity, but any municipal projects would be required to implement standard	• Possible localized reduction in surface water quality in immediate vicinity of various projects, however no predicted spatial overlap between

		mitigation measures to protect water resources. • There is adequate surface water and groundwater resources within the RSA to support the needs of local populations (and any anticipated minor increases) and mining projects without any significant effects.			projects and activities and their effects and effects on local water supply lakes will be not significant. • Localized reduction in groundwater and surface quantity related to water withdrawal for municipal and mining purposes, however not beyond existing capacity and no predicted spatial overlap in effects. No measurable cumulative effects on surface water resources are likely.			
Cumulative Effects Summary (Project + relevant other Projects and activities)	**Direction**	**Magnitude**	**Geographic Extent**	**Duration**	**Frequency**	**Reversibility**	**Significance**	**Confidence**
	N	L	S/LSA	M	S	R	N	H
Net water quantity reduction to Wabush Lake system is very small in magnitude and its geographic extent is focused within the LSA with only minor water quantity effects in the RSA. The residual effect is within the boundaries of the naturally-occurring hydrological regime, will only persist for the mid-term, is reversible at the end of mine operational life and are further dampened geographically by increased watershed area at the downstream point of interaction. Therefore the residual effect is not significant.								

16.7.2 Surface Water

As discussed previously, surface water quality residual effects relate to the net consumption of water by the Project under worse case conditions, however this residual effect is determined to be not significant. No other Project effects are determined to be residual and extending beyond the LSA boundary.

Because the Project will have negligible (i.e., surface water quality, drainage patterns, and watercourse alterations) or localized, low magnitude effects (i.e., low strength (iron) seepage, increases and reductions in flows within boundaries of natural flows) that are not significant, the Project is not likely to contribute to the cumulative effects of other projects and activities within the RSA. Future projects and activities will be required to comply with planning and regulatory processes, and therefore cumulative effects will be managed.

Similar to groundwater, other projects and activities will not overlap the physical footprint of the this Project or interfere with water supply and discharge potential. Therefore, there will be no cumulative effects to surface water resulting from other projects and activities in combination with this Project. The adverse cumulative effect is, therefore, not significant.

16.8 Accidents and Malfunctions

The main accidents and malfunctions scenarios that could affect surface water and groundwater include:

- Forest fire;
- Breach of the polishing pond or tailings dykes / berms;
- Train derailment and consequent spill of materials or contaminants; and
- AST fuel tank failure.

In the unlikely event of any of these scenarios, the quality of local water surface water and groundwater resources in the immediate and down-gradient areas could be affected. The following sections discuss each accidental event scenarios and the mitigation and contingency measures that will be implemented during these events to minimize the effects to surface water and groundwater resources.

Forest Fire

Although unlikely, Project activities involving the use of heat or flame could result in a fire. The extent and duration of a resulting fire would be dependent on response efforts and meteorological conditions. A Fire Suppression Water Supply will be extracted from Long Lake and will be kept pressurized at the pumping station near the concentrator area. Staff will be trained to prevent and control fires. A plan for preventing and combating forest fires will be incorporated into the Emergency Response Plan.

The nearest district forest management unit office is in Wabush, which has staff and equipment to provide initial suppression activities. Two seasonal fire protection staff are stationed in Wabush from mid-May to September, complemented by three permanent staff that are available for fire suppression when needed. After regular hours, the Department maintains one district duty officer and one regional duty officer for receiving fire reports and dispatching staff and equipment. Therefore, in the event of a fire, the on-site response and proximity of provincial fire suppression will limit the size of any burn.

Forest fires are unlikely to affect groundwater resources. While there could be a minor and temporary change in shallow groundwater chemistry due to recharge through in burned over areas, the long term effect is judged to be negligible.

Forest fires can change surface water quantity and quality. The burning of the forest cover and scorching of the forest floor will remove the interception capacity of the forest surface and temporarily eliminate the potential for transpiration. Therefore forest fire will affect the forest water balance by increasing overland flows and reducing evapotranspiration. The deposition of volatile organic compounds, ash and other burning residuals may affect local water quality. Continued runoff from a burn will continue to carry burn residual material to receiving waters and may continue to degrade surface water quality. Natural regrowth or planned reforestation will reverse the water quantity and quality effects.

Dyke Breach

The dykes located at the TMF will be designed to standards of the Canadian Dam Association (CDA) Dam Safety Guidelines. The CDA Dam Safety Guidelines will be used to guide the hazard consequence assessment process and associated design standards for the dykes at the TMF. The hazard consequence class for rockfill dams is determined through hydrotechnical, seismic, and geotechnical assessments of a dam breach failure. The dam design and hazard consequence classification process is subject to a risk assessment process to minimize and reduce risk of breach and, subsequently, to reduce risk to acceptable levels. The outlet structures and TMF are being designed to accommodate a 100-year storm. In addition, an emergency spillway will be incorporated into design to provide relief of larger runoff events such as the Probable Maximum Precipitation event.

A major breach of the TMF containment could result in significant flooding and inundation of down-stream areas with treated water and sediment. While surface water and groundwater resources are interactive, the effect to groundwater resources (e.g., well users) should be minimal, due to absence of well users near the TMF. A contingency plan for the containment and clean-up of the affected areas would be done in conjunction with the surface water and wetland VECs.

The proposed tailings pond will be a dynamic water feature whose location and shape will move and adjust over the life-of-mine due to the proposed upstream tailings deposition method. In the upstream method tailings are deposited starting from the tailings dam crest and form a tailings beach from the dam. The tailings pond formed is therefore always upstream of the tailings beach. This deposition method progressively moves the tailings pond farther away from the tailings dam and subsequently lowers the risk of a flooding breach of the tailings dam. In the event of a tailings dam breach, tailings pond water would have to migrate through the tailings beach to the breach and in the process peak flows would be expected to be attenuated to low consequence levels.

The proposed polishing pond dam will be a more static water feature maintaining its location throughout the life-of-mine. A potential breach of the tailings pond dam would result in release of impounded water to the downstream receiving environment, which is the TDA-02 stream. The environmental effects assessment is based on incremental effects between the inflow design flood without a breach and with a breach. As the TMF and polishing pond effectively removes the upstream portion of TDA-02, if a dam breach were to occur, much less water would route through the watercourse than if the polishing pond were an on-line system. A dam breach would be expected to cause localized flooding and may cause some erosion and sedimentation near the breach point. However these effects would be temporary and the downstream watercourse is expected to recover naturally. Polishing pond water quality is expected to be ≤ 100 mg/L due to this being the sedimentation criteria for reclaim water intake from the tailings pond. Further, installation of a system to treat red water is expected to improve resident water quality in the polishing pond. Therefore, dam breach water quality may exceed MMER TSS guidelines, however TSS concentrations are expected to be moderate and not greater than the maximum TSS concentrations that can occur naturally. This effect would also be temporary and one from which the receiving watercourse would be expected to recover naturally.

Train Derailment

Fuel will be transported along the rail line to the Project site and ore concentrate will be transported from the Project site to the QNS&L railway. The rail line will cross the Wahnahnish Lake Public Water Supply Area, following the existing road infrastructure through the area where possible, using the alignment of the road to Elephant Head Lake for a portion of the route. Water crossings in the water supply area are planned to be installed at locations of existing crossings used by the road infrastructure.

Diesel for the mining equipment as well as heating oil for the boilers will be brought to the Project site by rail from Sept-Îles. The railcars will be unloaded into separate fuel reservoirs at the fuel unloading station in proximity of the Kami rail loop. 30,000 gallon tank cars will be used to transport fuel. The frequency of fuel transport is estimated at:

- Three tank cars per week of heating oil during the 24-week heating season for boiler fuel; and
- Six tank cars per week of diesel fuel for mine vehicles.

Therefore, in a worst case scenario (i.e., six tanks of diesel fuel are de-railed), 180,000 gallons of diesel fuel could be released.

A train derailment with release of large amounts of petroleum or reagent chemicals would be immediately isolated and cleaned up under an emergency contingency plan. Of critical concern regarding the rail line alignment is the potential for accidents and malfunctions resulting in spills / releases to the Wahnahnish Lake Public Water Supply Area, as well as protection of surface water resources. Any well users potentially at risk would be identified, monitored, and if necessary remediated (provision of alternate supply, well repair, well replacement, etc.). A groundwater quality monitoring program will be implemented to assess the effectiveness of clean-up.

Alderon will prepare an Emergency Response Plan which will include measures to reduce the risk of accidents and malfunctions affecting water resources, and emergency spill response and management plans. Priority is given to spill prevention, however design of rail infrastructure will incorporate emergency response accommodations in design, development of spill response plans, training of first response staff including response practice, and comprehensive planning to ensure the protection of human and ecosystem health in the event of a spill accident or malfunction.

Mitigation measures to prevent derailments include:

- Manual inspection of rolling stock, undertaken before trains are loaded at the mine site, to confirm there are no problems with wheels, couplers, carbody, or brakes. Defective equipment will be removed from the train and kept out of service until repaired; and
- Track inspections (both manual and electronic) to be carried out in accordance with Transport Canada regulations to identify track defects that could lead to derailment.

AST Fuel Tank Failure

An additional accidental scenario has been developed for this VEC. Large on-site fuel tanks and fuel handling facilities are proposed for the Project. Groundwater and surface water quality may be adversely affected in the event of a fuel tank failure and the consequent releases of petroleum hydrocarbons. A major release may also result in disruption of the nearby mining or processing operations until the release is remediated. Because of the naturally low groundwater temperatures at the Project site, the potential adverse effects of a hydrocarbon spill can persist long after clean-up has been affected. Low temperature inhibits the natural biodegradation of hydrocarbon that becomes residually adsorbed to soil and rock.

A major release escaping secondary containment or other mitigative measures could result in the movement of free phase hydrocarbons across the surface towards receiving waters and drainage features, as well as movement of free hydrocarbons into the subsurface, thereby affecting the quality of the underlying groundwater. In addition to the potential risks of fire and explosion from the free phase product and associated vapors, the presence of floating hydrocarbon on the water table, and dissolved hydrocarbon constituents within the groundwater can result in a persistent anoxic groundwater condition (e.g., dissolved oxygen is consumed by micro-organisms degrading the hydrocarbon), which can indirectly result in the dissolution of otherwise poorly soluble metals such as iron, manganese and other metals from the host aquifer. When hydrocarbon-affected groundwater is intercepted by a water supply well, complaints of odor, iron fouling and vapors can render the well un-usable. Similarly, when hydrocarbon-affected groundwater discharges into the surface water environment, the aquatic habitat can become affected by metals, reduced dissolved oxygen and discoloration.

The risk of a major release will be mitigated through the provision of impermeable containment berms (or other forms of double containment), establishment of groundwater monitoring wells around the fuel storage and handling facilities, regular inspection of all components of the storage facility, provision of alarms on secondary containment measures, careful implementation of fuel transfer operations, and provision of an emergency response plan for the immediate isolation and clean-up of a release. In the event the release escapes the secondary containment, additional measures include the proposed sedimentation pond design which discharges water from the bottom of the pond specifically to enable the sedimentation pond to act as a secondary containment feature for the release of hydrocarbons to the ground surface.

A typical remediation response would involve the immediate containment and recovery of free product, excavation and removal of hydrocarbon saturated soil, interception and removal of hydrocarbon entrapped within the fractured bedrock using recovery wells and immiscible scavenger methods, repair of the failure mechanism (pipe, valve, tank) and confirmatory monitoring of clean-up efficiency. Where the release occurs within the capture area of an on-site water supply well, that well would be immediately shut down until remediation has been affected, followed by monitoring for the contaminants of concern for a period of time sufficient to confirm absence or concentration slow enough to make treatment of the well water feasible. If warranted, affected supply wells would be either decommissioned, or provided with appropriate water quality treatment devices.

Residual Environmental Effects Resulting from Accidents and Malfunctions

The results of the assessment of potential environmental effects of accidents and malfunctions is summarized in Table 16.55.

Table 16.55 Summary of Residual Environmental Effects for Water Resources – Accidents and Malfunctions

Accidents and Malfunctions	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	
Change in Surface Water Quantity											
Train Derailment / Fuel Storage Tank Failure	• EPP • ERP	N	N	S	ST	U	R	N/A	N	H	None recommended.
Forest Fire	• EPP • ERP	A	L	S	ST	U	R	U	N	H	None recommended.
Polishing Pond Dyke Breach	• EPP • ERP	A	M	L	ST	U	R	D	N	H	None recommended.
Change in Surface Water Quality											
Train Derailment / Fuel Storage Tank Failure	• EPP • ERP	A	H	L	MT	U	R	U/D	S	H	Standard surface water monitoring to confirm effectiveness of clean-up.
Forest Fire	• EPP • ERP	A	L	S	ST	U	R	U	N	H	Standard surface water monitoring to confirm effectiveness of clean-up.
Polishing Pond Dyke Breach	• EPP • ERP	A	M	L	ST	U	R	D	N	H	Standard surface water monitoring to confirm effectiveness of clean-up.
Change in Surface Water Drainage Patterns											
Train Derailment / Fuel Storage Tank Failure	• EPP • ERP	N	N	S	ST	UO	R	N/A	N	H	None recommended.
Forest Fire	• EPP • ERP	A	L	S	ST	U	R	U	N	H	None recommended.

Accidents and Malfunctions	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	
Polishing Pond Dyke Breach	• EPP • ERP	A	L	S	ST	U	R	D	N	H	None recommended.
Change in Groundwater Quality or Quantity											
Train Derailment / Fuel Storage Tank Failure	• EPP • ERP	A	M	S	LT	U	R	D/U	S	H	Standard groundwater monitoring to confirm effectiveness of clean-up.
Forest Fire	N/A	-	-	-	-	-	-	-	-	-	N/A
Polishing Pond Dyke Breach	N/A		-	-	-	-	-	-	-	-	N/A

Accidents and Malfunctions	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
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KEY

Direction:
P Positive.
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N Neutral.

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M Moderate: effect occurs that would cause an increase with regard to baseline but is within regulatory limits and objectives.
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Geographic Extent:
S Site – including PDA and 200 m beyond.
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LT Long term.
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U Unlikely.
O Occasionally: once per month or less.
S Sporadic: occurs sporadically at irregular intervals.
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C Continuous: occurs continuously throughout the Project life.

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R Reversible.
I Irreversible.

Environmental or Socio-economic Context:
U Undisturbed: Area relatively or not adversely affected by human activity.
D Developed: Area has been substantially previously disturbed by human development or human development is still present.
N/A Not Applicable

Significance:
S Significant.
N Not Significant.

Prediction Confidence:
Based on scientific information and statistical analysis, and effectiveness of mitigation or effects management measure.
L Low level of confidence.
M Moderate level of confidence.
H High level of confidence.

16.9 Determination of Significance of Residual Adverse Environmental Effects

Determination of Significance of Project-related Residual Environmental Effects

Only surface water quantity effects after mitigation present net residual surface water effects. Surface water quantity effects related to the net consumptive demands of tailings water retention within the tailings area and its effects on the Long Lake flow. The net reduction in Long Lake outlet flow of <1% is considered to be not significant because mitigation offsetting increases in flows from other Project components reduce net consumptive losses, the reduction is within the boundaries of natural flows within the Long Lake system, the net effects is even further dampened at the next downstream major water taking use at IOCC Carol Lake mine due to the much larger size of the Wabush Lake watershed, the effects are mid-term and reversible.

During operations and maintenance, the Pike Lake system will see an increase in outflows due to the increase in open pit mine surface and groundwater collection. The increase in flows did not discount the potential reduction in groundwater discharge which may ensue to Pike Lake South, therefore nullifying the increased groundwater discharge effect. The increase in flows are within the natural range of flows experienced in the Pike Lake system and are expected to primarily result in an increase in baseflows. Subsequently, during decommissioning and reclamation, flows to the Pike Lake system will be decreased for the period required to fill the open pit mine. The reduction in flows are also limited in magnitude and within the natural range of flows experienced in the Pike Lake system, contained within the LSA with limited geographic extent, mid-term duration and reversible. Therefore, the residual effect of operational increase and closure decrease in flows is not significant.

With the proposed mitigation, the residual environmental effects on groundwater and surface water resources during all phases of the Project are likely to be not significant. Potential changes to surface water quality, quantity, and drainage patterns and groundwater levels and quality have been assessed and residual effects are anticipated to be not significant. There is a high level of confidence in the assessment of environmental effects and significance prediction because of the localized effects on groundwater and surface water and the mitigation measures outlined in this assessment.

Determination of Significance of Cumulative Effects

The potential environmental effects of the Project on groundwater and surface water resources will not overlap nor affect the water supply or discharge potential of other known projects within the RSA, such as IOC Labrador Operations and Wabush Mines or activities that have been or will be carried out in any substantive way. Therefore, the residual cumulative effect on groundwater and surface water resources as a result of past, present, and reasonably foreseeable projects and activities, in combination with the environmental effects of the Project during all phases, is likely to be not significant. Potential changes to surface water quality, quantity, and drainage patterns and groundwater levels and quality have been assessed and residual effects are anticipated to be not significant. This determination has been made with a high level of confidence because of the limited extent of the Project and the lack of substantive overlapping or interfering environmental effects with other projects or activities that have been or will be carried out.

Determination of Significance of Accidents and Malfunctions

The potential environmental effects of accidents and malfunctions on groundwater and surface water resources are, for the most part, likely to be not significant. An exception is the accidental release of petroleum hydrocarbons or process chemicals from a major tank rupture or a train derailment. Depending on location, effects on groundwater resources and indirectly on surface water resources could be significant. Major remedial effort would be required to mitigate a major (> 1000 m^3) fuel oil release.

16.10 Follow-Up and Monitoring

16.10.1 Groundwater

Open Pit Mine (Operation and Maintenance Phase)

Perimeter monitoring wells will be installed to monitor progress of water level decline in overburden and bedrock at varying distances from the open pit mine. The objective is to monitor mine stability and the extent of dewatering around the open pit mine.

Shallow and deep monitoring wells will be installed on the shoreline of adjacent lakes or streams to monitor vertical hydraulic gradients and water levels as mining progresses.

One or more shallow and deep monitoring well pairs will be installed on the watershed divide between the open pit mine and Gleeson Lake / Lac Daviault, and will be instrumented with automated water level data loggers. The objective is to confirm anticipated absence of water level decline across the Labrador - Québec border.

The volume and chemistry of the open pit mine sump discharge will be monitored with cumulative flow meters and analyzed for general chemistry and metals analysis on a quarterly basis.

The pit wall rock will be inspected on a regular basis for sulfide mineralization. Standard ARD abatement procedures will be implemented if warranted.

Tailings Management Facility and Effluent Treatment Infrastructure (Operation and Maintenance, and Post-reclamation Phases)

Multi-level (overburden and shallow bedrock) perimeter monitoring wells will be installed around the TMF to conduct quarterly monitoring of general chemistry, metals and water levels. The objective will be to detect and characterize chemistry of seepage leaving the TMF.

A post-closure monitoring well will be installed in the main tailings mound in the TMF to monitor water table build-up and pore water quality.

Waste Rock Disposal Areas (Operation and Maintenance Phase)

Multi-level (overburden and shallow bedrock) perimeter monitoring wells will be installed around the waste rock disposal areas to detect and characterize chemistry of seepage leaving the waste rock disposal areas, and to determine whether or not long term monitoring is warranted.

Selected Site Water Supply Wells (Operation and Maintenance Phase)

Water supply wells will be monitored for water quality (quarterly for initial two years, then annual), yield and water levels to confirm suitability for domestic / potable use and detect Project-related effects so that mitigative measures may be applied.

Surface Water

The following aspects will be monitored at discharge and receiving environment locations for compliance with MMER, NL ECWSR, and the Project-specific Certificate of Approval:

- Water level recording;
- Channel velocity, depth and flow profiling during the ice-free period; and
- Water quality.

Monitoring Reporting

The results for surface water levels, flows, and water quality as well as weather records will be reported on an annual basis.

16.11 Next Steps

An EPP will be prepared for the Project to provide site and activity-specific mitigation measures for Water Resources, and application for permits will be made. Government regulators will be consulted throughout the development of the EPP and permit application stage. The Water Management Division of DOEC and Environment Canada will be consulted to confirm effluent criteria for MMER and NL Reg. 65/03 Schedule A limits, and to confirm red water effluent criteria.

16.12 Summary

The Project is located in an area where mining and rail activities currently occur. The proposed Project construction, operation and maintenance and decommissioning activities will result in localized changes to groundwater quality and quantity, and surface water quantity, quality and drainage patterns. All residual effects associated with these phases of the Project are predicted to be low in magnitude, i.e., effect occurs that is detectable but is within normal variability of baseline conditions, and contained within the LSA. Mitigation will be in place to ensure effluent and runoff from the Project are treated and meet applicable provincial and federal (MMER) discharge requirements. Monitoring for ground water and surface water quality will also be implemented. In conclusion, residual effects from these stages of the Project on Water Resources are not likely to be significant.

Significant residual effects have been predicted for several worst-case accidental event scenarios, including a train derailment, which could result in significant, but localized effects on surface and ground water quality. These effects will be mitigated through implementation of appropriate and timely emergency response procedures.

Likely cumulative effects on Water Resources as a result of the Project are not significant.

17.0 WETLANDS

17.1 Valued Ecosystem Component Definition and Rationale for Selection

Wetlands have been selected as a VEC in recognition of the potential for interactions between Project activities and the wetland environments and the relationship of those wetlands with wildlife and other biological and physical environments, as well as in recognition of the federal and provincial policies regarding wetlands.

Wetlands cover a sizable proportion of the natural landscape of Labrador and are a major constituent of the undisturbed boreal ecosystem, where they provide a number of ecological (physical, chemical and biological) and socio-economic functions that are of value to regulatory agencies, the public, and ecosystems. These may include, but are not limited to: the provision of habitat for many important plant and animal species (of particular importance for some that are rare or sensitive); groundwater recharge; amelioration of flooding; removal of some contaminants; and regulation of various bio-geochemical processes. They are linked to the traditional way of life of local Aboriginal people, in particular because of the cultural significance of the many wildlife species (e.g., moose, muskrat, beaver) and wetland plants (e.g., sphagnum moss, bog cranberry) that inhabit them. Further benefits of wetlands include their utility as outdoor educational exhibits and laboratories, value for recreational initiatives and pursuits, and harvesting potential for items such as berries, wild game and peat extraction (i.e., peat moss and fuel peat).

"Wetland" is defined by the Federal Policy on Wetland Conservation (Government of Canada 1991) as:

> *"…land that is saturated with water long enough to promote wetland or aquatic processes as indicated by poorly drained soils, hydrophytic vegetation and various kinds of biological activity which are adapted to a wet environment. Wetlands include organic wetlands or "peatlands", and mineral wetlands or mineral soil areas which are influenced by excess water but produce little or no peat."*

Under the same federal policy, "wetland function" is defined as:

> *"…the natural processes and derivation of benefits and values associated with wetland ecosystems, including economic production (e.g., peat, agricultural crops, wild rice, peatland forest production), fish and wildlife habitat, organic carbon storage, water supply and purification (groundwater recharge, flood control, maintenance of flow regimes, shoreline erosion buffering), and soil and water conservation, as well as tourism, heritage, recreational, educational, scientific, and aesthetic opportunities."*

This definition does not distinguish between the processes that wetlands perform and the value that society places on them for ecological, economic, and social reasons. Such a distinction is often made by others, with wetland "functions" being the natural physical, biological, and chemical processes that occur in the development and maintenance of wetlands, and wetland "values" being the benefits that these functions provide to people or the environment (Smith et al. 1995; Novitzi et al. 1997; Kusler 2004).

The Federal Policy on Wetland Conservation focuses on wetland functions as the target for conservation efforts. Wetland functions provide the best rationale for applying the policy to decisions involving wetlands, and the best basis for identifying and implementing the mitigation of environmental effects on wetlands. It is not the presence of a wetland on or near the Project site that determines what can and cannot be done. Rather, it is the ecological functioning of the wetland, that is, the role of the wetland in the surrounding environment that should determine the fate of the site (Environment Canada 1996).

Aspects of this VEC (wildlife habitat, species at risk) are assessed in Chapter 19: Birds, Other Wildlife and their Habitat and Protected Areas, and 20: Species at Risk and Species of Conservation Concern).

17.1.1 Approach to Assessment of Effects

The assessment considers the environmental effects of the Project on wetlands identified in the PDA that cannot be reasonably avoided. Where the Project disturbs wetlands, an assessment (including background research and field studies), which includes consideration of the Federal Policy on Wetland Conservation, was undertaken to determine the recommended technically and economically feasible mitigation measures to minimize residual adverse residual environmental effects, as required.

The assessment of environmental effects has been discussed with the provincial regulator, Department of Environment and Conservation (DOEC), most notably at a meeting on March 1, 2012, attended by:

- Environmental Assessment Division, DOEC;
- Wildlife Division, DOEC;
- Endangered Species & Biodiversity, Wildlife Division, DOEC;
- Executive VP - Environmental and Aboriginal Affairs, Alderon Iron Ore Corp. (Alderon);
- Manager of Environmental Assessment, Alderon; and
- Stassinu Stantec Consulting Ltd. (Stassinu Stantec).

The meeting included an outline of the results of the Wetlands Baseline Study and a presentation and discussion of the methodology for environmental effects. The DOEC expressed satisfaction with the overall approach and suggested some additional data sources relevant to the background research program. Other issues included ongoing consultation with relevant stakeholders, as well as the need for review, and potentially, field assessment of any pre-construction activities that might entail Project-related effects to existing Eastern Habitat Joint Venture (EHJV) Municipal Wetland Stewardship Agreements and Wetland Habitat

Conservation Plans (Labrador City 2010; Wabush 2010). The effect to the Habitat Management Units established under these agreements is assessed in Chapter 19: Birds, other Wildlife and their Habitats, and Protected Areas.

17.1.2 Issues

Alderon recognizes the importance of communications with federal, provincial, and municipal regulatory agencies, stakeholders, and the public, and conducted an extensive stakeholder consultation program as part of the issues scoping exercise for the Project. The consultation program focused primarily on the areas most likely to be affected by the Project, including Labrador City, Wabush, and the Town of Fermont in the province of Québec.

The issue raised relating to wetlands through the public engagement and community consultation process was the loss and possibility of replacement of wetland habitat in the Wetland Stewardship Zones. This issue was raised 20 times. Mitigation measures proposed by stakeholders included dedicating a new wetland, use of money for interpretation sites, viewing area for Wabush narrows, education, and clean-up of historically impacted areas. Alderon is in the process of pursuing a Corporate Stewardship Agreement with the municipalities and the Province (through the Eastern Habitat Joint Venture) to address the effects of the Project on Management Units, including the Pike Lake South Management Unit. Details are provided in Chapter 19: Birds, Other Wildlife and Their Habitats, and Protected Areas.

This concern informed baseline data collection and is addressed through an assessment of loss of wetland area and function within potentially affected watersheds.

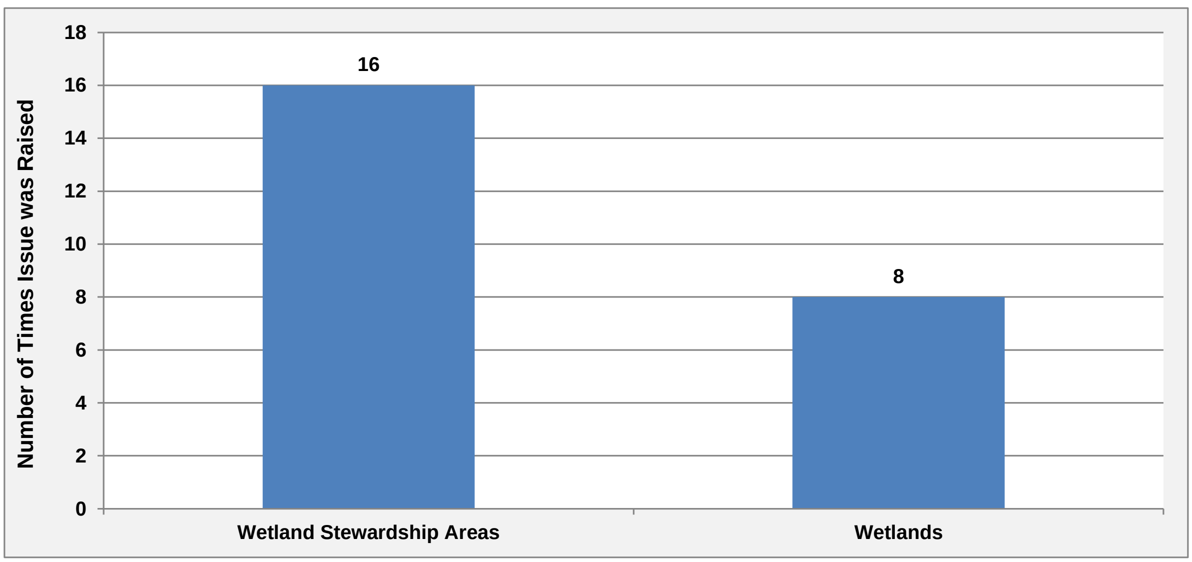
Alderon has engaged and consulted with a variety of stakeholders, Aboriginal groups, and members of the public throughout the EA process, and is committed to being responsive to questions and concerns that arise. Accordingly, these issues are included in the assessment of the VEC. Details on the issues raised by stakeholders are provided in Table 17.1. The number of times each issue was raised is provided in Figure 17.1.

Table 17.1 Issues Raised by Aboriginal Groups and Stakeholders

Issue	Community / Organization	Summary of Comments Raised During Consultation and Engagement Activities	Response / Location in the EIS
Wetlands	Lab City / Wabush	Participants identified wetlands as an issue of concern.	Wetlands are common throughout the Project area, and the region. Overall, no wetland types will be lost completely as a result of Project activities. Some mitigation measures to address Project effects on wetland include minimizing interaction with wetlands by restricting construction activities to the PDA, maintaining natural drainage where possible and conduct progressive rehabilitation and wetland restoration. The assessment of Project effects on wetlands is provided in Section 17.6.

Issue	Community / Organization	Summary of Comments Raised During Consultation and Engagement Activities	Response / Location in the EIS
Wetland Stewardship Area	Wabush / Fermont / Lab City	How can loss of habitat be avoided in the conservation area? Or how will habitats within the conservation area be replaced? Mitigation measures proposed included dedicating a new wetland, use of money for interpretation sites, viewing area for Wabush narrows, education, clean up of historically impacted areas, mitigations, etc.	Alderon is in the process of pursuing a Corporate Stewardship Agreement with the municipalities and the province (through the Eastern Habitat Joint Venture) to address the effects of the Project on Management Units. Additional information is provided in Section 17.6.

Figure 17.1 Frequency of Issues Raised Related to Wetlands



17.2 Environmental Assessment Boundaries

17.2.1 Spatial Boundaries

For the purposes of the assessment, a directly affected wetland is one where the wetland area directly affected by the Project activity and physical work associated with Project ground disturbance (e.g., drainage, clearing, removal of overburden excavation, infilling, leveling, and grading), for which wetland habitat (and therefore wetland function) will be completely lost or severely altered. These wetlands are likely to correlate with, or be in close proximity to, the area of physical ground disturbance (i.e., PDA).

Indirectly affected wetlands are those wetlands not experiencing the direct effects of any Project activity and physical work (i.e., ground disturbance); however, due to their location they may be at risk of functional degradation (e.g., alteration to hydrologic flow patterns, increased erosion and sedimentation, alteration of chemical composition, habitat fragmentation). This area extends beyond the PDA and includes those wetlands where connectivity could be affected, adjacent to the area where development will occur. Wetlands with permanent connectivity to those directly affected wetlands are at the highest risk of experiencing adverse functional effects from Project activity and physical works associated with Project development, followed by those wetlands with temporary or seasonal connectivity. Isolated wetlands outside the PDA with no connectivity, directly or indirectly, to affected wetlands are the least at risk from Project development. Spatial boundaries for the environmental effects assessment of wetlands are defined below.

17.2.1.1 Local Study Area

For the environmental assessment of wetlands, the Local Study Area (LSA) includes the PDA in its entirety, as well as the entire Kami mineral license area (Figure 17.2). The LSA is the maximum area within which Project-related environmental effects can be predicted or measured with a reasonable degree of accuracy and confidence. The LSA is the area where wetland area analysis was completed. The LSA generally corresponds to the survey area for the in-field component of the wetland inventory and evaluation.

The spatial boundary for the assessment of wetlands is approximately 16,100 ha, and includes the area for which detailed air photos were available.

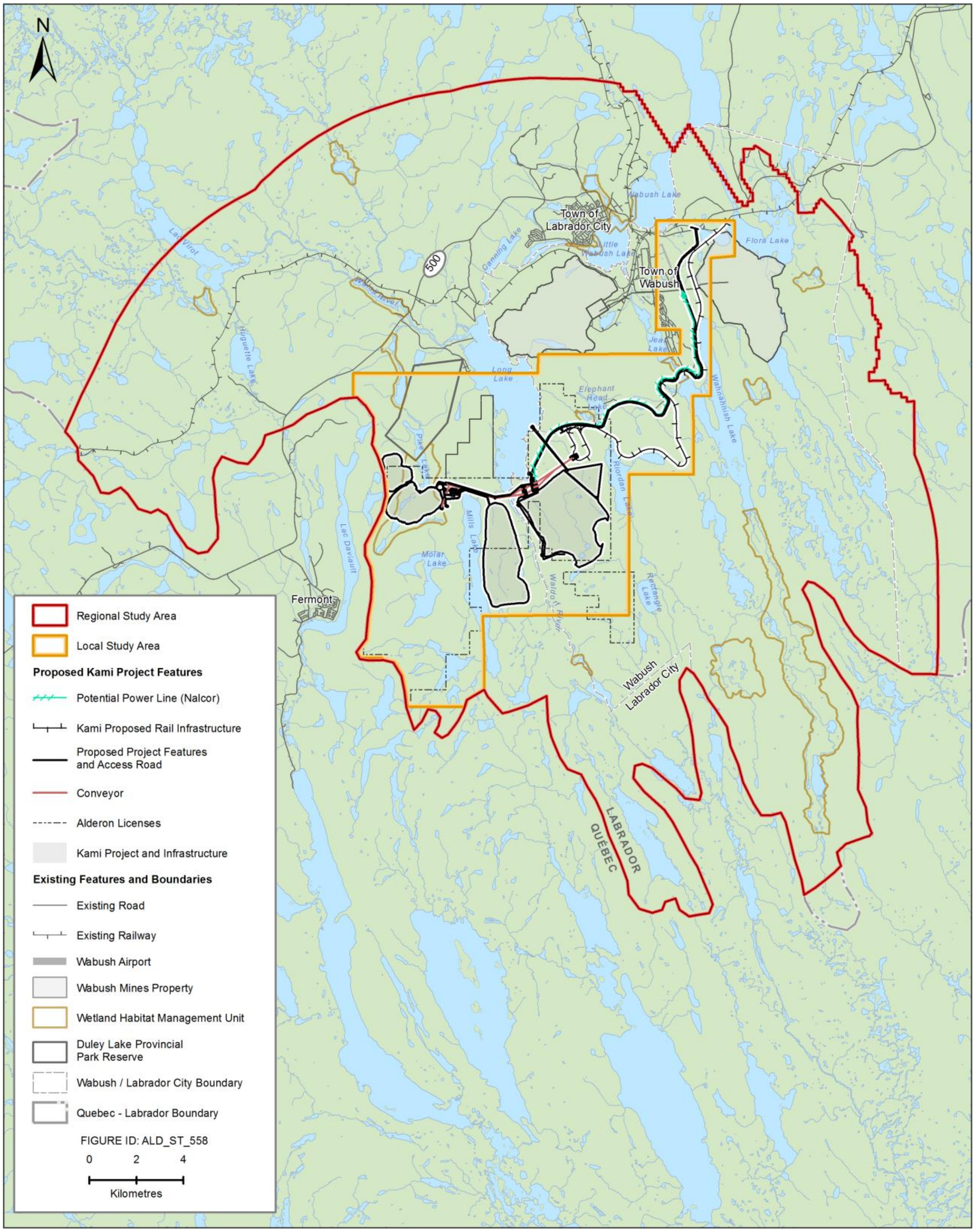
17.2.1.2 Regional Study Area

The Regional Study Area (RSA) is the area within which cumulative effects on Wetlands may occur. The RSA encompasses several sub-watersheds, including Mills Lake, Long Lake, Riordan Lake, Waldorf River, Pike Lake South, Wabush Lake, and several unnamed brooks and lakes. The RSA is approximately 73,900 ha and is bounded by the Québec-Labrador border on the west, a subwatershed boundary east of Wahnahinish Lake to the east, Wabush Lake on the north, the Québec-Labrador border to the south, and waterbodies over which the rail infrastructure and access road cross (Figure 17.2). Information on the distribution of wetlands in the RSA was obtained from an ecological land classification completed for the Project.

17.2.2 Temporal Boundaries

The temporal boundaries for the assessment of potential environmental effects of the Project on wetlands include the Project phases of construction (approximately two years), operation and maintenance (approximately 17 years), and decommissioning and reclamation (approximately two years).

Figure 17.2 Local Study Area and Regional Study Area Boundaries



17.2.3 Administrative Boundaries

17.2.3.1 Federal and Provincial Legislation

Wetlands are protected under federal and provincial legislation, regulations, policies, and guidelines published by the governments of Newfoundland and Labrador and Canada, and as such, a thorough assessment of Project-related effects on wetlands and wetland habitats, and their significance, is required under CEAA and NLEPA, and appropriate mitigation measures must be identified. This Wetland VEC chapter has been developed in accordance with applicable provincial and federal acts and associated regulations and may include the following:

- *Newfoundland and Labrador Environmental Protection Act*;
- *Newfoundland and Labrador Endangered Species Act*;
- *Newfoundland and Labrador Wildlife Act*;
- *Newfoundland and Labrador Water Resources Act*;
- *Canadian Environmental Assessment Act* (CEAA);
- *Species at Risk Act* (SARA);
- *Migratory Birds Convention Act* (MBCA);
- *Fisheries Act*; and
- *Canada Wildlife Act*.

In addition to regulatory requirements, the Federal Policy on Wetland Conservation, and the Newfoundland and Labrador Policy for Development in Wetlands have been considered.

Canada

Although there is no specific federal legislation regarding wetlands, they may be protected federally under the SARA (Government of Canada 2002), if they contain critical habitat for species at risk; the *Migratory Bird Convention Act* (MBCA), if they contain nests of migratory birds, and/or the *Fisheries Act*, if the wetland contributes to existing or potential fish habitat. Details on the application of the MBCA, SARA for protection of wildlife, and the *Fisheries Act* for the protection of fish and fish habitat are provided in Chapter 18: Freshwater Fish, Fish Habitat and Fisheries, and Chapter 20: Species at Risk and Species of Conservation Concern.

Wetland conservation is promoted federally by the Federal Policy on Wetland Conservation (Government of Canada 1991), although there is no legislative basis specific to wetlands. This policy has been adopted in order to help meet the objectives of wetland conservation as outlined in the North American Waterfowl Management Plan, Ramsar Convention on Wetlands (Ramsar Convention Secretariat 2006), and the Canadian Biodiversity Strategy (Government of Canada 1995). The federal government's objective with respect to wetland conservation is to "promote the conservation of Canada's wetlands to sustain their ecological and socio-economic functions, now and in the future" (Government of Canada 1991).

All federal departments are required to ensure "no net loss of wetland functions" on federal lands and waters, where a wetland is designated as important or when wetland loss has reached critical levels. The policy also requires that federal departments enhance wetland functions on all federal lands and waters. It is acknowledged that not all wetland losses can be avoided. The goal of the Policy is to balance the unavoidable loss of wetland functions, through rehabilitation of former degraded wetlands or the enhancement of healthy, functioning wetlands. As a last resort, compensation for lost functions could be sought through non-wetland replacement of functions or creation of wetland where there was none before.

No net loss requires federal land managers to work through a sequence of mitigation alternatives of avoidance, minimization, and compensation, with clear criteria and defined outcomes. Mitigation alternatives and associated criteria should recognize the limitations in the understanding of wetland functions (and ways and means to assess such functions), as well as the capacity to rehabilitate or create new wetlands (Environment Canada 1996).

Newfoundland and Labrador

Under the provincial Policy for Development in Wetlands, development activities in and affecting wetlands require a permit under Section 48 of the *Water Resources Act* (Government of Newfoundland and Labrador 2002). The objective of the policy is to permit developments in wetlands that do not adversely affect the water quantity, water quality, hydrologic characteristics or functions, and terrestrial and aquatic habitats of the wetlands (Government of Newfoundland and Labrador 2011a). Under this policy, all uses and developments of wetlands that result in potentially adverse changes to water quantity or water quality or hydrologic characteristics or functions of the wetlands require the implementation of mitigative measures to be specified in the terms and conditions for the environmental approval. Additionally, the terms and conditions of the environmental approval will specify the restoration measures to be implemented upon cessation of activities or abandonment of facilities on wetland areas (Government of Newfoundland and Labrador 2011b).

There are also provincial initiatives which aim to prevent loss of key wetland functions. For example, Newfoundland and Labrador's wetland habitat stewardship program "works within the context of the EHJV to secure, enhance and restore important fresh and saltwater wetlands for waterfowl and other wildlife species" (Government of Newfoundland and Labrador 2011b). The EHJV has Municipal Wetland Stewardship Agreements, in the form of Habitat Conservation Plans, with municipalities across Newfoundland and Labrador, the intent of which is to manage important wildlife habitat within their planning boundaries and where development pressure is often greatest. Under such agreements, municipalities commit to procuring designated wetlands within their planning boundaries and to implementing "wise use" principles, as outlined within a conservation plan (Government of Newfoundland and Labrador 2011b). The potential effects of the Project on the wetland Management Units are assessed in Chapter 19: Birds, Other Wildlife and their Habitats, and Protected Areas.

17.3 Establishing Standards or Thresholds for Determining the Significance of Environmental Effects

The likely effects of the Project on wetlands are described using the following attributes, which are based on standard environmental assessment practice and the EIS Guidelines. The following terms will be used to characterize residual environmental effects for wetlands: direction, magnitude, geographical extent, frequency, duration, reversibility, and ecological context. These descriptors, and definitions for each of their associated ratings, are defined below.

- **Direction:**
  - Positive – Beneficial or desirable change in the environment;
  - Neutral – No detectable or measureable change in the environment; or
  - Adverse – Worsening or undesirable change in the environment.
- **Magnitude:**
  - Low - the residual Project effects to wetlands (alteration / loss) are not expected to exceed 5 percent of the total area of wetland in the RSA;
  - Moderate - the residual Project effects to wetlands (alteration / loss) are expected to be greater than 5 percent and not exceed 25 percent of the total area of wetland in the RSA; or
  - High - the residual Project effects to wetlands (alteration / loss) are expected to exceed 25 percent of the total area of wetland in the RSA. Effect can be easily observed, measured and described, and may be widespread.
- **Geographic Extent:**
  - Site-specific – Effect confined to the footprint for all Project features (i.e., PDA). Effects limited to directly affected wetlands;
  - Local – Effect extends beyond the Project footprint into the surrounding areas (LSA), including potentially affected wetland communities within 1 km of the mineral license;
  - Regional – Effect extends into the RSA. Area where indirect or cumulative effects may occur; or
  - Beyond Regional (provincial, national, international) - Effect extends beyond the regional study area. Area where indirect or cumulative effects may occur.
- **Frequency:**
  - Once - Effect occurs occasionally, or once during the life of the Project (e.g., clearing);
  - Sporadic - Effect occurs sporadically, at irregular intervals, without any predictable pattern during the life of the Project (e.g., hydrocarbon spills);
  - Regular - Effect occurs on a regular basis and at regular intervals during the life of the Project; or
  - Continuous - Effect occurs continuously.

- **Duration:**
  - Short term – Effect occurs during the site-preparation or construction phase of the Project (i.e., 1 to 2 years);
  - Medium term – Effect extends throughout the construction and operation phases of the Project (up to 17 years);
  - Long term – Effect is greater than 17 years; or
  - Permanent - Effect persists.
- **Reversibility:**
  - Reversible – Effect is reversible during the life of the Project; or
  - Irreversible – A long-term effect that is permanent (i.e., remains indefinite as a residual effect).
- **Ecological Context:**
  - Undisturbed - Area relatively or not adversely affected by human activity; or
  - Disturbed - Area has been substantially previously disturbed by human development or human development is still present.

A significant adverse residual environmental effect on wetlands is one that:

- Results in the permanent loss of a wetland type (class and form), and its associated functions in the LSA and RSA;
- Affects a high proportion of wetlands, regionally (greater than 10 percent of wetland area within the RSA); or
- Results in the degradation, alteration, or loss of wetland function within the LSA and RSA, either physically, chemically, or biologically; in quality or extent, in such a way as to cause a change or decline in the distribution or abundance of wetlands and/or associated wetland functions dependent upon that habitat (e.g., species at risk and/or species of conservation concern), such that the likelihood of its long-term viability within the LSA and RSA is substantially reduced as a result.

An environmental effect that does not meet any of the above criteria is rated as not significant.

17.4 Potential Project-VEC Interactions

Activities associated with Project construction, operation and maintenance, and decommissioning and reclamation have potential to affect wetland quality and quantity in the LSA. Potential Project interactions with wetlands are summarized in Table 17.2.

Those interactions ranked as 0 or 1 are further assessed within this section and those that are ranked as 2 are further assessed and described in Section 17.6; or in the case of Accidents and Malfunctions, in Section 17.8. The accompanying text will elaborate upon or describe the nature and/or extent of the interaction, or provide the rationale for activities that are determined to not result in an interaction with wetlands. The analysis provides a first order assessment of environmental effects of each phase or Project activity on Wetlands and will serve to focus the remainder of the environmental effects assessment on those issues that may result in substantive interactions or have potential for significant residual environmental effects. All potential residual environmental effects that are ranked as 0 or 1 are considered to be not significant.

Table 17.2 Potential Project Environmental Effects to Wetlands

Project Activities and Physical Works	Potential Environmental Effects
	Change in Wetland Quantity and Quality
Construction	
Site Preparation (including clearing, excavation, material haulage, grading, removal of overburden and stockpiling)	2
Construction of Roads	2
Construction of Site Buildings and Associated Infrastructure (maintenance facilities, offices, plant, crushers, concentrator, conveyors, gatehouse, pumphouses, substation, security fencing, sanitation system)	2
Construction of Mine Tailings Management Facility (TMF)	2
Construction of Railway and Load-out Facilities (silos)	2
Construction of Power Line	2
Construction of Stream Crossings	2
Installation of Water Supply Infrastructure (wells, pumps, pipes)	1
Onsite Vehicle / Equipment Operation	1
Waste Management	0
Transportation of Personnel and Goods to Site	1
Expenditures	0
Employment	0
Operation and Maintenance	
Open Pit Mining (including drilling, blasting, ore and waste haulage, stockpiling, dewatering)	1
Ore Processing (including crushing, conveying, storage, grinding, screening)	0
Concentrator Operations (gravity and magnetic separation, tailings dewatering, tailings thickener, concentrate conveyance to load-out)	0
Tailings Disposal in TMF	1
Waste Rock Disposal on Surface	1
Water Treatment (including mine water and surface runoff) and Discharge	1
Rail Load-Out by Silo Discharge	0
Rail Transport	0
Onsite Vehicle / Equipment Operation and Maintenance	1
Waste Management	0

Project Activities and Physical Works	Potential Environmental Effects
	Change in Wetland Quantity and Quality
Transportation of Personnel and Goods to Site	1
Fuel Storage and Dispensing	1
Progressive Rehabilitation	1
Expenditures	0
Employment	0
Decommissioning and Reclamation	
Site Decommissioning (building demolition)	1
Site Reclamation (scarifying, recontouring, grading, revegetation)	1
Accidents and Malfunctions	
Train Derailment	2
Forest Fire	2
Polishing Pond Dyke Breach	2

KEY
0 Project activity that will not interact with Wetlands.
1 Project activity that may interact with Wetlands; however, based on past experience, the interaction would not result in a residual environmental effect or is effectively mitigated through standard environmental protection practices. No further assessment is warranted.
2 Project activity that will interact with Wetlands and may have residual environmental effects that exceed acceptable levels without implementation of specific mitigation. Further assessment is warranted.

Interactions Ranked as 0

There is no potential interaction of the following Project activities on wetlands:

- Construction – Waste Management, Expenditures, Employment; and
- Operation and Maintenance – Ore Processing, Concentrator Operations, Rail Load-out, Rail Transport, Waste Management, Expenditures, and Employment.

Waste management will follow applicable laws, regulations, and standards for the safe use, handling, storage, and disposal will be followed, and will use existing facilities as feasible. Expenditures and employment are not physical works or activities, and will therefore not interact with wetlands. The activities of ore processing and concentrating, and rail load out and transport, will not affect wetland area or function.

Interactions Ranked as 1

Project activities ranked as 1 may have effects on wetlands (e.g., introduction of dust or invasive species); however, standard environmental protection practices are available and will be implemented to effectively mitigate these interactions. Environmental protection measures designed to manage these effects associated with all Project phases will be detailed in a separate Environmental Protection Plan (EPP), prepared in support of the EIS, and prepared prior to construction. The EPP will describe the specific environmental protection and mitigation measures that will be applied throughout the life of the Project to avoid or minimize potential effects as a result of the Project. To promote effectiveness of the EPP, Alderon will have a full-time on-site Environmental Monitor, who will inspect worksites and activities for conformance with the EPP, and compliance with government regulations and permits.

The potential effects of the Project activities ranked as 1 are discussed below for each Project phase. All potential residual environmental effects that are ranked as 1 are likely to be not significant.

Construction

During construction, standard mitigation measures are available and will be implemented for the following activities:

- Installation of water supply infrastructure;
- On-site vehicle / equipment operation; and
- Transportation of personnel and goods to the site.

Installation of Water Supply Infrastructure (Wells, Pumps, and Pipes)

Water supply construction includes all infrastructure associated with water obtained from ground wells and Long Lake. Infrastructure associated with ground well water and surface water extractions is not anticipated to have a direct influence on wetlands or wetland habitat because disturbance will be temporary and will not affect drainage patterns. The infrastructure will be designed and installed using Best Available Control Technology (including DFO and DOEC Water Resources Division guidelines) to maintain the natural hydrology, and to prevent ponding or dewatering.

On-site Vehicle / Equipment Operation and Transportation of Personnel and Goods to Site

On-site vehicle and equipment operation has the potential for increased generation of air or waterborne particulates and could facilitate the dispersal, propagation, and establishment of non-native and invasive species. Non-native and invasive species can be introduced and spread due to the transportation of equipment and vehicles (i.e., transferred soil and propagules) to and within the LSA, affecting native plant species and/or populations through competitive exclusion, outcompeting natural vegetation for resources (e.g., available nutrients) and altering ecosystem function (e.g., nutrient cycling). Potential effects will be mitigated through the installation of appropriate erosion and sediment controls prior to ground disturbance, including silt fencing, vegetation cover, erosion control blankets, straw bales, check dams, siltation ponds, and rock riprap. To prevent the transfer of non-native and invasive species from infested areas along these rights of way, Alderon will establish equipment-cleaning stations at suitable locations, as appropriate.

Operations and Maintenance

During the Operations and Maintenance phase, the following activities may result in effects requiring standard mitigation practices:

- Open Pit Mining;
- Tailings Disposal in TMF;
- Waste Rock Disposal on Surface;
- Water Treatment;
- On-site Vehicle / Equipment Operation;
- Transportation of Personnel and Goods to the Site;
- Fuel Storage and Dispensing; and
- Progressive Rehabilitation.

<u>Open Pit Mining / Tailings Disposal in TMF / Waste Rock Disposal on Surface</u>

The primary effects of the Project on wetlands associated with the mining of ore and disposal / management of waste rock and tailings are the direct losses of wetlands that occur during construction and that are considered further in Section 17.6. During the operations and maintenance phase of the Project, tailings disposal in the TMF and waste rock disposal on surface are not anticipated to involve further ground disturbance activities in previously undisturbed areas or the addition of Project-related infrastructure in areas within or directly adjacent to wetlands. Thus, these activities have very limited potential to cause direct adverse environmental effects to these resources. The environmental effects of open pit mining on Wetlands is addressed fully in the construction phase, where a conservative approach is taken to assess the complete footprint of the open pit.

Dewatering of the overburden may adversely affect Wetlands during the Project operations and maintenance phase. Maintaining natural drainage patterns at the open pit, waste rock disposal areas and TMF, and the maintenance of Project infrastructure and vegetation management initiatives in accordance with applicable statutes and regulations, will mitigate this effect and it is therefore not likely to be significant.

<u>Water Treatment</u>

Effluent and site run-off water to be discharged will be treated and, therefore, effects of untreated wastewater or effluent release will not occur during normal operation. Wastewater or effluent discharge to the environment will be required to meet or exceed regulatory requirements prior to discharge. Therefore, the adverse residual effects are not likely to be significant.

On-site Vehicle / Equipment Operation, and Transportation of Personnel and Goods to the Site

The potential effects of, and mitigation for vehicle movement or equipment operation during the operation and maintenance phase are the same as those described for the construction phase above. Therefore, the adverse residual effects are not likely to be significant.

Decommissioning and Reclamation

The site will be progressively rehabilitated, and will provide opportunities for improvements in wetland function. During the decommissioning and reclamation phase, the following activities may result in effects requiring standard mitigation practices:

- Site Decommissioning; and
- Site Reclamation.

Site Decommissioning and Site Reclamation

A Rehabilitation and Closure Plan will be developed in accordance with the applicable regulations at the time of decommissioning. The Rehabilitation and Closure Plan will specify the procedures that will be followed with respect to the decommissioning, removal, and disposal of site equipment and structures, and for site remediation, where required. Potential environmental effects of decommissioning activities will also be managed following the Project-specific EPP. Therefore, the adverse residual effects are not likely to be significant.

Interactions Ranked as 2

Interactions ranked as 2 may result in significant environmental effects on Wetlands and are assessed in detail in Section 17.6. The interactions ranked as 2 are:

- Site Preparation (including clearing, excavation, material haulage, grading, removal of overburden, and stockpiling);
- Construction of Roads;
- Construction of Site Buildings and Associated Infrastructure;
- Construction of TMF;
- Construction of Railway and Load-out Facilities;
- Construction of Power Line; and
- Construction of Stream Crossings.

As indicated previously, the issue raised relating to wetlands through the public engagement and community consultation process was the loss of wetland habitat in the Wetland Stewardship Zones. Therefore, the effect of Project activities resulting in surface disturbance (listed above) and loss or alteration of wetlands is assessed in detail.

Selection of Environmental Effects and Measurable Parameters

The environmental assessment of the Wetlands VEC is focused on change in wetland quality and quantity. The measurable parameters used for the assessment and the rationale for their selection is provided in Table 17.3.

Table 17.3 Measurable Parameters for the Wetlands VEC

Environmental Effect	Measurable Parameter	Rationale for Selection of the Measurable Parameter
Change in Wetland Quality and Quantity	Wetland area: estimated proportion of wetland area (ha) within the LSA that has the potential to be affected by physical disturbance (by wetland class and form).	• Provides a conservative estimate of the maximum amount of wetland that may potentially be affected and is used to guide mitigation measures; • Alteration or loss of wetland area could affect vegetation species presence, ecosystem health, and biodiversity; and • Quantifiable based on results in the Wetlands assessment and when conditions measured by comparison to the baseline.
	Wetland function: function of affected wetlands (both direct and indirect).	• Wetland function is an important indicator in accordance with Federal Policy on Wetlands Conservation; • Alteration or direct loss of potential habitat could lead to changes in plant species abundance, ecosystem health and/or overall biodiversity; • The spread of non-native species, including weeds and invasive agronomic species is a potential threat to species diversity as these species may aggressively outcompete native vegetation (i.e., competitive exclusion), including rare plants, for resources (e.g., available nutrients) and alter ecosystem function (e.g., nutrient cycling); and • Alteration or loss of wetland function due to altered hydrologic function.

Wetland area is the most common and practical indicator of wetland function, primarily because of its accuracy of measure and relationship to wetland function. By assessing the potential loss of wetland area, assumptions can be made regarding the total loss or degradation of a wetland's ability to carry out many of its functions, thereby providing an indirect measure of functional effects. The amount of wetland area is also a factor in determining mitigation in conjunction with change in wetland function. Wetland function was chosen as it is considered a standard measure of wetland quality in Canada.

17.5 Existing Environment

Local knowledge pertaining to Wetlands is presented in Table 17.4.

Table 17.4 Local Knowledge – Wetlands

Date	Stakeholder	Community	Comment
March 14, 2012	Individual	Labrador City	The tailings impoundment and rail line areas are located on wetland / bogs.

17.5.1 Methodology for Characterization of Baseline Conditions

Data and Information Sources

Information used in support of the assessment of wetlands was derived from reviews of both historical and baseline data sources, including:

- A review of existing literature information pertaining to the distribution and character of wetlands within the region as well as functional assessment methodologies;
- Published and unpublished literature, including peer-reviewed academic journals, research project reports, and government publications;
- Use of recent digital aerial photographs and topographical maps that could indicate the presence of potentially rare plant species or habitats; and
- Project field data collected as a part of the environmental baseline program for the Project.

The majority of data were collected through surveys of the LSA and PDA, completed during the 2011 field season. The field surveys included detailed vegetation surveys, wetland inventories, and rare plant surveys. Relevant data from the Atlantic Canada Conservation Data Centre (ACCDC), other non-governmental and provincial conservation programs (e.g., Eastern Habitat Joint Venture (EHJV)), were also used to describe the existing environment.

Ecological Land Classification Enhanced for Wetlands

An ecological land classification (ELC) has been prepared in support of the EIS, the intent of which is to describe the ecological context of the LSA and RSA, such that interactions between biota, the physical environment and the Project could be assessed in the context of the specific ecology of the area. ELC provides a basis from which the effects of the Project on the surrounding environment can be understood and quantified. It was completed to identify, compile, and summarize information on vegetation and vegetation communities (including wetlands), and wildlife habitat in the vicinity of the proposed Project as environmental baseline information for use in the EIS.

ELC is a hierarchical and holistic approach that integrates a broad range of physical and biotic characteristics into discrete and ecologically unique units. In the context of the proposed Project, the ELC is an important tool for examining the interactions between the Project and the surrounding physical environment by interpreting key issues that may result from the Project in the context of the ecosystem properties identified in the ELC. The ELC was developed at the ecotype level, at a scale of 1:35,000. Ecotypes are defined on the basis of a uniformity of parent material, soils, vegetation and hydrology, as expressed by slope, position, aspect, and exposure. The ELC identified ecotypes based on predominant surficial geology, geomorphology, vegetation, and soils that in turn were grouped into 14 vegetated and 3 sparsely or non-vegetated ecotypes. These ecosystem units provide the basis for understanding how the Project may affect ecological function at a local and regional scale.

ELC provides an important tool for comparative analysis of wetland types and a framework for establishing practical indicators of wetland status and trends. Development of a standard classification is a critical first step to consistent identification and mapping of ecological units. Having a standard classification system allows the identification of patterns in biodiversity among wetland types and across regional landscapes. It also allows better documentation of factors that determine the ecological function of each wetland type in diverse landscape settings and clarification of indicators for use in conservation, management, and monitoring.

Wetland Studies

In order to evaluate the distribution and abundance of wetlands and their associated function and their interaction with the proposed Project, wetlands within the LSA were evaluated through detailed wetland assessments conducted during the period of September 28 to 30, 2011 and July 22 to 27, 2012 and reported in the Wetlands Baseline Study (Appendix I). Supported by the ELC, the objective was to provide additional detailed information on the distribution and relative abundance of various wetland types within the LSA and with potential of being effected by the Project. This information facilitated a comparative analysis of wetlands and wetland habitats and aided the production of maps depicting those wetlands potentially interacting with the Project, to be assessed in detail in this environmental assessment.

The detailed wetlands assessment was conducted for an area of approximately 16,100 ha for which detailed, high resolution aerial photography was available, using a combination of field surveys and analyses. Field surveys were used to identify and classify wetlands according to the Canadian Wetland Classification System (CWCS) (National Wetlands Working Group 1997), as well as assess their character and potential functions following guidelines outlined in *Correlating Enhanced National Wetlands Inventory Data with Wetland Functions or Watershed Assessments: A Rationale for Northeastern U.S.* (Tiner 2003), as summarized in NovaWET (Tiner 2009; NSE 2011), but has been modified and supplemented with additional information to better address the conditions of the LSA. This information was supplemented with data collected as part of the ELC for the Project, and used in conjunction with high-resolution aerial photos and topographical data to delineate and classify the wetlands within the LSA.

The CWCS is a hierarchical system used to classify wetlands into classes, forms, and types. Each class of wetland (i.e., bogs, fens, marshes, shallow water wetlands, and swamps) is distinguished on the basis of a number of ecological features, including their origin (e.g., hydrological regime) and character (e.g., dominant vegetation type). They may be subdivided into various wetland forms on the basis of surface morphology of the wetland (e.g., slope, raised, flat), position in the landscape (e.g., valley, delta, basin), surface features (e.g., ridges, nets, ribs, mounds), and proximity to waterbodies and tidal effects (e.g., lacustrine, riverine). This information, when combined with that for general physiognomy of vegetation cover (e.g., forb, graminoid, shrub, treed), constitute the wetland types (e.g., shrub slope fen, graminoid lacustrine marsh) that exist on the landscape. Due to the hierarchical nature of this system, wetlands may be classified at multiple levels and can be identified to be comprised of multiple wetland types, forms, or classes.

Using spatially-referenced field data as a guide, high-resolution ortho-rectified aerial photographs and topographical maps were used to delineate and classify wetlands within the LSA. Contiguous wetland areas were mapped, with the percentage, class, form, and physiognomic vegetation being recorded for all dominant (i.e., >10 percent by area) wetland types. However, when a contiguous wetland was composed of multiple wetland classes (e.g., fen and marsh), separate polygons were typically used (a descriptor was added to these polygons to indicate that they were part of the same wetland).

The analyses component of the functional assessment involved the collection of classification data for each of the delineated wetland polygons within the LSA and a review of baseline studies being prepared for the Project. Classification data obtained for each of the wetland polygons include information on wetland class, form, and type following guidelines of the CWCS (National Wetlands Working Group 1997); wetland landscape position, landform, and water flow pathways, as identified by Tiner (2005); and data on the proximity of wetlands to watercourses and other waterbodies.

A number of hydrogeomorphic descriptors were also identified for each wetland polygon to convey information on its landscape position, landform, and water flow path. A landscape-level approach, which relies heavily on wetland classification data and hydrogeomorphic descriptors, is applied to the wetlands of the LSA to evaluate their potential to provide a suite of functions:

- Surface water detention;
- Sediment and other particulate retention;
- Streamflow maintenance;
- Groundwater recharge;
- Nutrient transformation;
- Carbon sequestration and storage;
- Shoreline stabilization;
- Habitat for wildlife (including fish, waterfowl and other waterbirds, and species of conservation concern); and
- Socio-economic value.

Functions selected for evaluation were based on information on the location and character of the Project (e.g., coastal surge protection was not evaluated as a possible function to be performed by wetlands in the LSA due to the distance to the ocean). Information used for the functional assessment included: data on wetland types following the CWCS; information on wetland landscape position, landform, and water flow pathways (as defined by Tiner 2005); the results of other environmental field programs conducted for the Project, data from detailed functional assessments performed following the NovaWET field methodology (Tiner 2009; NSE 2011), and other information obtained on the character of wetlands.

Wetlands provide important functions with respect to: hydrological function contributing to the quantity of surface water and groundwater; biogeochemical function as wetlands contribute to improving the quality of surface water and groundwater; habitat functions as wetlands are transitional habitats with varying degrees of terrestrial and aquatic ecosystems providing desirable habitat to a diversity of plant and animal species, and ecological functions as wetlands are strongly linked to their surrounding environments.

17.5.2 Baseline Conditions

Ecological Context

There are 15 ecozones delineated for Canada (Natural Resources Canada 2007), of which two overlap with western Labrador: the Boreal Shield Ecozone and the Taiga Shield Ecozone. They differ from one another on the basis of climate, geomorphology, terrain, soils, and vegetation species composition and growth pattern. This is relevant as the ecosystem classification system may be used for: i) assessing and reporting on ecosystem status and trends; and ii) spatial planning for the conservation of ecosystem properties (i.e., critical habitats) and management of human activities. The ecosystem classification system uses climate, physical land features, and vegetation to identify and classify regional terrestrial ecosystems into a hierarchy of nested units at progressively smaller scales. The system reveals ecological potentialities and limitations of particular sites, and combined with the accumulation and widespread dissemination of ecological knowledge, provides an ideal framework for integrated resource management.

The RSA covers an area of approximately 73,900 ha and is located entirely within the Boreal Shield Ecozone, Canada's largest terrestrial ecozone. This Boreal Shield Ecozone stretches in a broad, U-shape pattern from northeastern Alberta to the eastern tip of Newfoundland covering an area of more than 1.8 million ha, or approximately 20 percent of Canada's land mass and 10 percent of its fresh water (Environment Canada 2005). The Boreal Shield Ecozone in Labrador is primarily contained within southeastern Labrador where it is primarily coastal, extending north to Hamilton Inlet and the area around Lake Melville. A massive rolling plain of ancient bedrock blanketed with gravel, sand, and other glacial deposits, its topography is comprised of broadly rolling uplands that form poorly drained depressions covered by lakes, ponds, and wetlands.

Vegetation (Including Wetlands)

Cool temperatures, a short growing season, frequent forest fires, and acidic soils are challenges to plant growth and development in this ecozone, although almost 88 percent of the area is forested by a few highly adaptable trees such as black spruce, white spruce, tamarack, jack pine, and balsam fir. Black spruce is, by far, the most common species. Lichen and shrub cover are common in areas where the scouring effects of glaciation gave way to bare rock outcrops. Extensive forests are intermixed with bogs, fens, marshes, and other wetlands. Within the LSA, the Boreal Shield Ecozone contains mostly stunted conifer stands, where black spruce and tamarack are common, along with large amounts of shrubs (e.g., dwarf birch, Labrador tea, and willows) and feathermoss and lichen covering the ground.

Wetlands in the area occupy the Atlantic Boreal wetland region, characterized as having a Maritime climate with cold winters, cool summers, frequent fog, and precipitation that ranges from 950 to 1,500 mm annually (Wells and Hirvonen 1988). The Interior Atlantic Boreal wetland subregion encompasses the entire LSA and RSA for the Project, as well as the majority of insular Labrador and adjacent Québec. String fens and string bogs have been noted as being abundant within this subregion; basin bogs and slope fens are considered common; and alder swamps and riparian marshes may occur along smaller streams and rivers (Wells and Hirvonen 1988). The reader is referred to Wells (1981, 1996), Wells and Hirvonen (1988), Wells and Pollett (1983), and Wells and Zoltai (1985) for a more comprehensive documentation of wetlands within Labrador.

Wetlands are comprised of a mixture of wetland vegetation and shallow open water. Vegetation includes emergent aquatic macrophytes, chiefly graminoids such as sedges, rushes, and grasses, and shrubs and other herbaceous species such as broad-leaved emergent macrophytes, floating-leaved, and submergent species in areas of shallow open water. Non-vascular plants such as brown and golden mosses are also common. The spatial variation of wetland vegetation is dependent on gradients of water depths, chemistry or disturbance, and forms as a series of concentric rings or parallel patterns (i.e., Atlantic ribbed fens). Wetland environments provide a crucial matrix of habitat for a number of plant and animal species.

These wetlands also provide important habitat for a wide range of wildlife, in particular ground nesting birds, waterfowl, and waterbirds. The ability of wetlands to provide habitat for waterfowl and other waterbirds varies according to their position relative to waterbodies and watercourses, the presence and character of open water, and the availability of appropriate vegetation for foraging and nesting opportunities. However, because of relationships to certain habitat features, some wetland types (e.g., lentic marshes, lotic river marshes) are generally associated with providing important waterfowl and other waterbird habitat, whereas others have little or no capacity to provide this function (Tiner 2003; NSE 2011).

Species of waterfowl and other waterbirds recorded from within the LSA during spring staging, breeding, and fall staging waterfowl surveys conducted for the Project are addressed in Chapter 19: Birds, Other Wildlife and their Habitat, and Protected Areas.

Ecotypes and Wetlands within the Project Area

The majority of land surrounding the Project is comprised of mid- to late-successional forests (Table 17.5). However, disturbance regimes, predominantly the occurrence of fire, has been extensive throughout the area and as a result, much of the forested area, particularly in the LSA, is currently in an early- to mid-successional state.

Table 17.5 Project Ecotypes and Their Representation (%) in the PDA, Local and Regional Study Areas

Ecosystem	Ecotype / Subtype	PDA		RSA		LSA	
		Area (ha)	Percentage (%)	Area (ha)	Percentage (%)	Area (ha)	Percentage (%)
Alpine Ecosystem	Alpine Heath	4.4	0.19	596.8	0.81	22.9	0.14
Forested Ecosystem	Black Spruce-Labrador Tea-Feathermoss	321.6	13.52	17,683.1	23.94	3,633.7	22.58
Forested Ecosystem	Black Spruce-Lichen	47.5	2.00	5,178.2	7.01	554.1	3.44
Forested Ecosystem	Hardwood Forest	26.1	1.10	1,132.7	1.53	223.3	1.39
Forested Ecosystem	Hardwood Forest Burn / Regen	442.5	18.60	5,093.0	6.89	1,706.6	10.61
Forested Ecosystem	Mixedwood Forest	125.8	5.29	3,480.3	4.71	707.3	4.39
Forested Ecosystem	Mixedwood Forest Burn / Regen	44.0	1.85	2,304.1	3.12	246.8	1.53
Forested Ecosystem	Softwood Burn / Regen	464.6	19.53	5,395.2	7.30	1,794.4	11.15
Forested Riparian Ecosystem	Tamarack / Black Spruce Feathermoss (Water Track)	317.6	13.35	5,209.0	7.05	1,399.6	8.70
Non-Forested Riparian Ecosystem	Riparian Thicket	0.7	0.03	37.1	0.05	22.1	0.14
Non-Forested Riparian Ecosystem	Riparian Marsh / Fen	0.5	0.02	148.3	0.20	20.2	0.13
Forested Ecosystem (Transitional)	Black Spruce / Tamarack-Sphagnum Woodland	303.8	12.77	10,412.8	14.09	2,064.6	12.83
Non-Forested Wetland Ecosystem	Non-Patterned Shrub (*including Graminoid Fen)	142.3	5.98	1,770.8	2.40	441.9	2.75
Non-Forested Wetland Ecosystem	Patterned Shrub Fen	44.8	1.88	708.3	0.96	132.6	0.82
Non-Forested Wetland Ecosystem	Shallow Open Water with Vegetation	28.4	1.19	1,081.9	1.46	150.0	0.93
Aquatic Ecosystem	Open Water	19.4	0.82	8,275.3	11.20	2,360.7	14.67
Anthropogenic	Exposed Earth / Anthropogenic	13.9	0.58	3,788.1	5.13	262.4	1.63
	Cloud	25.9	1.09	1,180.1	1.60	291.2	1.81
	Shadow	4.7	0.20	401.4	0.54	58.3	0.36
Totals (Rounded)		**2,379**	**100**	**73,877**	**100**	**16,093**	**100**

Upland forest ecosystems comprise a substantial area of land cover within the RSA and LSA, respectively. Softwood stands dominate (31 percent of the RSA; 26 percent of the LSA), followed by lesser amounts of mixed wood (5 percent of the RSA; 4 percent of the LSA), and scattered patches of hardwood (2 percent of the RSA; 1 percent of the LSA). Prominent trees within mature coniferous and mixedwood stands in moderately well-drained areas include black spruce (*Picea mariana*), balsam fir (*Abies balsamea*), paper birch (*Betula papyrifera*), and white spruce (*Picea glauca*). In areas with imperfect and poor drainage, tree composition is primarily comprised of black spruce and American larch (*Larix laricina*).

Upland shrub thickets accounting for in excess of 17 percent and 23 percent of the total RSA and LSA, respectively, are present in areas subject to recent disturbance by fire and anthropogenic activities and, therefore, have components that are at an early stage of successional development. Speckled alder (*Alnus incana*), green alder (*Alnus viridis*) and dwarf birch (*Betula glandulifera*) are prominent species in many of these areas.

Wetlands are relatively common throughout the RSA and LSA, accounting for approximately 13 percent and 13 percent of the total area, respectively (based on figures derived from the Project ELC). Fens are the most abundant wetland type and are predominantly treed (Table 17.5). They are represented by several large occurrences in the area of the TMF. These wetlands are dominated by tamarack, black spruce and a variety of ericaceous shrubs, and are represented by several large occurrences in the area of the TMF. Non-patterned fens comprised of low-shrub and graminoid vegetation are also prevalent. Additionally, graminoid fens were also present; however, typically as part of larger wetland complexes (the graminoid fen wetland class is not represented in Table 17.5 because complexes have been assigned their dominant class for simplicity of presentation). Shallow water wetlands that are dominated by aquatic vegetation are found within and towards the margins of many of the major waterbodies of the area. Shallow water wetland types are also present as a minor component within some of the smaller wetland complexes, but these tend to lack any characteristic vegetation. Marshes are the second most abundant wetland ecotype occurring within the Study Area; however, these wetlands are considered to be scarce, accounting for less than one percent of the total area of the RSA and LSA, respectively. For more detailed descriptions of wetland communities, including their abundance and dominant plants, see the Wetlands Baseline Study (Appendix I). Reference maps showing wetland locations where detailed studies were completed by Alderon have been developed and are provided as a supplement to this Wetlands VEC chapter. These maps illustrate the wetland assessment area, identify wetland locations where detailed studies were completed with a unique identifier (e.g., 158), and indicate whether the location is within or outside the PDA (predicted area of disturbance).

Several lakes are present within the LSA, most notably Long Lake, Mills Lake, Pike Lake, Riordan Lake, and Molar Lake. Although their peripheries are often comprised of shallow water wetland (where water depths are < 2 m) and other fringing wetland types (including riparian marsh), much of their edges show a quick transition from lacustrine conditions to upland habitat types. As a result of their water depth and rocky substrate, such areas provide limited opportunities for vegetative growth.

The large majority of land to be affected by the Project is forested (Table 17.5). In particular, softwood, mixedwood, and recently disturbed (i.e., burned) stands are to be most heavily affected, respectively. Wetlands are also identified for substantial amounts of direct affects, comprising almost 22 percent of the area to be affected.

Overall, the LSA is characterized by moderate habitat richness but fairly low overall habitat diversity owing to the fact that although a number of habitat types are present, most of the area is composed of only few of these habitat types (Table 17.5).

Regional and Local Study Area Wetlands

As described previously, the delineation and mapping of wetlands within the RSA was achieved using information on vegetation and vegetation communities (including wetlands), verified through the ELC process. Alternatively, wetlands within the LSA, and subsequently PDA, were classified according to the CWCS (National Wetlands Working Group 1997) using high resolution digital aerial photography. The approach focused on collecting data from wetlands with the highest potential for Project-related interaction (i.e., within the LSA), while collecting data at the appropriate scale for regional comparisons (i.e., within the RSA). The resulting datasets were geo-referenced, indicating the location and area of individual wetlands within the RSA, and similarly location, area, and CWCS class and form of individual wetlands within the LSA and PDA. However, due to differences in scale and mapping methods between the satellite imagery based RSA, and more detailed digital air photo interpretation of the LSA, direct comparisons between the results presented for RSA and the LSA effects cannot easily be made.

Regional Study Area

Five ecotypes (land cover classes) were identified for wetlands within the RSA and generally correspond to three major wetland types (fen, bog, and marsh) and combinations thereof.

Within the RSA, wetlands are represented by the following ecotypes:

- Tamarack / Black Spruce Feathermoss (Treed Fen)
- Patterned Shrub Fen;
- Non-Patterned Shrub Fen (including Graminoid Fen);
- Riparian Marsh / Fen; and
- Shallow Open Water with Vegetation.

Wetlands are relatively common throughout the RSA, accounting for 8,918 ha or 12 percent of its approximately 73,900 ha area (Table 17.6). Tamarack / Black Spruce Feathermoss (Watertrack) is the most abundant wetland ecotype (treed fen) occupying 5,209 ha or 58 percent of the total wetland area of the RSA (7 percent of the total RSA). Wetlands characterized by the Non-Patterned Shrub Fen ecotype are the second most abundant wetland classes within the RSA, accounting for approximately 1,771 ha or 20 percent of the total wetland area of the RSA (2 percent of the total RSA). These ecotypes are represented by numerous occurrences spread across the RSA, and typically dominated by scrub black spruce and a variety of ericaceous shrubs and graminoids. Patterned Shrub Fen ecotypes account for 708 ha or approximately 8 percent of the total wetland area of the RSA. Of note, potentially larger areas of the RSA may be appropriately characterized by this ecotype as it was often difficult to differentiate them due to the scale and morphological characteristics used to classify these ecotypes. Shallow Open Water ecotypes, as identified through the ELC, typically represent a minor component within some of the larger wetland complexes but these tend to lack any characteristic vegetation. Shallow Open Water ecotypes occupy 1,082 ha or 12 percent of the total wetland area of the RSA. Freshwater marshes, characterized by the Riparian Marsh / Fen ecotype are limited in their extent occupying 148 ha, or 2 percent of the RSA. They are scattered throughout the region and are often present as part of larger wetland complexes and comprised predominantly of graminoids. The Riparian Marsh / Fen ecotype is typically found in association with shallow water wetlands that are dominated by aquatic vegetation and found within and towards the margins of many of the major waterbodies in the area.

Table 17.6 Distribution and Abundance of Wetland Ecotypes within the Regional Study Area

Class	Ecotype	Area (ha)	Percent of Total Wetland Area	Percent of Total RSA
Fen	Tamarack / Black Spruce Feathermoss (Treed Fen)	5,209	58	7
	Patterned Shrub Fen	708	8	1
	Non-Patterned Shrub Fen (*including Graminoid Fen)	1,771	20	2
Marsh	Riparian Marsh / Fen	148	2	<1
	Shallow Open Water with Vegetation	1,082	12	2
All Wetland Polygons		8,918		12

Local Study Area

The Wetlands Baseline Study (Appendix I) uses available GIS data and aerial photo interpretation. A total of 265 wetlands were identified within the LSA, with a combined area of 1,763 ha, or 11 percent of the LSA (approximately 16,100 ha) (Figure 17.3 to Figure 17.5). Because multiple polygons were used to delineate wetlands with multiple classes (e.g., fen and marsh), the number of individual wetlands within the LSA is less than that of the delineated polygons. The size of individual wetlands varied considerably within the LSA, and ranged from less than 0.05 ha to greater than 500 ha (average of approximately 5.5 ha).

Two wetland classes were identified within the LSA: fen and marsh. Fens, or large wetland complexes that are dominated by this type, occupy the vast majority of wetlands within the LSA and are distributed throughout its extent. Fens are minerotrophic peatlands with fluctuating water levels (National Wetland Working Group 1997). Ground and surface water movement is common within fens, with surficial flow often being observable in the form of channels or pools. The vegetation of fens is strongly influenced by water depth and chemistry and they may be dominated by graminoids, bryophytes, shrubs, and/or trees. Fens were common throughout the

LSA and often formed complexes comprised of multiple forms. Specific forms identified include string, shore, slope, and stream fens. These forms are distinguished based on differences in their surface pattern, surface relief, proximity to waterbodies, and topography (National Wetland Working Group 1997).

Marshes are the second most prominent wetland class but were limited in distribution and abundance within the LSA, restricted primarily to the margins of fens found in association with certain waterbodies and watercourses. Marshes are typically mineral wetlands and are periodically inundated by standing or slow-flowing water whose levels generally fluctuate seasonally. Their surface waters are typically rich in nutrients and declining water levels may expose areas of matted vegetation or mud flats during dry periods. Although their substrate is usually mineral material, well-decomposed peat may occasionally be present. Marshes typically display zones or surface patterns consisting of pools or channels interspersed with patches of emergent vegetation (National Wetland Working Group 1997). Both lacustrine and riparian marsh forms were identified in the LSA. Due to their association and degree of interspersion, it was often not practical to separate “marsh” from “fen” and they are therefore presented here as being a combination of these two vegetation types.

For mapping purposes, it was necessary to map wetland complexes (areas containing more than one wetland type) found in each polygon separately. Dominant wetland types are those with the highest coverage within the polygon. For example, in a slope fen there are often scattered pockets of open, string fen. In this case, the dominant wetland type would be slope fen, and the secondary type would be string fen. Figure 17.3 to Figure 17.5 shows the location of dominant wetland types within the LSA. Secondary wetland types are not continuous within mapped polygons, but are a minor component, frequently found in scattered or isolated pockets.

Within the LSA, wetlands are composed of the following wetlands types:

- Slope fen;
- Shore fen;
- String (Atlantic Ribbed) fen;
- Lacustrine marsh (shore fen);
- Stream fen; and
- Wetland complexes.

The extent of each wetland type (class and form) in the LSA at baseline is shown in Table 17.7.

Figure 17.3 Wetlands within the Local Study Area -West

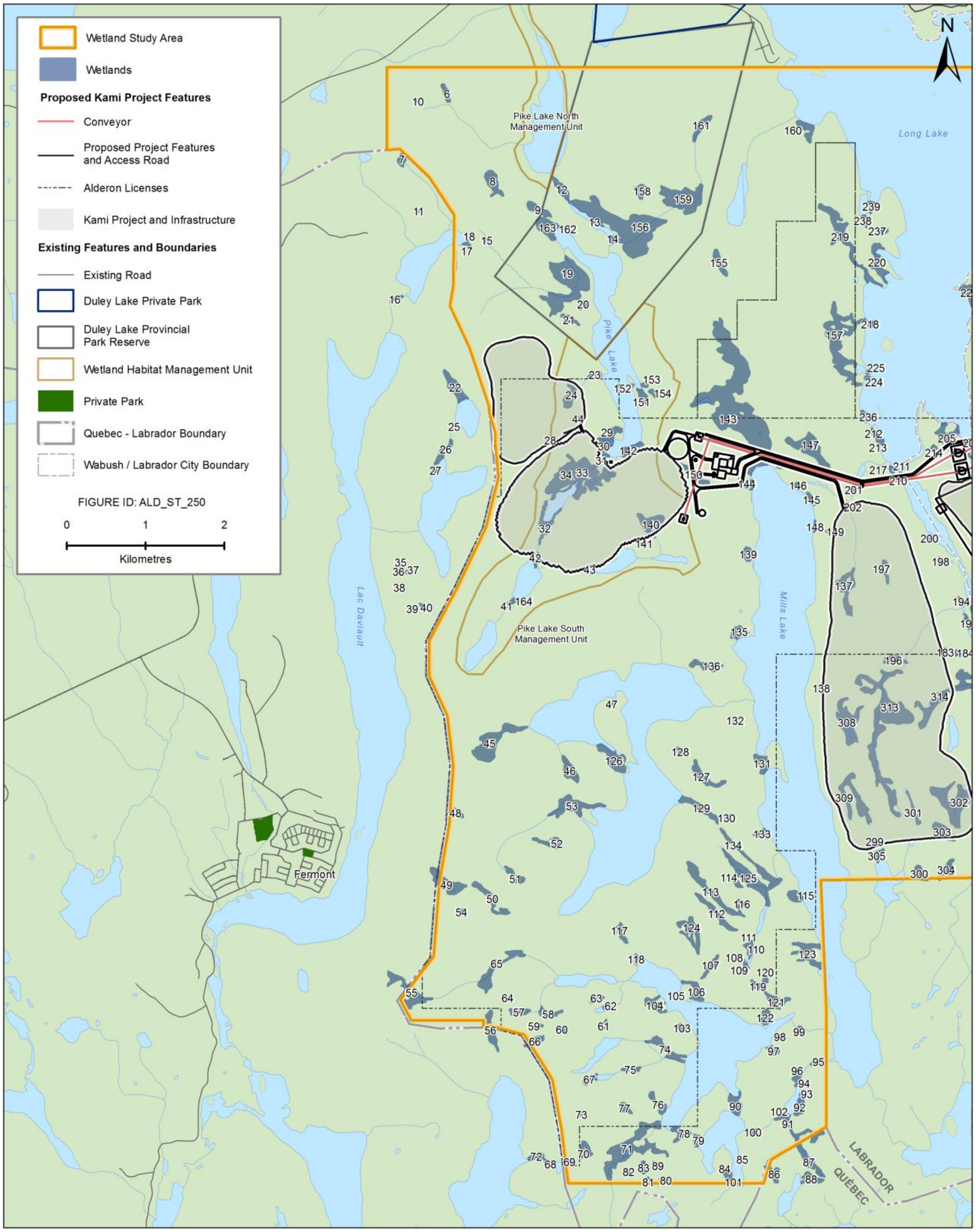


Figure 17.4 Wetlands within the Local Study Area – Central

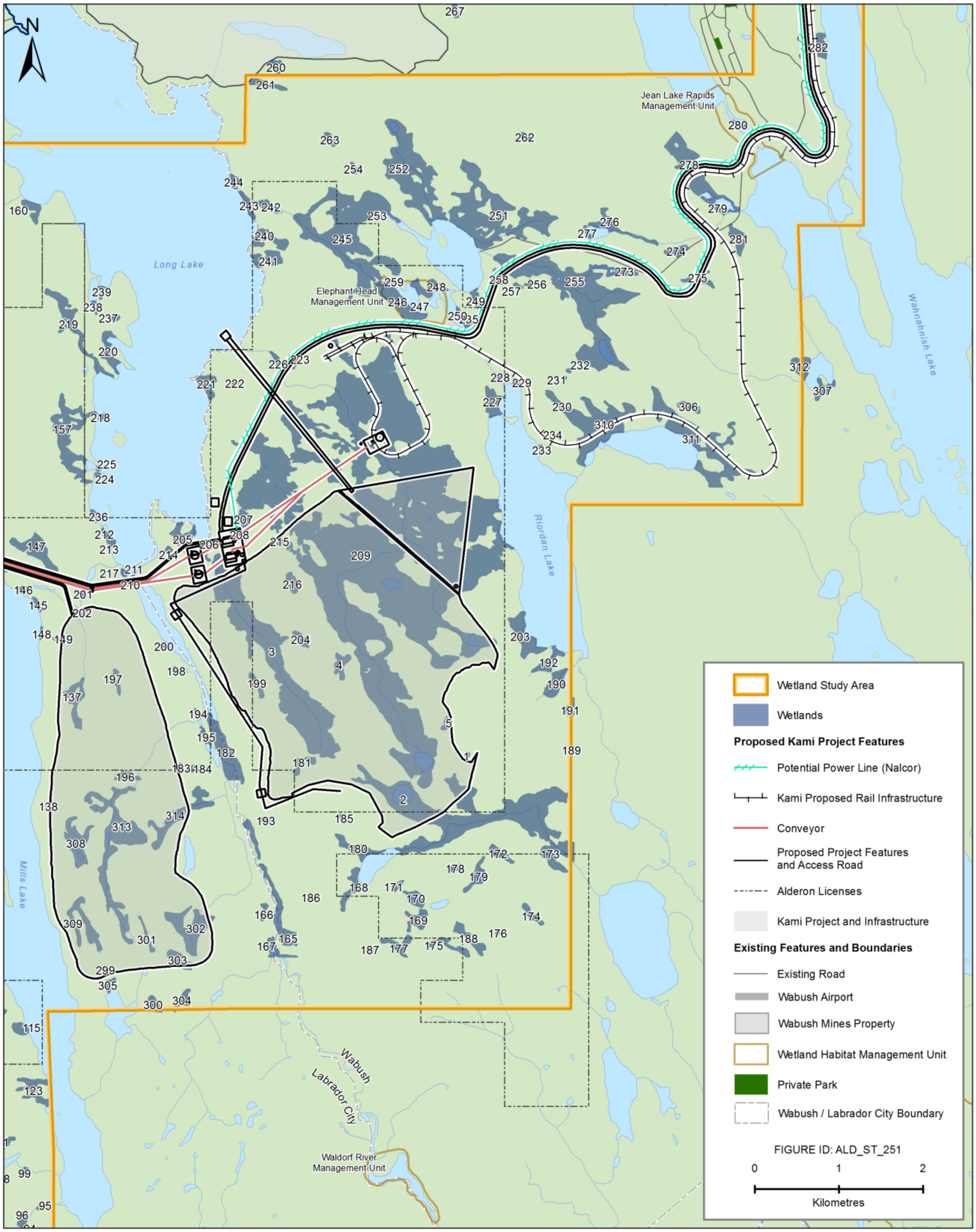


Figure 17.5 Wetlands within the Local Study Area - East

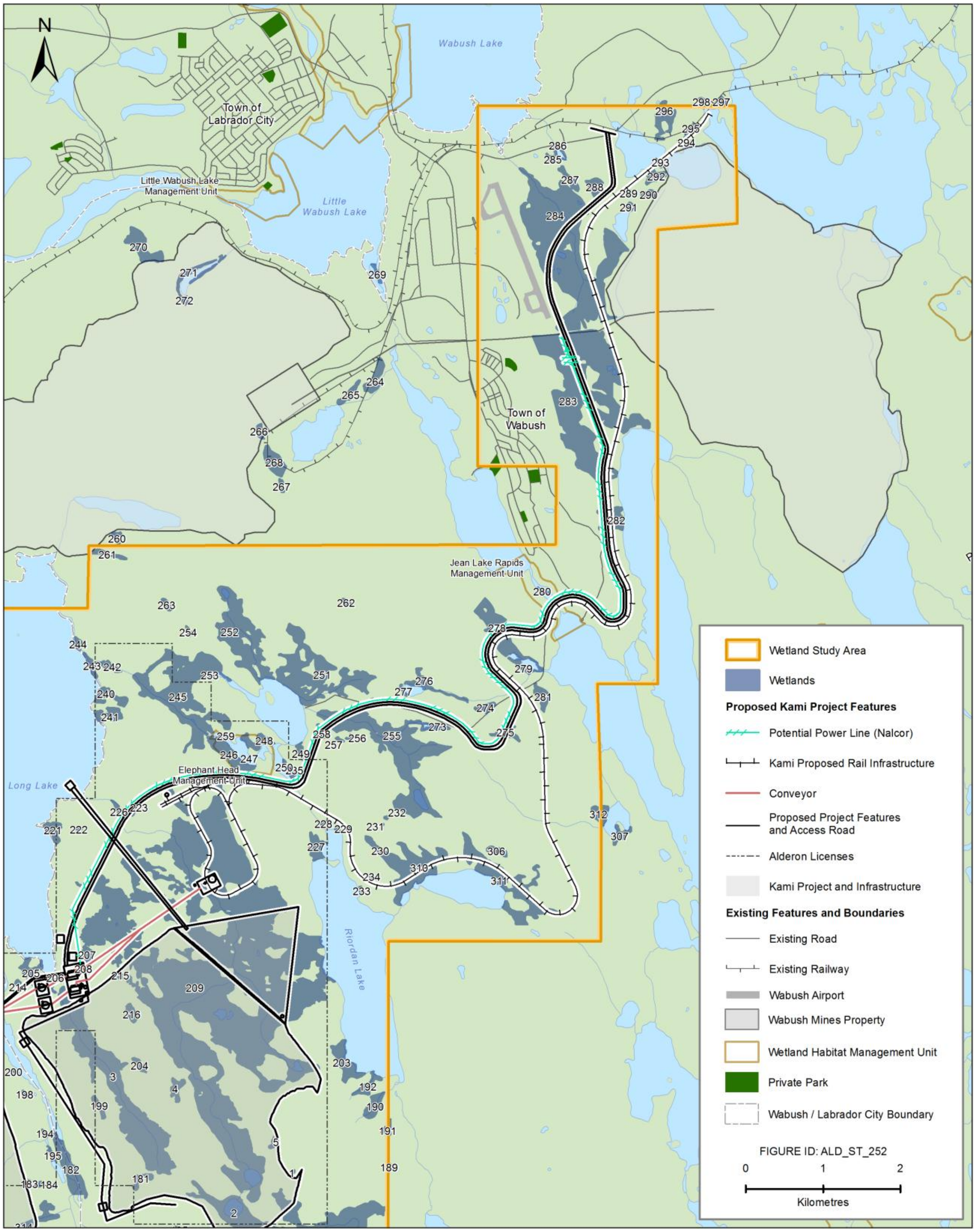


Table 17.7 Number and Area of Wetland Forms within the Local Study Area

Class	Form	Number of Occurrences[1]		Area (ha)		Percent of Total Wetland Area (LSA)
		#	Percent in Complexes	Area (ha)	Percent in Complexes	
Fen	Slope	242	25.2	1285.5	78.2	72.9
	Atlantic Ribbed	29	82.8	317.5	97.3	18.0
	Stream	41	58.5	139.8	91.8	7.9
	Shore	14	35.7	5.5	43.8	0.3
Marsh (Fen)	Lacustrine (Shore)	24	75.0	15.0	86.8	0.8
All wetlands		265	21.9	1763.3	82.7	100.0

[1] The number of occurrences for wetland forms conveys their representation within delineated wetland

The distribution and abundance of wetlands within the RSA is similar to that of the LSA, although some differences in the relative prominence of wetland classes do exist. In particular, Table 17.7 suggests that wetland complexes are relatively more prominent within the LSA than the RSA. However, this difference likely reflects variation in how wetlands were identified within the respective zones. That is, many of the wetlands within the LSA were subject to field surveys and their classification reflects the detailed site information that can be gained from such visits. Conversely, the classifications of wetlands outside of the LSA were based on information gained from the less detailed ELC. As such, their current classification may reflect limitations that are commonly associated with these approaches (including identifying their morphology, vegetative composition, boundaries, and connectivity to other patches of wetland). Similarly, the presence of string fen (Atlantic Ribbed) wetlands within the LSA (of which they are identified to comprise approximately 18 percent) and their relative absence within the RSA (<1 percent), except as components of complexes, likely reflects this limitation.

The character and functional attributes of those wetlands identified for potential direct or indirect effects in the LSA (and for which detailed field surveys were performed) are discussed in the following sections.

17.5.2.1 Wetland Function

Wetland functions are the natural processes (physical, chemical, biological) that occur in wetlands. While most wetland functions are generally present in all wetlands, the scale and importance of each function is highly variable. The value of the functions provided by a wetland is determined by the importance of the service (e.g., high capacity for retention of surface water runoff) and the need for the service (e.g., sensitive downstream environment). For this analysis, functions that are directly linked to products or services of likely value in the watershed are considered.

The wetland functions considered in this evaluation are surface water detention; sediment and other particulate retention; streamflow maintenance; groundwater recharge; carbon sequestration and storage; shoreline stabilization; habitat for wildlife (including fish, waterfowl and other waterbirds, and species of conservation concern); and socio-economic value. Key information used to identify and assign wetland functions and values are provided in Table 17.8. Because functions were assigned at the level of wetland polygons, they do not necessarily reflect the range of conditions that are represented therein (i.e., wetland complexes may encompass multiple forms and these may differ in their functional characteristics). A complete presentation of the functions performed by individual wetlands in the LSA is provided in the Wetlands Baseline Study (Appendix I).

Table 17.8 Key Criteria used to Identify and Assign Wetland Functions and Values within the Local Study Area

Function / Value	Key Criteria used for the Identification of Wetland Functions and Values within the Study Area	Estimated # of Contributing Wetland Polygons	Estimated Contributing Wetland Area (ha)
Surface Water Detention	All marshes; fens containing ribbed forms or have a terrene pond landscape position (i.e., wetlands with surface water features).	84	1309.3
Sediment and Other Particulate Retention	Lentic and lotic marshes; including accompanying shore or stream fen components.	24	16.1
Streamflow Maintenance	Headwater wetlands (those along streams of perennial order 1), as well as those with a lentic landscape position.	92	1244.1
Groundwater Recharge	Wetlands within the Study Area are not expected to perform this function.	0	0.0
Carbon Sequestration	All fens and seasonally or semi-permanently flooded marshes.	287	1763.3
Shoreline Stabilization	Wetlands with a lotic or lentic landscape position, excluding those with an islands landform; or that otherwise bordered the banks of a waterbody or watercourse.	164	1502.0
Fish Habitat	Lentic and lotic marshes.	24	16.1
Fish Habitat (stream shading)	Wetlands containing stream fen forms dominated by trees or shrubs.	35	890.4
Waterfowl and Waterbird Habitat	All marshes; fens having a lentic, lotic (river), or terrene pond landscape position; fens having a ribbed form.	101	1318.1
Species of Conservation Concern	Wetlands containing ecotypes which are known to be associated with Species of Conservation Concern.	287	1763.3
Socio-economic Value	N/A - socio-economic value not related to wetland classification data and no estimates are provided.	N/A	N/A

The approach to wetland function assessment was to define and then apply the structural criteria used to determine individual wetland function. Due to the number of wetlands in this area, this assessment does not provide an estimate of the functional performance of each individual wetland, but rather an indication of the functional potential. Professional experience with a variety of function assessment methods informs the criteria selection and most were assessed qualitatively by evaluating wetland function as recommended in Tiner (2003), and as summarized in NovaWET (Tiner 2009; NSE 2011). These criteria were then modified and supplemented with additional information so as to better suit the conditions of the area. A preliminary assessment of wetland function was conducted on wetlands near the PDA (see Wetlands Baseline Study, Appendix I). In general, the wetlands found within and adjacent to the PDA are considered poor to moderate with respect to function. This conclusion is based on several observations.

The potential value for waterfowl habitat was rated in each assessed wetland, and among other things, considered the physiographic structure of the wetland to meet specific life history requirements of various waterfowl groups. The types of wetlands found in the LSA represent low productivity for waterfowl habitat. As such, these wetlands would not likely be favoured locations where sport hunting of waterfowl is conducted.

Wetlands are commonly called the “kidneys of the earth” for their ability to improve water quality through physical and chemical processes. Physically, emergent and submerged wetland vegetation slows water velocity, allowing particles to settle out and accrete in wetland sediments. Wetlands may also cool water temperatures, buffer acidity, metabolize oxygen demand, precipitate and store certain metals, and uptake nutrients, depending on site-specific hydrology, biogeochemistry and vegetation (Kadlec and Wallace 2009). For a wetland to provide a water quality improvement function, a source of water quality degradation must be present. Nutrient inputs from surface run-off are generally very low due to the coarse sandy, impoverished upland soils and exposed bedrock.

Wetlands represent 14 percent of Canada’s land mass; however, one-third of the species at risk listed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) live in or near wetlands (Environment Canada 2009). Species at Risk and Species of Conservation Concern are assessed in Chapter 20.

In general, wetlands are contiguous with little hydrological fragmentation with the exception of wetland crossing locations for linear features (e.g., existing tertiary roads). Water quality protection is also not typically an important function of these wetlands as there are few identified inputs given the nature of up-gradient land uses, with little potential for high nutrient or sediment loads. The capacity for wetlands to store and regulate water flow of watercourses, especially fish-bearing watercourses, is however considered a hydrological function identified for the wetlands within and near the PDA.

The hydrological function of a wetland includes a wetland's influence on water quality and water balance of associated streams (which may be fish-bearing) and other wetlands. The hydrological value of the wetlands varies depending on the size and degree of connectivity between wetlands within watershed areas. Hydrological observations in the summer of 2011 have indicated that there is a high degree of connectivity between wetlands via seasonal drainages or small seasonal streams. Up-gradient wetlands tend to drain into down-gradient wetlands within the same watershed via small seasonal streams when their capacity to store water is reached. A hydrological feature of some wetlands is that they may have multiple outlets draining into different watersheds and sub-watersheds, especially those located at topographic divides.

In general, most of the identified wetlands are water collection basins within watersheds and, for this reason, many wetlands tend to exist in the headwaters of streams and/or are riparian in nature. Hydrological observations and watershed delineation of the surveyed or interpreted wetlands affirm that most wetlands are, indeed, contiguous with small streams, some of which were determined to be fish-bearing (Appendix H).

The importance of hydrological function of the wetlands varies, depending on the proportion of wetland within each watershed and sub-watershed, and depending on the receiving waters. For example, a wetland that makes up a high proportion of the watershed, and if the watershed contains a fish-bearing stream, it would have higher value than a wetland that makes up a small proportion of the watershed, and the watershed has no associated fish-bearing streams. Wetlands within a watershed that contribute substantively to the water balance downstream of confluences with fish-bearing streams may be of higher hydrological value than wetlands in watersheds leading directly to Long Lake. Other hydrological functions typically considered a social benefit such as flood control and flow regulation are not important to these small watersheds.

Due to inherent difficulties in assessing wetland functions, results are best considered qualitative in nature. In particular, estimates of contributing area to specific functions are based on the entire size of delineated wetland polygons although only portions of them may be important for supporting that function. For example, entire wetland polygons were identified as contributing to the function of stream shading when they contained stream fen forms dominated by trees or shrubs, although only a small portion of their area may have been comprised of such features.

17.6 Assessment of Project-Related Environmental Effects

The effects to wetland quantity and quality will occur primarily, if not exclusively, during the construction phase, and therefore the assessment is focused on the effects to wetland quantity and quality during this Project phase. For the purpose of this assessment, a conservative approach is taken where it is assumed that all the effects resulting from open pit development will occur in the construction phase, thereby accounting for the entire footprint of the open pit. Available spatial information was used to provide estimates of loss of wetland area.

Clearing and grubbing during site preparation associated with construction of the TMF, waste rock disposal areas and removal of wetland (i.e., organic) soils, and subsequent excavation of overburden materials, will directly remove vegetation whereas infilling of wetlands will cause permanent loss of wetland vegetation. Construction of access roads, railways, watercourse crossings, site buildings and other associated infrastructure may also contribute to the potential loss or alteration of wetlands.

Alteration or loss of wetland vegetation may be temporary (e.g., power line ROW, temporary workspaces, lay-down areas), resulting in a short-term shift in structural habitat characteristics (e.g., treed fen to shrub fen within the power line ROW). The direct effects of the power line will be limited to the footprint of the poles and towers. Alternatively, the permanent loss of wetlands is anticipated where site preparation activities, including the construction of the majority of Project infrastructure (e.g., mine site, TMF, waste rock disposal, permanent access roads, railway, substations, marshalling yards, staging areas) results in the clearing, grubbing, grading, infilling, and/or excavation of wetlands.

Indirect Effects

A number of indirect effects can result from site preparation and construction activities. For example, changes to hydrological function include a reduction in discharge to down-gradient wetlands, particularly fens, due to the loss of drainage area, surface water storage and release, and resultant flow moderation and/or a change in up-gradient wetlands. The effects of the Project on hydrology are assessed in Chapter 16: Water Resources. Possible effects to wetlands include an increase or decrease in water levels (with increase likely in some areas as a result of increased surface water flow, or impediments to drainage), moisture regime and a change in the nutrient levels, leading towards a shift in species composition and eventually a shift towards more upland terrestrial vegetation and vegetation communities. Indirect effects may also occur due to changes in substrate composition, moisture, drainage and temperature resulting from establishment of Project features and infrastructure. However, these effects will be limited to the Project footprint and will be minimal compared to the direct loss or alteration of wetlands. Standard mitigation measures for erosion and sediment control, maintenance of drainage, dust control and invasive species management will minimize these indirect effects to wetlands.

17.6.1 Mitigation of Project Environmental Effects

The timing, location, extent, type of proposed Project activities and existing legislated requirements will inform the level of restriction or mitigation that will be implemented to mitigate effects to wetlands and wetland functions in the LSA. Effective Project planning, design, and the application of known and proven mitigation measures will be implemented as part of the Project to avoid or minimize the environmental effects on wetlands.

In locations where wetlands cannot be avoided, standard and proven mitigation will be employed to minimize indirect effects. Culverts and stream crossings will be designed and installed using Best Available Control Technology (including DFO and DOEC Water Resources guidelines) to maintain the natural hydrology, prevent ponding or dewatering, and preventing the introduction of sediment into streams.

Where economically and technically feasible, wetlands will be avoided. Where avoidance is not possible, the minimum practical footprint will be used for construction activities to minimize adverse effects. A Project-specific Environmental Protection Plan (EPP) will be developed for the Project prior to start of the construction phase. Additionally, Alderon is in the process of pursuing a Corporate Stewardship Agreement with the municipalities and the Province (through the Eastern Habitat Joint Venture) to address the effects of the Project on Management Units, including the Pike Lake South Management Unit. Aspects of this agreement are outlined in Chapter 19: Birds, Other Wildlife and their Habitat and Protected Areas.

17.6.2 Characterization of Residual Project Environmental Effects

A summary of wetland area which is likely to be directly disturbed by Project activities in the PDA and which contributes to the suite of assessed wetland functions within the LSA is presented in Table 17.9. The area of future disturbance is identified in Figure 17.3 to Figure 17.5, with affected wetlands noted. A total of 265 wetlands were identified within the LSA, comprising over 1,763 ha (11 percent) of wetland habitats in the approximately 16,100 ha LSA. Of these wetlands, a total of 572 ha (32 percent of the total wetland area within the LSA) of wetland (portions of approximately 54 wetlands) are located within the PDA (Table 17.9) and will represent the loss and/or alteration of wetland habitat. Direct effects of the Project on the wetland have been estimated to vary from approximately <1 to 322 ha of the contributing area within the LSA. Although detailed wetland inventory data is not available throughout the extent of the RSA, ELC data suggests that the Project will affect approximately 6 percent of wetlands within the RSA.

Table 17.9 Number and Area (ha) of Wetlands within the PDA

Project Feature[1]	Number of Wetlands in PDA		Wetland Area in PDA	
	#	Percent in LSA	Area (ha)	Percent in LSA
Access Roads	19	7.2	33.7	1.9
Buildings	5	1.9	6.1	0.3
Conveyor	7	2.6	0.2	<0.1
Polishing Pond	1	0.4	86.5	4.9
Power Line	12	4.5	11.9	0.7
Proposed Rail Infrastructure	8	3.4	13.9	0.8
Rose North Waste Rock Disposal Area	3	1.1	3.3	0.2
Rose Pit	8	3.4	27.2	1.5
Rose South Waste Rock Disposal Area	13	4.9	65.4	3.7
Tailing Pipeline and Effluent Discharge	2	0.8	2.0	0.1
Tailings Impoundment (Ultimate)	8	3.8	321.9	18.3
Total (Rounded)	**54**	**22**	**572**	**32**
Note: Project features will be installed during the construction phase and remain throughout the operation and maintenance phase of the Project. Effects to Wetlands will occur progressively throughout the life of the Project.				

Project features are estimated to affect between approximately three and 572 ha of related wetland functions, with effects to carbon sequestration, habitat for species of conservation concern, shoreline stabilization, stream shading, streamflow maintenance, and waterfowl and waterbird habitat greatest (Table 17.10). The proportions of wetland functions within the LSA that are estimated to be affected by the Project range from approximately 16 to 47 percent, with stream shading being highest. Project features for which it is assumed wetlands will experience primarily long term (i.e., life of the Project) functional loss include conveyors, power lines, access roads, and pipelines, and for which, upon decommissioning and reclamation, it is anticipated will again contribute to the overall area of functioning wetlands in the LSA account for approximately 46 ha (8 percent) of wetlands (38 wetlands or wetland complexes). Therefore, given the current approach to wetland mitigation including avoidance and minimization, the potential does exist to conserve 46 ha of wetland, resulting in the direct loss of 526 ha (48 wetlands or wetland complexes) of the 572 ha the Project development.

Due to inherent difficulties in assessing wetland functions, results are best considered qualitative in nature. In particular, estimates of contributing area to specific functions are based on the entire size of delineated wetland polygons although only portions of them may be important for supporting that function. For example, entire wetland polygons were identified as contributing to the function of stream shading when they contained stream fen forms dominated by trees or shrubs, although only a small portion of their area may have been comprised of such features.

Of the proposed Project physical works identified above, construction of the TMF is estimated to encompass the largest amount (322 ha) of wetland habitat due to the presence of large peatland complexes in the area. Reflecting the large area of wetland to be directly disturbed, the TMF is expected to have the greatest effect on the functions of carbon sequestration, habitat for species of conservation concern, shoreline stabilization, stream shading, streamflow maintenance, and waterfowl and waterbird habitat. The prominence of wetlands in this area is an important characteristic related to their ability to contribute to a suite of hydrogeomorphological and wildlife-related functions. However, the types of functions that they support are represented throughout the LSA and would be common within the RSA as a result of the prominence of peatlands across the landscape.

As a result of inherent difficulties in estimating the amount of wetland area that provides certain functions (i.e., as previously discussed), the assessed effects of the TMF on some of the functions (e.g., stream shading, shoreline stabilization) are likely to be an overestimation of the area which directly contributes to these functions. For example, using the stream shading criteria, 312 and 87 ha of wetland within the tailings impoundment and polishing pond respectively, were identified as contributing to the function of stream shading. However, only a portion of the wetland area encompassed by these Project features are actually comprised of stream fen forms, and as a result, the area values presented here would be an overestimation of the actual area that directly contributes to this function. For example, only 20 percent of Wetland 209 (which has a total area within the TMF of 319 ha, representing the large majority of wetland area affected by the TMF) is actually composed of treed stream fen and would therefore directly contribute to this function.

Table 17.10 Estimated Contributing Wetland Area for each of the Assessed Wetland Functions by Project Feature

Project Feature	Surface Water Detention (ha)	Sediment and Other Particulate Retention (ha)	Streamflow Maintenance (ha)	Carbon Sequestration (ha)	Shoreline Stabilization (ha)	Fish Habitat (ha)	Stream Shading (ha)	Waterfowl and Waterbird Habitat (ha)	Habitat for Species of Conservation Concern (ha)
Access Roads	28.6	0.3	24.5	33.7	29.9	0.3	4.8	28.6	33.7
Buildings	4.2	0.0	4.2	6.1	6.0	0.0	4.2	4.2	6.1
Conveyor	0.1	0.0	0.1	0.2	0.2	0.0	0.1	0.1	0.2
Polishing Pond	86.5	0.0	86.5	86.5	86.5	0.0	86.5	86.5	86.5
Power Line	9.9	0.1	10.3	11.9	10.6	0.1	1.9	9.9	11.9
Proposed Rail Infrastructure	12.9	0.0	8.6	13.9	8.6	0.0	4.5	13.3	13.9
Rose North Waste Rock Disposal Area	0.0	0.0	2.8	3.3	2.8	0.0	0.0	0.0	3.3
Rose Pit	7.1	2.1	10.0	27.2	27.2	2.1	3.0	10.1	27.2
Rose South Waste Rock Disposal Area	23.2	0.0	17.0	65.4	6.0	0.0	0.0	14.1	65.4
Tailing Pipeline and Effluent Discharge	1.9	0.0	2.0	2.0	2.0	0.0	2.0	1.9	2.0
Tailings Impoundment (Ultimate)	245.7	0.0	312.0	321.9	312.0	0.0	312.0	245.7	321.9
Total in PDA (Rounded)	**420**	**3**	**478**	**572**	**492**	**3**	**419**	**415**	**572**
Total in LSA (Rounded)	**1,309**	**16**	**1,244**	**1,763**	**1,502**	**16**	**890**	**1,318**	**1,763**
% in LSA Affected (Rounded)	**32**	**16**	**38**	**32**	**33**	**16**	**47**	**31**	**32**

Although direct effects of development of Rose Pit are much less than that associated with construction of the TMF (i.e., 27 ha versus 322 ha), this feature of the Project is estimated to result in the greatest effect to the wetland functions of fish habitat and sediment and other particulate retention (Table 17.9). The comparatively large effect of this Project feature on these functions reflects the relative abundance of shore fens / lacustrine marshes that are present in the area. The Rose Pit area also overlaps with the Pike Lake South Management Unit (a designation assigned based on its importance as potential waterfowl habitat) and the shore fens / lacustrine marshes would represent an integral component of the areas appeal to waterfowl. Additionally, the proposed railway overlaps with the Elephant Head and Jean Lakes Rapids Management Units, both of which have been recognized for their importance to waterfowl. The Project effects to Habitat Management Units are assessed in Chapter 19: Birds, Other Wildlife and Their Habitats, and Protected Areas.

Indirect effects to wetlands during Project construction and operations and maintenance phases also have potential to alter wetland hydrological, biogeochemical, habitat, and ecological functions. For example, hydrological effects on wetlands could arise from the construction of the mine site, waste rock disposal area, TMF, access roads, and other permanent infrastructure, disrupting natural water flow (drainage patterns) and resulting in the inundation or alternatively desiccation of wetlands. Biogeochemical functions could be affected though subsurface contamination. If hydrological and biogeochemical functions are maintained, then protection of habitat and ecological functions will be also be maintained, negating any long-term or permanent alterations to wetlands function. The installation of bridges and culverts will be in accordance with federal and provincial standards and guidelines, minimizing hydrological effects and introduction of sediment into waterbodies.

A net decrease in wetlands is predicted primarily due to the permanent removal (loss) of wetlands (primarily slope fens) in vicinity of Rose Pit, the TMF, Rose North and Rose South waste rock disposal areas, and associated Project infrastructure, as a result of Project construction and operation and maintenance (Table 17.9).

The mitigation measures described above that are designed to minimize effects of the Project on wetland hydrological and biogeochemical functions will also serve to protect habitat and ecological functions. Avoidance of wetlands through constraints mapping will limit effects on wetland habitats and associated biodiversity values.

Areal extents of a number of wetlands will be altered or lost due to Project activities; however, these activities will not result in the complete loss of any wetland class, form, or type from within the LSA.

Current reclamation practices have not demonstrated effective reclamation of fens and bogs. However, in instances where the organic (peat) substrate will remain undisturbed or will not be removed through ground disturbance (i.e., conveyors, power line easements, access roads, tailings pipelines), wetlands are expected to naturally return to pre-existing conditions over a period of time. As such, it is anticipated that there will be a net loss of approximately 524 ha (less than 6 percent) of wetlands from within the RSA at decommissioning and reclamation. In addition, Alderon is pursuing a Corporate Stewardship Agreement to address Project effects. In light of the regional abundance and distribution of wetlands and wetland habitats, particularly peatlands, in addition to mitigation to be applied, the significant alteration or loss of wetlands from within the RSA is not likely to be.

Project effects on wetlands within the LSA are primarily related to a reduction in area of individual wetlands and loss or alteration of wetland function. Potential effects related to change in wetland quality and quantity are of moderate magnitude, site specific in extent, extended in duration, continuous in frequency, and are irreversible to reversible in the long term. Prediction confidence for analyses of wetlands and wetland function is moderate to high as they were both qualitative and quantitative in nature.

Owing to the open pit nature of the Project, restoration of the PDA upon decommissioning and reclamation is unlikely to result in the complete reversal of Project effects associated with wetlands. Several wetlands within the PDA are not expected to return to pre-Project conditions, or to take a long period of time to return to pre-Project conditions, especially in those areas where soils are less productive, there are insufficient native plant propagules in the soil or the landscape is unfavorable to the development of vegetation cover (i.e., sandy soils are unstable and revegetation is often difficult). Linear facilities constructed over wetlands in which soils are not removed or only temporarily disturbed are expected to regenerate naturally back to their pre-disturbance state in the reclaimed landscape over a long time.

At decommissioning and reclamation, the reclaimed landscape will remain dominated by wetlands, in particular slope fens, string fens, stream fens, and wetland complexes, although these wetlands will decrease in total area. For instances where the organic (peat) substrate will remain undisturbed or will not be removed (such as for linear features), wetlands are predicted to naturally regenerate to pre-existing conditions with time. When the organic substrate is not removed and infrastructure is built over top of it (such as for temporary access roads, power line easements, rail lines, conveyors, and tailings pipelines), reclamation techniques will be used to promote the natural regeneration of wetland features. Reclamation methods will include the grading of the site, installation of appropriate drainage areas, reestablishment of suitable substrate material and the promoting of artificially and naturally regenerating wetland plant species.

17.6.3 Summary of Project Residual Environmental Effects

There is a high level of certainty associated with the prediction of residual environmental effects for Wetlands, given the extent of baseline information, Project information, the understanding of interactions, the nature of the mitigation measures and resulting environmental effects.

The effect of the Project on Wetlands quality and quantity will occur primarily during the construction phase. The effect will be site-specific and long-term. No wetland types will be lost completely as a result of Project activities, although the areal extent of number of individual wetlands will be altered or lost. All wetland types present at baseline will remain after decommissioning and reclamation. On an aerial basis, the net or residual loss of wetlands in the PDA represents a low proportion of the total wetland area in the overall RSA. Alderon is in the process of pursuing a Corporate Stewardship Agreement with the municipalities and the Province (through the Eastern Habitat Joint Venture) to address the effects of the Project on Management Units, including the Pike Lake South Management Unit, thereby mitigating and reducing the Project effects. The residual environmental effects of the Project on the Wetlands are summarized in Table 17.11.

Table 17.11 Summary of Project Residual Environmental Effects: Wetlands

Project Phase	Mitigation/Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	
Change in Wetland Quality and Quantity											
Construction	• Minimize wetland loss and restrict construction activities to the PDA. • Comply with provincial and federal legislation, permits, approvals and guidelines. • Maintain hydrology at stream crossings. • Maintain natural drainage, where possible. • Erosion and sediment control. • Invasive species management. • Progressive reclamation, including wetland restoration. • Pursuing a Corporate Stewardship Agreement.	A	M	S	LT	O	I	U/D	N	H	Monitor for compliance with mitigation measures.

Project Phase	Mitigation/Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	
Operation and Maintenance	• Comply with provincial and federal legislation, permits, approvals and guidelines. • Erosion and sediment control. • Invasive species management. • Progressive reclamation, including wetland restoration. • Pursuing a Corporate Stewardship Agreement.	A	L	S	LT	C	I	D	N	H	Monitor for compliance with mitigation measures.
Decommissioning and Reclamation	• Comply with provincial and federal legislation, permits, approvals and guidelines. • Erosion and sediment control. • Invasive species management.	A/P	M	S	LT	O	I	D	N	H	Monitor for compliance with mitigation measures.

Project Phase	Mitigation/Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	

KEY

Direction:
- P Positive.
- A Adverse.
- N Neutral.

Magnitude:
- L Low: the residual Project effects to wetlands (alteration/loss) are not expected to exceed 5 percent of the total area of wetland in the RSA.
- M Moderate: the residual Project effects to wetlands (alteration/loss) are expected to be greater than 5 percent and not exceed 25 percent of the total area of wetland in the RSA.
- H High: the residual Project effects to wetlands (alteration/loss) are expected to exceed 25 percent of the total area of wetland in the RSA. Effect can be easily observed, measured and described, and may be widespread.

Geographic Extent:
- S Site-specific: Effect confined to the footprint for all Project features (i.e., PDA). Effects limited to directly affected wetlands.
- L Local: Effect extends beyond the Project footprint into the surrounding areas (LSA), including potentially affected wetland communities within 1 km of the mineral license.
- R Regional: Effect extends into the RSA. Area where indirect or cumulative effects may occur.
- B Effect extends beyond the regional study area. Area where indirect or cumulative effects may occur.

Duration:
- ST Short-term Effect occurs during the site-preparation or construction phase of the Project (i.e., 1 to 2 years).
- MT Medium-term Effect extends throughout the construction and operation phases of the Project (up to 17 years.
- LT Long-term Effect is greater than 17 years.
- P Permanent Effect persists.

Frequency:
- O Once Effect occurs occasionally, or once during the life of the Project (e.g., clearing).
- S Sporadic Effect occurs sporadically, at irregular intervals, without any predictable pattern during the life of the Project (e.g., hydrocarbon spills).
- R Regular Effect occurs on a regular basis and at regular intervals during the life of the Project.
- C Continuous Effect occurs continuously.

Reversibility:
- R Reversible Effect is reversible during the life of the Project.
- I Irreversible A long-term effect that is permanent (i.e., remains indefinite as a residual effect).

Environmental or Socio-economic Context:
- U Undisturbed: Area relatively or not adversely affected by human activity.
- D Developed: Area has been substantially previously disturbed by human development or human development is still present.
- N/A Not Applicable.

Significance:
- S Significant.
- N Not Significant.

Prediction Confidence:
Based on scientific information and statistical analysis and effectiveness of mitigation or effects management measure
- L Low level of confidence.
- M Moderate level of confidence.
- H High level of confidence.

17.7 Assessment of Cumulative Effects

Subsequent to the assessment of Project effects discussed above, an assessment was conducted of the potential cumulative effects of the Project in combination with those of other projects and activities within the RSA, or within hydrologically connected systems outside of the RSA. Potential cumulative effects on Wetlands are primarily related to wetland alteration or loss as a result of Project activities in combination with those of other developments or activities within the RSA, including past, current, and future mining initiatives.

The environmental effects of past and present projects and activities on wetlands in the RSA are reflected in the characterization of baseline conditions. Wetlands within the RSA exist generally in a natural pattern (i.e., have not been subject to anthropogenic disturbances). Wetlands are relatively common throughout the RSA, accounting for 8,918 ha or 12 percent of its approximately 73,876 ha area (Table 17.5). More than 90 percent of the wetland area in the RSA is of the fen-type, while the remaining wetlands are classed as lacustrine or riparian fen / marsh.

Most of the wetlands in the RSA are contiguous with little hydrological fragmentation, with the exception of wetland crossing locations for linear features (e.g., existing tertiary roads). Water quality protection is also not typically an important function of these wetlands as there are few identified inputs given the nature of up-gradient land uses, with little potential for high nutrient or sediment loads. Hydrological observations have indicated there is a high degree of connectivity between wetlands via seasonal drainages or small seasonal streams. Up-gradient wetlands tend to drain into down-gradient wetlands within the same watershed via small seasonal streams when their capacity to store water is reached. A hydrological feature of some wetlands is that they may have multiple outlets draining into different watersheds and sub-watersheds, especially those located at topographic divides. Most of the wetlands are water collection basins within watersheds and, for this reason, many wetlands tend to exist in the headwaters of streams and/or are riparian in nature, some of which were determined to be fish-bearing (Appendix H). Based on this sample size and wetland type representation, it is concluded that all functions provided by wetlands in the PDA are well represented in the wetlands that will remain unaffected in the RSA.

As presented in Table 17.11, Project-related environmental effects on Wetlands will be mitigated with well-established and proven mitigation measures. Alderon is in the process of pursuing a Corporate Stewardship Agreement with the towns of Labrador City and Wabush, and the Wildlife Division (EHJV) of DOEC, and has undertaken environmental studies necessary to support wetland rehabilitation, enhancement, and/or creation associated with the potential loss of protected areas (i.e., management units) assessed in Chapter 19: Birds, Other Wildlife and their Habitats, and Protected Areas.

A total of 572 ha (less than six percent) of the total wetland area in the RSA will be initially lost or altered as a result of Project activities. Tamarack / Black Spruce-Feathermoss wetland ecotype is estimated to decrease by approximately 318 ha (six percent of the 5,209 ha total wetland area in the RSA) while the Non-patterned Shrub Fen wetland ecotype is predicted to decrease by 142 ha (less than two percent of the wetland area in the RSA) following construction. Due to the prominence of peatlands across the landscape, the types of wetland functions which are likely to be affected by the Project are expected to be common throughout the RSA. A portion of the 572 ha of affected wetland may remain as a residual loss, though given the predominance of wetland in the RSA, a residual loss of wetland area will not result in a change or decline in the distribution or abundance of wetlands and/or associated wetland functions dependent upon that habitat (e.g., species at risk and/or species of conservation concern), such that the likelihood of its long-term viability within the RSA is substantially reduced as a result.

The IOC Labrador Operations project, Wabush mining project, Bloom Lake Mine and Rail Spur, and urbanization have the potential for cumulative effects in combination with those of the Project. Construction of older projects (e.g., IOC Labrador Operations, which has been in operation since 1962, Wabush Mines, which has been in operation since 1965, and historical development of the towns of Labrador City and Wabush) was not subject to regulatory or policy protection for wetlands. As such, these projects are anticipated to have resulted in the loss of wetlands and wetland function in the RSA. Currently, wetland area accounts for approximately 12 percent of the RSA. Assuming similar distribution of wetlands in the past and a total area of development for the other projects of approximately 64 km^2, it can be estimated that approximately 12 km^2 of wetlands were lost as a result of these projects. However, given that wetlands in western Labrador are currently abundant and healthy, it can be assumed that these projects did not have significant adverse environmental effects on wetlands.

As a result of provincial and federal regulatory requirements for wetlands, recent (i.e., the Bloom Lake Mine and Rail Spur, which was opened in 2010) and future projects (i.e., expansion of mines in the RSA) will be subject to the federal and provincial wetland regulations and policies described previously in Section 17.2.

Therefore, because the current Project will affect 572 ha (less than six percent) of the total wetland area in the RSA, and because Alderon is in the process of pursuing a Corporate Stewardship Agreement with the towns of Labrador City and Wabush and the Wildlife Division of DOEC, the cumulative effects resulting in the loss of wetlands or wetland function in combination with past, present, or future projects and activities is likely to be not significant.

Table 17.12 summarizes the base-case (i.e., existing conditions) and the residual effects of the Project, and identifies the potential residual effects on Wetlands from other projects and activities.

As presented in Section 17.6, the Project-related environmental effects on wetlands will be mitigated with well-established and proven mitigation measures. Alderon is in the process of pursuing a Corporate Stewardship Agreement with the towns of Labrador City and Wabush, and the Wildlife Division of DOEC. Alderon has undertaken baseline studies necessary to support wetland rehabilitation, enhancement and/or creation associated with the potential loss of protected areas (i.e., Management Units) assessed in Chapter 19: Birds, Other Wildlife and their Habitats, and Protected Areas.

Table 17.12 Summary of Potential Cumulative Effects to Wetlands

VEC Existing Condition (Past & On-Going Activities)	Wetlands are relatively common throughout the RSA, accounting for 8,918 ha or 12% of its approximately 73,876 ha area. More than 90% of the wetland area in the RSA is of the fen-type, while the remaining wetlands are classed as lacustrine or riparian fen/marsh. Most of the wetlands are water collection basins within watersheds and, for this reason, many wetlands tend to exist in the headwaters of streams and/or are riparian in nature. Most of the wetlands in the RSA are contiguous with little hydrological fragmentation with the exception of wetland crossing locations for linear features (e.g., existing tertiary roads). Water quality protection is also not typically an important function of these wetlands as there are few identified inputs given the nature of up-gradient land uses, with little potential for high nutrient or sediment loads.		
Project Residual Environmental Effects	A total of 572 ha (less than 6%) of the total wetland area in the RSA will be lost or altered as a result of Project activities. Tamarack/Black Spruce-Feathermoss wetland ecotype is estimated to decrease by approximately 318 ha (6% of the 5,209 ha total wetland area in the RSA) while the Non-patterned Shrub Fen wetland ecotype is predicted to decrease by 142 ha (less than 2% of the wetland area in the RSA) following construction.		
Other Projects and Activities	**Likely Effect Interaction (Y/N)**	**Rationale**	**Cumulative Effects**
IOC Labrador Operations	Y	The IOC Labrador Operations project is within the RSA and therefore there is potential for cumulative effects.	The IOC Labrador project was developed prior to environmental assessment practice in Labrador and Canada, and therefore the extent of wetlands affected by that project were not recorded. Current operations are not known to be adversely affecting wetlands.
Wabush Mines (Cliffs Resources)	Y	The Wabush Mines project is located within the RSA of the Project and therefore there is potential for cumulative effects.	The Wabush Mines project was developed prior to environmental assessment practice in Labrador and Canada, and therefore the extent of wetlands affected by that project were not recorded. Current operations are not known to be adversely affecting wetlands.
Mont Wright Mine (ArcelorMittal)	N	The Mont Wright Mine project is not located within the RSA and does not contribute to changes in the amount, type and quality of wetlands in the RSA.	N/A
Bloom Lake Mine and Rail Spur (Cliffs Resources)	Y	The Bloom Lake Mine and Rail Spur is located within the RSA of the Project and therefore there is potential for cumulative effects.	The Bloom Lake Mine and Rail Spur was developed in 2010 and was subject to federal and provincial regulations and policies. Effects on wetlands are expected to have been mitigated.

Schefferville Iron Ore Mine (Labrador Iron Mines)	N	The Schefferville Iron Ore Mine project is not located within the RSA and does not contribute to changes in the amount, type and quality of wetlands in the RSA.	N/A
DSO Iron Ore Project (Tata Steel Minerals Canada)	N	The DSO Iron Ore project is not located within the RSA and does not contribute to changes in the amount, type and quality of wetlands in the RSA.	N/A
Lower Churchill Generation Project (Nalcor Energy)	N	The Lower Churchill Generation project is not located within the RSA and does not contribute to changes in the amount, type and quality of wetlands in the RSA.	N/A
Infrastructure or other projects at Port of Sept-Îles	N	The Infrastructure or other projects at Port of Sept-Îles is not located within the RSA and does not contribute to changes in the amount, type and quality of wetlands in the RSA.	N/A
Urbanization	Y	The towns of Labrador City and Wabush are located within the RSA of the Project and therefore there is potential for cumulative effects.	The towns of Labrador City and Wabush were initially developed prior to environmental assessment practice in Labrador and Canada, and therefore the extent of wetlands affected were not recorded. Recent and future development would be subject to federal and provincial regulations and policies.

Cumulative Effects Summary (Project + relevant projects and effects)	**Direction**	**Magnitude**	**Geographic Extent**	**Duration**	**Frequency**	**Reversibility**	**Significance**	**Confidence**
	A	L	R	P	C	I	N	H

The IOC Labrador Operations, Wabush Mines, Bloom Lake Mine and Rail Spur, and urbanization may have had direct effects on wetland area when they were constructed and had indirect effects on wetland function during their operation; however, wetlands remain abundant and of high quality in the RSA. The residual effects of the Project on wetlands will be of limited extent and will not result in a change or decline in the distribution or abundance of wetlands and/or associated wetland functions dependent upon that habitat (e.g., species at risk and/or species of conservation concern), such that the likelihood of its long-term viability within the RSA is substantially reduced as a result. Therefore, the cumulative effects of the Project acting in combination with other projects and activities are likely to be not significant.

Note: Environmental effects descriptors and their definitions are as used in the assessment of Project-related environmental effects.

A total of 572 ha (6 percent) of the total wetland area in the RSA (8,918 ha) will be initially lost or altered as a result of Project activities. Tamarack / Black Spruce-Feathermoss wetland ecotype are predicted to decrease by approximately 318 ha (6 percent of the 5,209 ha total wetland area in the RSA) while the Non-patterned Shrub Fen wetland ecotypes are predicted to decrease by 142 ha (less than 2 percent of the 8,918 ha wetland area in the RSA) following construction. Due to the prominence of peatlands across the landscape, these types of wetland functions, which are likely to be affected by the Project, are expected to be common throughout the RSA. A portion of the 572 ha of affected wetland may remain as a residual loss, though given the predominance of wetland in the RSA, a residual loss of wetland area will not result in a change or decline in the distribution or abundance of wetlands and/or associated wetland functions dependent upon that habitat (e.g., species at risk and/or species of conservation concern), such that the likelihood of its long-term viability within the RSA is substantially reduced as a result. Therefore, the residual effects of the Project on wetlands are determined as not significant.

The IOC Labrador Operations project and the Wabush mining project have the potential for cumulative effects. Both the IOC Labrador Operations project and the Wabush Mines project were developed prior to environmental assessment practice in Labrador and Canada, and therefore the extent of wetlands affected by these projects was not recorded prior to mine development (including the waste rock piles). Current operations are not known to be adversely affecting wetlands. Given that wetlands in western Labrador are currently abundant and healthy, it can be reasonably assumed that these projects did not have significant effects on wetlands, and that the current operation of these projects acting in combination with the potential residual effects of the Project will not result in significant cumulative effects on wetlands.

17.8 Assessment of Accidents and Malfunctions

Although unlikely, three potential accident or malfunction scenarios could interact with Wetlands. These are:

- Forest fire caused by the Project;
- Breach of the polishing pond dyke; and
- Train derailment and consequent spill of materials or contaminants.

In the unlikely event of any of these scenarios, alteration or loss of wetlands could result. An Emergency Response Plan will be developed prior to initiation of construction activities and will include detailed measures for responding to the accidents and malfunctions listed above.

Forest Fire

Although unlikely, a Project-related forest fire could occur during any phase of the Project due to natural causes (i.e., lighting strike resulting in a forest fire under dry conditions), equipment involving the use of heat or flame, or human carelessness, the potential for occurrence of which is greater during the construction phase and operations and maintenance phase of the Project due to increased human activity on the site. The potential environmental effects of a fire in the

Project area could alter wetland quality, with the potential for a loss of wetland function (e.g., waterfowl habitat).

Factors influencing the extent and duration of a resulting fire would be dependent on response efforts and meteorological conditions, and may also include time of year, type of fire, degree of fuel loading, and fire extent. Risk of fire along the proposed road / rail routes is possibly higher than in other areas due to the presence of human activity, including commercial and recreational traffic along access roads and rail transport.

The magnitude of the environmental effect on wetlands is largely dependent on the scale of the forest fire. Reversibility of the physical effects of a fire is high, but would be anticipated to occur over a number of years. Restoration of wetland quality or function would depend upon the reestablishment of vegetation communities through succession.

The potential for Project-related fires will be mitigated through proper planning, Project design, and the use of standard best management practices, including employee training, proper vigilance working with power equipment in forested areas (e.g., power saw mufflers), and equipment maintenance (e.g., vehicle exhaust systems). All Project activities will be completed in compliance with all appropriate regulation (e.g., *Forest Fire Regulations* under the provincial *Forestry Act*) and any burning of vegetative debris will be completed in accordance with permits obtained from the Newfoundland and Labrador Department of Natural Resources (NLDNR). Fire suppression water supply will be extracted from Long Lake and will be kept pressurized at the pumping station near the concentrator area. Staff will be trained to prevent and control fires. A plan for preventing and combating forest fires will be incorporated into the Emergency Response Plan. In the unlikely event of a large fire, local emergency response and fire-fighting capability will be called to respond to reduce the severity and extent of damage and to protect the safety of workers. The nearest district forest management unit office is in Wabush, which has staff and equipment to provide initial suppression activities. Two seasonal fire protection staff are stationed at Wabush from mid-May to September, complemented by three permanent staff that are available for fire suppression when needed. After regular hours, the Department maintains one district duty officer and one regional duty officer for receiving fire reports and dispatching staff and equipment. Therefore, in the event of a fire, the on-site response and proximity of provincial fire suppression will limit the size of any burn.

Polishing Pond Dyke Breach

The dykes located at the TMF will be designed to standards of the Canadian Dam Association (CDA) Dam Safety Guidelines. The CDA Dam Safety Guidelines will be used to guide the hazard consequence assessment process and associated design standards for the dykes at the TMF. The hazard consequence class for rockfill dams is determined through hydrotechnical, seismic, and geotechnical assessments of a dam breach failure. The dam design and hazard consequence classification process is subject to a risk assessment process to minimize and reduce risk of breach and, subsequently, to reduce risk to acceptable levels. The outlet structures and TMF are being designed to accommodate a 100-year storm. In addition, an emergency spillway will be incorporated into design to provide relief of larger runoff events such as the from the Probable Maximum Precipitation event.

The proposed tailings impoundment will be a dynamic water feature whose location and shape will move and adjust over the life-of-mine due to the proposed upstream tailings deposition method. Tailings will be deposited starting from the tailings dam crest and form a tailings beach extending within the TMF away from the dam. The standing tailings impoundment water is therefore always upstream of the tailings beach. This deposition method progressively moves the tailings impoundment water farther away from the tailings dam and subsequently lowers the risk of a flooding breach of the tailings dam. In the event of a tailings dam breach, tailings impoundment water would have to migrate through the tailings beach to the breach and in the process peak flows would be expected to be attenuated to low consequence levels.

The proposed polishing pond dyke will maintain its location throughout the life-of-mine. A breach of the polishing pond dyke would result in the release of impounded water to the downstream stream (TDA-02). As the TMF and polishing pond effectively remove the upstream portion of TDA-02, much less water would route through the watercourse in the event of a dyke breach than if the polishing pond were an on-line system. A polishing pond dyke breach would be expected to cause localized flooding and may cause some erosion and sedimentation near the breach point. However, these effects would be temporary and the downstream watercourse is expected to recover naturally. Polishing pond water quality is expected to be ≤ 100 mg/L TSS, which is the criterion for reclaim water intake from the tailings impoundment. Further, installation of a system to treat red water is expected to improve resident water quality in the polishing pond. Therefore, water quality in TDA-02 in the immediate vicinity of a dyke breach may exceed MMER TSS guidelines; however, TSS concentrations are expected to be moderate and not greater than the maximum TSS concentrations that can occur naturally. This effect would also be temporary and one from which the receiving watercourse would be expected to recover naturally.

The extent of the environmental effect of a failure of the Polishing Pond control structure on wetlands and, in particular, wetland function is predicted to be low, as the effects would primarily occur in low-lying areas along the shorelines of Long Lake, such that the extent of effects will be limited. Reversibility of the physical effects of a dyke breach is high, but would be anticipated to occur over a number of years. Restoration of wetland quality or function would depend upon the reestablishment of vegetation communities through succession.

Train Derailment

No. 2 diesel fuel will be transported along the rail line to the Project site and ore concentrate will be transported from the Project site to the QNS&L railway. In the event of a train derailment, hazardous materials and/or iron ore concentrate could be deposited into wetlands. Such spills are usually highly localized and can be effectively cleaned up by on-site crews using standard equipment and spill response materials. The unlikely event of a large spill into a wetland or wetlands could result in a degradation of wetland quality with potential effects on wetland function, in particular where those wetlands provide habitat for fish and wildlife (e.g., waterfowl). The magnitude and duration of any potential effects of accidental spills depends on the nature of material spilled, the quantity spilled, the location of the spill, and the time of year in which the incident occurs.

The Emergency Response Plan will address emergency preparedness measures necessary to provide effective response in the unlikely event of a spill. In addition to spill response procedures identified in the EPP and Emergency Response Plan, the transportation of dangerous goods is strictly regulated in Newfoundland and Labrador, and across Canada, and the regulatory spill response system is highly coordinated and effective means of dealing with such events. Additionally, track inspections (both manual and electronic) will be carried out in accordance with Transport Canada regulations to identify and address any track defects that could lead to derailment. Given the aforementioned mitigation, the magnitude of the environmental effects attributable to these infrequent and unlikely accidents and malfunctions is considered low, or under potentially worse case scenarios medium. Reversibility of the environmental effects on wetland function will depend on the specific wetland involved, and the proportion of wetland area affected, but would be anticipated to occur naturally over a number of years.

The residual environmental effects of Project-related accidents and malfunctions on wetlands are summarized in Table 17.13.

Table 17.13 Summary of Residual Environmental Effects for Wetlands – Accidents and Malfunctions

Accidental Event / Malfunction	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	
Forest Fire	• Implement EPP. • Implement ERP. • Employee training.	A	L-H	L/R	ST	U	R	U	S	H	None.
Polishing Pond Dyke Breach	• Design polishing pond to handle 1 in 100 year peak discharge event. • Inclusion of spillway. • Implement EPP. • Implement ERP. • Employee training.	A	L-M	L	ST	U	R	U	N	H	Monitor for success of response measures.
Train Derailment	• Compliance with provincial and federal regulations. • Implement EPP. • Implement ERP. • Employee training.	A	L-M	L	ST	U	I	U/D	N	H	Monitor for success of response measures.

Accidental Event / Malfunction	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	

KEY

Direction:
P Positive.
A Adverse.
N Neutral.

Magnitude:
L Low: wetlands alteration / loss not expected to exceed 5% of the total mapped area of wetland in the RSA. No measurable effect on wetlands as a whole.
M Moderate: wetlands alteration / loss expected to be greater than 5% and not exceed 25% of the total mapped area of wetland in the RSA. Effect can be measured.
H High: wetlands alteration / loss expected to exceed 25% of the total mapped area of wetland in the RSA. Effect can be easily observed, measured and described, and may be widespread.

Geographic Extent:
S Site-specific: including PDA and 200 m beyond.
L Local: within the LSA.
R Regional: within the RSA.
B Beyond Regional: beyond the RSA.

Duration:
ST Short-term.
MT Medium-term.
LT Long-term.
P Permanent – will not change back to original condition.

Frequency:
U Unlikley.
O Occasionally, once per month or less.
S Occurs sporadically at irregular intervals.
R Occurs on a regular basis and at regular intervals.
C Continuous.

Reversibility:
R Reversible.
I Irreversible.

Environmental or Socio-economic Context:
U Undisturbed: Area relatively or not adversely affected by human activity.
D Developed: Area has been substantially previously disturbed by human development or human development is still present.
N/A Not Applicable.

Significance:
S Significant.
N Not Significant.

Prediction Confidence:
Based on scientific information and statistical analysis, professional judgment and effectiveness of mitigation or effects management measure
L Low level of confidence.
M Moderate level of confidence.
H High level of confidence.

17.9 Determination of Significance of Residual Adverse Environmental Effects

17.9.1 Project-related Residual Environmental Effects

The Project is being designed, and will be constructed and operated to minimize potential environmental effects on Wetlands that could result during the normal course of the Project as well as those that could result from Accidents and Malfunctions. The implementation of an EPP and an Emergency Response Plan will minimize the likelihood, extent, and magnitude of residual environmental effects.

During construction, some wetlands and wetland habitat will be altered or lost through site preparation activities primarily related to construction of the mine site, waste rock disposal areas, TMF, and other permanent infrastructure. Construction of access roads, power lines, pipelines, and conveyors will contribute to habitat loss and alteration, but of lesser consequence. As a result of site preparation, many of the existing wetlands within the PDA will be altered or lost, and a reduction in abundance of wetlands and wetland habitat is expected. Of the 265 wetlands identified in the LSA, 54 are expected to be affected by the Project (211 will remain unaffected). On an aerial basis, the total wetland habitat to be affected by the Project represents approximately 6 percent of the total wetland area identified in the RSA (572 ha versus 8,918 ha). Although the Project will alter wetland quantity and quality, all wetlands classes / forms, and their associated functions, are predicted to remain upon decommissioning of the Project. Progressive rehabilitation will be conducted throughout the life of the Project, further mitigating effects to Wetlands.

Additional residual adverse effects are not expected during operation and maintenance, or decommissioning and reclamation because they will occur primarily, if not exclusively, as a result of first-time ground disturbance (i.e., site preparation) during construction.

Although the Project is expected to have an adverse effect on local area wetlands, the Project will not result in a change or decline in the distribution or abundance of wetlands and/or associated wetland functions dependent upon that habitat (e.g., species at risk and/or species of conservation concern), such that the likelihood of its long-term viability within the LSA is substantially reduced as a result. Although detailed wetland inventory data is not available throughout the entire extent of the RSA, the ELC data suggests that the Project will affect approximately 6 percent of wetlands within the RSA. The environmental effect of the Project on wetlands may be further mitigated through the progressive rehabilitation, enhancement and/or creation of additional wetland habitat. Therefore, there are no likely significant effects on Wetlands as a result of the Project.

17.9.2 Cumulative Effects

The IOC Labrador Operations project, Wabush mining project, Bloom Lake Mine and Rail Spur, and urbanization may have had direct effects on wetland area and function. The effects of these projects are reflected in the baseline conditions, and are determined to be not significant because wetlands remain abundant (12 percent) and of high quality (contiguous hydrology with minimal anthropogenic disturbances) in the RSA. The Project may have residual adverse effects on wetlands, though these are predicted to be of limited extent (less than 6 percent of the wetlands in the RSA) and will not result in a change or decline in the distribution or abundance of wetlands and/or associated wetland functions dependent upon that habitat (e.g., species at risk and/or species of conservation concern), such that the likelihood of its long-term viability within the RSA is substantially reduced as a result. Future projects and activities will be subject to provincial and federal regulatory requirements for wetlands and are not expected to have significant residual environmental effects that will act in combination with those of the Project. Therefore, the cumulative effects of the Project acting in combination with past, present, and future projects and activities on Wetlands are not likely to be significant.

17.9.3 Accidents and Malfunctions

Design features and procedures will be incorporated to minimize the probable occurrence of accidents and malfunctions. Proven engineering techniques are available to prevent these accidents and will be employed for the Project. Safety, spill response, and contingency plans will be developed and implemented to reduce adverse environmental effects of such unlikely event incidents. All safety procedures will be documented and in place prior to the commencement of the Project.

An Emergency Response Plan will further reduce the magnitude of effects resulting from forest fire, polishing pond dyke breach, or train derailments. In addition, design features and safety precautions at the Project will minimize the likelihood of significant effects due to accidents and malfunctions.

Forest Fire

Although the effects of a fire on Wetlands would be temporary, depending on the extent of a fire, the magnitude of the resulting effects could be high. The likelihood of a forest fire will be reduced through employee training and other mitigation measures. In the event of a fire, response measures to be detailed in the Emergency Response Plan would be implemented. The potential environmental effects of a Project-induced forest fire on Wetlands could be significant in the unlikely event it should occur.

Breach of Polishing Pond Dyke

Based on the temporary nature and limited geographic extent of the potential interactions, and in consideration of the mitigation (e.g., engineering design and Emergency Response and Contingency Plan) and potential receiving environment (i.e., Long Lake), the potential environmental effects of a polishing pond dyke breach on Wetlands are not likely to be significant in the highly unlikely event should it occur.

Train Derailment

Based on the temporary nature and limited geographic extent of the potential interactions and the natural reversibility of effects, and in consideration of the mitigation (e.g., Emergency Response Plan measures and provincial / federal regulatory spill response system), the potential environmental effects of a Project-related train derailment on Wetlands are rated as not significant in the highly unlikely event should it occur.

17.9.4 Overall Residual Effects Conclusion

The level of information is considered sufficient to confidently predict the significance of residual Project-related environmental effects, including cumulative effects.

While the construction, operations and maintenance and decommissioning and reclamation activities will all have some effect on wetlands and wetland habitat, the residual effects are not considered to be significant as the wetlands that are to be disturbed are representative of the wetlands and wetland habitats that are generally available throughout western Labrador. Hence from a regional perspective, there will be minimal residual effects with the implementation of mitigation measures. Alderon is in the process of pursuing a Corporate Stewardship Agreement.

No one wetland type will be significantly affected because there are no unique habitats within the PDA or within the area that may be affected by indirect effects related to construction and operations and maintenance activities (i.e., LSA).

Through this environmental assessment, various measures have been identified so that the potential environmental effects of this Project are managed to an acceptable level. In conclusion, the Project is not likely to result in significant adverse residual effects on Wetlands.

17.10 Follow-up and Monitoring

Compliance monitoring will be conducted to confirm that wetland mitigation measures are appropriately implemented.

17.11 Next Steps

Alderon is in the process of pursuing a Corporate Stewardship Agreement with the municipalities and the EHJV. Prior to construction, an EPP will be developed. Mitigation measures for Wetlands will be incorporated. The relevant permits and approvals will be obtained prior to the disturbance of waterbodies.

17.12 Summary

The Project is situated in variable terrain that contains many wetlands, including several large peatlands (i.e., bogs and fens). Through extensive background and field research, wetlands have been identified and their functions evaluated across the LSA. Detailed wetland mapping indicates that the LSA is comprised largely of two wetland classes, fen and marsh. Fens occupy the large majority of wetland habitat, whereas marshes are found in limited abundance, being restricted to the shorelines of certain waterbodies and watercourses. Interaction between the Project and Wetlands will occur within the LSA, specifically within the PDA, primarily during the construction phase resulting from ground disturbance activities.

The environmental effects of site preparation (including clearing, excavation, material haulage, grading, and removal of overburden and stockpiling) represent the single largest effect on wetland quality and quantity as a result of the Project. At the completion of construction, wetlands are anticipated to decrease in the LSA by approximately 32 percent (from 1,763 ha to 1,191 ha). Within the RSA, the Project will however have a limited effect on wetlands, with a net loss of less than 6 percent (572 ha of 8,918 ha available in the RSA). The environmental effects of the Project will be the change in distribution and abundance of wetlands.

Project planning and design, and mitigation measures have been prescribed to minimize Project related effects on Wetlands. Many environmental factors affect wetlands both within and adjacent to the Project, including anthropogenic activities associated with mining and other forms of landscape development including the building of roads, clearing of land, and recreational pursuits. More naturally, induced changes to wetlands could alternately take place through forest fires, flooding, insect outbreaks, and climate change. When assessed against other development in Labrador, and as described geographically in the context of the region, the residual effects of the Project are quite limited, and should remain within the natural range of variation over the long-term. Wetlands are expected to remain abundant and widely distributed throughout the RSA. Because the long-term viability of wetland types is not expected to be significantly affected, the adverse cumulative effect on Wetlands of all past, present and reasonably foreseeable projects and activities, in combination with the environmental effects of the Project, is considered not significant.

Compliance monitoring will ensure that the mitigation is applied effectively, and post-construction wetland effects monitoring will confirm the effectiveness of mitigation measures.

Based on the results of the environmental assessment, including background research and field surveys, and the application of standard mitigation measures, adverse residual effects on Wetlands are not likely to be significant.

18.0 FRESHWATER FISH, FISH HABITAT, AND FISHERIES

The Project effects, including accidents and malfunctions, and cumulative effects are assessed for Freshwater Fish, Fish Habitat, and Fisheries. Proposed mitigation measures, an evaluation of residual and cumulative effects, determination of significance and suggestions for follow-up work and monitoring are also presented.

18.1 Valued Ecosystem Component Definition and Rationale for Selection

Freshwater Fish, Fish Habitat, and Fisheries was chosen as a VEC because of its importance as a resource, and the high level of potential interactions with the Project. The quantity and quality of available freshwater fish and fish habitat is an indicator of aquatic ecosystem health, and has socio-economic implications. The issues arising from Project effects will be addressed under the requirements of the *Fisheries Act*, which govern the protection of fish and fish habitat. By identifying sustainable fish habitats potentially affected by the Project, and developing mitigation measures to protect these resources, the overall ecological function of the aquatic ecosystem will be protected.

Freshwater Fish, Fish Habitat, and Fisheries includes the populations and associated habitats for all freshwater fish species within areas that may or will be affected by the Project. As stated in the EIS Guidelines, freshwater fish and fish habitat means freshwater fish species and the habitat upon which they depend. Fish include all species that reside within or utilize habitat during any life stage within the local and regional study areas. In accordance with Section 2(1) of the revised *Fisheries Act*, fish habitat is defined as “spawning grounds and any other areas, including nursery, rearing, food supply and migration areas, on which fish depend directly or indirectly in order to carry out their life processes”. For this EIS, fish habitat consists of all productive and migratory fish habitat areas that may be affected by Project works. Fisheries are defined as the commercial, recreational, Aboriginal, and subsistence fisheries which have the potential to be affected by the Project. There are no commercial fisheries and no reported Aboriginal or subsistence fisheries. Therefore Fisheries consists of the recreational fishery.

This VEC is linked to other Project VECs, including Chapter 16: Water Resources, and Chapter 23: Other Current Use of Land and Resources.

18.1.1 Approach to Assessment of Effects

Final guidelines for the assessment of the Project were received on June 26, 2012 which included Freshwater Fish, Fish Habitat, and Fisheries as a VEC. The assessment of environmental effects was discussed with Fisheries and Oceans Canada (DFO), on June 5, 2012. The meeting included an outline of the results of the Aquatic Baseline Study and a presentation and discussion of the methodology for environmental effects. DFO expressed satisfaction with the overall approach. Discussions with DFO are also ongoing regarding the further development of the Fish Compensation Strategy and Plan, which must be approved prior to any loss of productive fish habitat. While the *Fisheries Act* is currently being revised, the approach being taken to quantify the existing habitat, production, and fisheries will address any modifications required.

18.1.2 Issues

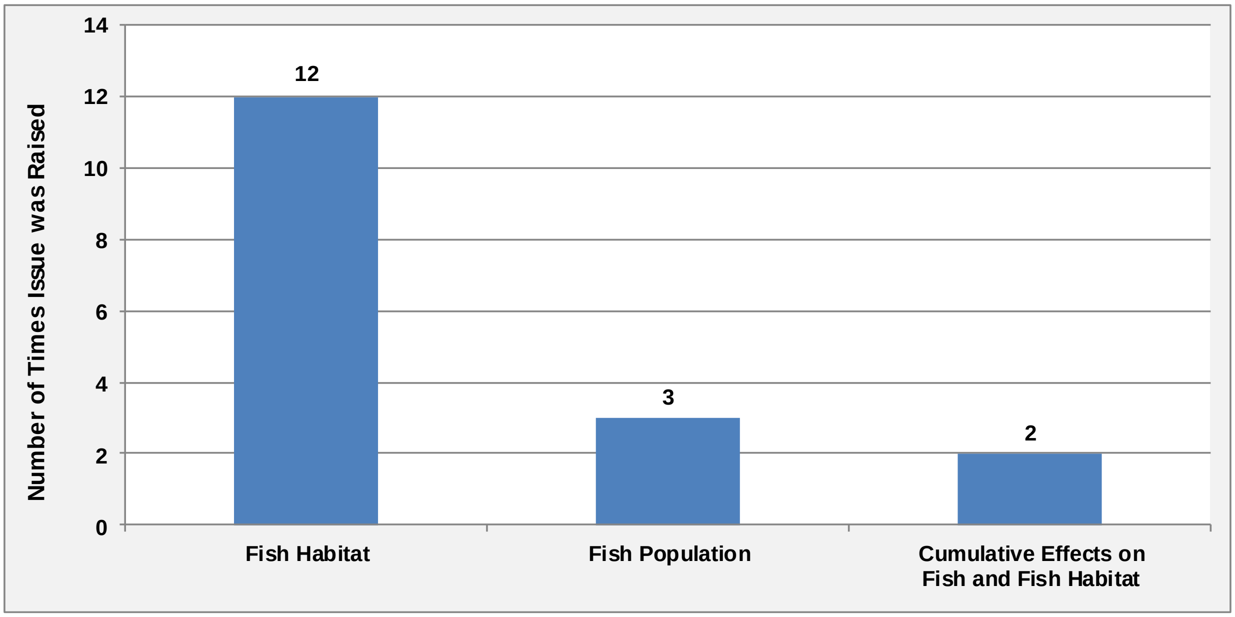
The issues that were raised regarding Freshwater Fish, Fish Habitat, and Fisheries during Aboriginal, public, and stakeholder consultations are shown in Table 18.1 as well as a brief description of the mitigation measures and reference to further information within the EIS. The number of times an issue was raised is shown in Figure 18.1. The identified issues were used to provide additional focus for the assessment as well as identified Project-VEC interactions. They also assisted in finalizing the assessment boundaries.

Table 18.1 Issues Raised by Aboriginal Groups and Stakeholders

Issue	Community / Organization	Summary of Comments Raised During Consultation and Engagement Activities	Response / Location in EIS
Cumulative effects on fish and fish habitat	Innu Nation	Most elders and land users are afraid to hunt in the Wabush area because of the landscape and pollution. They are scared to eat the fish and animals. In the spring, summer and fall, Innu go hunt in that area. They are concerned with what partridges, beavers and other animals eat there. They are also concerned with contamination of fish.	Existing land and resource use by Aboriginal persons and potential health effects are discussed in Sections 22.5 and Chapter 25 of the EIS. In the EIS, potential effects to fish have also been assessed and mitigation identified. The Project is not anticipated to result in heavy metal or chemical contamination. See Section 18.6 for more information about this assessment.
Fish population and species	Wabush	Will the Project have effects on fish?	In the EIS, potential effects to fish have been assessed and mitigation identified. This assessment determined that fish mortality as a result of the Project is not anticipated. Alderon will prepare a Compensation Plan as required under the *Fisheries Act.* See Section 18.6 for more information.
	Wabush	3-4 lb speckled trout are caught in area lakes.	In the EIS, potential effects to fish have been assessed and mitigation identified. This assessment determined that changes to trout populations are not anticipated. See Section 18.6 for more information.

Issue	Community / Organization	Summary of Comments Raised During Consultation and Engagement Activities	Response / Location in EIS
Fish habitat	Cabin Owners	An important issue for me is community impact due to the destruction of aquatic life.	In the EIS, potential effects to fish have been assessed and mitigation identified. This assessment determined that there will be minimal destruction of aquatic life as a result of the Project. Under *Metal Mining Effluent Regulations,* effluent must be tested monthly to verify that it is not acutely lethal to fish or Daphnia (water flea). Alderon will prepare a Compensation Plan as required under the *Fisheries Act.* See Section 18.6 for more information.
	Le mouvement citoyen de Fermont	What measures will be taken to protect the aquatic system?	
	Innu Nation	Alderon needs to be cautious of bogs and streams around the mine, to make sure they do not flow in lakes and contaminate them.	Alderon will treat all effluent to meet regulatory standards, including *Metal Mining Effluent Regulations,* prior to release into the environment. The key characteristics and features of the TMF and effluent treatment infrastructure are described in Section 2.5.4 and 2.6.2. See Section 16.6 for more information about the assessment and mitigation of effects on water resources.
	Labrador City	Concern of fish migration between the small lakes south of Mills Lake to Mills Lake and Molar Lake.	The Project will not block passage of fish from Mills Lake to Molar Lake. See Section 18.6 for more information.
	Labrador City	What will happen to fish in the proposed tailings areas and nearby water system?	Alderon will prepare a Compensation Plan as required under the *Fisheries Act.* Fish will be relocated from areas to be dewatered. See Section 18.6 for more information.
	Labrador City	How is fish habitat replaced?	
	Labrador City	There is a water system south of Riordan Lake that the local people fish. Concerns that the tailings area is just north of the water body and that it might affect fish.	The TMF is located primarily in the Long Lake watershed and is contained by a series of natural ridges, dams and dykes. All discharges from the TMF and polishing pond will flow north into Long Lake and are therefore not anticipated to affect fish habitat outside of the footprint watershed, including Riordan Lake.

Figure 18.1 Frequency of Issues Raised in Relation to Freshwater Fish, Fish Habitat, and Fisheries



18.2 Environmental Assessment Boundaries

18.2.1 Spatial Boundaries

Project Development Area (PDA)

The PDA comprises the footprint of the Rose Pit Mine, the Rose North Waste Rock Disposal Area, the Rose South Waste Rock Disposal Area, the TMF, and associated infrastructure. The PDA encompasses all areas where Freshwater Fish, Fish Habitat, and Fisheries may be physically disturbed through direct Project-related activities that will alter fish habitat.

Local Study Area

The Local Study Area (LSA) for Freshwater Fish, Fish Habitat, and Fisheries includes all areas where potential direct Project-related effects may be measureable to some degree of confidence. It includes the PDA and associated surrounding area where environmental effects may reasonably be expected to occur. Project components that were considered when defining the LSA are the proposed Rose Pit Mine, the waste rock disposal areas, the concentrator / processing area, all facilities infrastructure, the TMF, on-site roads, the conveyor line, the rail infrastructure, the on-site transmission line, and the various required crossings (Figure 18.2).

Watercourses and waterbodies included in the LSA are the Rose Pit ponds and associated streams, Pike Lake South and North and associated streams, one stream associated with the Rose North Waste Rock Disposal Area, the four small stream sections associated with the Rose South Waste Rock Disposal Area, Mills Lake, Long Lake, three small ponds and associated streams at the Tailings Management Area, Riordan Lake, Harris Lake, Elephant Head Lake, the Waldorf River from the unnamed lake directly downstream of Swanson Lake to the inflow to Long Lake, the Walsh River from the confluence with the Pike lakes system to the inflow to Long Lake, the stream section connecting Wahnahnish and Jean lakes, the upper portion of the northern arm of Wahnahnish Lake, and an unnamed pond located directly west of Flora Lake and south of the Trans Labrador Highway.

Regional Study Area

The Regional Study Area (RSA) includes all areas where foreseeable effects may result. The RSA was defined to capture the farthest extent of potential effect of the Project on Freshwater Fish, Fish Habitat, and Fisheries, but which are not directly measureable to a specific degree of confidence. The RSA is also the area within which cumulative effects can be assessed. In general, the RSA includes all watercourses, waterbodies and respective watersheds surrounding the PDA that eventually drain into and include Wabush Lake (Figure 18.3).

Watercourses and waterbodies within the RSA include all those mentioned within the LSA as well as the watercourses and waterbodies within the Mills Lake drainage area from the provincial boundary to Long Lake, the Walsh River drainage from Strawberry Lake to Long Lake, the Pike lakes drainage area from the upper Rose Ponds to the Walsh River, the Walsh River from Walsh Bridge to Long Lake, the Riordan Lake drainage area from the provincial boundary (including Rectangle Lake) to Long Lake, the Wahnahnish Lake drainage area from Upper Loon Lake to Little Wabush Lake, the watercourses between Long Lake and Little Wabush Lake including Canning Lake and Harrie Lake, and Little Wabush and Wabush Lakes. It also includes Lac Daviault for the purpose of assessing the effects to fisheries.

18.2.2 Temporal Boundaries

The temporal boundaries for the Project encompass all Project phases from construction through to reclamation. The construction phase will be approximately two years, followed by the operation and maintenance phase (approximately 17 years), and decommissioning and reclamation (decommissioning to run approximately two years).

Of additional note, with respect to temporal boundaries, are seasonal considerations related to potential effects and interactions with the Project. Temporal boundaries for Freshwater Fish, Fish Habitat, and Fisheries are seasonally focused due to the various life stage requirements for the area's fish species. Specific time periods are critical for insuring habitat integrity and reducing mortality risk. The fish species in the LSA and RSA are either spring or fall spawners with emergence occurring shortly after ice-out or early in the spring. Therefore, the most critical time periods are from September-October through winter to April to June of each year.

Figure 18.2 Local Study Area

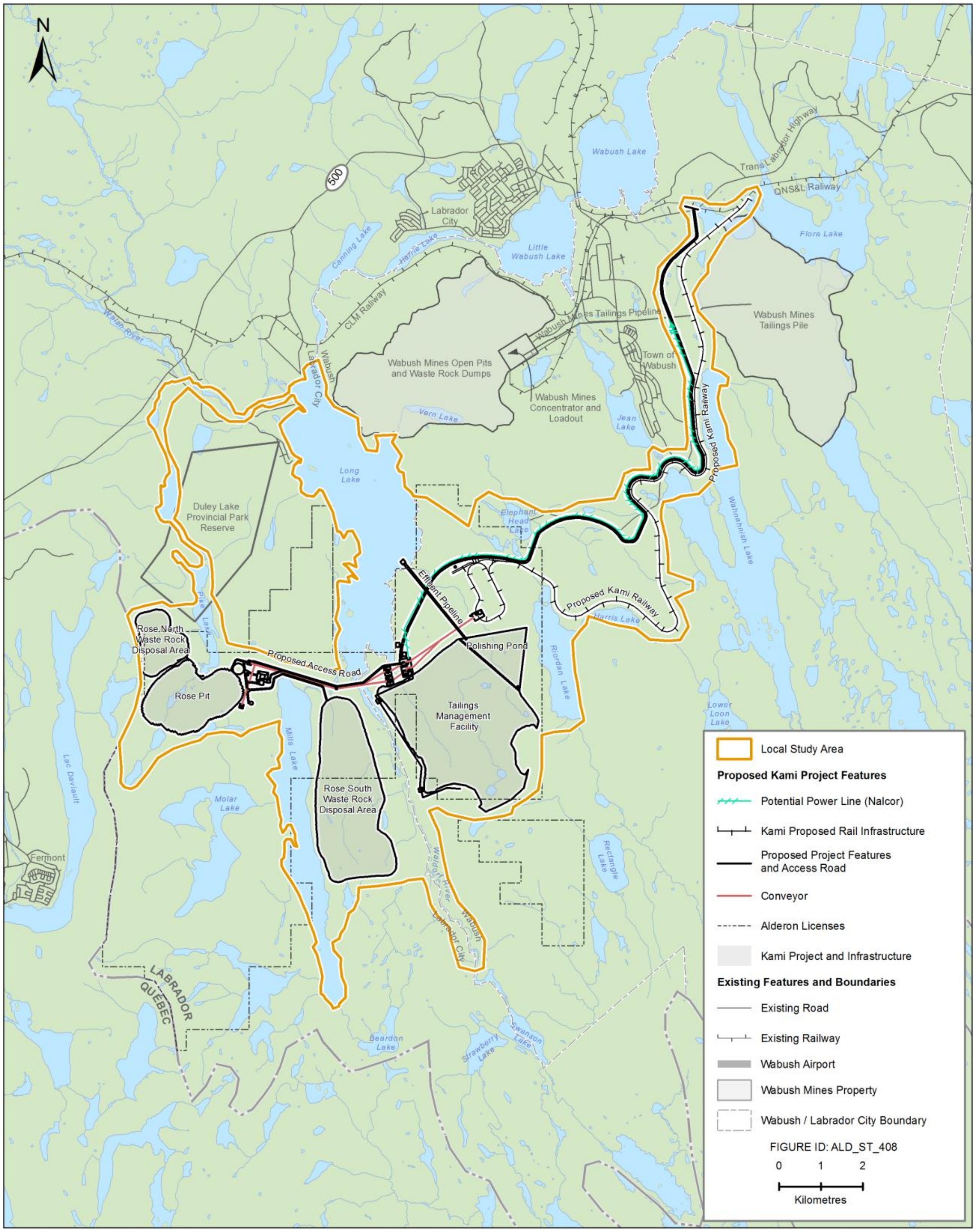
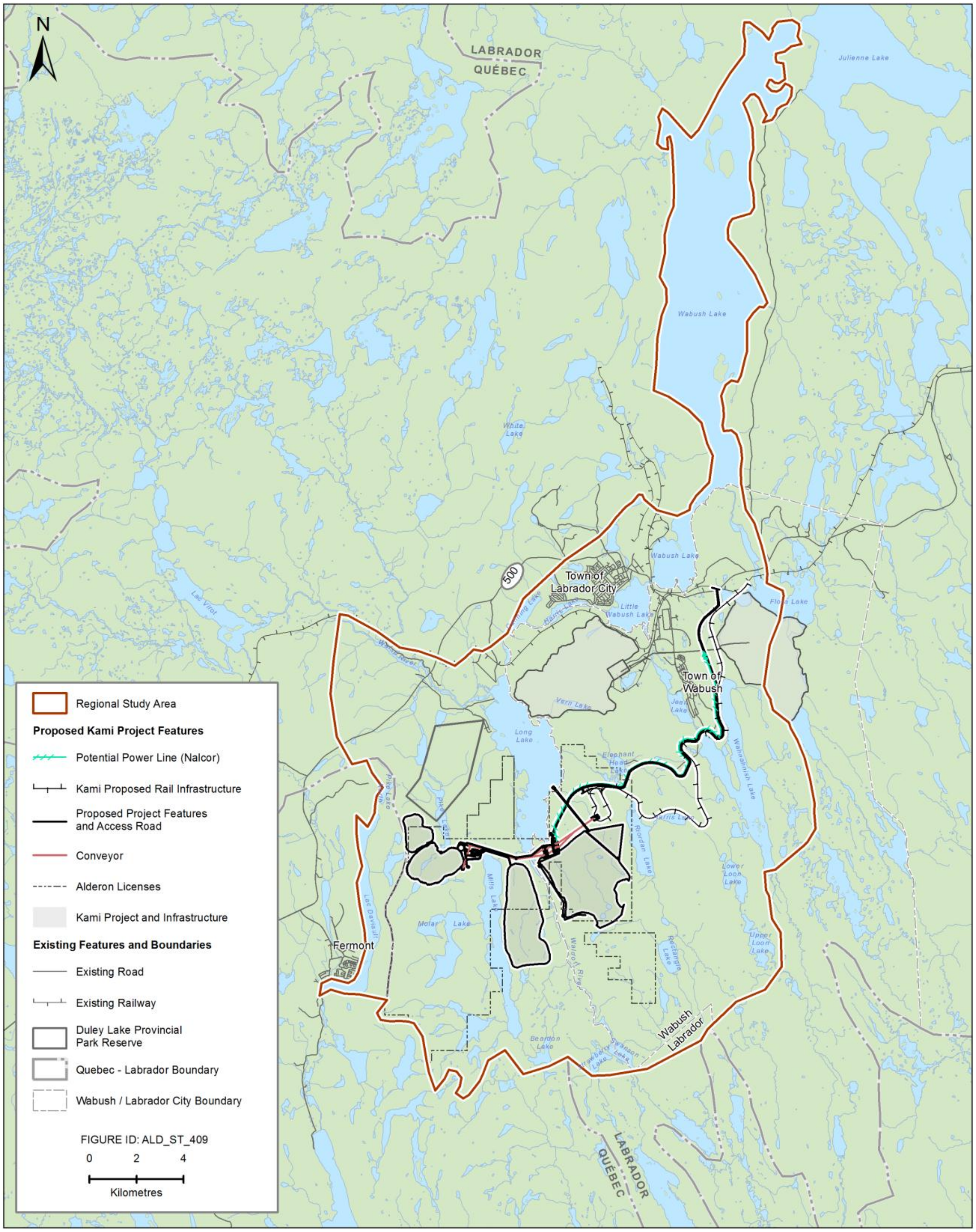


Figure 18.3 Regional Study Area



18.2.3 Administrative Boundaries

Legislative considerations and requirements for Freshwater Fish, Fish Habitat, and Fisheries include the federal *Fisheries Act* and its supporting regulations and the federal *Species at Risk Act* (SARA). Currently, American eel, banded killifish (Newfoundland population), and fourhorn sculpin (freshwater form) are designated as species at risk by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). The scientific name and status are shown for listed species in Table 18.2.

Table 18.2 Federal and Provincial Listed Freshwater Fish Species at Risk in Newfoundland and Labrador

Common Name	Scientific Name	Federally Listed [1]	Provincially Listed [2]
American eel	*Anguilla rostrata*	Threatened (May 2012)	Vulnerable (2006)
Banded killifish	*Fundulus diaphanous*	Special concern (May 2003)	Vulnerable (2003)
Fourhorn sculpin	*Myoxocephalus quadricornis*	Data deficient	-

Notes:
1. COSEWIC. June 2012. Canadian Wildlife Species at Risk according to *Species at Risk Act.*
2. Department of Environment and Conservation, Newfoundland and Labrador 2012 - *Endangered Species Act, 2001.*

None of these listed freshwater species are found near or within the regional study area of the Project. Banded killifish is known from a limited number of sites on insular Newfoundland, on the west and northeast coasts and the Burin Peninsula. American eels can be found in most coastal areas and adjacent accessible rivers in Newfoundland, but are only known as far north as English River in Labrador. The freshwater fourhorn sculpin is resident in the Northwest and Nunavut territories and Newfoundland and Labrador is the only province where it has been found; a single specimen, in 1964, at Sipukat Lake, which is on the coast of northern Labrador (COSEWIC 2003).

Legislative directives and regulatory requirements related to effluent releases and mining operations are included in the Chapter 16: Water Resources. Applicable legislative directives are summarized in Table 18.3.

Table 18.3 Legislative Directives and Guidelines for Freshwater Fish, Fish Habitat, and Fisheries

Regulations	Nature of Authorization	Relevance to Project	Relevant Federal Authority
Fisheries Act			
Sections 20-22	Implement designs that avoid obstructions to or impediment of fish passage.	Potentially applicable with respect to crossing designs.	DFO

Regulations	Nature of Authorization	Relevance to Project	Relevant Federal Authority
Section 30	Implement mitigations as per guidelines for screening and flows for water intakes.	Applicable for Long Lake water intake.	DFO
Section 32	Unauthorized destruction of fish (mortality) by means other than fishing.	Applicable due to interference with water bodies.	DFO
Section 35(2)	Harmful alteration, disruption or destruction (HADD) of fish habitat.	Applicable due to interference with fish habitat.	DFO
Section 36	Implement mitigations as per guidelines for Introduction of deleterious substances into fish bearing waters.	Applicable for all inputs into waters.	Environment Canada
Guidance	Implement mitigations for use of explosives in or near fish bearing waters.	Applicable due to Rose Pit and close proximity to PLS and Rose Ponds.	DFO
Species at Risk Act			
Sections 32 and 33	Ensure protection of fish species of conservation concern.	Not applicable as no listed species present in the regional assessment area.	DFO

Section 35 of the *Fisheries Act* is the main regulatory instrument for the Project related to Freshwater Fish, Fish Habitat, and Fisheries as it will govern the authority to alter or destroy fish habitat / production related to a fishery. Fish habitat is defined as "spawning grounds and nursery, rearing, food supply, and migration areas on which fish depend directly or indirectly to carry out their life processes". The *Fisheries Act* is currently undergoing revisions and development of additional regulations with respect to protection of fisheries. For the proposed works associated with this Project, any permanent losses in fish habitat, determined by DFO to require authorization, will require adequate compensation to offset those losses. Given the scope of Project, an authorization under the *Fisheries Act*, Section 35(2) will most likely be required prior to commencement of much of the construction activities. Additional fisheries concerns related to Sections 20 through 22, 32, and 36 may occur with respect to specific Project components, and will be addressed specifically through design and best available control technologies (BACT).

18.3 Establishing Standards or Thresholds for Determining the Significance of Environmental Effects

The following terms are used to characterize residual environmental effects for Freshwater Fish, Fish Habitat, and Fisheries: direction, magnitude, geographical extent, frequency, duration, reversibility and ecological context. The definitions of these terms are detailed below and appear again in the summary tables used for the assessment of residual and cumulative effects.

- **Direction:**
  - Positive: condition is improving compared to baseline conditions;
  - Neutral: no change compared to baseline conditions; or

  - Adverse: negative change compared to baseline conditions.
- **Magnitude:**
  - Negligible: no measurable adverse effects anticipated;
  - Low: measureable effects anticipated in low-sensitivity habitats or no measureable mortality risk to non-listed species;
  - Moderate: measureable effects anticipated in moderately sensitive habitat or anticipated mortality risk to non-listed species; or
  - High: measureable effects anticipated in highly sensitive habitat or habitat designated as important to listed species or anticipated mortality risk to listed species.
- **Geographic Extent:**
  - Site Specific: effects restricted to the PDA;
  - Local: effect extends beyond the PDA but remain within the LSA; or
  - Regional: effects extend to the RSA.
- **Frequency:**
  - Once: effect occurs only one time;
  - Sporadic: effect occurs more than once at irregular intervals;
  - Regular: effect occurs on a regular basis and at regular intervals; or
  - Continuous: effect occurs constantly.
- **Duration:**
  - Temporary: effects are measureable for days to six months;
  - Moderate: effects are measureable for seven months to two years;
  - Long Term: effects are measurable for multiple years but are not permanent; or
  - Permanent: effects are permanent.
- **Reversibility:**
  - Reversible: effects will cease during or after the Project is complete; or
  - Irreversible: effects will persist after the life of the Project, even after habitat restoration and compensation works.
- **Ecological Context:**
  - Disturbed: effect takes place in an area that has been previously affected by human development or in an area where human development is still present; or

- Undisturbed: effect takes place in an area that has not been adversely affected by human development.

For the purposes of the effects assessment, a significant adverse residual environmental effect on Freshwater Fish, Fish Habitat, and Fisheries is defined as follows:

- A permanent and irreversible reduction in the productive capacity of fish habitat that remains after mitigation and compensation measures are implemented and which will likely result in an uncompensated HADD of fish habitat; or fish productivity;
- The likelihood of fish mortality, after mitigation measures are implemented, at a level that would require regulatory bodies to implement specific management plans for the recovery of the affected fish populations;
- A measureable decrease in fish condition, below baseline conditions and directly attributable to Project activities, which threatens the sustainability of the regional fisheries; and
- The Project is not compatible with recreational fishing activities, such that patterns of fishing are changed throughout the local study area.

18.4 Potential Project-VEC Interactions

Throughout the life of the proposed Project, there will be numerous interactions with Freshwater Fish, Fish Habitat, and Fisheries. For assessment purposes, potential interactions were identified with respect to Project phases (i.e., construction, operations and maintenance, and decommissioning and reclamation) and ranked with respect to anticipated level of interaction. The potential environmental effects that will be assessed for Freshwater Fish, Fish Habitat, and Fisheries respectively are change in fish habitat / production, change in fish health or mortality, and change in utilization of existing fisheries.

A listing and evaluation of Project activities and physical works that have the potential to interact with Freshwater Fish, Fish Habitat, and Fisheries is detailed below. Potential interactions are evaluated based on Project phase and a ranking assigned to each. Ranking includes 0 (no interaction occurs), 1 (interaction occurs however the resulting effect can be managed through BACT), and 2 (an interaction occurs and the resulting effect may exceed acceptable levels without implementation of specified mitigation). Assessed interaction rankings for Project activities are shown in Table 18.4, with an overview and rationale of those ranked as 0 and 1 provided thereafter. Project interactions with rankings of 2 are assessed in detail in Section 18.6 (Project-related Environmental Effects).

Table 18.4 Potential Project Environmental Effects on Freshwater Fish, Fish Habitat, and Fisheries

Project Activities and Physical Works	Potential Environmental Effects		
	Change in Fish Habitat/ Production	Change in Fish Health or Mortality	Change in Utilization of Existing Fisheries[A]
Construction			
Site Preparation (incl. dewatering, clearing, excavation, material haulage, grading, removal of overburden and stockpiling, waste rock disposal areas, and Rose Pit)	2	1	2
Construction of Roads	1	1	1
Construction of Site Buildings and Associated Infrastructure (maintenance facilities, offices, plant, crushers, concentrator, conveyors, gatehouse, pumphouses, substation, security fencing, sanitation system)	0	0	0
Construction of Mine Tailings Management Facility (TMF)	2	1	0
Construction of Railway and Load-out Facilities (silos)	0	0	0
Construction of Power Line	0	0	0
Construction of Stream Crossings	2	1	0
Installation of Water Supply Infrastructure (wells, pumps, pipes)	1	0	0
Onsite Vehicle / Equipment Operation	0	0	0
Waste Management	0	0	0
Transportation of Personnel and Goods to Site	0	0	0
Expenditures and Personnel	0	0	0
Employment	0	0	0
Operation and Maintenance			
Open Pit Mining (incl. drilling, blasting, ore and waste haulage, stockpiling, and dewatering)	1	1	0
Ore Processing (incl. crushing, conveying, storage, grinding, screening)	1	0	0
Concentrator Operations (gravity and magnetic separation, tailings dewatering, tailings thickener, concentrate conveyance to load-out)	0	0	0
Tailings Disposal in TMF	1	0	0
Waste Rock Disposal on Surface	1	0	0
Water Treatment (incl. mine water and surface runoff) and Discharges	1	1	0
Rail Load-Out by Silo Discharge	0	0	0

Project Activities and Physical Works	Potential Environmental Effects		
	Change in Fish Habitat/ Production	Change in Fish Health or Mortality	Change in Utilization of Existing Fisheries[A]
Rail Transport	0	0	0
Onsite Vehicle / Equipment Operation and Maintenance	0	0	0
Waste Management	0	0	0
Transportation of Personnel and Goods to Site	0	0	0
Fuel Storage and Dispensing	0	0	0
Progressive Rehabilitation	1	0	0
Expenditures and Personnel	0	0	0
Employment	0	0	0
Decommissioning and Reclamation			
Site Decommissioning (Dismantling, cleaning and offsite removal of facilities, processing equipment, infrastructure, roads, rails, power lines, water systems, and wastes)	1	1	0
Site Rehabilitation (grading, scarifying, hydro-seeding, contouring, establishment of natural drainage, and monitoring)	1	1	0
Accidents and Malfunctions			
Train Derailment	2	2	2
Forest Fire	2	2	2
Polishing Pond Dyke Breach	2	2	2

KEY

0 No interaction.

1 Interaction occurs; however, based on past experience, the resulting effect can be managed to acceptable levels through standard operating practices and/or through the application of best available control technologies (BACT). No further assessment is warranted.

2 Interaction occurs, and resulting effect may exceed acceptable levels without implementation of specified mitigation. Further assessment is warranted.

[A] The effect of loss of access on utilization of fisheries is addressed in Chapter 23.

Changes in Fish Habitat / Production

Construction

There will be no physical fish habitat alteration or serious, permanent change to fish habitat productivity resulting from onsite vehicle operation, waste management, transportation of personnel and goods to site, expenditure and personnel, or employment. Therefore there will be no interaction or effect to fish habitat.

Interactions with fish habitat during construction that are ranked as 1 consist of potential introductions of deleterious substances and dust borne particulates that may alter water and sediment chemistry, and the removal of riparian vegetation as a result of road and other construction activities. These interactions can be fully mitigated through adherence to guidelines, BACT, or operational statements, implementation of activity specific plans (such as spill prevention, surface water management, materials handling, erosion and sediment control) and inclusion of aspects within the mine operations plan (such as dust suppression, riparian buffers, progressive rehabilitation). Therefore, there are no likely significant effects to fish habitat resulting from these activities. Among other things, a Water Management Plan, a Tailings Management Plan, and an Environmental Protection Plan will be prepared for the Project, in addition to a dust suppression program that will mitigate adverse effects to aquatic ecosystems.

Alterations to riparian areas will be mitigated through establishment of riparian set back limits, adherence to BACT, and progressive rehabilitation of riparian areas. The majority of riparian area alteration will occur during the construction phase. Impacts to the riparian area will be reduced by the establishment of riparian setbacks for all retained watercourses within the Project area. In addition, BACT and conservation of riparian areas will be maintained for all right-of-way clearings. The Project mining plan also includes a progressive rehabilitation program that will ensure any riparian areas disturbed are rehabilitated quickly and effectively with native grasses and shrubs.

Alterations to water and sediment quality will be mitigated through design and application of surface water management systems, erosion and sediment control measures, spill prevention and cleanup procedures, a dust suppression program, adherence to riparian set back limits, reclamation of disturbed surfaces, water treatment, and effluent discharge adherence to MMER requirements. Currently, preliminary analysis of ARD has shown little potential for the waste rock disposal areas, but it has been recommended that in situ studies be conducted to verify this. Work is ongoing to assess control of nitrates and ammonia, which should readily dissipate in an open pit mine operation. Red water is not so much a regulatory concern as an aesthetic one; however, Alderon is committed to mitigating red water, should it occur. Effluent discharges are required to be monitored for compliance with federal and provincial criteria (MMER and the provincial C of A). It is not anticipated that adverse effects will occur with respect to water and sediment quality.

Interactions between Project construction and fish habitat / production ranked as a 2 (site preparation, construction of TMF, construction of stream crossings) are assessed further in Section 18.6.

Operations and Maintenance

There will be no physical fish habitat alteration or serious, permanent change to fish habitat productivity resulting from concentrator operations, rail load-out, rail transport, on-site vehicle operation, waste management, transportation of personnel and goods to site, expenditure and personnel, or employment. Therefore, there will be no interaction or effect to fish habitat.

During operations, interactions with fish habitat could result in introductions of deleterious substances and dust borne particulates that may alter water and sediment chemistry as a result of open pit mining, ore processing, tailings disposal in the TMF, waste rock disposal, water treatment and discharges, and progressive rehabilitation. These interactions can be fully mitigated through adherence to guidelines, BACT, or operational statements (such as conducting works near or within fish bearing waters), implementation of activity specific plans, and inclusion of aspects within the mine operations plan. With all mitigations and BACT applied diligently during the construction and operation and maintenance phases, it is anticipated that many of the interactions between the Project and fish habitat / production will not persist into operations and maintenance. The residual operations and maintenance interactions include Rose Pit mining, the TMF (including red water treatment), the waste rock disposal areas, and areas of progressive rehabilitation because activities associated with each of these components will require specified mitigations to reduce potential environmental effects on fish habitat. Residual adverse effects to fish habitat during operations and maintenance will be neutral and negligible. Therefore, there are no likely significant effects to fish habitat resulting from these activities.

There are no interactions between Project operations / maintenance and fish habitat / production ranked as a 2.

Decommissioning and Reclamation

The decommissioning phase includes two aspects that will interact with fish habitat: overall decommissioning (removal, dismantling, and disposal) of all related buildings and infrastructure, and the rehabilitation of the Project area. Direct interactions will include removal of instream crossings and the water intake infrastructure in Long Lake. Indirect interactions will include the potential for introductions of deleterious substances into fish bearing waters. Potential changes to fish habitat / production may include alterations to water quality or sediment quality and physical alteration of habitat. The potential for changes in water quality and sediment quality can be mitigated through surface water, erosion and sediment controls, isolation and spill prevention, and cleanup programs. Any potential physical alteration of fish habitat / productivity would most likely require review under the *Fisheries Act* of activities and outcomes at the time of decommissioning. Interactions with fish habitat during decommissioning can be fully mitigated and may also lead to positive gains in overall fish habitat. Therefore, there are no likely significant effects to fish habitat resulting from these activities.

There are no interactions between Project decommissioning and fish habitat ranked as a 2.

Change in Fish Health or Mortality

Construction

During construction, the application of environmental protection measures, guidelines, BACT, or operational statements (such as conducting works near or within fish bearing waters) will mitigate interactions between fish health or mortality and Project activities for site preparation, construction of roads, site buildings and associated infrastructure, TMF, stream crossings, railway and load-out facilities, power lines, installation of water supply infrastructure, onsite / vehicle operations, and waste management.

For all construction activities that result in the removal of existing watercourses and waterbodies, fish mortality will be minimized through adherence to proper fish removal / relocation protocols and techniques and identification of appropriate relocation sites, and a phased relocation program that properly addresses the logistical demands of this large scale fish relocation effort. Isolation of work areas and environmental protection measures (such as silt curtains) for the installation of water intake and effluent discharge pipes in the lake, and working in the dry for stream crossings will greatly reduce potential fish losses. Measures will be taken where possible to avoid instream works during sensitive seasonal periods for various fish species. In addition, instream work protocols that include maintaining continued water flow around works, and controlling erosion, and the use of proper fish screening will all reduce the risk to fish.

A formal blasting plan will be developed to include protective measures for adjacent fish bearing waters and all blasting will adhere to applicable setback limits to ensure no harm to fish or fish eggs.

These activities are not anticipated to produce any loss of fish, or to influence fish condition. Therefore, there are no likely significant effects to fish health or mortality resulting from these activities.

Interactions between employment with fish health or mortality are discussed in Chapter 23: Other Current Use of Lands and Resources.

There are no interactions between Project construction and fish health or mortality ranked as a 2.

Operations and Maintenance

During the operations and maintenance phase, no direct interactions between fish health or mortality and Project activities are anticipated for ore processing, concentrator operations, tailings disposal in the TMF, waste rock disposal on the surface, rail load-out by silo discharge, rail transport, onsite vehicle / equipment operation and maintenance, waste management, transportation of personnel and goods to site, fuel storage and dispensing, progressive mitigation, or employment. Indirect interaction will be by effluent discharges or airborne contaminants all of which are closely regulated under compliance standards of the MMER. The MMER requires biological studies to determine fish health and condition, based on condition factor, gonad development, liver development, and egg size and numbers. Fish entrainment will be mitigated through placement of intake screening as detailed in DFO guidelines (DFO 1995; Gosse et al 1998). In addition, federal guidelines for use of explosive in or near fish bearing waters are available for calculating setback distances to ensure no detrimental harm to local fisheries (Wright and Hopky 1998). These Guidelines will be used to manage potential adverse effects related to gas filled organs (swim bladder, spleen, and sinus venosus) of fish (Mahtab et al. 2004) and incubating eggs (Wright and Hopky 1998). Therefore, there are no likely significant effects to fish health or mortality resulting from these activities.

There are no interactions between Project operations / maintenance and fish health or mortality ranked as a 2.

Decommissioning and Reclamation

The decommissioning phase includes two components: overall decommissioning and the rehabilitation of the Project area. Site rehabilitation including grading, scarifying, re-establishment of natural drainage, and monitoring is not anticipated to result in fish mortality or reduced fish condition. The removal, dismantling, and disposal of Project components, such as those that are installed in waterbodies will have potential interactions with fish. Interactions that may result from the removal of stream crossings and water intake infrastructure within Long Lake can be fully mitigated through BACT, appropriate isolation techniques, and fish relocation operations. Therefore, there are no likely significant effects to fish health or mortality resulting from these activities.

There are no interactions between Project decommissioning and fish health or mortality ranked as a 2.

Change in Utilization of Existing Fisheries

Fisheries may be affected as a result of lost or altered fish habitat / production by the construction, operation, and decommissioning of the Project. Ponds and streams that will be removed or modified by the Project may be areas where fishing currently occurs. Other areas may be excluded as potential fishing locations due to proximity to Project activities, such as process areas, heavy equipment traffic routes, or safety zones set for blasting in the pit. Effects relating to increased access and fishing pressure are assessed in Chapter 23: Other Current Use of Lands and Resource Use.

Construction

Activities other than site preparation and road construction are ranked as 0 because all of the changes to waterbodies will occur as part of site preparation. Some short-term disruption to access to fisheries may occur during the construction of the roads and rail infrastructure.

Interactions between Project construction and utilization of existing fisheries ranked as a 2 are assessed further in Section 18.6. These interactions occur during site preparation.

Operations and Maintenance

The potential harmful effects to utilization of existing fisheries will occur primarily in the construction phase. Therefore, there are no likely significant effects to fisheries during operations and maintenance resulting from those Project activities ranked as 0. However, during operations there will be access restrictions to areas for safety or other reasons that may reduce utilization of existing fisheries. This is further discussed in Chapter 23.

Decommissioning and Reclamation

During decommissioning and rehabilitation, some of the areas that excluded fishers, for safety or other reasons, may be restored to be available for fishing. Therefore, there are no likely significant effects to fisheries during decommissioning resulting from those Project activities ranked as 0.

Measureable parameters used for each of the effects are outlined in Table 18.5.

Table 18.5 Measureable Parameters for Freshwater Fish, Fish Habitat, and Fisheries

Environmental Effect	Measureable Parameter	Rationale for Selection of the Measureable parameter
Change in Fish Habitat	Area of fish habitat altered (m^2) or production losses.	Habitat loss or alteration can lead to changes in fish abundance, behaviour and/or species mortality and breeding success. The *Fisheries Act* provides for the protection of fish habitat. Quantification of HADD is necessary to request authorization and compensation under the act.
	Change in water quality and/or sediment quality.	Changes in water or sediment quality can lead to degradation of fish habitat/production, resulting in reduced suitability for fish and the organisms they depend on. Changes in water and sediment quality, including TSS, can be measured directly and assessed against known metrics (MMER and CCME guidelines).
	Change in flow rates (m^3/s).	Changes in seasonal and/or baseline flows can influence habitat utility or suitability for various life stages of fish. Changes in flow rates can be measured and compared against baseline data.
	Barrier to fish passage.	Obstructions to fish passage can reduce availability to or eliminate habitat that may be critical for certain life stages.
	Reduction of riparian vegetation.	Riparian vegetation functions to increase fish habitat quality through increased connection to terrestrial food sources, increased biomass for benthic communities, protection against water temperature increases through shading, provision of instream cover, and reduction of erosional and sedimentation potential. The loss of riparian vegetation is measurable.
Change in Fish Health or Mortality	Loss of individuals attributable to the Project.	Works within fish bearing waters may result in isolation or fish kills or relocation. The removal of fish habitat will require relocation of resident fish populations. Loss of individuals can be measured through counting or estimated based on applicable removal procedures.
	Loss of species of conservation interest.	Species of conservation interest are more vulnerable to disturbance.
	Reduction in fish condition (length / weight ratio).	A general metric of relative fish health is fish condition. Fish condition, energy reserves (liver weight), or reproductive indices (egg numbers, egg size, gonad weight) are measurable and can be used to assess changes in relative fish health.
Change in Utilization of Existing Fisheries	Number of recreational fishing locations that are lost.	Fish habitat has been removed, adversely altered, or excluded from local fisheries (i.e., direct effect due to Project footprint or proximity) A reduction in fishing locations would naturally reduce existing fishing opportunity. The change in fishing locations available is measurable.

18.5 Existing Environment

The watersheds that make up the existing fish habitat in the RSA flow in the general north-northeast direction to eventually empty into Wabush Lake, the exception being Lac Daviault which flows in a southerly direction within Québec. The Project will not interact with fish, fish habitat, or fisheries within the Lac Daviault watershed. The major waterways can be subdivided in to several smaller drainages to assist interpretation (Figure 18.4).

The fish species present in the RSA are listed in Table 18.6, which is augmented by sampling results from other sources.

Table 18.6 Fish Species Present in the Local and Regional Study Areas

Location	Species Present															Source
	Brook Trout	Burbot	Creek Chub	Lake Chub	Longnose Dace	Longnose Sucker	Lake Trout	Lake Whitefish	Northern pike	Ouananiche	Pearl Dace	Round Whitefish	Mottled Sculpin	Slimy Sculpin	White Sucker	
Long Lake	√	√		√		√	√	√	√					√	√	2, 3
Mills Lake	√	√		√	√	√	√	√	√		√	√		√	√	1, 2
Walsh River	√			√	√									√		6
Waldorf River	√															1
Riordan Lake	√			√	√						√			√		1
TMF Streams	√	√									√			√		1
Wahnahnish Lake	√	√		√	√	√	√	√			√			√	√	1, 2
Jean Lake	√			√	√	√	√	√				√		√	√	8
Wabush Lake	√	√	√	√	√	√	√	√	√	√		√	√	√	√	1, 2, 3, 4, 5, 6, 7

Notes:

Lakes include tributaries and outlets.

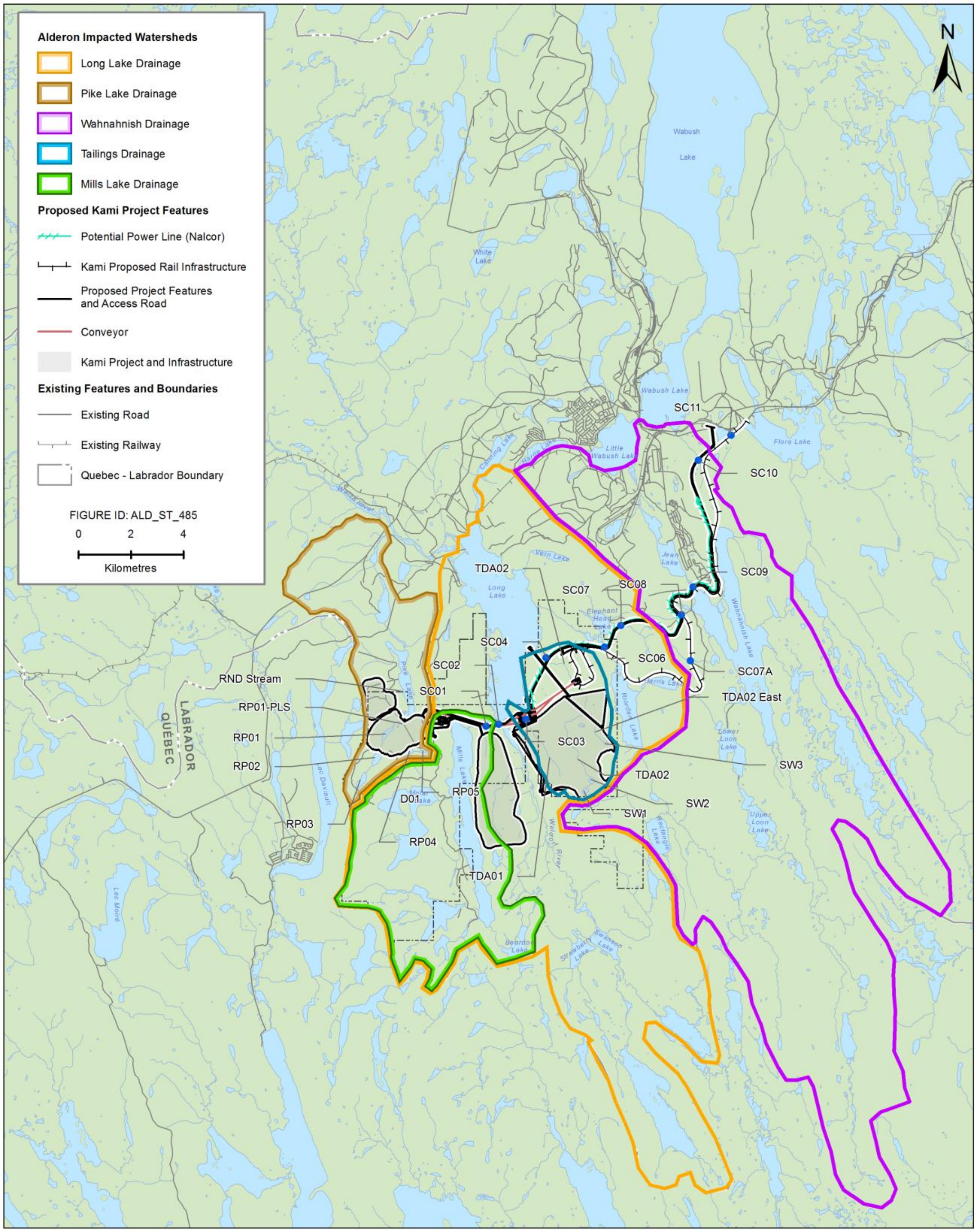
Different levels of effort and different gear were used for sampling; some species present may not have been captured.

NS = Not sampled.

Source:

1 AMEC 2012 (Appendix H)
2 Bruce et al. 1979
3 Hicks 1974
4 IOC 1996
5 IOC 2001
6 JWL 2008
7 Town of Lab City 2010
8 Wicks pers. comm.

Figure 18.4 Study Area Drainage Areas



18.5.1 Long Lake Drainage

Long Lake is located southwest and upstream of Little Wabush Lake (Figure 18.4). Drainage inputs into the Long Lake system include the Mills Lake drainage located southwest, the Waldorf River located directly south, the Riordan Lake drainage located east and southeast, and the Walsh River located northwest of Long Lake, which also includes the Pike Lakes drainage located directly west of Long Lake.

The Mills Lake drainage is located southeast of the proposed Rose Pit and west of the proposed Rose South Waste Rock Disposal Area. It drains into the south end of Long Lake. The southwest boundary of the RSA includes the southern extent of the Mills Lake drainage to the provincial boundary with Quebec. This drainage includes headwater lakes and ponds associated with Lakes D01 and D02, located to the west and southwest, and Beardon Lake located directly south. Although sampling was not conducted in Mills Lake, sampling in the associated streams resulted in catches of several species of fish (Table 18.6).

Walsh River is located northwest of Long Lake and north of the Mills Lake drainage (Figure 18.4). The RSA includes an approximate 8.5 km long section of Walsh River that begins at the Walsh Bridge and runs southeast into the north end of Long Lake. The Pike lakes drainage, located west of Long Lake, drains directly north into the Walsh River approximately 2.7 km upstream from Long Lake. The Pike lakes drainage includes the headwater Rose Pit Ponds, which drain into Pike Lake South, then into Pike Lake North and from there into the Walsh River. The majority of waterbodies and watercourses within this system were surveyed as part of the baseline works. A total of eight fish species were obtained in this watershed.

Waldorf River runs directly east of Mills Lake, between the proposed Rose South Waste Rock Disposal Area and TMF. This river runs from Strawberry and Swanson lakes near the southern extent of the RSA, northwest for approximately 10 km to the southern end of Long Lake. Currently there is no fish species information for the Waldorf River system; however, results of sampling in Long Lake provide an indication of species presence. In addition, tributaries of the main river have been sampled (those within the Rose South Waste Rock Disposal Area).

The Riordan Lake drainage is located east of the Waldorf River and runs in a northwest direction from the headwaters of Rectangle Lake, to Riordan Lake, then into a series of unnamed ponds before entering into the western shore of Long Lake. This drainage also includes Harris Lake which drains into Riordan Lake, and Elephant Head Lake which drains into the unnamed ponds downstream of Riordan Lake. Located between the Waldorf River drainage and the Riordan Lake drainage is a small drainage area southwest of Long Lake, which has been called the tailings area drainage (Figure 18.4). This drainage area includes three upland ponds (SW1, SW2, and SW3), and three streams (TDA01, TDA02, and TDA02 East) that drain into the southwest shore of Long Lake. The three upland ponds are interconnected, average less than 1 m depth, and have a combined surface area of 8.81 ha. The three streams have a combined length of 11,200 m.

18.5.2 Wahnahnish Lake Drainage

The Wahnahnish Lake drainage flows into the southwestern portion of Little Wabush Lake. The drainage area located within the RSA begins in the southeast at Upper Loon Lake, which drains into Lower Loon and then Wahnahnish Lake. Waters from Wahnahnish Lake drain northwest into Jean Lake and then into Little Wabush Lake. Although no fish sampling of Wahnahnish or Jean lakes was conducted in the baseline program, previous reports and sampling of tributary streams provide a list of species that are present.

18.5.3 Wabush Lake and Others

Two additional crossing areas not covered within the drainages discussed include SC10 and SC11. SC10 is located on a stream that flows northeast, between Wabush airport and the Wabush Mines Tailing Pile, to the southwestern shore of Wabush Lake. SC11 is located on the northern portion of a pond formed by the isolation of a former bay of Flora Lake by tailings deposition. Fish sampling on SC10 confirmed the presence of brook trout and pearl dace. No sampling was conducted at SC11.

Additional fish presence information for the Wabush Lake system includes species for Wabush Lake, for lakes located along the western drainage area of Wabush Lake, Julienne Lake, and Shabogamo Lake. Previous fish surveys for Wabush Lake, including associated ponds and streams, have recorded 14 species.

18.5.4 Limnology

There is limited existing literature addressing Long Lake and the subwatersheds in the Project area; however, what is available provides some insight to the limnology of the area. There are several studies that have been conducted on Wabush Lake by IOC, some of which are in the public domain as provided by IOC or posted on the provincial government website. The relevant information has been provided below.

Dissolved oxygen levels for Wabush Lake and upstream drainage areas have historically approached saturation throughout the water column, which does not strongly stratify (Hicks 1974 and IOC 1996). The pH of these waters is slightly alkaline (pH 8.1). Although suspended solids in Wabush Lake are not notably elevated historically, turbidity was high due to red water, which has been mitigated by flocculation of the tailings effluent from IOC. There are no regulatory requirements related to the colour of effluent discharged to the receiving environment, as there is no evidence that red water adversely affects fish or fish habitat. Aesthetics are the primary concern for red water from the tailings effluents; however, it is reported that red water caused a slight discolouration of the tissue of whitefish, and this may have contributed to a reduction of recreational fishing in Wabush Lake (Canada Gazette 2009[1]).

[1] Canada Gazette. SOR/2009-27. Regulations Amending the Metal Mining Effluent Regulations. P.C. 2009-160 February 5, 2009.

18.5.5 Freshwater Biota

Freshwater biota that have been surveyed in the LSA include benthic invertebrate communities, aquatic vegetation, and fish populations.

Benthic Invertebrate Communities

Benthic invertebrate communities were sampled using a Surber sampler in representative stream habitats in the proposed open pit area, the outlet from Pike Lake North, the inflow to Mills Lake, and the stream through the TMF. These four sites had from 17 to 37 taxa at densities from 133 to 1581 organisms per metre squared. There were a total of 65 taxa or groups identified with clams, midges, caddisflies, mayflies, mites, beetles, and roundworms being most numerous. These are all typical freshwater groups. The complete details of the sampling results for the benthic invertebrate community are provided in the Freshwater Fish, Fish Habitat, and Fisheries Baseline Study (Appendix H). Additional benthic invertebrate sampling will be conducted in streams or ponds as requirements for mines under the *Fisheries Act* (MMER). The exact locations will be determined based on these MMER requirements.

Aquatic Vegetation

During the fish habitat characterization, which is described below, the presence of aquatic vegetation was noted as vegetation provides habitat and cover for some fish species, both in streams and ponds.

Fish Populations

Fish sampling was conducted during the latter half of July 2011 and again in August of 2012. Fyke nets and gillnets were set in the ponds and lakes, while electrofishing was conducted in the rivers and streams. Nearly all of the ponds and streams that would potentially be affected by the Project were sampled (Figure 18.4). Changes in the Project footprint (i.e., relocation of waste rock sites and changes in the rail line) added a few ponds and streams that are being sampled in 2012.

A summary of the fish sampling results to date are shown in Table 18.7. The table identifies the location of sampling (Figure 18.5) and the species that were taken.

Table 18.7 Species Presence by Watercourse – 15 July, 2011 to 31 August 2012

Site Name	Site Type	Fish Species											Total Species
		B	BT	LC	LND	LNS	LT	NP	PD	RWF	SS	WS	
PLS	Pond	✓		✓				✓			✓	✓	5
RP01	Pond	✓		✓				✓				✓	4
RP02	Pond							✓				✓	2
RP03	Pond			✓				✓			✓		3
RP04	Pond	✓	✓	✓					✓		✓	✓	6

Site Name	Site Type	Fish Species											Total Species
		B	BT	LC	LND	LNS	LT	NP	PD	RWF	SS	WS	
RP05	Pond	✓	✓	✓					✓		✓	✓	6
D01	Pond	✓	✓	✓		✓	✓		✓	✓	✓	✓	9
D02	Pond	✓	✓	✓	✓	✓			✓		✓		7
M01	Pond		✓										1
M02	Pond	✓	✓	✓			✓		✓				5
RP1-PLS	Stream	✓		✓							✓	✓	4
RP2-RP1	Stream		✓	✓							✓		3
RP3-RP2	Stream	✓	✓	✓					✓		✓		5
RP4-RP2	Stream		✓									✓	2
RP5-RP4	Stream		✓	✓					✓				3
TRIB1	Stream	Stream is intermittent pockets of water. No fish caught.											
RND	Stream	No stream evident.											
RSD	Stream		✓										1
M01-M02	Stream		✓										1
M02-ML	Stream		✓		✓								2
PLS-S1	Stream	✓	✓	✓	✓				✓			✓	6
PLS-S2	Stream	✓	✓	✓	✓				✓		✓	✓	7
PLN-S1	Stream	✓	✓	✓	✓						✓	✓	6
PLN-S2	Stream	✓	✓	✓	✓								4
PLN-S3	Stream		✓		✓						✓		3
TDA01	Stream		✓										1
TDA02	Stream		✓						✓		✓		3
TDA02East	Stream	Not fished.											
AD01	Stream		✓										1
AD02	Stream												0
AD03	Stream		✓										1
AD04	Stream												0
SC01	Crossing		✓	✓	✓						✓		4
SC02	Crossing	Not fished.											
SC03	Crossing	✓	✓										2
SC04	Crossing		✓								✓		2
SC05	Crossing		✓								✓		2
SC06	Crossing		✓	✓	✓				✓		✓		5
SC07	Crossing		✓										1
SC08	Crossing	Not fished.											

Site Name	Site Type	Fish Species											Total Species
		B	BT	LC	LND	LNS	LT	NP	PD	RWF	SS	WS	
SC09	Crossing	✓	✓	✓	✓	✓			✓		✓	✓	8
SC10	Crossing		✓						✓				2
SC11	Crossing	Not fished.											
Total Occurrences		**15**	**28**	**19**	**10**	**3**	**2**	**4**	**13**	**1**	**18**	**11**	

Notes:
B=burbot, BT=brook trout, LC=lake chub, LND=longnose dace, LNS=longnose sucker, LT=lake trout, NP=northern pike, PD=pearl dace, RWF=round whitefish, SS=slimy sculpin, WS=white sucker.

The species presence shown above adequately represent the species that comprise the fish communities in each of the sampled waterbodies. The life stages present are reflected by the size and reproductive condition of the fish at the time of sampling. The species encountered during the sampling surveys are listed in Table 18.8 along with an indication as to the timing of spawning, the preference of spawning location, and whether young-of-the-year (YOY) size fish were captured during the sampling. As the sampling occurred in late July and August, none of the fish were in spawning condition. The presence of YOY for each species is assumed from the lengths of the captured fish, noting that gillnets often will not take the smallest fish and fyke nets, which will capture small fish, are limited to shallow water sampling at pond margins. Further details on the life histories of the fish species and the catches at each sampling location are provided in the Freshwater Fish, Fish Habitat, and Fisheries Baseline Study (Appendix H).

Table 18.8 Life Stages Present for Fish Species Sampled 15 July - 3 August 2011 and 17-27 August, 2012

Species	Spawning Season	Spawn in Lakes / Streams [1]	YOY captured in Lakes	YOY captured in Streams
Burbot	Winter	**Lakes** / Streams	Yes	Yes
Brook Trout	Fall	Lakes / **Streams**	No	Yes
Lake Chub	Spring	Lakes / **Streams**	Yes	No
Longnose Dace	Spring	Lakes / **Streams**	Yes	Yes
Longnose Sucker	Spring	Lakes / Streams	No	-
Lake Trout	Fall	**Lakes** / Streams	No	-
Northern Pike	Spring	Lakes / Streams	Yes	-
Pearl Dace	Spring	Lakes / **Streams**	Yes	No
Round Whitefish	Fall	Lakes / Streams	No	-
Slimy Sculpin	Spring	Lakes / Streams	Yes	Yes
White Sucker	Spring	Lakes / **Streams**	Yes	Yes

Notes:
1. Preferred habitat is indicated in **bold**. All species spawn in both lake and stream habitat.

18.5.6 Rare Fish Species

As discussed above in Section 18.2, none of the listed rare or endangered fish species have been reported within the RSA.

18.5.7 Fish Habitat Characterization

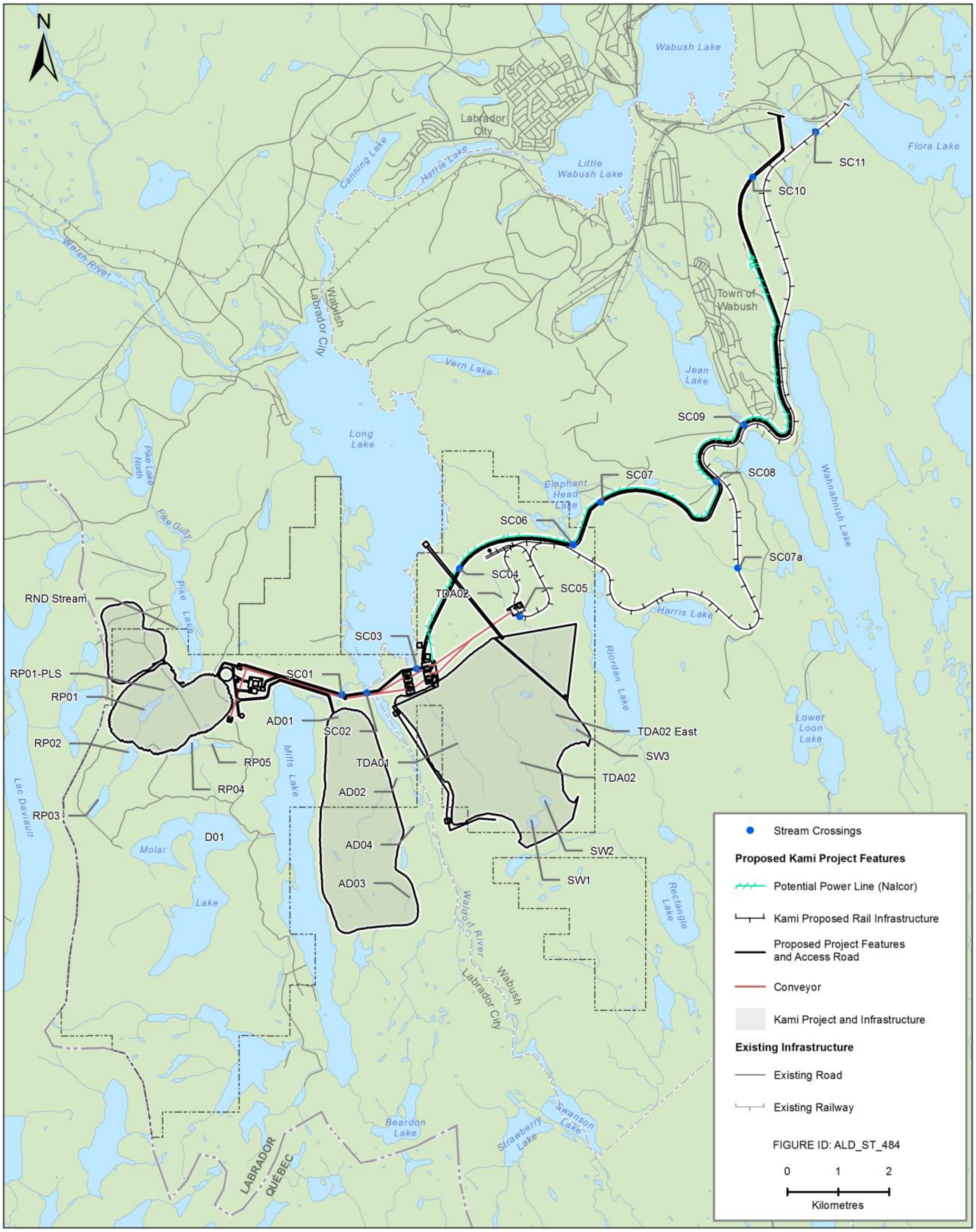
Pond habitat was surveyed and characterized as stated in the guidelines as per standard methods outlined by Fisheries and Oceans Canada (see Bradbury et al. 2001). Ponds were surveyed in grid fashion using a depth sounder and logging observations by GPS. Depth, substrate, and the presence of aquatic vegetation were noted. Data was collected for littoral and profundal zones, based on the Secchi depth, which indicates the depth of light penetration. A summary of results is provided in Table 18.9 to generally indicate the size of the ponds, the depth, the proportion of substrate grain size, and the presence of aquatic vegetation; the latter three factors largely determine the quality of fish habitat. The locations of the ponds are shown on Figure 18.5. The Freshwater Fish, Fish Habitat, and Fisheries Baseline Study (Appendix H) provides additional detail and mapping of the pond habitat, as well as calculations to determine the habitat suitability for the species found in the pond.

Table 18.9 Summary of Fish Habitat in the Surveyed Ponds

Pond	Area (m^2)	Mean Depth (m)	Littoral (% composition of pond area)							Profundal (% composition of pond)					
			Bo	R	C	G	S	M	Veg	Bo	R	C	G	S	M
RP01	87,387	0.74	1	1				98	13						
RP02	106,825	4.3	5	3	3		9	42	2						38
RP03	117146	2.2	10	1			1	88							
RP04	92,221	4.6	7	5			30	12	10					25	21
RP05	25,296	2.4	2	5	6	3	34	50	9						
Loon	258,625	3.5	2		1	2	11	56	37						27
Pike Lake	1,668,000	2.6	13	14	19		7	33	2						12
Pike Gully	48,618	0.75	24	9			4	43	20						

Notes:
Substrate: boulder (Bo), rubble (R), cobble (C), gravel (G), sand (S), muck (M includes silt and clay) (totalling 100%).
Aquatic vegetation (Veg) – percent occurrence of pond area.

Figure 18.5 Locations of Ponds Streams and Crossings Related to the Project



Stream habitat was surveyed and characterized as stated in the guidelines as per standard methods outlined by DFO (DFO draft 2012). In streams, fish habitat is usually characterized on the basis of channel, depth, velocity, substrate, and the presence of aquatic vegetation. Stream habitat was surveyed for the stream sections that might be affected by the Project as well as those locations where stream crossings are contemplated. Summaries are provided in the following tables while more information and data interpretation are provided in the Freshwater Fish, Fish Habitat, and Fisheries Baseline Study (Appendix H). The baseline report also calculates the habitat areas based on the suitability for the fish species that are present in the streams. The streams included in Table 18.10 are in the Rose Pit and Pike Lakes areas and were surveyed for their entire lengths to address the potential interaction with the Project (Figure 18.5). The same treatment was applied to the streams in the TMF and the Rose South Waste Rock Disposal Area (Table 18.11). For the proposed stream crossing locations, a suitably long section of stream was surveyed to cover the possibility of minor road and rail alignments (Table 18.12).

Table 18.10 Fish Habitat Summary of Streams in the Rose Pit and Pike Lakes Area

Stream	Length (m)	Minimum, Mean, Maximum			Substrate (% composition)						Veg
		Width (m)	Velocity (m3/s)	Depth (m)	Bo	R	C	G	S	F	
RP5-RP4	100	1.4 2.0 2.6	0.00 0.05 0.25	0.06 0.20 0.58	10	13	25			52	15
RP4-RP2	550	0.4 1.3 4.9	0.00 0.13 0.53	0.03 0.20 0.48		20	28	10	17	25	
RP3-RP2	300	0.8 1.8 3.9	0.00 0.08 0.59	0.04 0.18 0.58	10	13	14	12	3	48	
RP2-RP1	300	0.8 2.3 4.9	0.00 0.07 0.20	0.02 0.33 0.80	3	12	9			76	
RP1-PLS	450	2.4 3.1 4.2	0.00 0.13 0.58	0.16 0.57 0.95	17	12	5	1		65	16
RSD	1000	0.3 1.1 2.1	0.00 0.10 0.69	0.04 0.23 0.82	9	20	18	8	24	21	
RND	No channel.										
TRIB1	No defined stream channel, intermittent water pockets evident.										
PLS S1	100	3.1 7.4 11.8	0.00 0.16 0.39	0.08 0.32 0.67	25	35	40		5	25	10
PLS S2	425	2.7 4.3 6.7	0.00 0.13 0.61	0.10 0.31 0.68	57	29	8	1	1	4	9

Stream	Length (m)	Minimum, Mean, Maximum			Substrate (% composition)						Veg
		Width (m)	Velocity (m3/s)	Depth (m)	Bo	R	C	G	S	F	
PLN S1	425	0.4 5.2 11.8	0.00 0.34 1.15	0.12 0.26 0.64	53	26	3	8	7	3	
PLN S2	50	6.4 10.2 14.0	0.00 0.18 0.70	0.12 0.19 0.36	50	40		5	5		
PLN S3	400	4.1 6.7 14.2	0.00 0.38 0.90	0.10 0.29 0.46	26	21	23	21	9		

Notes:
Substrate: boulder (Bo), rubble (R), cobble (C), gravel (G), sand (S), fines (F) (totalling 100%).
Aquatic vegetation (Veg) – percent occurrence of stream area.

Table 18.11 Fish Habitat Summary of Streams in the Tailings Management Facility Area

Stream	Length (m)	Minimum, Mean, Maximum			Substrate (% composition)						Veg
		Width (m)	Velocity (m3/s)	Depth (m)	Bo	R	C	G	S	F	
TDA 01	2800	0.5 1.0 2.2	0.00 0.09 0.78	0.04 0.38 0.96	12	8	1	17	16	46	1
TDA 02	6800	0.7 2.5 5.5	0.00 0.14 0.82	0.01 0.27 0.76	20	19	13	20	17	11	3
TDA 02E	1650	0.4 0.8 1.3	0.00 0.13 0.50	0.08 0.22 0.55	5		2	18	46	29	
AD01	916	0.27 0.69 1.20	0.00 0.52 2.06	0.00 0.21 0.62	31	20	12	4	5	28	
AD02	3,915	0.42 0.96 1.70	0.00 0.10 0.79	0.00 0.11 0.39	4	11	9	10	25	38	3
AD03	320	0.41 0.50 0.58	0.00 0.08 0.17	0.02 0.11 0.17				2	37	61	
AD04	763	0.18 0.56 0.88	0.00 0.07 0.43	0.00 0.05 0.13		4	8	7	47	34	

Notes:
Substrate: boulder (Bo), rubble (R), cobble (C), gravel (G), sand (S), fines (F) (totalling 100%).
Aquatic vegetation (Veg) – percent occurrence of stream area.

Table 18.12 Fish Habitat Summary of Stream Sections at Proposed Crossing Areas

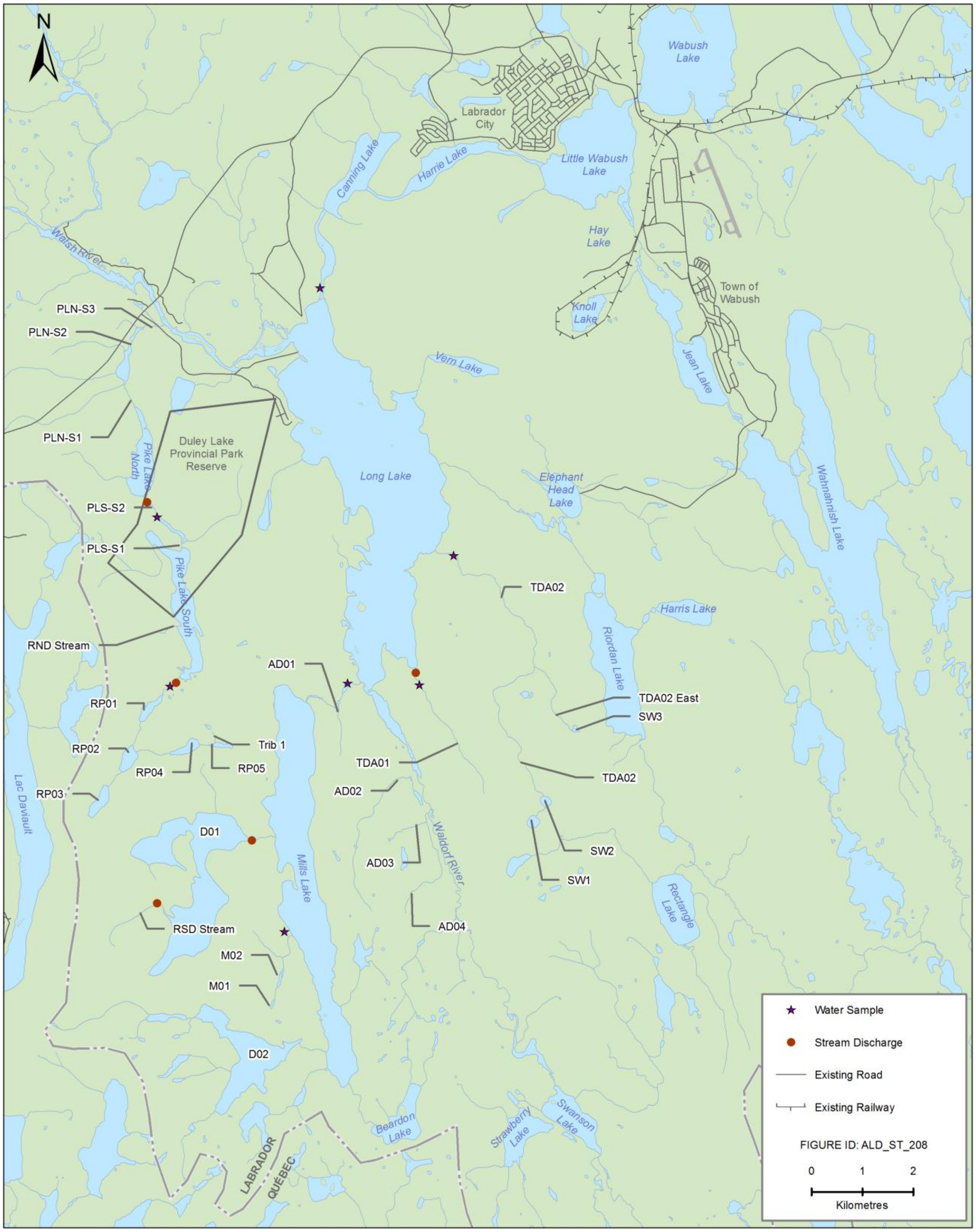
Stream	Length (m)	Minimum, Mean, Maximum			Substrate (% composition)						Veg
		Width (m)	Velocity (m3/s)	Depth (m)	Bo	R	C	G	S	F	
SC01	150	6.8 11.8 17.0	0.08 0.42 1.66	0.14 0.36 0.69	15	30	17	7	31		
SC02	100	23	0.00 0.09 0.30	0.24 0.77 1.27		5		8	13	70	5
SC03 [1]	200	0.7 1.1 1.5	0.00 0.11 0.49	0.06 0.19 0.31	30	20		25	25		3
SC04	400	2.4 3.0 3.6	0.10 0.30 0.84	0.20 0.46 0.95	17	25	23	17	18		
SC05	200	2.1 2.9 3.6	0.00 0.05 0.46	0.10 0.21 0.40	30	26	23	21			3
SC06	400	1.0 3.0 5.0	0.06 0.48 1.11	0.08 0.21 0.36	63	4	19	11	3		
SC07	350	0.8 1.4 2.0	0.00 0.10 0.35	0.08 0.17 0.44	19	21	16	8	19	17	6
SC07a [4]	n/a	-	-	-	-	-	-	-	-	-	-
SC08	400	0.4 0.7 1.2	0.00 0.12 0.29	0.04 0.14 0.25	16		8	1	57	18	
SC09	200	10.8 12.6 15.1	0.00 0.73 1.03	0.34 0.48 0.58	30	26	25	11	8		
SC10	200	2.3 2.5 2.8	0.02 0.04 0.05	0.61 0.80 0.98						100	18

Notes:
1. There is 5% bedrock in the SC03 surveyed stream section.
2. Substrate: boulder (Bo), rubble (R), cobble (C), gravel (G), sand (S), fines (F) (totalling 100%).
3. Aquatic vegetation (Veg) – percent occurrence of stream area.
4. Identified crossing location was surveyed by no stream identified.

18.5.8 Stream Discharge Measurements

Stream discharge measurements were collected in October, 2011. The locations of discharge measurement sites are illustrated in Figure 18.6. There are two sites in the Rose Pit area (RP01-PLS and RSD), one site in the Pike Lake outflow area (PLS S2), and one site in the TMF (TDA 01).

Figure 18.6 Water Quality and Stream Discharge Locations



Discharge measurements and cross-sections of the discharge locations were recorded for each sample location. Level loggers were installed at all stream sampling locations and in Mills Lake and Long Lake. Level loggers are intended to provide long-term trend data on lake and stream water levels as the Project progresses. The data from the level loggers is presented in Table 18.13.

Table 18.13 Summary of Stream Discharge Measurements

Location	Discharge (m^3/sec)
RP01-PLS	0.0874
PLS S2	0.2820
RSD	0.0223
D01-ML	0.1030
TDA 01	0.0047

Water Quality

Water quality sampling was conducted at seven locations during the July 2011 field survey. Sample stations included streams RP01 to PLS, PLS S1, M01 to Mills Lake (ML), SC01, TDA01, TDA02 and the outflow of Long Lake (Figure 18.5). Samples were analyzed for nutrients, metals, mercury, and TSS. In situ measurements of temperature, conductivity, pH, and DO were also recorded. The complete analytical results are included in the Freshwater Fish, Fish Habitat, and Fisheries Baseline Study (Appendix H). A summary of results is presented in Table 18.14, including the following parameters; units of measurement; reportable detection limit (RDL), which is the level that can be reliably reported considering factors such as sample volume and sample matrices (i.e., other elements and compounds that may be present); number of samples with reportable quantified values (values above RDL); maximum value recorded for all samples; minimum value recorded for all values; mean value, only if all samples had reportable values (otherwise blank); median value, only if all samples had reportable values (otherwise blank); and *Water Quality Guidelines for the Protection of Aquatic Life* (CCME 2011).

Table 18.14 Summary of Water Quality Monitoring Results

Parameter	Units	RDL	>RDL	AVG	Min	Max	CCME Guideline
Calculated TDS	mg/L	1	7	47.1	18.0	76.0	
Hardness ($CaCO_3$)	mg/L	1	7	41.4	15.0	70.0	
Nitrate	mg/L	0.05	0	<0.05	<0.05	<0.05	1.3
Inorganics							
Total Alkalinity (Total as $CaCO_3$)	mg/L	5	7	44.7	15.0	77.0	
Dissolved Chloride)	mg/L	1	0	<1	<1	<1	
Colour	TCU	5	7	26.1	13.0	42.0	Note 1
Nitrate + Nitrite	mg/L	0.05	0	<0.05	<0.05	<0.05	

Parameter	Units	RDL	>RDL	AVG	Min	Max	CCME Guideline
Nitrite	mg/L	0.01	0	<0.01	<0.01	<0.01	0.6
Nitrogen (Ammonia Nitrogen)	mg/L	0.05	3	-	<0.05	0.1	
Total Organic Carbon)	mg/L	0.5	7	4.3	2.7	5.7	
Orthophosphate	mg/L	0.01	0	<0.01	<0.01	<0.01	
pH	pH	N/A	7	7.6	7.3	7.8	6.5 to 9.0
Reactive Silica (SiO_2)	mg/L	0.5	7	3.9	2.3	5.6	
Total Suspended Solids	mg/L	2	5	-	<2	4.0	
Dissolved Sulphate (SO_4)	mg/L	2	1	-	<2	3.0	
Turbidity	NTU	0.1	7	0.5	0.3	0.6	Note 2
Conductivity	µS/cm	1	7	78.1	32.0	130.0	
Metals							
Total Aluminum	µg/L	5.0	7	50.5	13.7	119.0	100
Total Antimony	µg/L	1.0	0	<1.0	<1.0	<1.0	
Total Arsenic	µg/L	1.0	0	<1.0	<1.0	<1.0	5
Total Barium	µg/L	1.0	7	13.7	9.4	20.0	
Total Beryllium	µg/L	1.0	0	<1.0	<1.0	<1.0	
Total Bismuth	µg/L	2.0	0	<2.0	<2.0	<2.0	
Total Boron	µg/L	50	0	<50	<50	<50	1,500
Total Cadmium	µg/L	0.017	5	-	<0.017	1.2	Note 3
Total Calcium	µg/L	100	7	9740.0	3950.0	15800.0	
Total Chromium	µg/L	1.0	3	-	<1.0	101.0	
Total Cobalt	µg/L	0.40	0	<0.40	<0.40	<0.40	
Total Copper	µg/L	2.0	2	-	<2.0	2.4	2
Total Iron	µg/L	50	6	-	<50	287.0	300
Total Lead	µg/L	0.50	1	-	<50	0.7	1
Total Magnesium	µg/L	100	7	4158.6	1190.0	7520.0	
Total Manganese	µg/L	2.0	7	60.2	11.9	138.0	
Total Mercury	µg/L	0.013	0	<0.013	<0.013	<0.013	0.026
Total Molybdenum	µg/L	2.0	0	<2.0	<2.0	<2.0	73
Total Nickel	µg/L	2.0	0	<2.0	<2.0	<2.0	25
Total Phosphorus	µg/L	100	0	<100	<100	<100	Note 4
Total Potassium	µg/L	100	7	1051.6	323.0	2380.0	
Total Selenium)	µg/L	1.0	0	<1.0	<1.0	<1.0	Note 3
Total Silver	µg/L	0.10	0	<0.10	<0.10	<0.10	Note 3
Total Sodium	µg/L	100	7	763.4	430.0	1430.0	
Total Strontium	µg/L	2.0	7	14.9	11.6	21.6	
Total Thallium	µg/L	0.10	0	<0.10	<0.10	<0.10	0.8
Total Tin	µg/L	2.0	0	<2.0	<2.0	<2.0	

Parameter	Units	RDL	>RDL	AVG	Min	Max	CCME Guideline
Total Titanium	µg/L	2.0	5	-	<2.0	5.5	
Total Uranium	µg/L	0.10	3	-	<0.10	0.4	
Total Vanadium	µg/L	2.0	0	<2.0	<2.0	<2.0	
Total Zinc	µg/L	5.0	2	-	<6.0	15.4	30
In Situ Measurements							
Temperature	ºC	NA	7	15.1	11.1	18.8	
Conductivity	mS/cm^3	NA	7	83.7	35.0	173.0	
pH	Units	NA	7	7.37	6.54	8.0	6.5-9.0
Dissolved Oxygen	mg/L	NA	7	9.8	8.6	11.1	8

Notes:

ND = Non-Detect, RDL=Reportable Detection Limit.

1. Colour can be expressed as True Colour or Apparent Colour. True Colour is the mean absorbance of filtered water samples at 456 nm and shall not be significantly higher than the seasonally adjusted expected value for the stream under consideration. Apparent Colour is the mean percent transmission of white light per metre and shall not be significantly less than the seasonally adjusted expected value for the stream under consideration (CCME, 2011).
2. Turbidity can be expressed as Clear Flow or High Flow (turbid water). Clear Flow Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g., 24-hour period). Maximum average increase of 2 NTUs from background levels for a longer term exposure (e.g., 30-day period). High flow or turbid waters Maximum increase of 8 NTUs from background levels at any one time when background levels are between 8 and 80 NTUs. Should not increase more than 10 percent of background levels when background is >80 NTUs (CCME, 2011).
3. The guideline values for cadmium, selenium and silver are all lower than the RDLs. Only cadmium had reported values above the RDL.
4. Canadian Trigger ranges from ultra-oligotrophic less than 4 to hyper-eutrophic great than 100 (CCME, 2011).

The results for individual parameters have been compared to Water Quality Guidelines for the Protection of Aquatic Life published by the CCME (2011), where numerical guidelines exist. CCME guidelines were exceeded for three parameters: aluminum, cadmium, and copper. Aluminum concentrations exceeded the guideline at RP01 to PLS, the remaining six sample sites had aluminum concentrations below the CCME guideline. Concentrations of cadmium exceeded the guideline for five of seven samples; streams M01 to ML and TDA02 are the only streams to have cadmium concentrations that are below the guideline. Copper exceeded the guideline at one of seven stations, RP01 to PLS. The results suggest that parameter concentrations in excess of the CCME guideline are naturally occurring and represent baseline conditions at the Project site.

18.5.9 Fisheries

Aboriginal traditional knowledge has been collected through engagement activities. Currently, there is no known published source of Aboriginal traditional knowledge collected at or near the Project area. In the absence of this, Aboriginal traditional knowledge was also collected through published sources from other areas.

There are no reports of Aboriginal or subsistence fisheries in the study area; however, they have been reported in the Schefferville area and the following is a summary of information (Weiler 2009):

- The survey revealed that the Howells River and the lakes along its course are being used extensively and year-round by members of the Naskapi community.
- Lake trout, pike, whitefish (both Lake and Round whitefish) and ouananiche are identified as species harvested in all of the lakes along the Howells River (Stakit, Fleming, Elross, Rosemary and Kivivic lakes).
- Most of the smaller lakes on the valley's eastern slope are also utilized, though to a lesser extent, with Speckled trout and sucker being the most common species.

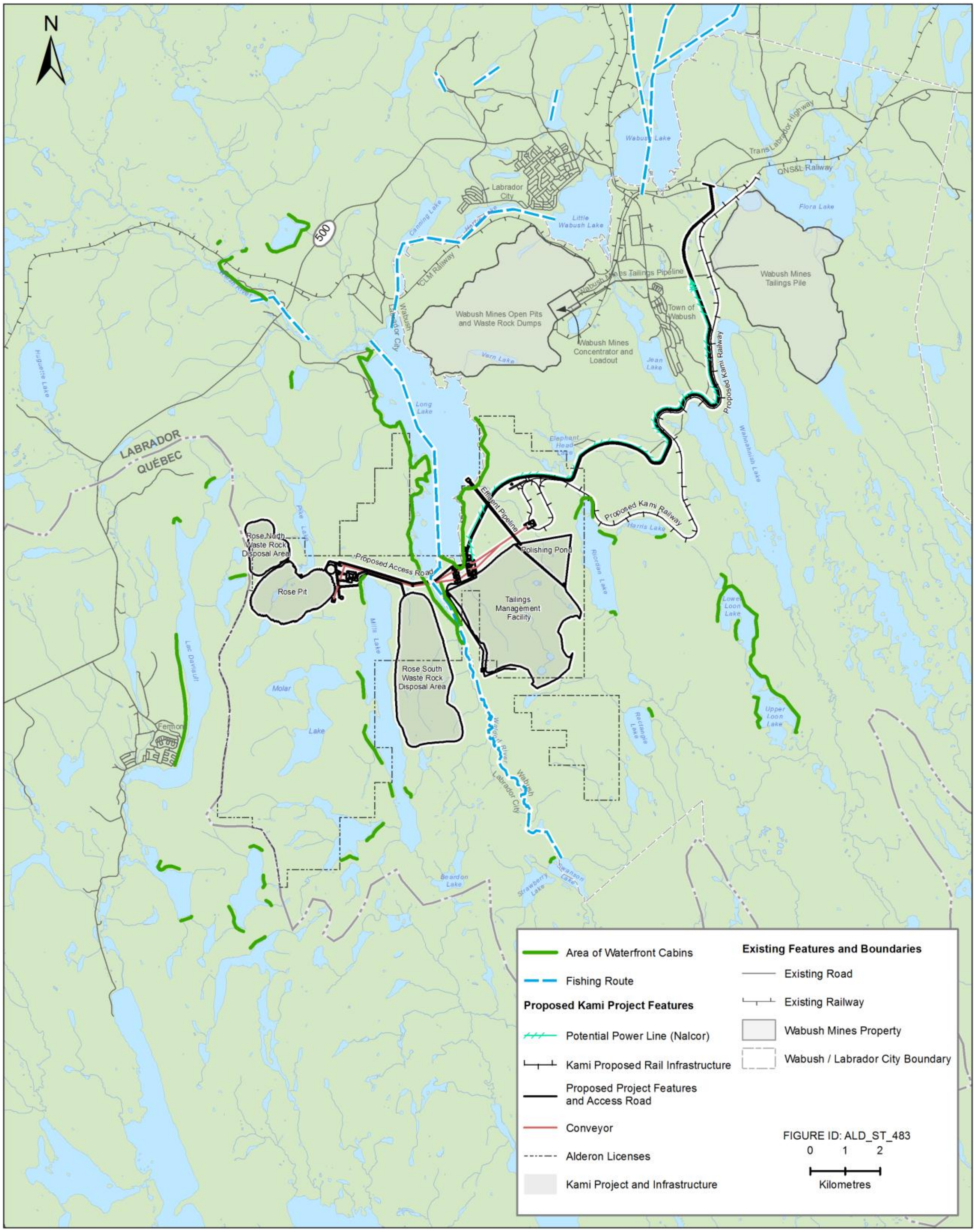
There are no commercial fisheries and no reported Aboriginal or subsistence fisheries within the RSA. Therefore fisheries is defined as the recreational fishery. Based on interviews with residents of Labrador City, Wabush, and Fermont, the target fish species angled include lake trout, brook trout, whitefish, burbot, northern pike, and ouananiche. Local knowledge pertaining to fisheries is presented in Table 18.15.

Table 18.15 Local Knowledge – Freshwater Fish, Fish Habitat, and Fisheries

Date	Stakeholder	Community	Comment
March 13, 2012	Individual	Wabush	3 to 4 lb speckled trout.
March 13, 2012	Individual	Wabush	Cabin owner utilizes a fishing area near Rose South Waste Rock disposal area.
February 9, 2012	Town of Fermont	Fermont	Fermont is also planning to build a camping site by the Lac Daviault, in which they would seed trout in the lake to organize an annual fishing derby.
March 14, 2012	Individual	Labrador City	Fish migration between the small lakes south of Mills Lake to Mills Lake and Molar.
March 14, 2012	Individual	Labrador City	There is a water system south of Riordan Lake that the local people fish.

Recreational fisheries are pursued throughout the region with activity tending to be centered in accessible streams, ponds and lakes near the towns of Labrador City and Wabush, cabins in the area, and along the highway and rail lines. In the LSA and RSA, angling is pursued in Long Lake, Waldorf River, and other areas as indicated on Figure 18.7. Most of the recreational fishery interest is associated with burbot, brook trout, lake trout, northern pike, ouananiche, and whitefish. Additional information on the local fisheries, as obtained through community consultation and interviews, is contained in Chapter 23: Other Current Use of Lands and Resources.

Figure 18.7 Locations Where Fishing Activities are Pursued



18.6 Assessment of Project-related Environmental Effects

The Project-environment interactions that could be mitigated with federal / provincial guidelines, BACT, and therefore not likely to result in significant adverse residual effects, were assessed in Section 18.4. This section describes the interactions that will require specified mitigation measures (those potential interactions given a rank of 2 in Section 18.4). Each effect (change in fish habitat, change in fish mortality and health, and change in utilization of existing fisheries) is assessed for each appropriate Project phase using the identified measurable parameters. Two phases of the Project have activities that result in interactions with Freshwater Fish, Fish Habitat, and Fisheries that require implementation of specified mitigation; construction and operations / maintenance. These phases are discussed below. Accidents and malfunctions are discussed separately in Section 18.8.

18.6.1 Potential Environmental Effects on Fish Habitat / Production

Assessment of change in fish habitat / production includes the measurable parameters of alteration or removal of existing fish habitat, change in water quality or sediment quality, change in water flow rates, and potential barriers to fish passage. The dimensions and character of the waterbodies are based on the road and rail alignment as described in the registration and as surveyed in the summer / fall of 2011.

Construction

The serious, permanent change to fish production associated with a fishery requires quantification and, if determined to require authorization under the *Fisheries Act*, appropriate compensation. Detailed descriptions of lakes / ponds and streams / rivers within the Project area can be found in the Freshwater Fish, Fish Habitat, and Fisheries Baseline Study (Appendix H). Fish habitat that will be potentially altered or lost to the construction of the Project is summarized below and shown on Figure 18.5. Descriptions are broken into the Rose Pit watershed (includes the development of Rose Pit and associated Rose North and Rose South Waste Rock Disposal Areas), TMF watershed, and stream crossings (includes habitat affected by the installation of stream crossing infrastructure associated with proposed access roads and rail line).

Rose Pit / Waste Rock Disposal Areas

The Rose Pit watershed is composed of a series of five interconnected ponds identified as RP01, RP02, RP03, RP04 and RP05 in Figure 18.5, which drain in a generally northerly direction into Pike Lake South. These ponds have a combined total surface area of 42.89 ha. Of the five ponds, only RP01 is located within the anticipated footprint of Rose Pit and will, therefore, be removed. Pond RP01 has a total surface area of 8.74 ha and comprises approximately 20 percent of the lacustrine habitat within the watershed above Pike Lake South. There are no anticipated effects of the Project upon any other lacustrine habitat within the watershed.

The Rose Pit ponds are interconnected by a series of five streams identified as RP05-04, RP04-02, RP03-02, RP02-01 and RP01-PLS in Figure 18.5. These streams have a combined length of 2,700 m. Of the six streams, only RP02-RP01, RP01-PLS and RSD occur within the footprint of the proposed pit development.

Within the RP02-RP01stream reaches, the available fish habitat is characterized as rearing whereas the RP01-PLS stream reaches are primarily characterized as rearing habitat with limited spawning.

There are a total of four streams within the Rose South Waste Rock Disposal Area. Of the four streams present, only one has a mean width near 1 m. AD01 drains from the northern most portion of the waste rock area and empties into the outflow of Mills Lake. This outflow empties into Long Lake. AD02, AD03 and AD04 drain the remainder of the waste rock area to the east, into Waldorf River. The majority of the habitat is characterized as shallow, boggy drainage; however, AD02 is characterized as rearing habitat.

Tailings Management Facility

The TMF watershed is composed of a series of three small interconnected ponds (SW1, SW2 and SW3 in Figure 18.5) which drain in a generally northerly direction into Long Lake. These ponds have a combined total surface area of 8.81 ha. The three ponds are located within the anticipated footprint of the TMF and are all less than 1 m deep and have bottom substrates comprised of fines and organics.

The TMF ponds are interconnected and connected to Long Lake by a series of three streams (TDA01, TDA02 and TDA02 East in Figure 18.5). These streams have a combined length of 11,200 m and account for all the riverine fish habitat within the watershed, comprising a mixture of rearing and spawning habitat. TDA02 East is entirely within the TMF footprint and will be removed from the watershed to allow for the development of the TMF. Both TDA01 and TDA02 have stream reaches below the TMF that will not be removed but may have reduced flows as a result of the loss of upstream habitat. These habitats have conservatively been included in the loss of productive habitat and compensation requirements and are quantified in Table 18.16 as habitat with reduced flow. Habitat with reduced flow has been determined as habitat that would experience a decrease in flow due to reduced drainage area upstream. The extent of the potential loss in production will be determined during the authorization process.

Table 18.16 Summary of Habitat Equivalent Units most likely within Authorization Requirements, Kami Iron Ore Mine

Habitat Location	HADD Equivalent Units[1]		
	Lost (Pond)	Lost (stream)	Reduced Flow
Rose Pit / Waste Rock Disposal Areas			
RP01	8.59 ha[3]	0	0
RP02	7.87 ha[3]	0	0
RP03	0.94 ha[3]	0	0
RP04	4.82 ha[3]	0	0
RP05	1.78 ha[3]	0	0
RP01-PLS	0	9.28 units[4]	0

Habitat Location	HADD Equivalent Units[1]		
	Lost (Pond)	Lost (stream)	Reduced Flow
RP02-RP01	0	5.07 units[4]	0
RP02-RP03[5]	0	3.56 units[4]	0
RP02-RP04[5]	0	4.58 units[4]	0
RP04-RP05[5]	0	1.19 units[4]	0
PLS-S1[5]	0	0	0
AD01	0	3.45 units[4]	0
AD02	0	0	0
AD03	0	1.6 units[4]	0
AD04	0	0	0
Tailings Management Facility			
SW1	2.78 ha[4]	0	0
SW2	2.34 ha[4]	0	0
SW3	0.78 ha[4]	0	0
TDA01	0	20.88 units[4]	0
TDA02	0	54.06 units[4]	101.55[4] units
TDA02 East	0	10.63 units[4]	0
Long Lake outflow[6]			TBD
Stream Crossings			
SC-01	0	2.86 units[4]	0
SC-02	0	4.82 units[4]	0
SC-03	0	- -[2]	0
SC-04	0	- -[2]	0
SC-05	0	- -[2]	0
SC-06	0	0.77 units[4]	0
SC-07	0	0.34 units[4]	0
SC-07a	0	TBD	
SC-08	0	0.16 units[4]	0
SC-09	0	3.48 units[4]	0
SC-10	0	0.30 units[4]	0
SC-11		TBD	
Total	**29.9 ha**	**133.03 units**	**101.55 units**

Notes:
1. Stream habitat is quantified in units (one unit = $100m^2$) whereas pond habitat is quantified in hectares.
2. Habitat Equivalent Units at these crossings are incorporated into habitat loss associated with the Tailings Management Facility.
3. HEU based on Northern Pike.
4. HEU based on Brook trout.
5. Pike Lake outflow may have reduced flow and therefore included in potential reduction in productivity– TBD.
6. Water extraction from Long Lake may affect hydrology at outflow and therefore may be included in HADD – TBD.

Stream crossings are assumed to be 25 m wide.

Stream Crossings

A total of 11 streams, one river (Waldorf River) and one small lake adjacent to Flora Lake have been identified which will be crossed by site access roads and/or rail line (Figure 18.5). At each of these sites it is anticipated that it will be necessary to install culverts or bridges. For each stream crossing the potential loss of habitat (HADD) is assumed to be the average stream width multiplied by a 25 m right of way for the crossing. For the pond crossing, the area required to be infilled has not been determined at this point but will be calculated during final engineering.

Table 18.16 presents the habitat quantification summary (Habitat Equivalent Units) which could be included in the authorization determination and, therefore, the habitat that will require compensation to offset its loss. Habitat altered is that which will be dewatered or altered in some way due to construction to the extent that it is no longer considered productive fish habitat.

The *Fisheries Act* is currently being amended to provide protection to ongoing Aboriginal, commercial, and recreational fisheries by protecting the productivity of habitat that supports them. The trigger for authorization is serious harm to fish that are part of a commercial, recreational, or Aboriginal fishery, or serious, permanent harm to ecosystem productivity that supports such a fishery. The *Fisheries Act* allows the Minister to issue an Authorization under Section 35(2) which will permit the work, undertaking, or activity to occur that results in serious harm to fish. The issuance of an Authorization is at the discretion of the Minister; however, the process for issuing an Authorization is well established. A Section 35(2) Authorization will be issued only with the acceptance of an appropriate Compensation Plan which offsets any serious harm to fish, including permanent alteration or destruction of fish habitat. An Authorization must be issued before any action can be taken that would result in serious harm.

Mitigation of Environmental Effects on Fish Habitat

The development and implementation of a Fish Compensation Plan will mitigate losses of fish habitat resulting from the Project to avoid serious harm to fish. In order to receive an Authorization, the following must occur:

- DFO determines that an Authorization under the *Fisheries Act* is likely required, triggering assessment under the CEAA; and
- The Proponent is required to quantify the habitat / productivity which will be affected by their undertaking. This quantification must reflect the productivity of the habitat, and take into account the use of the habitat to support an Aboriginal, commercial, or recreational fishery. It must also identify all opportunities to avoid or mitigate potential habitat losses and reduced production.

Once the habitat quantification is accepted by DFO, a determination is made (i.e., a formal statement is made identifying the residual habitat / production which will require authorization). This determination establishes the basis for fish habitat compensation to offset the loss in habitat / production.

The Proponent develops a Compensation Plan in two stages:

- A Compensation Strategy; and
- A Compensation Plan.

The targeted habitat with respect to a freshwater *Fisheries Act* Authorization was conducted using the Standard Methods Guide for the Classification / Quantification of Lacustrine Habitat in Newfoundland and Labrador (Bradbury et al. 2001) and the Draft Standard Methods Guide for the Classification and Quantification of Fish Habitat in Rivers of Newfoundland and Labrador for the determination of Harmful Alteration Disruption or Destruction of Fish Habitat (DFO 2012 Draft).

Should the Project footprint or any layout configurations change or further mitigations be employed, potentially affected fish habitat will be reassessed and the habitat requirement re-determined by DFO.

The location of the Project footprint will cause a *Fisheries Act* Authorization. The total quantity of habitat directly within the Project area has been quantified as per DFO guidelines and direction (see Bradbury et al. 2001 and DFO 2012). The total habitat equivalent units (HEU) has been calculated at 230 units (1 unit = 100 m^2) of stream habitat (i.e., proposed open pit, waste rock disposal areas, TMF, processing infrastructure, rail line stream crossings, and access road stream crossing footprints) and 30 ha of lacustrine habitat (i.e., proposed open pit and TMF footprints) (Figure 18.5). Due to the recent *Fisheries Act* amendments, additional information regarding the productivity of these areas is being gathered. At this point, in order to remain conservative, the overall HEU values are being used in determining the quantity and types of habitat that will be required for compensation. The potential options are outlined below.

Fish Habitat Compensation Options

Several habitat rehabilitation activities will be conducted that will achieve a no net loss of productive aquatic habitat / production. The most preferred options are those that would occur within the same ecological unit (e.g., Pike Lake North and South streams). Options outside the ecological unit have been formulated should they be required as part of the overall compensation plan. These generally entail habitat / production enhancement within ponds and their tributaries within the general western Labrador area and increased productive capacity within existing fishless ponds.

While all options outlined below are considered candidates to improve habitat / production, all feasible options will be further assessed as part of the final Compensation Plan design and submission in order to determine the best overall net gain in productive capacity. It should be kept in mind that any undertaking will need to be conducted in concert with all activities within the area so that long-term benefits are realized and integrated. It should also be noted that further public consultation with respect to final compensation options is required.

a) Enhancement of Pike Lake North and South Tributary Streams

Assessment of the fish habitat / production within the Pike Lake streams during 2011 identified primarily boulder, rubble, and cobble substrates (Figure 18.8 and Figure 18.9). Stream reaches surveyed within the Pike Lake system, identified gravels only within the section immediately upstream of the confluence with Walsh River. While the larger Pike Lakes (both North and South) and streams contain much rearing habitat for species residing there, the dominance of larger substrates within the Pike Lake streams limits the spawning potential of this area of the watershed.

The limited availability of spawning substrate (i.e., gravels) most likely limits production of young-of-year by concentrating all spawning activity within small areas of suitable habitat. This may also increase predation on spawning adults by having higher concentrations of prey in a confined spawning area. As a result, a compensation option outlined in the strategy is the enhancement of spawning by converting a portion of the current rearing habitat to spawning habitat. The strategic placement of suitable gravels and installation of low head barriers, to hold upstream substrates in place and provide upwelling, have been effective in other streams within the province to increase spawning success of resident and anadromous fish populations. Substrates will be placed in stream reaches with low slope such that they remain stable in high spring runoff and storm events.

Figure 18.8 Typical Habitat within Pike Lake North Tributary Streams

Figure 18.9 Typical Habitat within Pike Lake South Tributary Streams

b) Enhancement of Lac Daviault Tributary Streams

Lac Daviault is a large waterbody just west of the proposed Project footprint. It has been identified by the Town of Fermont as a potential waterbody for enhancement of fishing opportunities for local anglers and residents. They have begun considerations to enhance the fish populations within the lake via stocking. However, opportunities may exist to improve the population by more sustainable methods such as enhancing existing habitat to increase the carrying capacity (i.e., support more and/or larger fish). Enhancement of fish habitat within Lac Daviault tributary streams (e.g., conversion of rearing habitat to spawning habitat as described above) would provide suitable compensation to offset the habitat losses associated with Project development. In addition, enhancement of lacustrine habitat within Lac Daviault is also being considered should additional analysis determine limited rearing potential for preferred salmonid species (e.g., brook trout). The placement of suitable substrates (e.g., boulders), in water (e.g., root wads) and overhanging structures can provide enhanced rearing habitat and increase the productive capacity for juvenile and adult fish.

c) Increased Production within Fishless Ponds / Lakes

The stocking of fishless ponds has been previously used for fish habitat compensation within the vicinity of the Project (e.g., White Lake) and elsewhere in the province (e.g., Voisey's Bay) which have been very successful in establishing self-sustaining fish populations. The initial stage of pond identification has been completed with the use of GIS, Digital Elevation Mapping (DEM), and pond attributes. The attributes of current known fishless ponds have been used to develop query filters to identify additional local ponds with similar attributes. Attributes used for the analysis include pond altitude, connectivity to other water bodies, outflow slope and general slope of the surrounding landscape. Ponds identified will be field surveyed prior to finalization of the Plan to confirm whether they are candidates. Each pond within the Project footprint would require fish to be removed prior to loss of the habitat. Fish are typically relocated to other habitat within the same watershed. However, if scheduling allows, candidate fishless ponds would receive fish from the ponds within the Project footprint.

Maintenance of Sustaining Flows to Fish Habitat

Alterations to existing flow levels will be mitigated through water reuse and recycling, and collection and redistribution of surface waters to existing streams where warranted. Surface water management systems will ensure adequate baseflows are maintained for the stream section associated with the Rose North Waste Rock Disposal Area. Although not formalized, adequate baseflow waters will also be maintained into Pike Lake South through transfer of waters from the upland Rose ponds. Changes to water flow levels for the Rose South Waste Rock Disposal Area are currently being investigated. Baseflow waters will be altered for streams within the TMF; however, the habitat / production in these streams will be compensated for as part of the *Fisheries Act* Section 35(2) Authorization.

Avoidance of Barriers to Fish Migration

The Project has the potential to create barriers to fish passage with respect to the connection between the upper Rose ponds and Pike Lake South, and with respect to the various stream crossings. The designs for the Rose ponds connection are ongoing, so final assessment of a barrier is not possible. However, if it is only a water transfer system, then a fish barrier will be created. Designs for the crossings are also ongoing; however, it is anticipated that they will likely be culverts. These will have to be properly sized and installed to insure that the natural stream velocities are maintained in order to foster continued fish passage. Design consideration will include maintaining a minimum water level (200 mm) within culverts and culverts will be countersunk to permit fish migration.

Characterization of Residual Environmental Effects on Fish Habitat / Production

Based on the following mitigation measures, residual adverse effects to fish habitat will be neutral, low in magnitude, site specific, permanent, continuous, and irreversible:

- Fish habitat compensation will be provided to the satisfaction of DFO;
- TSS will be controlled through designed surface water management and settling ponds;

- Red water issues will be addressed prior to discharge;
- Mine site waters will be treated for nitrates, ammonia, or any other contaminants, if required, prior to release into surface waters;
- All discharges to surface waters will meet MMER requirements;
- The site dust suppression plan will minimize airborne particulate introduction into LSA watercourses and waterbodies;
- Adequate surface water and baseline flows will be maintained for all affected watercourses and waterbodies;
- All culverts will be designed to provide flow rates similar to those in existing channels; and
- Riparian disturbances will be minimized and progressive rehabilitation instituted to ensure integrity and reduce erosion potential.

18.6.2 Potential Environmental Effects on Fish Health or Mortality

Project interactions and resulting environmental effects can be managed to acceptable levels using standard, accepted mitigation measures and procedures and therefore significant adverse effects are not likely. Details are provided in Section 18.4.

18.6.3 Potential Environmental Effects on Utilization of Existing Fisheries

Change in utilization of existing fisheries was assessed based on the measureable parameter of the number of recreational fishing locations that are lost. Based on local informant interviews, many nearby lakes are used for recreational fishing, particularly those lakes where cabins are located (Figure 18.7). Most of the fishing activity in the LSA is on Long Lake and on the Waldorf River.

Construction

During site preparation, at least one small pond of the five ponds at Rose Pit location will be removed for pit development. At least one of these ponds was noted to be a fishing spot through informant interviews. This series of ponds will also have restricted access due to their close location to construction activities. Three other small ponds that will be removed to prepare the TMF are shallow bog ponds that are not known to be used for fishing. Other areas on the Project site may affect fisheries by the construction of stream crossings or the development of features such as waste rock disposal areas near ponds and streams. The installation of water intake or effluent release pipes into Long Lake will not deter fishing in the lake. The environmental effect of loss of access to fisheries is addressed in Chapter 23.

Operation and Maintenance

There will be no additional loss of waterbodies or streams during the operation and maintenance phase, and therefore no further subsequent effects to fisheries. The environmental effects of loss of access on utilization of fisheries is addressed in Chapter 23.

Mitigation of Project Environmental Effects on Fisheries

The primary mitigation measures related to fisheries are to minimize any effect to fish and habitat beyond the PDA. This includes the maintenance of existing flow and production. The provision of flows around the Rose Pit from upstream drainage will minimize the flow loss into the Pike Lake system and hence limit any effect on downstream recreational fishing. There may also be a reduction in flow from the TMF as a result of water diversion and treatment; however all water that enters the TMF area will be released, therefore reducing downstream effects. The recycling and reuse of water within the mine and processing will also reduce the need for water extraction and reduced downstream flows. In addition, any habitat / production required for a *Fisheries Act* Authorization will offset any losses in production but will also be available for expanded fisheries (described in Section 18.6 above).

Characterization of Residual Environmental Effects on Fisheries

The loss of opportunities for recreational fishing will occur during construction and continue through operation and maintenance. The loss of fishing locations is minimal, being a single pond near the Rose Pit area.

It was reported that most of the fishing activity in the Project area is on Long Lake and on the Waldorf River, as well as the ponds and lakes where cabins are located. Any fish habitat that is altered at the Waldorf River crossing will be replaced. Fish habitat will not be lost in Long Lake or the other ponds and lakes where cabins are located. Therefore the residual effects to the recreational fishery resulting from the loss of fishing locations are adverse, negligible, localized, long term, continuous and irreversible. Mitigations will be implemented to reduce adverse effects to fish health or mortality, and therefore the adverse residual effects to the recreational fishery resulting from changes in fish health or mortality are negligible.

18.6.4 Summary of Residual Effects

A summary of the Freshwater Fish Habitat, Fish Health, and Fisheries residual effects are provided in Table 18.7.

Fish Habitat / Productivity

Effects to fish habitat will be limited to alterations and losses from site preparation activities during construction. These will be mitigated with fish habitat compensation, which will result in a low level and localized adverse effect that will last for a year or two while the compensation habitat gradually supports fish production. The success will be monitored and adjustments will be made as necessary. The residual effect will be not significant; the prediction is made with a high level of confidence based on past experience with fish habitat/productivity enhancements. No additional effects to habitat are anticipated during operations and decommissioning.

Table 18.17 Summary of Residual Environmental Effects to Changes in Fish Habitat, Fish Health or Mortality, and Utilization of Existing Fisheries

Project Phase	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context	Significance	Prediction Confidence	
Change in Fish Habitat											
Construction	• Compensation Plan as required under *Fisheries Act* Authorization.	N	L	S	P	C	I	U	N	H	Compensation Plan monitoring under *Fisheries Act.*
Operation and Maintenance	• N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N	H	
Decommissioning and Reclamation	• Any activities near/within waterbodies will most likely require review under the *Fisheries Act* at that time.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N	H	
Fish Health or Mortality											
Construction	• Fish relocation. • Maintenance of flows.	A	N	S	T	O	R	U	N	M	Water quality sampling as per EPP/EEM requirements.
Operation and Maintenance	• Fish screens. • Blasting guidelines. • MMER regulations regarding discharges.	N	N	L	T	C	R	D	N	M	Water quality and biota sampling as per MMER requirements.
Decommissioning and Reclamation	• Any activities near/within waterbodies will most likely require review under the *Fisheries Act* at that time.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N	H	
Change in Utilization of Existing Fisheries											
Construction	• Compensation Plan.	A	N	L	L	C	I	U	N	H	
Operations and Maintenance	• N/A*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N	H	

Project Phase	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context	Significance	Prediction Confidence	
Decommissioning and Reclamation	• N/A*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N	H	

KEY

* Effects of loss/alteration of access on fisheries is addressed in Chapter 23.

Direction:
- P Positive: condition is improving compared to baseline.
- N Neutral: no change compared to baseline.
- A Adverse: negative change compared to baseline.

Magnitude:
- N Negligible: no measureable adverse effects anticipated.
- L Low: measureable effects anticipated in low-sensitivity habitats and no measureable reduction in the number of fish species anticipated.
- M Moderate: measureable effects anticipated in moderately sensitive habitat or anticipated mortality risk to non-listed species.
- H High: measureable effects anticipated in highly sensitive habitat or habitat designated as important to listed species or anticipated mortality risk to listed species.

Geographic Extent:
- S Site Specific: effects restricted to PDA.
- L Local: effects extend beyond the PDA but remain within the LSA.
- R Regional: effects extend to the RSA.

Duration:
- T Temporary: effects are measureable for days to a few months.
- M Moderate: effects are measureable for up to a year but not multiple years.
- L Long-term: effects are measurable for multiple years but not permanent.
- P Permanent – effects are permanent.

Frequency:
- O Once: effect occurs only one time.
- S Sporadic: effect occurs more than once at irregular intervals.
- R Regular: effect occurs on a regular basis and at regular intervals.
- C Continuous: effect occurs constantly.

Reversibility:
- R Reversible: effect will cease during or after the Project is complete
- I Irreversible: effects will persist after the life of the Project, even after habitat restoration and compensation works

Environmental Context:
- U Undisturbed: effect takes place in an area that has not been previously affected by human development.
- D Developed: effect takes place in an area that has been previously affected by human developed, in an area where human development is still present, or in an area previously disturbed by Project activities.

Significance:

S Significant:
- A permanent and irreversible reduction in the productive capacity of fish habitat that remains after mitigation and compensation measures are implemented and which will likely result in an uncompensated HADD of fish habitat.
- The likelihood of fish mortality, after mitigation measures are implemented, at a level that would require regulatory bodies to implement specific management plans for the recovery of the affected fish populations.
- A significant measureable decrease in fish condition, below baseline conditions and directly attributable to Project activities, and which threatens the sustainability of the regional fisheries.
- The Project is not compatible with recreational fishing activities, such that patterns of fishing are changes across the area .

N Not Significant.

Prediction Confidence:

Based on scientific information and statistical analysis, and effectiveness of mitigation or effects management measure
- L Low: biological processes not well understood, limited baseline data, predictive analysis not available, quantitative metrics limited, and mitigation measure effectiveness unknown.
- M Moderate: general biological processes understood, adequate baseline, some predictive analysis, quantitative metrics available, proven mitigation measures.
- H High: biological process well understood and predictable, adequate baseline and regional data, statistical and predictive modeling is proven, mitigation measures proven successful.

Fish Health or Mortality

Fish health or mortality will experience some losses where fish relocation is required prior to dewatering ponds or streams during construction. The removal of fish habitat during construction will include the relocation of fish prior to any disturbance or dewatering which will result in minimal losses. Where temporary dewatering occurs at stream crossing locations, water flow will be maintained to preserve downstream habitat to prevent incidental losses. There is a high level of confidence that the residual effect will be not significant. Fish health is likely to experience a negligible magnitude effect as habitat protection and effluent quality measures will prevent adverse effects on fish health.

During operation, the potential for effects on fish health are monitored as a requirement of the MMER. Screens will be installed on pump lines used for short-term and long-term water withdrawals. Blasting guidelines will protect fish and eggs in the vicinity of the pit. The resulting residual adverse effects to fish health and mortality will be neutral, of negligible magnitude, localized, occurring once per site, and reversible. The effect will not be significant and there is a moderate to high level of confidence based on previous fish relocation programs and Alderon's commitment to water / effluent treatment and MMER requirements.

Fisheries

The removal of fish habitat during construction will result in loss of opportunity for recreational fishing at up to five small ponds at the open pit site. Fish habitat compensation will address the requirements for no net loss of productive fish habitat, and this will provide alternative opportunities for recreational fishing. The residual effect on fisheries will be a of negligible magnitude and localized. It will continue until the site is decommissioned (long term duration). The effect is reversible and not likely significant because access to alternate ponds will be possible. The prediction is made with a high degree of confidence.

18.7 Assessment of Cumulative Effects

Subsequent to the assessment of Project effects discussed previously, an assessment of potential cumulative effects was conducted for other projects and activities that have potential to interact with the Project within the RSA. Potential cumulative effects on Freshwater Fish, Fish Habitat, and Fisheries relate to loss of fish habitat, a decline in fish health and/or increase in fish mortality, and loss of fisheries as a result of the Project in combination with those of other developments or human activities within the RSA. A summary of results of the cumulative effects assessment is provided in Table 18.18.

The environmental effects of past and present projects and activities on Freshwater Fish, Fish Habitat, and Fisheries in the RSA are reflected in the characterization of baseline conditions. Disturbances to waterbodies and watercourses in the RSA include municipal, industrial, residential and recreational developments (including water withdrawals and effluent releases), waste disposal (including tailings disposal from two major iron ore mines), and air borne particulate deposition from large scale land disturbances and tailings areas. As a result, baseline fish habitat conditions in the RSA vary from pristine to heavily impacted; however, the overall condition of fish and fish habitat is considered stable and sustainable. The RSA supports robust recreational fisheries and most ongoing commercial activities, particularly mines have been providing fish habitat compensation to offset negative effects related to their ongoing and future activities.

As presented in Table 18.18, Project-related effects on Freshwater Fish, Fish Habitat, and Fisheries are limited and will be mitigated through the use of well-established and proven mitigation measures. The adverse environmental effects of the loss of fish habitat and associated fisheries will be mitigated through DFO-approved compensation planning and implementation as part of the required *Fisheries Act* Authorization, which is designed to result in a no-net loss of productive fish habitat. Additionally during construction, maintenance of water flow during dewatering at stream crossing locations and relocation of fish during construction will result in the minimal loss of individuals. During operation, screens will be installed on pump lines used for water withdrawals and blasting guidelines will protect fish and eggs in the vicinity of the pit. Therefore, the residual effects of the Project on Freshwater Fish, Fish Habitat, and Fisheries are determined to be low or negligible and likely not significant.

IOC Labrador Operations, Wabush Mines, Bloom Lake Rail, and urbanization have the potential to result in cumulative effects with the Project. Other identified projects are either located in a different watershed or outside the RSA, beyond which Project residual effects are not measureable for Freshwater Fish, Fish Habitat, and Fisheries. There are no projects located upstream of the Project site. Downstream of the site is Long Lake, and Pike Lake that drains to Long Lake via Walsh River. Long Lake flows through two smaller lakes (Canning and Harrie) to Little Wabush Lake, which receives municipal discharges from both the towns of Labrador City and Wabush. Downstream of Little Wabush Lake is Wabush Lake, which receives the mine effluent from IOC Labrador Operations and Wabush Mines. The Bloom Lake Rail runs east-west approximately 7.5 km downstream of the Project.

Losses of freshwater habitat associated with construction of existing projects (e.g., IOC Labrador Operations, which has been in operation since 1962, and Wabush Mines, which has been in operation since 1965) did not initially fall under habitat protection provisions of the *Fisheries Act* and the associated requirement for compensation. As such, these projects likely resulted in a loss of fish habitat in the RSA; however, these local mines have been involved in habitat compensation as a result of past and future developments within their respective operations. The process of authorization and compensation planning that will be undertaken for the current Project, which will result in a no-net loss of fish habitat in the RSA, will prevent the activities of the current Project from contributing further to any historical cumulative effect of the loss of fish habitat in the RSA.

The residual environmental effects of the Project, which are negligible or low in magnitude and likely not significant, will not contribute measurably to cumulative effects with respect to Freshwater Fish, Fish Habitat, and Fisheries within the RSA (Table 18.18).

Table 18.18 Cumulative Effects to Freshwater Fish, Fish Habitat, and Fisheries

VEC Existing Condition (Past & On-Going Activities)	• Baseline habitat conditions vary from pristine to heavily impacted within the RSA. • Disturbances to waterbodies and watercourses within the RSA include municipal, industrial, residential and recreational developments (including water withdrawals and effluent releases), waste disposal (including tailings disposal from two major iron ore mines), and air borne particulate deposition from large scale land disturbances and tailings. • Fish species within the RSA reside predominately within specific water bodies, with limited migration between lake systems of drainage areas. • Overall condition of Freshwater Fish, Fish Habitat, and Fisheries is considered stable and sustainable. • The RSA supports diverse and robust fisheries.		
Project Residual Environmental Effects	• Fish habitat compensation will result in protection of fish habitat/production for the Project; however, there will be a low level and localized effect while compensation habitat gradually supports fish production. Based on the outlined activities, proposed mitigation measures, including compensation, and the current understanding of the regional baseline conditions, the residual environmental effects of the Project on regional fish habitat are predicted to be not likely significant. • There may be some loss of individuals during construction of the Project; however, predicted residual regional environmental effects are likely not significant with respect to changes in fish health or mortality. • Removal of fish habitat during construction will result in loss of opportunity for recreational fishing at up to five small ponds at the open pit site. Fish habitat compensation will provide alternative opportunities for recreational fishing. The residual effect on fisheries will be localized, neutral and negligible.		
Other Projects / Activities	**Likely Effect Interaction (Y/N)**	**Rationale**	**Cumulative Effects**
IOC Labrador Operations	Y	• In the same watershed, IOC is 24 km downstream of the Project.	• Past effects to fish habitat include TSS and habitat loss. • All ongoing habitat losses are compensated for by fish habitat compensation to achieve protection of fish productivity. • No predicted residual effect to fish health or fisheries.
Wabush Mines (Cliffs Resources)	Y	• In the same watershed, Wabush Mines is 22 km downstream of the Project.	• Past effects to fish habitat include TSS and habitat loss. • All ongoing habitat losses are compensated for by fish habitat compensation to achieve protection of fish productivity. • No predicted residual effect to fish health or fisheries.
Mont Wright Mine (ArcelorMittal)	N	• Located in Quebec, no Hydraulic connection, different watershed.	• None.

Bloom Lake Mine (Cliffs Resources)	N	• Located in Quebec, no Hydraulic connection, different watershed.	• None.
Bloom Lake Rail (Cliffs Resources)	Y	• In the same watershed, Bloom Lake Rail crosses 7.5 km downstream of Kami.	• Effects to fish habitat include habitat loss. • All habitat loss is compensated for by fish habitat compensation to achieve protection of fish and production. • No predicted residual effect to fish health or fisheries.
Schefferville Iron Ore Mine (Labrador Iron Mines)	N	• Located 300 km away, Project residual effects not measureable beyond the Pike Lake and Long Lake systems.	• None.
DSO Iron Ore Project (Tata Steel Minerals Canada)	N	• Located 300 km away, Project residual effects not measureable beyond the Pike Lake and Long Lake systems.	• None.
Lower Churchill Generation Project (Nalcor Energy)	N	• Located >500 km downstream, Project residual effects not measureable beyond the Pike Lake and Long Lake systems.	• None.
Infrastructure or other projects at Port of Sept-Îles	N	• No hydraulic connectivity, different watershed.	• None.
Urbanization	Y	• In the same watershed, Labrador City and Wabush are located approximately 24 km and 22 km downstream of the Project, respectively.	• Effects to fish habitat include loss of habitat. • All habitat loss is compensated for by fish habitat compensation to achieve protection of fish and production. • No predicted residual effect to fish health or fisheries.

Cumulative Effects Summary	**Direction**	**Magnitude**	**Geographic Extent**	**Duration**	**Frequency**	**Reversibility**	**Significance**	**Confidence**
	A	L	R	L	C	R	N	M

The residual effects for Freshwater Fish, Fish Habitat, and Fisheries are low in magnitude or neutral (after compensation) and, in all cases, they are not likely significant. There is a large spatial separation between the Project and effects from other existing or planned projects (iron ore mines and municipal effluent releases). It is highly unlikely that there will be perceptible cumulative effects with other projects and effluent releases.

18.8 Assessment of Accidents and Malfunctions

Three scenarios have been evaluated for the accidents and malfunctions assessment related to Freshwater Fish, Fish Habitat, and Fisheries. These include train derailment, forest fire, and dyke breach. Each of these scenarios has the potential to create direct and indirect interactions with Freshwater Fish, Fish Habitat, and Fisheries. A brief summary of the context of each scenario is provided below.

Train Derailment

Fuel will be transported along the rail line to the Project site and ore concentrate will be transported from the Project site to the QNS&L railway. The rail line extends along a portion of the Town of Wabush water supply area, following the existing road infrastructure through the area where possible, using the alignment of the road to Elephant Head Lake for a portion of the route. As described in Chapter 4, worst case scenarios for a train derailment include the release or deposition of diesel fuel or iron ore concentrate near or within fish bearing waters. Measures to prevent derailment include manual inspection of all railway components, electronic wayside inspections during transport, and both manual and electronic track inspections. In the event of a derailment, response measures include: spill containment through absorbent booms and pads, temporary containment pits, diking and surface water control structures, liquid and solids cleanup and waste removal, site cleanup, and physical reclamation or removal and replacement of contaminated soils.

Forest Fire

Project activities involving the use of heat or flame could result in a fire. The extent and duration of a resulting fire would be dependent on response efforts and meteorological conditions. Fire suppression water will be extracted from Long Lake and will be kept pressurized at the pumping station near the concentrator area. Staff will be trained to prevent and control fires. A plan for preventing and combating forest fires will be incorporated into the Emergency Response and Contingency Plan. Therefore, in the event of a fire, it is expected that the on-site response and proximity of provincial fire suppression (Town of Wabush) will limit the size of any burn.

Dyke Breach

The dykes located at the TMF will be designed to standards of the Canadian Dam Association (CDA) Dam Safety Guidelines. The CDA Guidelines will be used to guide the hazard consequence assessment process, and associated design standards for the dykes at the TMF. The outlet structures and TMF are being designed to accommodate the 1:100-year storm. However, in the unlikely event of a breach at the polishing pond, effluent could be released to the downstream environment. In such an event, the remaining stream habitat downstream of the TMF could be smothered and fish killed. TSS levels on a localized site-specific basis may exceed regulated release criteria; however, the nature of the material that would be released is not acid generating and it will be chemically inert and non-toxic. It is anticipated that Long Lake could rapidly recover. Depending on whether the breach inundated TDA02, this habitat may be difficult to recover and may be long-term in duration. It should be noted that much of this habitat is anticipated to be included in the *Fisheries Act* Authorization at this time due to the potential of reduced flow as a result of the TMF.

Residual Effects of Accidents and Malfunctions

All three of the specified scenarios would produce direct and indirect interactions with Freshwater Fish Habitat, Fish Health or Mortality, and Fisheries resulting in changes to fish habitat quality, water and sediment quality, possible direct fish kills and likely reductions in riparian areas. The implementation of Emergency Response and Contingency plans will minimize adverse effects environmental effects and enable rapid rehabilitation and effective recovery. The results of the assessment of potential residual environmental effects of accidents and malfunctions are summarized in Table 18.19.

Fish Habitat / Productivity

The residual environmental effects resulting from a train derailment are considered adverse in that they will likely lead to degradation of existing fish habitat, water quality, and disturbance of existing riparian areas. The magnitude of the effects would be medium as they may occur in areas where sensitive habitat may be affected, at a local level. The anticipated duration of the effects on fish habitat can be short term or long term given it may take several years for fish habitat to recover from each scenario, but the effects are likely reversible given adequate cleanup, and rehabilitation. It is anticipated that the degree of recovery and permanence of the effects on fish habitat will depend on the magnitude of the event. The predictive confidence is considered moderate based on the understanding of the fish habitat and fish species within the RSA.

The residual environmental effects resulting from a polishing pond dyke breach are considered adverse, but low in magnitude, given the nature of the effluent (i.e., not toxic) and distance to Long lake. The anticipated duration of the effects on fish habitat are likely temporary and reversible. It is anticipated that the degree of recovery and permanence of the effects on fish habitat will depend on the magnitude of the event. The predictive confidence is considered moderate based on the understanding of the fish habitat and fish species within Long Lake.

For forest fires, the magnitude is considered negligible, and the direction is considered neutral because the only direct effect to fish habitat would be the destruction of riparian areas similar to what may occur naturally within the ecosystem.

Fish Health or Mortality

The residual environmental effects from train derailment is similar with respect to fish health or mortality. Depending on the nature of the material spilled as a result of a derailment, there could be localized adverse effects to fish health and mortality.

Table 18.19 Summary of Residual Environmental Effects for Freshwater Fish, Fish Habitat and Fisheries – Accidents and Malfunctions

Accident / Malfunction	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	
Change in Fish Habitat											
Train Derailment	• Implementation of EPP and ERP. • Spill containment / cleanup / reclamation. • Manual / electronic / track inspections.	A	M	L	L	U	R	D/U	S	M	Monitor success of remediation.
Forest Fire	• Implementation of EPP and ERP. • Forest fire emergency response plan. • Fire suppression water supply.	N	L	R	L	U	R	D/U	N	M	None recommended.
Polishing Pond Dyke Breach	• Implementation of EPP and ERP. • Dyke design to CDA standards.	A	L	L	T/M	U	R	D/U	N	M	Monitor success of remediation.
Change in Fish Health or Mortality											
Train Derailment	• Implementation of EPP and ERP. • Spill containment / cleanup / reclamation. • Manual / electronic / track inspections.	A	M	L	M	U	R	D/U	S	M	Monitor success of remediation.
Forest Fire	• Implementation of EPP and ERP. • Forest fire emergency response plan. • Fire suppression water supply.	N	L	R	T	U	R	D/U	N	M	None recommended.
Polishing Pond Dyke Breach	• Implementation of EPP and ERP. • Dyke design to CDA standards.	A	L	L	M	U	R	D/U	N	M	Monitor success of remediation.

Accident / Malfunction	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	
Change in Utilization of Existing Fisheries											
Train Derailment	• Implementation of EPP and ERP. • Spill containment / cleanup / reclamation. • Manual / electronic / track inspections.	A	L	L	L	U	R	D/U	S	M	Monitor success of remediation.
Forest Fire	• Implementation of EPP and ERP. • Forest fire emergency response plan. • Fire suppression water supply.	A	L	R	L	U	R	D/U	N	M	None recommended.
Polishing Pond Dyke Breach	• Implementation of EPP and ERP. • Dyke design to CDA standards.	A	L	L	T	U	R	D/S	N	M	Monitor success of remediation.

Accident / Malfunction	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	

KEY

Direction:
- P Positive: condition is improving compared to baseline.
- N Neutral: no change compared to baseline.
- A Adverse: negative change compared to baseline.

Magnitude:
- N Negligible: no measureable adverse effects anticipated.
- L Low: measureable effects anticipated in low-sensitivity habitats and no measureable reduction in the number of fish species anticipated.
- M Moderate: measureable effects anticipated in moderately sensitive habitat or anticipated mortality risk to non-listed species.
- H High: measureable effects anticipated in highly sensitive habitat or habitat designated as important to listed species or anticipated mortality risk to listed species.

Geographic Extent:
- S Site Specific: effects restricted to PDA.
- L Local: effects extend beyond the PDA but remain within the LSA.
- R Regional: effects extend to the RSA.

Duration:
- T Temporary: effects are measureable for days to a few months.
- M Moderate: effects are measureable for up to a year but not multiple years.
- L Long term: effects are measurable for multiple years but not permanent.
- P Permanent – effects are permanent.

Frequency:
- U Unlikely.
- O Once: effect occurs only one time.
- S Sporadic: effect occurs more than once at irregular intervals.
- R Regular: effect occurs on a regular basis and at regular intervals.
- C Continuous: effect occurs constantly.

Reversibility:
- R Reversible: effect will cease during or after the Project is complete.
- I Irreversible: effects will persist after the life of the Project, even after habitat restoration and compensation works.

Environmental Context:
- U Undisturbed: effect takes place in an area that has not been previously affected by human development.
- D Developed: effect takes place in an area that has been previously affected by human developed, in an area where human development is still present, or in an area previously disturbed by Project activities.

Significance:
- S Significant:
  - A permanent and irreversible reduction in the productive capacity of fish habitat that remains after mitigation and compensation measures are implemented and which will likely result in an uncompensated HADD of fish habitat.
  - The likelihood of fish mortality, after mitigation measures are implemented, at a level that would require regulatory bodies to implement specific management plans for the recovery of the affected fish populations.
  - A significant measureable decrease in fish condition, below baseline conditions and directly attributable to Project activities, and which threatens the sustainability of the regional fisheries.
  - The Project is not compatible with recreational fishing activities, such that patterns of fishing are changes across the area.
- N Not Significant.

Prediction Confidence:
Based on scientific information and statistical analysis, and effectiveness of mitigation or effects management measure.
- L Low: biological processes not well understood, limited baseline data, predictive analysis not available, quantitative metrics limited, and mitigation measure effectiveness unknown.
- M Moderate: general biological processes understood, adequate baseline, some predictive analysis, quantitative metrics available, proven mitigation measures.
- H High: biological process well understood and predictable, adequate baseline and regional data, statistical and predictive modeling is proven, mitigation measures proven successful.

Other than any immediate mortality at the time of the breach, the effect to fish health or mortality resulting from a polishing pond dyke breach is likely to be of negligible to low magnitude due to the distance from the polishing pond to Long Lake. The residual adverse effects resulting from a derailment or dyke breach will likely not show a permanent increase in fish mortality or decrease in fish condition.

For forest fires, the potential residual effects would be negligible, and the direction would be neutral because there are no likely direct effects to fish mortality and health.

Fisheries

The residual environmental effects to fisheries resulting from a train derailment or dyke breach would be adverse and potentially long-term, but local and reversible. The potential residual effects resulting from a forest fire would be adverse and depending on the extent of the fire could be regional. The adverse effect would be temporary and reversible.

18.9 Determination of Significance of Residual Adverse Environmental Effects

18.9.1 Project-Related Residual Environmental Effects

Change in Fish Habitat

The magnitude of the residual adverse effect on fish habitat is considered low within the RSA because it is restricted to the site, and will be compensated in accordance with Section 35(2) of the *Fisheries Act*. The residual adverse effect is therefore not likely to be significant. The level of confidence is high because the effects of the Project are well understood and the success of previous Fish Compensation Plans for similar activities.

Change in Fish Health or Mortality

With respect to fish health or mortality, the only likely residual adverse environmental effect will be limited to injury and loss of fish during relocation efforts. The residual adverse effect is likely to be not significant because the magnitude is negligible, and will be limited to the Project site. The effect is reversible, which will permit recovery of the stock. The overall predictive confidence is high based on past fish relocation programs and monitoring.

Change in Utilization of Existing Fisheries

The residual effects to fisheries will be adverse with the loss of one known recreational fishing location, negligible, localized, reversible (upon Project decommissioning) but continuing through operations. The effects will likely be not significant based on alternative opportunities available for fishing and the required compensation in other areas to offset any habitat/production losses. There is high confidence in this prediction.

18.9.2 Cumulative Effects

With respect to Freshwater Fish, Fish Habitat, and Fisheries, cumulative effects within the RSA are likely to be limited due to the local extent and not likely significant residual effects predicted from the Project. With the proposed mitigation and environmental protection measures, the Project contributions to cumulative effects is not likely to be significant. Given there is negligible or low magnitude short-term interactions with other existing or planned projects, the cumulative effects of the Project acting in combination with other past, present, and planned projects and activities on Freshwater Fish, Fish Habitat, and Fisheries is determined to be not likely significant.

18.9.3 Accidents and Malfunctions

The residual environmental effects resulting from accidents and malfunctions are not likely to be significant, with the exception of a train derailment. Depending on the location and extent of the event, and the volume and nature of spilled material into a waterbody, the residual environmental effect to fish habitat, and to fish health and mortality could be significant. Although the residual effects on fisheries would be adverse, they are not likely to be significant because the removal of recreational fishing opportunities would likely be short term, reversible, and local in extent.

18.9.4 Overall Residual Effects Conclusion

Effects to Freshwater Fish, Fish Habitat, and Fisheries will be mitigated through commonly used practices to mitigate potential effects during construction, operation, and decommissioning of the Project. The baseline study identified no uniquely sensitive species or habitats. The habitat / production at risk will be compensated for where there is habitat destruction and/or loss of ecosystem productivity. Similarly, procedures will be in place to minimize potential direct and indirect losses of fish. Effects on fisheries will be limited, and measures will be taken to mitigate these by habitat compensation or other methods. An EPP will detail the environmental protection measures and the Fish Compensation Plan will detail the compensation requirements and follow-up monitoring to verify effective implementation of the plan. Therefore, there is no likely significant effect resulting from the Project to Freshwater Fish, Fish Habitat, and Fisheries.

18.10 Follow-Up and Monitoring

Following approval and initiation of the Project, monitoring will be implemented to ensure compliance in accordance with the *Fisheries Act* and other legislation. These will include:

- Compliance Monitoring:
  - Monitoring, testing and reporting as required by the MMER; and
  - Monitoring, testing and reporting as required by the DOEC Certificate of Approval.
- Fish Compensation Monitoring:
  - Compensation Plan compliance monitoring for effectiveness; and
  - EEM required under the Section 35(2) authorization.

- Environmental Effects Monitoring (EEM):
  - Biological Studies as required by the MMER.

18.11 Next Steps

Prior to construction, a Fish Compensation Plan and Environmental Protection Plan (EPP) will be developed. The Fish Compensation Plan will be developed in consultation with DFO. In addition to regulator involvement, public consultation will also be required. Mitigation measures for Freshwater Fish, Fish Habitat and Fisheries will be incorporated into the EPP.

18.12 Summary

Effects to fish habitat / productivity will be mitigated through development of a comprehensive Fish Compensation Plan, designed controls or treatment for surface water contaminants, and a rigorous water quality control and monitoring system for surface, process, and subsurface waters with adherence to MMER standards for all discharges. Significant adverse effects to fish habitat are therefore not likely. Significant adverse effects to fish health or mortality are not likely with proper mitigation, such as adherence to operational procedures and formal fish relocation plans.

There is no commercial fishing in the area and there are no reported Aboriginal or subsistence fisheries in the area. The direct interactions between the Project and current fisheries is limited, to one to five ponds near the proposed pit location and some localized pond and stream areas at stream crossings. Many other areas will remain available for recreational fishing, including those that comprise fish compensation.

19.0 BIRDS, OTHER WILDLIFE AND THEIR HABITATS, AND PROTECTED AREAS

19.1 Valued Ecosystem Component Definition and Rationale for Selection

Birds, Other Wildlife and their Habitats were selected as a Valued Ecosystem Component (VEC) because of the potential for interactions between Project activities and wildlife species and their habitat, and protected areas. This VEC is of importance to resource managers, and regulated under the federal *Migratory Birds Convention Act* (MBCA) and the Newfoundland and Labrador *Wildlife Act.* These species provide recreational, domestic (food supply) and economic benefit for residents in western Labrador.

This VEC includes migratory and non-migratory birds (i.e., waterfowl, raptors, shorebirds, wetland birds and other landbirds), amphibians, small mammals, ungulates (i.e., sedentary or migratory caribou populations in the region, and moose), furbearers (i.e., black bear, wolf, marten, red fox, beaver and otter). Species at risk or species of special conservation status are addressed in Chapter 20. Wetlands are addressed in Chapter 17 as there is some overlap of subject matter.

Protected Areas is a VEC because of the potential for interactions between Project activities and existing or planned designated protected areas (e.g., national, provincial and regional parks; protected natural areas and watersheds; ecological reserves) and the need to protect ecosystems, species diversity, important habitats and ecosystems. Protected Areas near the Project include Duley Lake Provincial Park Reserve and a series of Habitat Management Units established pursuant to Municipal Stewardship Agreements in Wabush and Labrador City in 2005. In addition, species and other ecosystem components within the Protected Areas are important to local residents, regional stakeholders, and regulatory authorities (i.e., municipal, provincial and federal) for recreation, economic and/or management considerations.

19.1.1 Approach to Assessment of Effects

Many wildlife species use habitats in the Project area for feeding, breeding and/or migrating through. Information used to determine the known or likely presence of wildlife species in or near the PDA was derived from reviews of local historical records and other baseline data sources including:

- *Species at Risk Act* (SARA), Newfoundland and Labrador *Endangered Species Act* (NLESA), Committee on the Status of Endangered Wildlife in Canada (COSEWIC) Status Reports, Recovery and Management Plans (where available);
- Government and non-government sources, (i.e., Atlantic Canada Conservation Data Centre (ACCDC) 2010 Provisional Status Ranks [Labrador], DOEC General Status Rankings [Labrador]); Breeding Bird Survey (BBS) data; eBird data;

- Published and unpublished literature by the Study Team and others, including peer-reviewed academic journals, research project reports, government publications; and
- Project field data collected as a part of the environmental baseline program for the Project (2011-2012).

The majority of relevant data were collected through surveys completed during the 2011 and 2012 field seasons. The field surveys included targeted forest landbird surveys, nine waterfowl surveys, two aerial winter wildlife surveys, and the collection wildlife use and potential of various habitats during Ecological Land Classification (ELC) surveys.

19.1.2 Issues

Issues and/or concerns raised by the public and Aboriginal groups are provided in Table 19.1.

Table 19.1 Issues related to Birds, Other Wildlife and their Habitat, and Protected Areas

Issue	Community / Organization	Summary of Comments Raised During Consultation and Engagement Activities	Response / Location in the EIS
Cumulative Effects on Wildlife Species	Innu Nation	Most elders and land users are afraid to hunt in the Wabush area because of the landscape and pollution. They are scared to eat the fish and animals. In the spring, summer and fall, Innu go hunt in that area. They are concerned with what partridges, beavers and other animals eat there. They are also concerned with contamination of fish.	Existing land and resource use by Aboriginal persons and potential health effects are discussed in Sections 22.5 and Chapter 25 of the EIS. In the EIS, potential effects to birds and wildlife have also been assessed and mitigation identified. See Section 19.6 for more information about this assessment.
	Innu Nation	There are cumulative effects from all of the projects in the area on the George River caribou herd.	This herd does not currently overlap the Project area, therefore potential effects from the Project are not anticipated. The range of the George River caribou herd is discussed in Section 19.5.3.
Potential Effects on wildlife Species	NNK	Alderon needs to make sure the land is protected and that the environmental impacts are minimal.	The purpose of the EA process is to identify mitigation measures to avoid or reduce environmental issues or effects. These are described throughout the EIS and summarized in Chapter 27.

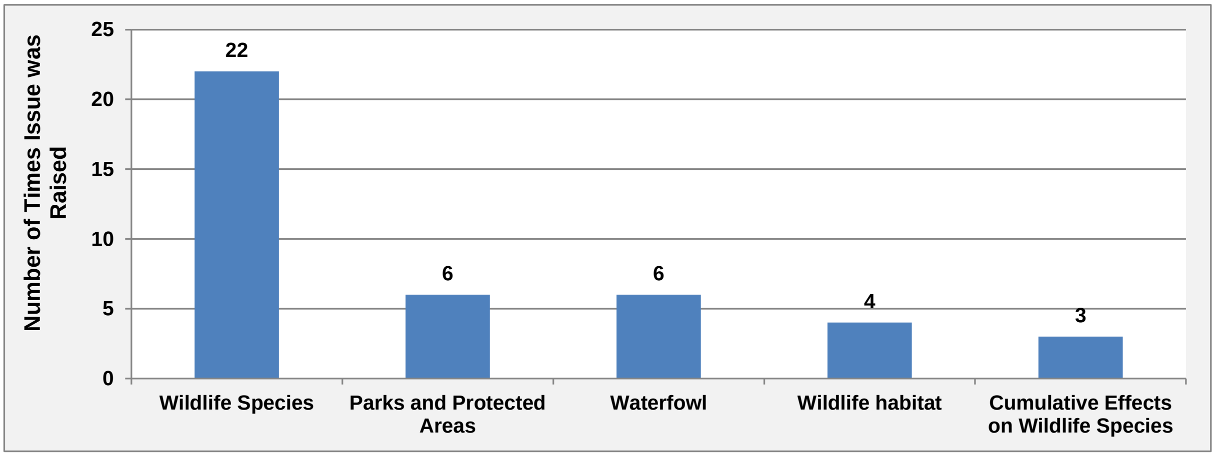
Issue	Community / Organization	Summary of Comments Raised During Consultation and Engagement Activities	Response / Location in the EIS
	Innu Nation	Alderon should put a fence around the tailings and the pit to prevent wildlife (e.g. caribou and partridge) that go in these areas from eating the tailings.	The TMF will be contained by a series of natural ridges and containment dams/dykes. Key considerations in the design and planning of the TMF are described in Section 2.5.4 and 2.6.2. Section 19.6 includes an assessment of potential effects to wildlife and their mitigation.
	Innu Nation of Matimekush-Lac John	Concern about potential effects of the Project on caribou. Caribou are presently hunted near Smallwood reservoir.	Caribou herds do not currently overlap the Project area, therefore potential effects from the Project are not anticipated. The range of the George River caribou herd is discussed in Section 19.5.3.
	NNK	Community members have followed caribou into Labrador in the past and may again in the future. The caribou once came through the community but not anymore (there were 900,000 caribou, now there are around 80,000). One caribou came into the community over Christmas, and this was the first in 6 years.	
	NNK	There are cumulative effects of all projects in the area on the George River caribou herd. The Project will potentially affect the George River herd, which is located just outside of the limits of Wabush.	

Issue	Community / Organization	Summary of Comments Raised During Consultation and Engagement Activities	Response / Location in the EIS
	Labrador City / Wabush	Specific wildlife sightings reported by community members: lynx in southwest corner area; wolverine in area but no fisher; wolves (>6) are going around in circles around community; Mourning Dove (first sighting in 1981); American Robin (seen in Labrador West until Christmas); Eastern Bluebird (sighting in November); Gray-cheeked Thrush (sightings to the east) Bald Eagle (probable nest around Dolomite quarry); Great Horned Owl (nest is located on north end of Riordan Lake); Boreal owl (common); Hawk Owls (further east); phalaropes; bats (20-40 at cabin); marmot; and wolverine (uncertain); Great Horned Owl, Snowy Owl, otters, lynx, marmot, muskrat, moose. Barred Owl (great horned owl) nesting.	A description of existing wildlife is provided in Section 19.5. Baseline data collection for the EIS included aerial surveys for waterfowl completed in 2011, songbird survey completed in 2011 and 2012, and winter aerial surveys in 2012. Potential effects to wildlife have been assessed and mitigation identified. See Section 19.6 for more information about this assessment.
	Labrador City / Wabush	Specific wildlife sightings reported by community members: wood duck are rare but active in incinerator gully; Harlequin duck are in Jean Lake and Wabush Pond during migration bird count; diver (June-October).	

Issue	Community / Organization	Summary of Comments Raised During Consultation and Engagement Activities	Response / Location in the EIS
Potential Effects on Waterfowl	Cabin Owners	An important issue for me is community impact due to the destruction of wildlife.	Existing land and resource use is discussed in Sections 23.5 of the EIS. In the EIS, potential effects to birds and wildlife have also been assessed and mitigation identified. See Section 19.6 for more information about this assessment.
Potential Effects on Wildlife Habitat	Le mouvement citoyen de Fermont	Is the Quebecois territory at risk of deforestation in the future by the Alderon mine?	Alderon has no plans to harvest timber. A complete list of Project activities are included in Section 2.6.
	Innu Nation	Alderon needs to be cautious of bogs and streams around the mine to make sure they do not flow in lakes and contaminate them.	Alderon will treat all effluent to meet regulatory standards, including *Metal Mining Effluent Regulations,* prior to release into the environment. The key characteristics and features of the TMF and effluent treatment infrastructure are described in Section 2.5.4 and 2.6.2. See Section 16.6 for more information about the assessment and mitigation of effects on water resources.
	Labrador City / Wabush	Are the potential effects of the Project on wildlife being studied? What will be the effects on Jean Lake? Will there be any effect on the wildlife at Mills Lake from tailings drainage?	Jean Lake rapids will use existing crossing, dust will be controlled, and effects will be mitigated to existing area of effect. Effluent will be treated to ensure compliance with release criteria and will be tested monthly. Additional information is presented in Chapter 19 and 20.

The frequency of issue type is summarized in Figure 19.1.

Figure 19.1 Frequency of Issue Type related to Birds, Other Wildlife and their Habitat, and Protected Areas



The assessment of environmental effects to Birds, Other Wildlife and their Habitats, and Protected Areas has been discussed with government agencies, most notably with Environment Canada and the provincial departments of Environment and Conservation, and of Natural Resources. The results of baseline surveys and the proposed methodology to assess the Project effects were discussed in detail with these regulatory agencies and presented at a series of public consultations in March 2012. Comments regarding the approach and scope were incorporated into subsequent field work in 2012.

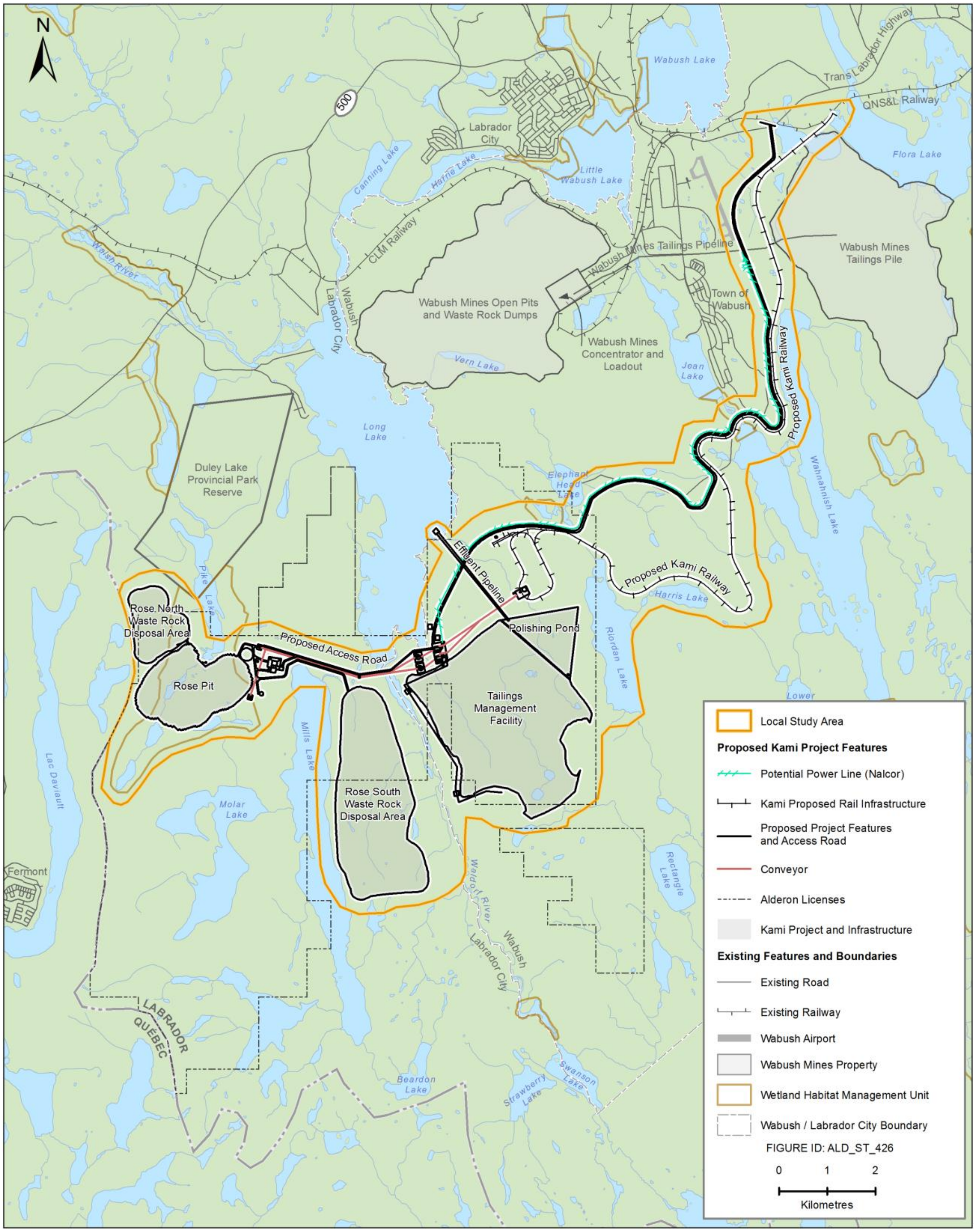
19.2 Environmental Assessment Boundaries

19.2.1 Spatial Boundaries

Local Study Area

The Local Study Area (LSA) includes all proposed Project infrastructure (i.e., mine site, Tailings Management Facility (TMF), waste rock disposal areas, concentrator buildings, office buildings, access road, rail infrastructure, and powerline components), with a 500 m buffer placed around these Project components. The LSA includes the area that will be directly affected by surface disturbance activities (i.e., the Project footprint), in addition to the buffer, which represents a zone of other potential effects (e.g., air emissions or particulates, dust). The LSA area is approximately 71 km^2 (Figure 19.2).

Figure 19.2 Local Study Area



Regional Study Area

The Regional Study Area (RSA) includes the LSA and surrounding area to provide a regional context for understanding Birds, Other Wildlife and their Habitat that could potentially interact with the Project. The RSA was defined to capture the farthest measurable effect of the Project on these species. It is the area within which cumulative effects for this VEC may occur. The RSA is the area within which the significance of Project effects is predicted. The RSA boundary encompasses an area of approximately 1,193 km^2 (Figure 19.3).

The RSA for Protected Areas includes the LSA and surrounding area within the municipal boundaries of the towns of Labrador City, Wabush, and Fermont (Figure 19.3). This RSA provides a regional context for potential effects to Protected Areas of greatest interest for this Project; those Management Units identified in the municipal Habitat Conservation Plans [Town of Wabush (2009), Town of Labrador City (2010a)]. This RSA differs from that associated with Birds, Other Wildlife and their Habitats as the measureable parameter of interest relates to the quantity and quality of lands within Protected Areas, versus the fauna of interest under the other aspect of this VEC. It also encompasses key areas used for resource harvesting, recreation and cultural activities. The RSA is the area within which cumulative effects for Protected Areas may occur. The RSA is the area within which the significance of Project effects is predicted for the entire VEC.

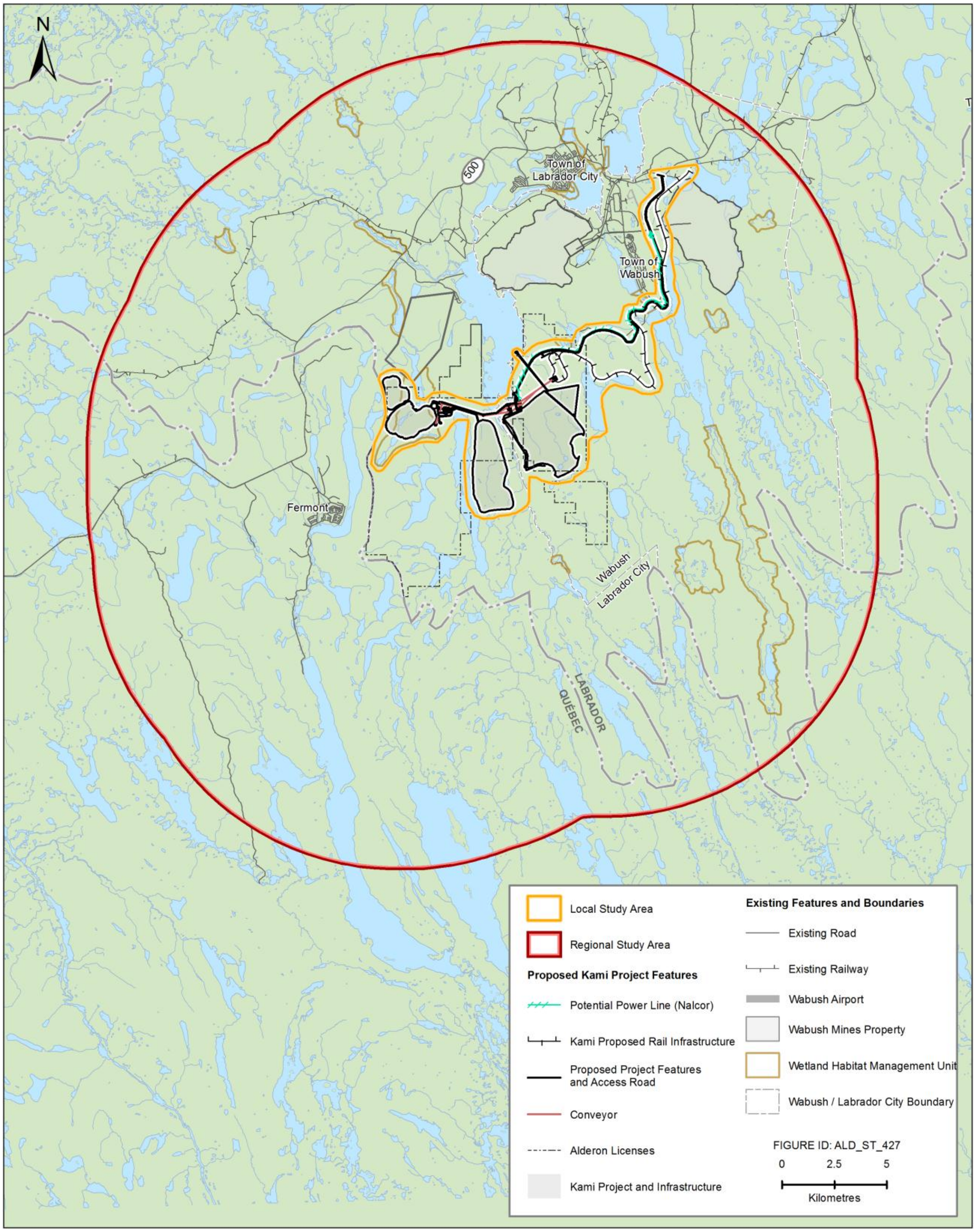
19.2.2 Temporal Boundaries

The temporal boundaries for the assessment of potential environmental effects of the Project on Birds, Other Wildlife and their Habitats, and Protected Areas include the Project phases of construction (approximately two years), operation and maintenance (approximately 17 years), and decommissioning / reclamation (approximately one year after operations cease). While many birds and other wildlife are resident in the Project area throughout the year, others are present seasonally, either during the breeding season, or in passage during spring and fall migration.

19.2.3 Administrative Boundaries

Several regulations and policies at the federal and provincial levels apply to management and mitigation of wildlife resources during the construction and operational phases of the Project. These include the *Migratory Birds Convention Act*, *Species at Risk Act*, Newfoundland and Labrador *Wildlife Act*, and Newfoundland and Labrador *Endangered Species Act*.

Figure 19.3 Local and Regional Study Areas for Birds, Other Wildlife and their Habitat, and Protected Areas



Migratory Birds Convention Act

The purpose of the *Migratory Birds Convention, 1994* (MBCA) is to protect and conserve migratory bird populations and individuals and their nests. Migratory birds covered under the MBCA in Canada, include (refer to Environment Canada 1991 for full list):

- Waterfowl (e.g., ducks and geese);
- Cranes (e.g., sandhill cranes);
- Shorebirds (e.g., plovers and sandpipers); and
- Songbirds (e.g., robins).

Birds not falling under federal jurisdiction within Canada include grouse, quail, pheasants, ptarmigan, hawks, owls, eagles, falcons, cormorants, pelicans, crows, jays and kingfishers. Most birds not included in this list are protected under provincial laws.

The possession or purchasing, selling, exchanging or giving a migratory bird or nest are prohibited without authorization, as stated in Section 5 of the MBCA. As an amendment to the MBCA, Bill C-15 "expands the purpose of the Act to include conserving migratory birds… specifies that the birds are to be protected and conserved as populations and as individual birds… incorporates habitat and ecosystem concepts, along with concern for the protection of individuals" (Government of Canada 2005). The MBCA is the enabling statute for the *Migratory Birds Regulations,* 1994*.*

In the *Migratory Birds Regulations*, Section 6 states that the disturbance, destruction, taking a nest, egg, nest shelter, eider duck shelter or duck box of a migratory bird; possessing a migratory bird, carcass, skin, nest or egg of a migratory bird are prohibited (Government of Canada 2011a). In addition, Section 35 (1) has been repealed and replaced with Section 5(1) of the MBCA which prohibits the deposition of substances harmful to migratory birds in waters or areas frequented by migratory birds or in a place from which the substance may enter such waters or such an area.

As there are no authorizations to allow construction-related effects on migratory birds and their nests, best management practices must be followed to prevent contravention of the MBCA.

Newfoundland and Labrador Wildlife Act

In Newfoundland and Labrador, wildlife protection is governed through the *Wildlife Act*, applied in conjunction with the *Labrador Inuit Land Claims Agreement Act*, and with the Department of Environment and Conservation responsible for managing the province's wildlife resources. Section 7.1(a) of the Newfoundland and Labrador *Wildlife Act*, 1990 prohibit the hunting, taking or killing of wildlife or classes of wildlife whether in particular places or at particular times and seasons or by particular methods except under licence or permit. Furthermore, Section 7.1(j) prevents the disturbance of wildlife in reserved areas, in wildlife parks or in other specified places.

According to the Newfoundland and Labrador *Wildlife Regulations*, 1996, Section 14 states that:

> *(1) A person shall not hunt, trap, take or kill any furbearing animal except during the open season prescribed in these regulations or in any order made under them.*
>
> *(2) A person shall not possess a trap, snare or other device commonly used to take furbearing animals in any area frequented by wild life except during the open seasons prescribed in the Furbearing Animals Trapping Order.*
>
> *(3) A person shall not hunt, take or kill a furbearing animal by means of firearms except that the holder of a trapper's licence who is also the holder of a permit to carry firearms may use that firearm to kill furbearing animals that are alive in traps or snares.*

In addition, Section 75 states that:

> *(1) A person shall not hunt, take or kill small game except during the open season prescribed under these regulations or the Migratory Birds Regulations (Canada).*
>
> *(2) A person shall not take or destroy the nests or eggs of any wild birds except when authorized under the provisions of the Migratory Birds Convention Act (Canada) and the regulations.*

The Newfoundland and Labrador *Wildlife Act* provides regulations for all hunters, big and small game, trapping, and migratory game birds. In combination with other provincial regulations and acts including the *Wilderness and Ecological Reserves Act* and the *Endangered Species Act*, the biodiversity and wildlife resources of Newfoundland and Labrador will not be compromised.

Protected Areas

Duley Lake Provincial Park Reserve is located 10 km south of Labrador City and has an area of approximately 7 km^2 (DOEC 2011). The main purpose of the Duley Lake Park Reserve is to protect open lichen woodlands, which is representative of Ecoregion V (Labrador). Day use is allowed in the Park Reserve; however, overnight camping and timber harvesting are not permitted.

The municipal Wetlands Stewardship Program distinguishes two levels of priority for wetland habitat: Stewardship Zones and Management Units. Stewardship Zones encompass important wetlands within municipal boundaries. Under a Wetland Stewardship Agreement, a municipality agrees to permit only those activities within the Stewardship Zone that have no negative or adverse impacts upon the wetland habitats or the waterfowl and other species that utilize those habitats. A guiding principle for the Stewardship Zones is no net loss of wetland habitat. Management Units, on the other hand, are areas of wetland defined by Eastern Habitat Joint Venture (EHJV) biologists and residents to be important for waterfowl and therefore habitat alteration or degradation due to development should be prohibited. Management Units are intended to be incorporated into the Municipal Plan as environmentally "sensitive areas", "conservation areas" or sometimes formal "protected areas". Biologists from the provincial Wildlife Division work with communities that have signed an Agreement to develop a Habitat Conservation Plan, which identifies the boundaries of the Stewardship Zone and Management Units and describes recommended actions for conserving and enhancing waterfowl habitat. Under the Wetlands Stewardship Agreement, the town identifies designated Management Units as protected areas within their Habitat Conservation Plans (and subsequently indicated in Municipal Plans) under subsection 13(3) of the *Urban and Rural Planning Act, 2000*.

19.3 Establishing Standards or Thresholds for Determining the Significance of Environmental Effects

Significance of environmental effects is assessed in accordance with CEA Agency guidelines:

- **Direction:**
  - Positive – Beneficial or desirable change in the environment;
  - Neutral – No detectable or measureable change in the environment; or
  - Adverse – Worsening or undesirable change in the environment.
- **Magnitude:**
  - Low - the residual Project effects (alteration / loss) are not expected to exceed 5 percent of the known population in the RSA, and are not measurable;
  - Moderate - the residual Project effects (alteration / loss) are expected to be greater than 5 percent but less than 25 percent of the known population in the RSA, and the effect can be measured; or
  - High - the residual Project effects (alteration / loss) are expected to exceed 25 percent of the known population in the RSA; the effect can be easily observed, measured and described, and may be widespread.
- **Geographic Extent:**
  - Site-specific – Effect confined to the Project footprint for all Project components (i.e., PDA), and limited to directly affected environmental components;
  - Local – Effect extends beyond the Project footprint into the surrounding areas within the LSA;
  - Regional – Effect extends beyond the LSA into the RSA, where indirect or cumulative effects may occur; or
  - Beyond Regional (provincial, national, and/or international extent) - Effect extends beyond the RSA, where indirect or cumulative effects may occur.
- **Frequency:**
  - Once - Effect occurs once during the life of the Project (e.g., clearing);

  - Sporadic - Effect occurs sporadically, at irregular intervals, without any predictable pattern during the life of the Project (e.g., hydrocarbon spills);
  - Regular - Effect occurs at regular intervals during the life of the Project; or
  - Continuous - Effect occurs continuously.
- **Duration:**
  - Short term – Effect occurs during the site-preparation or construction phase of the Project (i.e., 1 to 2 years);
  - Medium term – Effect extends throughout the construction and operation phases of the Project (up to 17 years);
  - Long term – Effect is greater than 17 years; or
  - Permanent - Effect persists.
- **Reversibility:**
  - Reversible – Effect is reversible during the life of the Project; or
  - Irreversible – A long-term effect that is permanent (i.e., remains indefinitely as a residual effect).
- **Ecological Context:**
  - Undisturbed - Area relatively or not adversely affected by human activity; or
  - Disturbed - Area has been substantially previously disturbed by human development or human development is still present.

A significant adverse residual environmental effect for Birds, Other Wildlife and their Habitat, and Protected Areas is defined as a Project-related environmental effect on fauna species that:

- Results in the degradation, alteration or loss of critical or important habitat (physical loss, noise, light and other stimuli), either physically, chemically, or biologically; in quality or extent, in such a way as to cause a change or decline in the distribution or abundance of a species that is dependent upon that habitat, such that the likelihood of the long-term viability or survival of the population within the RSA is substantially reduced as a result; or,
- A significant adverse residual environmental effect for Protected Areas is defined as a Project-related environmental effect that results in the degradation, alteration or loss (e.g., physical loss, noise, light and other stimuli) in the quantity and quality of Protected Areas, either physically, chemically, or biologically; in quality or extent, in such a way as to cause a change or decline in the effectiveness of that protected status, such that the likelihood of the long-term viability or designated function of the Protected Areas within the RSA is substantially reduced.

An environmental effect that does not meet any of the above criteria is rated as not significant.

19.4 Potential Project-VEC Interactions

The assessment of this VEC is focused on the following environmental effects:

- Change in habitat;
- Change in distribution and movement;
- Change in mortality risk;
- Change in health; and
- Change in protected areas.

Table 19.2 provides a list of Project activities and physical works and whether or not an interaction is expected to occur with each identified potential environmental effect. The interactions are ranked either as a 0, no interaction occurs, 1, interaction occurs however the resulting effect can be managed through proven mitigation and codified practice, or as a 2, an interaction occurs and requires further assessment.

Table 19.2 Potential Project Environmental Effects to Birds, Other Wildlife and their Habitat, and Protected Areas

Project Activities and Physical Works	Potential Environmental Effects				
	Change in Habitat	Change in Distribution and Movement	Change in Mortality Risk	Change in Health	Change in Protected Areas
Construction					
Site Preparation (including clearing, excavation, material haulage, grading, removal of overburden and stockpiling)	2	2	2	2	2
Construction of Roads	2	2	2	2	2
Construction of Site Buildings and Associated Infrastructure (maintenance facilities, offices, plant, crushers, concentrator, conveyors, gatehouse, pumphouses, substation, security fencing, sanitation system)	1	2	1	1	1
Construction of Mine Tailings Management Facility (TMF)	2	2	1	2	2
Construction of Railway and Load-out Facilities (silos)	2	2	1	1	2
Construction of Power Line	2	2	1	1	1
Construction of Stream Crossings	2	2	1	1	2
Installation of Water Supply Infrastructure (wells, pumps, pipes)	2	2	1	1	2
Onsite Vehicle / Equipment Operation	1	2	2	1	1
Waste Management	1	2	2	1	1
Transportation of Personnel and Goods to Site	1	2	2	1	2

Project Activities and Physical Works	Potential Environmental Effects				
	Change in Habitat	Change in Distribution and Movement	Change in Mortality Risk	Change in Health	Change in Protected Areas
Expenditures	0	0	0	0	0
Employment	0	0	0	0	0
Operation and Maintenance					
Open Pit Mining (including drilling, blasting, ore and waste haulage, stockpiling, dewatering)	1	2	1	2	2
Ore Processing (including crushing, conveying, storage, grinding, screening)	1	2	1	2	2
Concentrator Operations (gravity and magnetic separation, tailings dewatering, tailings thickener, concentrate conveyance to load-out)	1	1	1	1	1
Tailings Disposal in TMF	1	2	2	2	2
Waste Rock Disposal on Surface	1	2	1	2	2
Water Treatment (including mine water and surface runoff) and Discharge	1	1	2	2	1
Rail Load-Out by Silo Discharge	1	1	1	2	2
Rail Transport	1	2	2	1	2
Onsite Vehicle / Equipment Operation and Maintenance	1	2	2	1	1
Waste Management	1	1	1	1	1
Transportation of Personnel and Goods to Site	1	1	2	1	2
Fuel Storage and Dispensing	1	1	1	1	1
Progressive Rehabilitation	2	2	1	2	2
Expenditures	0	0	0	0	0
Employment	0	0	0	0	0
Decommissioning and Reclamation					
Site Decommissioning	1	1	1	1	1
Site Reclamation (building demolition, grading, scarifying, hydroseeding)	2	2	2	2	1
Accidents and Malfunctions					
Train Derailment	2	2	2	2	2
Forest Fires	2	2	2	2	2
Polishing Pond Dyke Breach	2	2	2	2	2

KEY
0 No interaction
1 Interaction occurs; however, based on past experience, the resulting effect can be managed to acceptable levels through standard operating practices and/or through the application of best management or codified practices. No further assessment is warranted.
2 Interaction occurs, and resulting effect may exceed acceptable levels without implementation of specific mitigation. Further assessment is warranted.

Interactions Ranked as 0

As summarized in Table 19.2, a number of potential interactions are not expected to occur (0) or might occur, but do not warrant further assessment because the resulting effect can be limited to acceptable levels through standard approaches. In terms of no interaction with the effects and the Project, Expenditures or Employment during either construction or operation and maintenance would be considered to have no measurable influence on this VEC.

Interactions Ranked as 1

There are several Project activities that will have interactions with change in habitat that can be easily limited to acceptable levels. Construction of site buildings and associated infrastructure, onsite vehicle / equipment operation, waste management, and transportation of personnel and goods to site are expected to be within the area already cleared (i.e., no additional clearing required). During operation and maintenance, all of the remaining Project activities except progressive rehabilitation will occur within an area that is already disturbed habitat. Site decommissioning will result in changes, but all the areas affected are likely to be previously disturbed, and the net change in wildlife habitat availability is expected to be positive.

During construction, most Project activities (except those identified as 0 above) will influence the change in distribution and movement. However, a number of Project activities during operations and maintenance are expected to have minor interactions with distribution and movement of birds and other wildlife. Concentrator operations, water treatment and discharge, rail load-out, waste management, transportation of personnel and goods to site, and fuel storage and dispensing may through sensory disturbance have an acceptable effect on distribution and movement of birds and other wildlife. Site decommissioning will result in changes, but for most birds and other wildlife will likely results in a net increase in occurrence.

A variety of Project activities have the potential to increase risk of mortality, but to an extent that would be acceptable. During construction, these include construction of site buildings and associated infrastructure, construction of the TMF, construction of railway and load-out facilities, construction of power line, construction of stream crossings, and installation of water supply infrastructure. During operation and maintenance, activities that may result in a minor increase in mortality include open pit mining, ore processing, concentrator operations, waste rock disposal on surface, rail load-out by silo discharge, waste management, fuel storage and dispensing, and progressive rehabilitation since all these activities have potential to cause mortality through collisions or other direct effects, but few birds or other wildlife are expected to be present in proximity to these activities due to previous displacement and ongoing sensory disturbance. During progressive rehabilitation and site decommissioning, there is also a small risk of mortality associated with operations.

Changes in health are anticipated to be largely related to generation of dust. However, a variety of Project activities are expected to be local and/or short-term and generate relatively little dust and therefore their effect on health of birds and other wildlife is expected to be managed to acceptable levels. During construction, these include construction of site buildings and associated infrastructure, construction of the TMF, construction of railway and load-out facilities, construction of power line, construction of stream crossings, installation of water supply infrastructure, onsite vehicle / equipment operation, waste management, and transportation of personnel and goods to site. During operation and maintenance, activities expected to cause a minor change in the health of birds and other wildlife are concentrator operations, rail transport, onsite vehicle / equipment operation and maintenance, waste management, transportation of personnel and goods to site, and fuel storage and dispensing. Site decommissioning is also expected to generate some change in health, through generation of dust that would be controlled through mitigation and appropriate codified practices.

Interactions Ranked as 2

A detailed environmental effects analysis was completed for interactions that have the potential to result in significant adverse environment effects to habitat, distribution and movement, mortality risk, and Protected Areas. Changes in protected areas consider the other effects for this VEC as it is the integrity of the habitat and the species it supports that underlines the conservation function for a given area.

Selection of Environmental Effects and Measurable Parameters

The measurable parameters used for the assessment of the environmental effects presented above and the rationale for their selection is provided in Table 19.3.

Table 19.3 Measurable Parameters for Birds, Other Wildlife and their Habitat

Environmental Effect	Measurable Parameter	Rationale for Selection of the Measurable Parameter
Change in Habitat	Primary or other sensitive or limiting habitat (km^2) (physical change)	Habitat loss or alteration can lead to changes in wildlife abundance, behaviour and/or species mortality and breeding success. The *Migratory Birds Convention Act*, SARA and Newfoundland and Labrador *Endangered Species Act* afford protection to habitat for species of migratory birds and/or species of conservation concern. Habitat lost or altered is characterized as a proportion of habitat (ha) in the RSA.
Change in Distribution and Movement	Density and distribution of individuals on the landscape; Sensory disturbance (noise – sound pressure levels measured in dBA; light; other stimuli)	Sensory disturbance to wildlife behaviour can result in potential change of behaviour including feeding, breeding, migration and movement, in response to: • Physical hazards and attractants for wildlife (e.g., roads, pits, and other structural features); • Chemical hazards and attractants for wildlife (e.g., identified contaminants of potential concern); and • Sensory disturbance causing wildlife attraction or deterrence (e.g., noise, light, and human presence).
Change in Mortality Risk	Mortalities Amount of new access Volume of air emissions	Direct mortality can occur through collision with trains or construction vehicles. Indirect mortality can result from an increase in predation, hunting and/or poaching because of improved access or other habitat changes. Loss of individuals is characterized as a proportion of the population in the RSA. A change in mortality risk may occur as a result of contamination from emissions.

Environmental Effect	Measurable Parameter	Rationale for Selection of the Measurable Parameter
Change in Health	Reproductive output and success	Physiological effects from contamination could cause lowered fitness amongst animals breeding in the LSA.
Change in Protected Area	Amount (km^2) of designated Protected Area function lost or altered	Examines the spatial and other sensory emissions (such as visual, noise or air) that overlap Protected Areas in a manner that compromises the effectiveness of the protection status. Important to resource managers, municipal councils, residents and others in Labrador west.

19.5 Existing Environment

19.5.1 Information Sources

Information used to determine the known or likely presence of wildlife species in or near the PDA was derived from a variety of baseline data sources, including traditional knowledge, reviews of literature and other information sources, wildlife field surveys, and an ELC habitat analysis.

Local and Aboriginal Traditional Knowledge

Local knowledge regarding Birds, Other Wildlife and Their Habitats and Protected Areas is presented in Table 19.4.

Table 19.4 Local Knowledge – Birds, Other Wildlife and Their Habitats, and Protected Areas

Date	Stakeholder	Community	Comment
March 1, 2012	Individual	Wabush	Wildlife sightings in area identified: • Lynx in southwest corner area; • Wolverine in area but no fisher; and • Wolves (>6) are going around in circles around community.
March 14, 2012	Individual	Labrador City	Approximately 24 active birders on distribution. Provided information about bird and other wildlife sightings in area. • Mourning dove first sighting in 1981. • American robin seen in Lab West until Christmas. • Eastern bluebird sighting in November. • Gray-cheeked thrush – some sightings to the east. • Cabin owners with cabin on west side of Mills Lake confirmed loon sightings. Other wildlife includes great horned owl, snowy owl, otters, lynx, marmot, muskrat, moose. Barred owl (great horned owl) nesting. • Bald eagle probable nest around Dolomite

Date	Stakeholder	Community	Comment
			quarry. • Photo confirming presence of marmot. Also have 30 to 40 bats at cabin. Diver June to October. • Great horned owl nest is located on north end of Riordan Lake. Boreal owl is also common, Hawk owls further east around km 195/200. • Some phalaropes being picked up. • Major declines in sparrow use of Wabush tailings re-vegetation • Wolverine uncertain
March 14, 2012	Individual	Labrador City	CBC Radio aired on interview of Ducks Unlimited and environmental group discussing impact of this project on bird life. Wood duck are rare but active. Harlequin duck are in Jean Lake and Wabush Pond during migration bird count (Gordon Parsons).

Aboriginal traditional knowledge has been collected through engagement activities. Currently, there is no known published source of Aboriginal traditional knowledge collected at or near the Project area. In the absence of this, Aboriginal traditional knowledge was also collected through published sources from other areas. This information is presented in Table 19.5.

Table 19.5 Aboriginal Traditional Knowledge - Birds, Other Wildlife and Their Habitats, and Protected Areas

Group	Source	Page or Date Reference	Comment or Excerpt
Naskapi Nation of Kawawachikamach	Consultation Meeting with Naskapi Nation of Kawawachikamach	January 23, 2012	They do not currently practice land use activities in the Project area but still have land claims in Labrador. Naskapi have an unresolved land claim deep in Labrador territory. They have followed the caribou there in the past and may again in the future. The caribou once came through the Kawawachikamach community but no longer. At one point there were 900,000 caribou; now there are around 80,000. One caribou came into the Kawawachikamach community over Christmas, and this was the first in 6 years.
Naskapi	Consultation Assessment Report CEAR Doc#501	p.13-9	The Naskapi moved with the herd, ranging through its annual range, travelling north to Ungava Bay, east to the coast and south to the Churchill River (Henriksen 1978). They hunted caribou during the migration past Indian House Lake.

Group	Source	Page or Date Reference	Comment or Excerpt
Naskapi	Consultation Assessment Report CEAR Doc#501	P.13-9	In the past, some of the best caribou harvesting areas were between Border Beacon and Lake Mistastin, east and northeast of Indian House Lake, and just north of Border Beacon (Henriksen 1978). Naskapi of Schefferville hunted slightly north of Churchill Falls in the early 1960s (Henricksen 1978). Wolves follow the caribou herds.
Naskapi First Nation	Weiler, M. 2009. Naskapi Land Use in the Schefferville, Quebec, Region. Prepared as an Appendix to the Environmental Assessment of the Direct Shipping Ore Project		This data set contained no records of caribou hunting activities in vicinity of IOC mining operations. One of the explanations for this lack of hunting activities in these particular locations was that migrating caribou were avoiding this area due to the noise and dust created by the mining machinery, blasting and truck traffic as well as that these activities had denuded much of the area of the vegetation caribou might feed on.
Naskapi First Nation	Weiler, M. 2009. Naskapi Land Use in the Schefferville, Quebec, Region. Prepared as an Appendix to the Environmental Assessment of the Direct Shipping Ore Project		As the migration passes, some caribou tend to stay behind and overwinter in small, scattered groups in the Howells River valley and on the plateau to the west of it, both wooded areas that are able to provide shelter and sustenance to the animals. Hunting activities in these areas therefore tend to occur in late-season (after the main migration has passed) and winter. Since the George River caribou herd has recovered from its crash in the early 1900s and begun to reappear in significant numbers in the Schefferville region, and since mining activity along the Ridge has ceased and the area has become accessible to hunters, it has become the primary caribou hunting area during the fall.
Naskapi First Nation	Weiler, M. 2009. Naskapi Land Use in the Schefferville, Quebec, Region. Prepared as an Appendix to the Environmental Assessment of the Direct Shipping Ore Project		Most of the interviewees commented on the valley's special richness in small game. The strong population of porcupine seems to be particularly appreciated. Porcupine is a highly nutritious food resource, and the largest animal of the small game species. Over many decades, porcupine populations were fairly low across the entire hunting territory of the Naskapi. During the past 20 years, however, porcupine populations have gradually been rebounding, and the Howells River valley has become a very reliable source of porcupine for Naskapi hunters.

Group	Source	Page or Date Reference	Comment or Excerpt
Naskapi First Nation	Weiler, M. 2009. Naskapi Land Use in the Schefferville, Quebec, Region. Prepared as an Appendix to the Environmental Assessment of the Direct Shipping Ore Project		Small game is also hunted on the Ridge, primarily ptarmigan, and, in some sheltered wooded areas, hare. Along the more heavily vegetated eastern slopes, grouse and porcupine may be found as well. Ptarmigan, hare and porcupine have been identified as three of the small game species harvested in the Swampy Bay River portion of the Study Area around La Tesserie and Hameau lakes. Ptarmigan and porcupine are indicated as being hunted in the Guillet and Matemace lakes area.
Naskapi First Nation	Weiler, M. 2009. Naskapi Land Use in the Schefferville, Quebec, Region. Prepared as an Appendix to the Environmental Assessment of the Direct Shipping Ore Project		During the spring migration, both geese and ducks are harvested in the Howells River valley. Along the course of the river and the associated string of lakes there are a number of Ashkui sites where the water opens up early in the spring. These are the sites most attractive to migrating waterfowl inducing them to land, rest and feed. And these are also the most productive hunting locations. Stakit Lake in the southern valley and Kivivic and Rosemary lakes in the northern part were most frequently identified as waterfowl hunting areas. During the summer, the valley is reported to retain a considerable breeding population of geese and ducks nesting mostly in the wetlands along the western shore of the Howells River, and especially so on the western side Kivivic Lake. Some of the interviewees hunt these resident populations during the molting period in June or later in the summer.
Naskapi First Nation	Weiler, M. 2009. Naskapi Land Use in the Schefferville, Quebec, Region. Prepared as an Appendix to the Environmental Assessment of the Direct Shipping Ore Project		During the fall migration, the hilltops along the Ridge offer staging areas for flocks of geese. Attracted by a good supply of berries growing on the northern half of the Ridge, geese rest and feed there before moving on. This area is therefore used for goose hunting in the fall, when access to this resource is generally much more difficult than it is during the spring migration. Waterfowl hunting is also carried out in the Swampy Bay River basin. Within the Study Area, lakes Annabel, Hameau, Mollie, and La Tesserie have been confirmed as waterfowl hunting areas. Hunting there is done mostly during the spring migration.

Group	Source	Page or Date Reference	Comment or Excerpt
Naskapi First Nation	Weiler, M. 2009. Naskapi Land Use in the Schefferville, Quebec, Region. Prepared as an Appendix to the Environmental Assessment of the Direct Shipping Ore Project		Populations of forest-dwelling species such as marten, weasel, ermine, squirrel and lynx are strong and are harvested by Naskapi trappers. The same can be said of riparian species such as otter, mink and muskrat. Presently, beaver numbers appear to be moderate but rising. Beaver lodges are reported to be located near the mouths of many of the smaller Howells River tributaries and in the wetlands along the western shore of Kivivic Lake. Beavers are trapped by some of the interviewees, while others are waiting for their numbers to increase further.
Naskapi First Nation	Weiler, M. 2009. Naskapi Land Use in the Schefferville, Quebec, Region. Prepared as an Appendix to the Environmental Assessment of the Direct Shipping Ore Project		Wolves and (red) foxes are plentiful in the valley and both are harvested in good numbers. The number of wolves tends to increase during the time of the caribou migration. Wolverines are reported to be present in this area, and are sought after by trappers. Sightings of wolverine tracks and the animal itself have been indicated, but none of the interviewees reported a wolverine catch.

Literature and Information Review

A literature and information review was conducted to determine the likelihood of presence for various fauna species within the RSA. The status of each species of interest was determined through a review of SARA, NLESA, and Committee on the Status of Endangered Wildlife in Canada (COSEWIC) Status Reports, Recovery and Management Plans (where available). Data from citizen initiative data sources such as Breeding Bird Survey (BBS) routes, Christmas Bird Counts, and eBird, as well as published and unpublished literature by the Study Team and others, including peer-reviewed academic journals, research project reports, and government publications, were used to summarize life history information (including habitat use) and determine the likelihood of presence for various wildlife species within the RSA. This information was also used to plan the approach and methodology of associated field programs in 2011 and 2012.

Wildlife Field Surveys

Several field-based wildlife survey programs were completed during the 2011 and 2012 field seasons to gain additional knowledge on the distribution and abundance of wildlife species within the PDA. The field surveys included targeted forest songbird (i.e., passerine or perching bird) surveys, nine waterfowl surveys, two aerial winter wildlife surveys, an amphibian survey, and the collection of wildlife use data and potential of various habitats during ELC surveys.

ELC Habitat Analysis

Not all habitat is equal for all wildlife species. Depending on what it can provide for a particular species, habitat can generally be classified as primary, secondary, or tertiary. Primary habitat is habitat that a species may be dependent on or strongly prefers, and is defined as that which provides the main requirements for a species, such as breeding (nesting), foraging, protection, and resting opportunities. Secondary habitat may provide some but not all of these requirements, and would not be used exclusively. Tertiary habitat provides little of these requirements for a species, though they may occasionally be found there. As wildlife species mainly occupy primary habitat as it best meets their needs, primary habitat can be viewed as a reflection of the population, and is used as such in this VEC in the absence of detailed population data throughout the entirety of the RSA.

To quantify and qualify the habitat for several indicator species in this VEC near the Project, an ELC habitat analysis was completed and a series of habitat maps were prepared. The ELC habitat analysis approach was to qualify ELC ecotypes and assign them as constituting primary, secondary, or tertiary habitat for each indicator species. Indicator species were selected based on their affinities for a particular habitat type, and/or their representation of a wildlife group (i.e., migratory birds, waterbirds and waterfowl, other birds including raptors, ungulates, furbearers, and amphibians) and include: Boreal Chickadee (*Poecile hudsonica*), Tennessee Warbler (*Vermivora peregrine*), Lincoln's Sparrow (*Melospiza lincolnii*), Common Goldeneye (*Bucephala clangula*), Common Loon (*Gavia immer*), Canada Goose (*Branta canadensis*), Greater Yellowlegs (*Tringa melanoleuca*), Spruce Grouse (*Falcipennis canadensis*), Gray Jay (*Perisoreus canadensis*), Northern Harrier (*Circus cyaneus*), Osprey (*Pandion haliaetus*), moose (*Alces americanus*), Canada lynx (*Lynx canadensis*), American marten (*Martes americana*), porcupine (*Erethizon dorsatum*), snowshoe hare (*Lepus americanus*), beaver (*Castor canadensis*), red squirrel (*Tamiasciurus hudsonicus*), and wood frog (*Rana sylvatica*).

19.5.2 Migratory Birds

Migratory birds are protected under the federal *Migratory Birds Convention Act* (MBCA) and associated regulations. Data on migratory birds are available from a variety of citizen initiatives, as well as baseline surveys conducted for the Project.

There is only one Breeding Bird Survey route (NL 57-041) near the Project, extending nearly 40 km along the Trans-Labrador Highway, east of Labrador City. It was surveyed annually from 2008 to 2011, with 51 species observed, and a range of 29 to 36 per year. Of these, 42 species overall are considered migratory birds. The most numerous species were Ruby-crowned Kinglet (annual mean 57), White-throated Sparrow (31), Dark-eyed Junco (28), Gray Jay (17), and American Robin (16) (USGS Patuxent Wildlife Research Center 2012).

A Christmas Bird Count was conducted annually between 1998 and 2009 in a 12 km radius around Wabush, with 38 species observed, and an annual count ranging from 8 to 22. Of these, 29 species overall are considered migratory birds. Only five species (Gray Jay, Common Raven, Boreal Chickadee, Pine Grosbeak, and Common Redpoll) have been observed on all counts, while another 11 have been observed just once (Lesser Scaup, Common Merganser, Rough-legged Hawk, Downy Woodpecker, Northern Shrike, Chipping Sparrow, White-crowned

Sparrow, Fox Sparrow, Rose-breasted Grosbeak, Red-winged Blackbird, and Common Grackle). The most numerous species were Common Redpoll (annual mean 266 individuals), Bohemian Waxwing (122), Common Raven (82), Pine Grosbeak (50), and Willow Ptarmigan (44) (National Audubon Society 2010).

The first Québec Breeding Bird Atlas was limited to southern Quebec and therefore does not have any data relevant to the Project. However, the second iteration that is ongoing, is targeting the entire province. A 10 x 10 km square is situated near Fermont, but the effort to date has not been sufficient for meaningful results.

Observations from Wabush-Labrador City throughout the year have also been submitted to eBird. Overall, 163 species have been observed, of which 138 are considered migratory birds. Many of these species are considered uncommon in the area, including 24 that have been recorded on just one occasion (Sullivan et al. 2009).

To supplement existing data, additional surveys of migratory birds were conducted specifically for the Project incorporating recommendations for design after Hanson et al. (2010).

Forest songbird surveys were conducted by Stassinu Stantec in June, 2011, in and around the Kami Property, to determine species biodiversity, distribution, and relative abundance by habitat type (identified in the ELC) within the RSA. A total of 50 10-minute point count surveys of forest songbirds were arranged on transects around four areas of interest: proposed rail infrastructure; the TMF; Rose Pit; and east of Rose South Waste Rock Disposal Area. Raptors, waterfowl, and other wildlife species were also documented when observed. Thirty songbird species were detected during the surveys (Table 19.6), including Olive-sided Flycatcher (*Contopus cooperi*), which is listed as "Threatened" under Schedule 1 of *SARA* and under NL*ESA*. Although not observed during targeted forest songbird surveys, Rusty Blackbird (*Euphagus carolinus*), listed as "Special Concern" under Schedule 1 of *SARA* and as "Vulnerable" under NL*ESA*, was observed during other work completed in support of the Project. Six non-passerine avian species (Spruce Grouse, Common Loon, American Black Duck (*Anas rubripes*), Wilson's Snipe (*Gallinago delicata*), Osprey, and Greater Yellowlegs) as well as five mammal species (red squirrel, snowshoe hare, black bear (*Ursus americanus*), beaver, and moose) were also observed during these surveys.

Nine aerial waterfowl surveys were completed by Stassinu Stantec to assess the distribution and abundance of these species throughout a large portion of the RSA. Surveys were conducted by helicopter, from May to mid-September, 2011 to examine three periods of activity:

- Spring staging and breeding pairs – three surveys were completed on May 20, May 31, and June 8-9;
- Brood rearing – two surveys were completed on July 12 and July 27; and
- Fall staging – four surveys were completed on August 17, August 24-25, September 8, and September 14-15.

Table 19.6 Forest Songbirds Observed During Field Surveys Conducted in Support of the Project

Common Name	Scientific Name
Alder Flycatcher	Empidonax alnorum
American Robin	*Turdus migratorius*
Black-and-white Warbler	*Mniotilta varia*
Blackpoll Warbler	*Dendroica striata*
Boreal Chickadee	*Poecile hudsonica*
Chipping Sparrow	*Spizella passerine*
Fox Sparrow	*Passerella iliaca*
Gray Jay	*Perisoreus canadensis*
Hermit Thrush	*Catharus guttatus*
Lincoln's Sparrow	*Melospiza lincolnii*
Nashville Warbler	*Vermivora ruficapilla*
Northern Flicker	*Colaptes auratus*
Northern Waterthrush	*Seiurus noveboracensis*
Olive-sided Flycatcher	*Contopus cooperi*
Orange-crowned Warbler	*Vermivora celata*
Palm Warbler	*Dendroica palmarum*
Pine Grosbeak	*Pinicola enucleator*
Pine Siskin	Carduelis pinus
Pine Warbler	Dendroica pinus
Ruby-crowned Kinglet	*Regulus calendula*
Slate-coloured Junco	*Junco hyemalis*
Swainson's Thrush	*Catharus ustulatus*
Tennessee Warbler	*Vermivora peregrine*
Tree Swallow	*Tachycineta bicolour*
White-crowned Sparrow	*Zonotrichia leucophrys*
White-throated Sparrow	*Zonotrichia albicollis*
White-winged Crossbill	*Loxia leucoptera*
Wilson's Warbler	*Wilsonia pusilla*
Yellow-bellied Flycatcher	*Empidonax flaviventris*
Yellow-rumped Warbler	*Dendroica coronate*

Fifteen species of waterfowl were observed throughout the nine surveys (Table 19.7). The most abundant species observed within the RSA were Common Merganser (*Mergus merganser*), Common Goldeneye, Canada Goose, American Black Duck, Ring-necked Duck (*Aythya collaris*), and Common Loon. Waterbirds were generally observed wherever suitable habitat was available, i.e. wetlands or other waterbodies.

Table 19.7 Waterfowl and Waterbirds Observed During Field Surveys

Common Name	Scientific Name
American Black Duck	*Anas rubripes*
Black Scoter	*Melanitta americana*
Canada Goose	*Branta canadensis*
Common Goldeneye	*Bucephala clangula*
Common Loon	*Gavia immer*
Common Merganser	*Mergus merganser*
Greater Scaup	*Aythya marila*
Green-winged Teal	*Anas crecca*
Hooded Merganser	*Lophodytes cucullatus*
Lesser Scaup	*Aythya affinis*
Mallard	*Anas platyrhynchos*
Common or Red-Breasted Merganser species	*Mergus* spp.
Northern Pintail	*Anas acuta*
Red-breasted Merganser	*Mergus serrator*
Ring-necked Duck	*Aythya collaris*
Surf Scoter	*Melanitta perspicillata*

19.5.3 Other Wildlife

Other wildlife includes non-migratory birds (primarily gamebirds, cormorants, raptors, kingfishers, corvids, and blackbirds), mammals (including ungulates such as caribou and moose, and furbearers such as black bear, wolf (*Canis lupus*), red fox (*Vulpes vulpes*), American marten, beaver, and otter and small mammals), and amphibians.

In most sources of bird data for western Labrador, non-migratory bird species account for less than 20 percent of species reported; therefore, the occurrence of birds is largely summarized in this section. Data from the Breeding Bird Survey, Christmas Bird Count, and eBird indicate the occurrence of 25 non-migratory bird species in the RSA, including four gamebirds (Ruffed Grouse (*Bonasa umbellus*), Spruce Grouse, Willow Ptarmigan (*Lagopus lagopus*), and Rock Ptarmigian (*L. muta*)), Double-crested Cormorant (*Phalacrocorax auritus*), 12 raptors (Osprey, Bald Eagle (*Haliaeetus leucocephalus*), Northern Harrier, Sharp-shinned Hawk (*Accipiter striatus*), Northern Goshawk (*Accipiter gentilis*), Red-tailed Hawk (*Buteo jamaicensis*), Rough-legged Hawk (*Buteo lagopus*), Golden Eagle (*Aquila chrysaetos*), American Kestrel (*Falco sparverius*), Merlin (*Falco columbarius*), Gyrfalcon (*Falco rusticolus*), and Peregrine Falcon (*Falco peregrinus*)), Belted Kingfisher (*Megaceryle alcyon*), three corvids (Gray Jay, American Crow (*Corvus brachyrhynchos*), and Common Raven (*Corvus corax*)), and four blackbirds (Red-winged Blackbird (*Agelaius phoeniceus*), Rusty Blackbird, Common Grackle (*Quiscalus quiscula*), and Brown-headed Cowbird (*Molothrus ater*)).

Two winter aerial wildlife surveys were completed by Stassinu Stantec on January 27 and March 27, 2012. The objective of these surveys was to provide baseline information on wildlife species that are better detected in winter, or may only be present in the RSA during that period. Aerial strip-transect surveys were completed at 2 km intervals throughout the RSA, during which field staff identified animal tracks to species using known characteristics such as track pattern, size, and spacing. Ten terrestrial wildlife species (or their sign) were detected during the two surveys. Snowshoe hare were the most frequently observed and occupied a variety of habitats. Other species documented included moose, wolf, Canada lynx, red fox, American marten, ermine (*Mustela erminea*), otter (*Lontra canadensis*), porcupine, and red squirrel. Possible coyote (*Canis latrans*) tracks were also recorded. Other surveys conducted in support of the Project, such as those associated with waterfowl during 2011, also identified black bear and beaver. No unusual or unexpected species were encountered throughout these surveys based on the experience of the Study Team working in this region since the 1980s.

No caribou were observed (or expected) during any of the ground investigations or 11 aerial surveys. The range of the sedentary Lac Joseph caribou herd is within an area south and east of the Study Area (Bergerud et al 2008). Discussions during the public consultations in March confirmed the distribution of the migratory George River caribou herd as occurring to the north and north east. Due to this lack of spatial overlap, caribou are not considered further in this assessment.

Amphibians were surveyed during July 2012, in the Wabush tailings area, and in two candidate protected areas outside of the LSA. Wood frog and American toad (*Bufo americanus*) were the only amphibians noted within the LSA during these or other surveys. Wood frog were prevalent in all appropriate habitats. Three adult American toads and two ponds supporting American toad tadpoles were noted within the surveyed areas. It is expected that the surveyed area is representative of the remainder of the LSA. Two northern two-lined salamanders (*Eurycea bislineata*) were noted in the greater RSA in Walsh River, downstream of the Trans-Labrador Highway; however, this species is not expected within the LSA, as there is no similar, appropriate habitat.

19.5.4 ELC Habitat Analysis

The ELC habitat analysis approach was to qualify ELC ecotypes and assign them as constituting primary, secondary, or tertiary habitat for each indicator species. This was completed using a summary of original field data collected through the baseline program, literature review, and professional experience. Primary, secondary and tertiary habitat was then summarized and displayed in a GIS to describe habitat potential within the RSA (Appendix Y). The ELC ecotypes and their habitat designations for each indicator species are summarized in Appendix Y and also the percentage of primary, secondary, and tertiary habitat within the RSA for each indicator species.

19.5.5 Protected Areas

Duley Lake Provincial Park Reserve

Duley Lake Provincial Park Reserve is an approximately 7 km^2 park reserve that protects an open lichen woodland habitat, which is representative of Ecoregion V (Labrador). It is located immediately north of the proposed Rose North Waste Rock Disposal Area (DOEC 2011). The main purpose of the Duley Lake Provincial Park Reserve is to protect open lichen woodlands. Day use is allowed in the Park Reserve, however overnight camping and timber harvesting area are not permitted.

Wetland Stewardship Habitat Management Units

The Wetland Stewardship Program is designed to empower citizens at the municipal level to take responsibility and control of their own wetlands and wildlife resources (Intervale 2003). The vision of a participating community in the Wetlands Stewardship Program may include actions that go beyond protection of wildlife habitat such as:

- Taking a biodiversity and ecosystem approach to the conservation of wetlands;
- Improving the local economy (e.g., by partnering with mining and other local industry on rehabilitation and enhancement projects and by creating local jobs associated with the projects);
- Investing in future generations through education programs;
- Advancing public dialogue and informed decision-making;
- Incorporating local ecological knowledge;
- Improving the quality of life; and
- Addressing social justice needs.

The location of Management Units is shown on Figure 19.4.

Town of Labrador City

There are nine separate Management Units within the municipal boundaries of Labrador City (Labrador City 2010a, 2010b), which act to maintain and enhance existing waterfowl and wildlife populations (Table 19.8). Wetlands within this municipality contribute to a series of habitats along migration routes for a wide variety of both waterfowl and upland bird species.

Figure 19.4 Wetland Stewardship Habitat Management Units

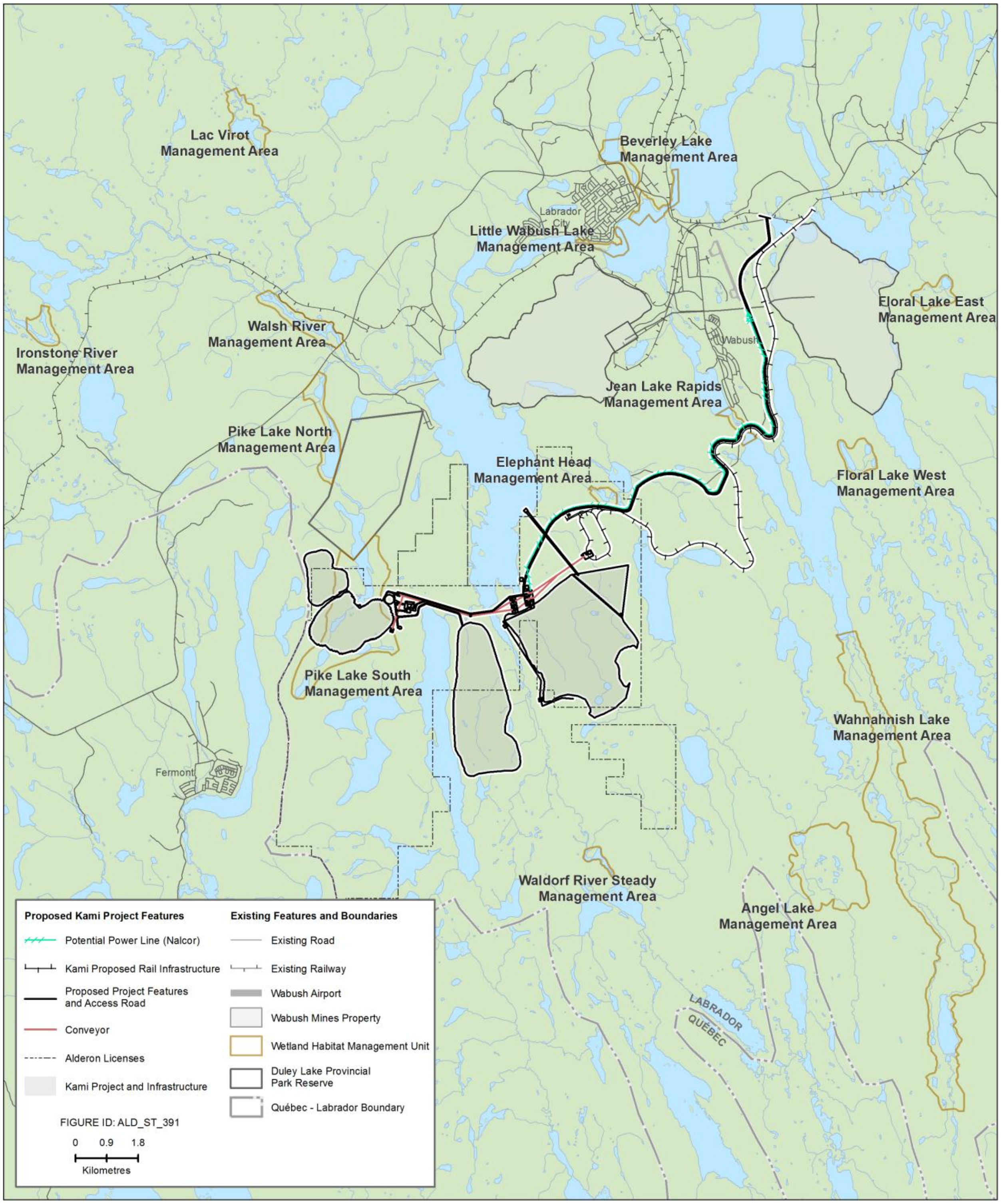


Table 19.8 Labrador City Management Units

Non Town-Site Management Units	
Lac Virot Management Unit ($0.64\ km^2$)	Western edge of the municipal planning area; rich, active breeding area for waterfowl, particularly at wetlands in the northern section of the MU.
Pike Lake North and South Management Units ($7.41\ km^2$)	Lakes are located on the eastern side of Route 500, south of the entrance to Duley Lake Provincial Park Reserve; both MUs border the Park and include ponds, bogs and streams; northern MU supports nesting, breeding and staging waterfowl; southern MU also has habitat for many waterfowl and upland birds.
Walsh River Management Unit ($1.17\ km^2$)	Immediately northwest of Walsh River bridge; river and adjacent ponds and streams provide nesting and breeding habitat for a variety of avifauna; MU is northwest of the privatized portion of Duley Lake Provincial Park Reserve.
Ironstone River Management Unit ($1.17\ km^2$)	A small steady with associated bogs and uplands located in the Ironstone River; noteworthy for waterfowl.
Town Site Management Units: (total area = $1.75\ km^2$)	
Beverly Lake Management Unit	At the eastern shoreline of Beverly Lake; provides habitat for Belted Kingfisher; bordered in north by the Town's previous Municipal Boundary; west side extends south along route 500, and ends at Tamarack Creek; important area for waterfowl.
Tamarack Creek Management Unit	Extends from outlet of Beverly Lake to inlet of Wabush Lake; considerable development here, yet serves as feeding area for numerous waterfowl and provides nesting / feeding areas for Osprey; the Labrador West Agricultural Society's Alex Duffett Community Garden is located here.
Wabush Narrows Management Unit	Extends from the southern end of Tamarack Creek MU to Wabush Narrows; important for hundreds of waterfowl availing of the open water and shoreline for feeding during migration in late April; the sandy shoreline near a floatplane dock is unique within the municipal planning area for its number of species and terrain.
Little Wabush Lake Management Unit	North shore has undergone development; includes habitat for migratory waterfowl and shorebirds; the MU extends south to the municipal boundary and west toward Harrie Lake.
Source Labrador City 2010a.	

Town of Wabush

The Wabush Habitat Conservation Plan (Wabush 2010) includes the entirety of the municipal planning boundary excluding existing, and proposed expansion, development areas to the west and east of the town's current infrastructure (Table 19.9). The Wetland Stewardship Agreement was signed in 2005, and seven Management Units of wetland or upland areas of importance to waterfowl and other wildlife were established within the municipal boundaries of Wabush.

Table 19.9 Wabush Management Units

Management Units	
Jean Lake Rapids Management Unit (0.34 km^2)	Within space designated for recreation and watershed purposes only; one of the few places where the Harlequin duck has been observed (C. Porter and G. Parsons, pers. com.); is traversed by a bridge and access road.
Elephant Head Management Unit (0.30 km^2)	Located southwest of Elephant Head Lake; nesting area for several waterfowl species; encompasses the pond and adjacent wetland areas.
Flora Lake East Management Unit (0.73 km^2)	Provides important habitat for waterfowl; far from habitation, roads or current development; this pond and associated bog and uplands provide habitat for several species of waterfowl.
Flora Lake West Management Unit (0.79 km^2)	Provides nesting habitat for waterfowl.
Wahnahnish River Management Unit (13.83 km^2)	Largest of the MUs; Wahnahnish River provides a chain of habitats used by a variety of waterfowl; of particular interest is the association between the river and a series of eskers rich in berries, which form an integral part of the diet of these waterfowl.
Angel Lake Management Unit (4.08 km^2)	Adjacent to the Wahanish River MU; provides waterfowl staging and breeding habitat.
Waldorf River Steady Management Unit (0.26 km^2)	Occurs along the western edge of the municipal planning area; includes an associated lake and river segment with an esker that is attractive for waterfowl.
Source Wabush 2010	

Management Units of Interest to the Project

The Labrador City Stewardship Zone (Labrador City 2010a) makes up the majority of the town's municipal planning boundary (Town of Labrador City 2010b) and contains most of the important wetlands and waterfowl habitat regardless of the actual level of waterfowl use. The zone does exclude existing commercial and industrial developments, including areas occupied by mining companies on the northeastern side of the planning boundary. Note that the Iron Ore Company of Canada (IOC) also operates within the municipal planning area of the Town of Labrador City.

There are three Management Units, one within the municipality of Labrador City and two within Wabush, which are adjacent to or overlap the proposed infrastructure for the Project:

- **Jean Lake Rapids Management Unit (0.34 km^2)** – the Project will further develop an existing crossing to support the proposed railway and road access from the east;
- **Elephant Head Management Unit (0.30 km^2)** – the proposed railway and road access from the east will run along this area's southern boundary; and
- **Pike Lake South Management Unit (approximately 5 km^2)** – a portion of this Management Unit overlaps the Rose Pit and will be lost as a result of the development.

It is the loss of at least a portion of the Pike Lake South Management Unit within the Labrador City Stewardship Area that is of concern to the Newfoundland and Labrador Department of Environment and Conservation (DOEC). Points raised by DOEC, the Town of Labrador City and the Town of Wabush, and the public include:

- There would be a loss of relatively uncommon habitat and/or wildlife resources;
- The education and environmental awareness role provided by the affected Management Unit(s) would be compromised;
- The intent of the Wetland Stewardship Agreement between the Province of Newfoundland and Labrador and the Town of Labrador City, as well as the Agreement for the Town of Wabush, would be compromised; and
- There would be a precedent established that may weaken other Municipal Stewardship Agreements and Habitat Conservation Plans in Newfoundland and Labrador or other provinces within the EHJV.

19.6 Assessment of Project-related Environmental Effects

Each effect (change in habitat; change in distribution and movement; change in mortality risk; change in health; and change in protected areas) will be assessed for each Project phase. In particular, the potential effects on species known to be important to Aboriginal people will be assessed.

The residual environmental effects on habitat, distribution and movement, mortality risk, health and protected areas in the immediate vicinity of the PDA are assessed. Mitigation measures will be implemented to minimize environmental effects. These measures will be outlined in the Project-specific EPP and include such mitigation as the minimizing of Project footprint, minimizing the disturbance to environmentally sensitive areas (e.g., wetland habitat), and where possible, avoiding known locations of species having special status.

19.6.1 Change in Habitat

Construction

Site preparation and construction activities related to the Project will result in the most important adverse effects of the Project on wildlife through the loss or alteration of habitat for wildlife species. Site preparation and construction activities will cause ground disturbance, clearing, grubbing, grading, infilling, and/or excavation, the removal of overburden, material haulage, and stockpiling will result in the loss or alteration of habitat for wildlife species and protected areas.

Change in habitat may result in adverse environmental effects such as the loss of breeding, nesting, rearing, or other habitat for birds and other wildlife species.

Clearing of upland forest areas can change the quality of the habitat along the edge of the Project footprint as a result of increased side lighting or drying of what was previously forest interior habitat. This may enable more disturbance-tolerant and edge species to inhabit adjacent forest habitat. Indirect effects may also occur due to changes in substrate composition, moisture, drainage and temperature. Alteration or loss of habitat for wildlife species or in protected areas could also occur due to changes in other environmental conditions and increased human activity (i.e., indirect effects), including dust generation. However, the magnitude of these effects will be low, and they will be localized.

As wildlife species mainly occupy primary habitat as it best meets their needs, primary habitat can be viewed as a reflection of the population. In this respect, change in habitat resulting from the Project can be evaluated by measuring loss of primary habitat within the RSA for indicator wildlife species. Change in habitat resulting from the Project is expected to generally result in limited adverse environmental effects. The average amount of primary habitat expected to be changed or lost within the RSA is: for migratory birds, 3.1 percent; for waterfowl and waterbirds, 4.0 percent; for other birds, including raptors, 2.0 percent; for mammals, 1.4 percent; and for amphibians, 4.3 percent.

Several individual species may experience higher relative loss of primary habitat such as Lincoln's Sparrow, 6.0 percent; Canada Goose, 5.7 percent; Greater Yellowlegs, 6.0 percent; and Northern Harrier, 5.7 percent. For these species, loss of primary habitat may represent greater adverse environmental effect in the absence of mitigation.

Lincoln's Sparrow is a small migratory passerine that prefers shrubby wet habitats with scattered trees. In particular, the following ELC ecotypes represent primary habitat for Lincoln Sparrow: riparian thicket, non-patterned shrub fen, and patterned shrub fen. These habitats (with graminoid fen) are not well represented in the greater landscape, accounting for only 2.6 percent of the RSA, but are more concentrated within the PDA, representing 7.8 percent. Within the PDA, the majority of primary habitat (approximately 50 percent) is located in the Tailing Impoundment Area.

Canada Goose is associated with open grassy areas that provide both feeding and nesting habitat, and uses riparian marsh / fen, non-patterned shrub fen, patterned shrub fen, and graminoid fen ELC ecotypes as primary habitat. These habitats represent 7.8 percent of the PDA, but only 2.8 percent of the RSA, and are thus not as well represented in the larger landscape relative to the amount that will be changed or lost within the PDA. Within the PDA, the majority of primary habitat (approximately 50 percent) is located in the Tailing Impoundment Area.

Greater Yellowlegs is a tall, long-legged shorebird most often found in shallow water habitats. The ELC ecotypes non-patterned and patterned shrub fens are considered primary habitat for this species. These two ecotypes (with graminoid fen) account for 7.8 percent of the PDA, but only 2.6 percent of the RSA, indicating that a disproportionate amount of primary habitat for this species will be lost as a result of Project activities. Within the PDA, the majority of primary habitat (approximately 50 percent) is located in the Tailing Impoundment Area.

Northern Harrier is a medium-sized, long-tailed raptor that is uncommon in the region, and is associated with grassy, often wet habitats such as marshes, fens, prairies, and agricultural land. This species is expected to use the following ELC ecotypes as primary habitat: riparian marsh / fen, non-patterned fen, patterned shrub fen, and graminoid fen. These habitats are not well represented in the greater landscape, accounting for only 2.8 percent, but are more concentrated within the PDA, representing 7.8 percent. Within the PDA, the majority of primary habitat (approximately 50 percent) is located in the Tailing Impoundment Area.

Each of these species uses various types of wetland, primarily non-treed fens, as primary habitat. Non-treed fen ELC ecotypes—which include riparian marsh / fen, non-patterned shrub fen, patterned shrub fen, and graminoid fen—are generally not well represented in the greater landscape, equalling 2.8 percent of the RSA, but are sufficiently represented within the PDA, equalling 8.0 percent. Thus, a disproportionate amount of primary habitat for these species will be lost as a result of Project activities.

Operation and Maintenance

Project effects on habitat and protected areas will occur primarily, if not exclusively, during the construction phase. The effects due to operational maintenance activities (access road grading and ditching) and siltation from tailings will be managed so that erosion and sediment run-off are controlled. Any resulting effects would be low in magnitude and localized.

Decommissioning and Reclamation

Project effects on habitat will occur primarily, if not exclusively, during the construction phase. A Rehabilitation and Closure Plan will be developed in accordance with the applicable regulations at the time of decommissioning. The Rehabilitation and Closure Plan will specify the procedures that will be followed with respect to the decommissioning, removal, and disposal of site equipment and structures, and for site remediation, where required. Potential environmental effects of decommissioning activities will also be managed following the Project-specific EPP Owing to the open pit nature of the Project restoration of the mine footprint upon decommissioning is unlikely to result in the complete reversal of a number of the effects associated with the Project. Most vegetated communities within the Project footprint are not expected to return to pre-Project conditions.

Mitigation of Project Environmental Effects

Project planning, design, and the application of known and proven mitigation measures will be implemented as part of the Project to avoid or minimize environmental effects. Final decisions on mitigative measures will be made by Alderon in consultation with experts, and where appropriate, the regulatory authority (e.g., DOEC). Standard practices and general environmental protection measures for mining projects will address most outstanding issues likely to arise during the Project. General measures to minimize the effects of such activities as temporary access trails, borrow areas, clearing of the RoW, and working in and around waterbodies and wetlands, equipment maintenance, and work site cleanup and decommissioning and reclamation will also be addressed in the EPP. A Project-specific EPP will be developed for the Project prior to start of the construction phase. Activities such as handling and storage of fuel and other hazardous materials are regulated by law and will comply with all applicable standards and regulations, guidelines and reference documents.

In summary, Alderon will construct the Project using accepted and proven best practices and procedures. Mitigation measures will be employed to reduce the potential effects of Project construction on species within the LSA, wherever possible. This includes the use of appropriate, accepted best practices to limit activities resulting in disturbance to ground vegetation, to the extent practical. Surface disturbance activities will comply with the requirements (e.g., buffer widths and permitted activities at these locations) of applicable permits. Reclamation plans, developed by Alderon in co-ordination with regulators will be implemented, where practical, to limit potential Project effects.

The following mitigation measures are proposed to mitigate Project-related effects related to change in habitat during the construction phase. Note that some of these mitigation measures would also address issues associated with other effects:

- Minimize construction footprint (i.e., PDA) to the extent feasible;
- Avoid sensitive species and their habitats to the extent feasible;
- Minimize disturbance and infilling within adjacent wetlands and maintain hydrological conditions to the extent feasible;
- Rehabilitate access routes that are no longer needed;
- Locate borrow pits more than 100 m away from the high water mark of water bodies, where feasible;
- Maintain natural buffers around wetlands and riparian zones;
- Dispose of slash from clearing, as specified in permits;
- Comply with provincial and federal legislation, permits, approvals and guidelines;
- Implement erosion and sediment control;
- Conduct invasive species management;
- Conduct progressive rehabilitation; and
- Implement an Avifauna Management Plan.

Many of the measures used to mitigate potential effects identified above for the construction phase are also applicable to the operation and maintenance phase. During the Project operations and maintenance phase, the only additional ground disturbance beyond those areas affected during Project construction will result from development of the open pit mine, and through disposal of waste rock and tailings. As part of infrastructure maintenance, access roads will be periodically graded and ditched to improve water flow, reduce erosion and/or to deter excessive vegetative growth. The effects of the Project on wetlands are assessed in Chapter 17.

Vegetation management will be periodically required adjacent to the access road and rail line. This activity will consist of mechanical control of vegetation, although the use of herbicides may be considered where undesirable species persist. Brush cutting will occur adjacent the access road and rail line on an as-needed basis to control the growth of trees and tall shrubs.

When the Project is decommissioned Alderon will prepare a Rehabilitation and Closure Plan for remediating the mine site, and associated ROW. Established procedures are available for decommissioning temporary infrastructure or facilities (e.g., access roads, rail beds, transmission lines, marshalling areas). Owing to the open pit nature of the Project, restoration of the mine footprint upon decommissioning is unlikely to result in complete reversal of a number of the effects associated with the Project.

Similar to the construction phase, all decommissioning and reclamation activities will comply with applicable standards and regulations, guidelines and reference documents.

Characterization of Residual Effects

Habitat alteration or loss during the construction phase may result in fewer individuals / populations of species in the immediate vicinity of the Project. The main factor influencing important habitats is vegetation management, which will continue over the life of the Project, and will be the greatest potential interaction with species in the area during operation and maintenance. However, this is unlikely to cause further disruption of habitat, as clearing activities are short-lived and occur within the existing PDA. For most species, potential effects to important habitats are geographically limited, therefore, adverse residual effects will not be seen on sustainability or populations in the RSA as a whole.

As for effects on change in habitat, the effects of Project construction on important habitat for flora and fauna are predicted to be adverse, because there is a permanent alteration and/or reduction in the amount of available habitat. For the majority of species, this is a relatively small change in habitat availability and resulting displacement of individuals or populations from across the RSA; however, for several indicators species, namely Lincoln's Sparrow, Canada Goose, Greater Yellowlegs, and Northern Harrier, primary habitat loss represents more than 5 percent of the primary habitat available within the RSA.

Approximately 6.0 percent of the primary habitat for Lincoln's Sparrow within the RSA will be changed or lost within the PDA as a result of Project activities.

For Canada Goose, approximately 5.7 percent of the primary habitat for this species will be lost within the PDA due to Project activities.

Approximately 6.0 percent of Greater Yellowlegs primary habitat within the RSA will be changed or lost within the PDA. However, this species is found at low densities throughout its range, and it is believed that not all of the primary habitat for Greater Yellowlegs would be occupied. Therefore, loss of primary habitat is not believed to reflect a similar potential loss to the population.

Although approximately 5.7 percent of the primary habitat for Northern Harrier in the RSA is associated with the PDA and expected to be lost or changed as a result of Project activities, because this species is uncommon, it is believed that not all of the primary habitat for that species would be occupied. Therefore, loss of primary habitat is not believed to reflect a similar potential loss to the population.

The PDA represents a potential "worst case scenario" for area of actual disturbance and habitat loss. With careful Project planning and implementation, such as limiting the footprint to only those areas that need to be cleared (particularly in non-treed fen habitats), and considering timing of Project activities and reclamation schedules so that not all habitat is disturbed simultaneously and areas are rehabilitated as soon as activities have ceased, the actual amount of primary habitat lost at any one time is likely to be less than what is currently estimated.

Additional standard mitigation measures to protect species and/or their habitats from direct disturbance, primarily involving site preparation, will be adequate to effectively reduce or eliminate residual effects.

Therefore, the magnitude of adverse Project effects during construction and operations and maintenance on will be low because of the following: the amount of primary habitat lost for the majority of species will be 5 percent of the RSA or less once mitigation is implemented; additional habitat of varying quality will be made available as a result of Project activities and reclamation; and, these species are generally not limited by habitat within their breeding range, i.e., habitats are not at maximum capacity and therefore loss of primary habitat is not believed to accurately reflect potential loss to the population. Disturbance-related construction effects are anticipated to be long term. Removal of habitat from some areas of the PDA (e.g., open pit) will be permanent, and will be medium term for other areas (e.g., access roads) as these areas will be rehabilitated.

There is a high degree of confidence that the level of effect will not be greater than predicted.

19.6.2 Change in Distribution and Movement

Construction

Site preparation and construction activities related to the Project will result in the most important adverse effects of the Project in terms of the distribution and movement of wildlife. Site preparation and construction activities, including ground disturbance, clearing, grubbing, grading, infilling, and/or excavation, the removal of overburden, material haulage, and stockpiling, may result in the direct loss of primary habitat for birds and other wildlife species. These species may be forced to move into other habitat, which may be potentially lower quality habitat if the primary habitat is limiting. This could result in crowding and increased competition for resources. In addition, site preparation and construction activities may cause the displacement of wildlife species as a result of sensory disturbance.

Construction activities may also result in habitat fragmentation (i.e., discontinuity in preferred habitat) leading to the reduction or loss of freedom of movement between such patches. This may be particularly problematic for species that are found near the Project Area and currently move through and within the Project area to access preferred habitat.

Construction of the access road and rail line will require installation of several watercourse crossings. Standard and proven mitigation will be employed to minimize the environmental effects of stream crossings. Culverts will be designed and installed using Best Available Control Technology (including DFO and DOEC Water Resources guidelines) to maintain the natural hydrology, and to prevent ponding or dewatering.

Noise associated with construction (and later, operation and maintenance) activities can cause the displacement of individuals to less productive habitats, and can affect the flight patterns of migratory birds.

Operation and Maintenance

The primary effects to wildlife species will occur primarily, if not exclusively, during the construction phase. Some noise-related effects will continue throughout operation and maintenance, but are expected to be reduced, relative to the construction phase. The effects due to operational maintenance activities (access road grading and ditching) and discharge from the TMF will be managed so that erosion and sediment run-off are controlled. Any resulting effects would be low in magnitude and localized.

Decommissioning and Reclamation

Project effects on change in mortality risk will occur primarily, if not exclusively, during the construction phase. A Rehabilitation and Closure Plan will be developed in accordance with the applicable regulations at the time of decommissioning. The Rehabilitation and Closure Plan will specify the procedures that will be followed with respect to the decommissioning, removal, and disposal of site equipment and structures, and for site remediation, where required. Potential environmental effects of decommissioning activities will also be managed following the Project-specific EPP Owing to the open pit nature of the Project restoration of the mine footprint upon decommissioning is unlikely to result in the complete reversal of a number of the effects associated with the Project. Most vegetated communities within the Project footprint are not expected to return to pre-Project conditions.

Mitigation of Project Environmental Effects

The following mitigation measures are proposed for effects related to change in distribution and movement during the construction phase:

- Implement an Avifauna Management Plan;
- Minimize construction footprint (i.e., PDA) to the extent feasible. Avoid those locations of sensitive species to the extent feasible;
- Restrict clearing activities to the period outside of the bird breeding bird season, whenever feasible;
- Restrict clearing and other activities within 800 m of an active raptor nest, and within 200 m of an inactive nest;

- Flag the boundaries of sensitive areas before commencing any work in the area;
- Limit noise levels whenever feasible;
- Allow wildlife to pass through construction sites without harassment;
- Comply with all provincial and federal legislation, permits, approvals and guidelines;
- Maintain hydrology at stream crossings through approved methods to install culverts;
- Implement erosion and sediment control;
- Conduct invasive species management; and
- Conduct progressive rehabilitation.

Many of the measures used to mitigate potential effects on distribution and movement as identified above for the construction phase are also applicable to the operation and maintenance phase. The most substantive Project-related effects during operation and maintenance are likely due to the ongoing activities that will possibly continue to displace wildlife. Additionally, maintenance of the Project infrastructure and related vegetation management initiatives will have the potential to adversely affect fauna supported by this vegetation.

All relevant mitigation measures enacted during construction or operations and maintenance will also apply during decommissioning and reclamation.

Characterization of Residual Effects

Clearing and other activities, as well as noise associated with the construction, operation and maintenance, and decommissioning and reclamation phases, will result a Change in Distribution and Movement for wildlife species. These activities will continue over the life of the Project. The effects of Project construction and other activities on Change in Distribution and Movement for wildlife species are predicted to be adverse. The magnitude of adverse effects during construction and operation and maintenance phases will be low because the estimated number of individuals potentially redistributed or lost due to construction and other activities following implementation of mitigative measures is expected to be less than 5 percent of the local population. There is a high degree of confidence that the level of effect will not be greater than predicted.

19.6.3 Change in Mortality Risk

Construction

Site preparation and construction activities related to the Project will result in the most important adverse effects of the Project on wildlife through the loss or alteration of habitat for wildlife species, and/or the direct loss of individual animals. Direct mortality could occur mainly to small species such as herpetiles, small mammals, and the eggs or flightless young of birds. Increases in forest edges associated with construction clearing activities may also result in increased predation on birds and small mammals.

Larger species of hibernating mammals could also be affected by direct mortality during the winter months. Most birds and mammals would leave the cleared and grubbed areas and would move to adjacent undisturbed habitats. Indirect mortality could occur to these animals if they are unable to find suitable unoccupied habitat.

Some wildlife species are attracted to open disturbed sites such as those created by clearing and grubbing. Birds such as Common Nighthawk and Short-eared Owl use habitats such as this for nesting. Subsequent construction of mine site infrastructure on these sites can result in the destruction of the eggs and unfledged young of these species.

Operation and Maintenance

Although the majority of Project effects on mortality risk will occur primarily, if not exclusively, during the construction phase, site lighting can lead to mortality of migrating birds. Under certain conditions, such as nights with fog or mist, migrating birds may be attracted to lights. They may collide with the light or structures near the light or circle around the light until they become exhausted, making them easy prey for predators.

Various factors affect the level of attraction to lights including intensity, spectral characteristics and the manner in which lights are placed in the environment. Typically, more intense lights are more attractive to birds (Jones and Francis 2003). White light and red light are far more attractive than green or blue light (Poot et al. 2008). Lights that are shielded from above are generally less attractive than those that are visible from above. Strobe lighting is less attractive to birds than continuous lighting since the strobe allows birds that are attracted to the light to disengage (Jones and Francis 2003).

Decommissioning and Reclamation

Project effects on change in mortality risk will occur primarily, if not exclusively, during the construction phase. A Rehabilitation and Closure Plan will be developed in accordance with the applicable regulations at the time of decommissioning. The Rehabilitation and Closure Plan will specify the procedures that will be followed with respect to the decommissioning, removal, and disposal of site equipment and structures, and for site remediation, where required. Potential environmental effects of decommissioning activities will also be managed following the Project-specific EPP Owing to the open pit nature of the Project restoration of the mine footprint upon decommissioning is unlikely to result in the complete reversal of a number of the effects associated with the Project. Most vegetated communities within the Project footprint are not expected to return to pre-Project conditions.

Mitigation of Project Environmental Effects

The following mitigation measures are proposed to effects related to change in mortality risk during the construction and operation and maintenance phases:

- Prohibit hunting or harassment of wildlife on Project site;
- Implement Avifauna Management Plan to address incidental take;

- Limit situations leading to potential collisions;
- Use welding mats from April 1 to November 15 to prevent forest fires;
- Dispose of all waste appropriately;
- Limit lighting to that required for safe operation;
- Shield exterior lights from above; and
- Use motion sensors for security lighting.

All relevant mitigation measures enacted during construction or operations and maintenance will also apply during decommissioning and reclamation.

Characterization of Residual Effects

Project activities associated with the construction phase will result a change in mortality risk for wildlife species either through direct loss, or indirect loss associated with habitat loss. Project activities associated with operation and maintenance, and decommissioning and reclamation phases, could result in a Change in Mortality Risk through the effects of site lighting on migratory birds. These activities will continue over the life of the Project. The effects of Project construction and other activities on Change in Mortality Risk for wildlife species are predicted to be adverse. The magnitude of adverse effects will be low, as the estimated number of wildlife species potentially affected by Project activities following implementation of mitigative measures is expected to be less than 5 percent of the local population. Disturbance-related construction effects are anticipated to be long term. Removal of habitat from some areas of the PDA (e.g., open pit) will be permanent, and will be medium term for other areas (e.g., access roads) as these areas will be rehabilitated.

19.6.4 Change in Health

Construction

Site preparation and construction activities related to the Project will result in the most important adverse effects of the Project on wildlife through the increase in stress levels leading to the possible introduction of disease, and the masking of key auditory signals.

Noise associated with construction (and later, operation and maintenance) activities can cause increased stress levels, leading to behavioral changes, and possibly, disease. Noise can also mask important auditory signals, such as mating and distress calls, and prey sounds. Breeding and hunting success may be decreased as a result. Noises associated with the Project are expected to be short in duration, or for sustained noise, animals are likely to be displaced from areas with excessive noise levels and are not likely to experience significant adverse environmental effects.

Operation and Maintenance

The primary effects to wildlife species will occur primarily, if not exclusively, during the construction phase.

Decommissioning and Reclamation

Project effects on change in health will occur primarily, if not exclusively, during the construction phase. A Rehabilitation and Closure Plan will be developed in accordance with the applicable regulations at the time of decommissioning. The Rehabilitation and Closure Plan will specify the procedures that will be followed with respect to the decommissioning, removal, and disposal of site equipment and structures, and for site remediation, where required. Potential environmental effects of decommissioning activities will also be managed following the Project-specific EPP Owing to the open pit nature of the Project restoration of the mine footprint upon decommissioning is unlikely to result in the complete reversal of a number of the effects associated with the Project. Most vegetated communities within the Project footprint are not expected to return to pre-Project conditions.

Mitigation of Project Environmental Effects

The following mitigation measures are proposed to effects related to change in health for fauna during the construction and operation and maintenance phases:

- Consider clearing by mulching and mechanized forestry equipment;
- Use best practices for fuels and other hazardous materials, e.g., herbicides;
- Implement various dust-control measures;
- Do not bury waste during progressive rehabilitation activities;
- Allow fuel trucks to travel only on approved access roads;
- Ensure equipment arrives on site free from fluid leaks;
- Inspect and maintain equipment on a regular schedule; and
- Establish a site for equipment maintenance, repair and cleaning that is at least 100 m from any lake, river, stream or wetland.

All relevant mitigation measures enacted during construction or operations and maintenance will also apply during decommissioning and reclamation.

Characterization of Residual Effects

Project activities associated with the construction, operation and maintenance, and decommissioning and reclamation phases will result a Change in Heath for wildlife species either through an increase in stress possibly leading to disease, or masking of auditory signals. These activities will continue over the life of the Project. The effects of Project construction and other activities on Change in Health for wildlife species are predicted to be adverse. The magnitude of adverse effects will be low, as the estimated number of wildlife species potentially affected by Project activities following implementation of mitigative measures is expected to be less than 5 percent of the local population. Disturbance-related construction effects are anticipated to be long term. Removal of habitat from some areas of the PDA (e.g., open pit) will be permanent, and will be medium term for other areas (e.g., access roads) as these areas will be rehabilitated.

19.6.5 Change in Protected Areas

Construction

Site preparation and construction activities related to the Project will result in the most important adverse effects of the Project on Protected Areas. Site preparation and construction activities associated with the Rose Pit and the Rose North Waste Rock Disposal Area, including ground disturbance, clearing, grubbing, grading, infilling, and/or excavation, the removal of overburden, material haulage, and stockpiling, will result in the direct loss of a portion of the Pike Lake South Management Area, a Wetland Habitat Management Unit (Figure 19.4). Indirect change in wetland habitat area adjacent to these Project components is also expected to result from changes in hydrology.

Operation and Maintenance

The primary effects on change in protected areas will occur primarily, if not exclusively, during the construction phase.

Decommissioning and Reclamation

The primary effects on change in protected areas will occur primarily, if not exclusively, during the construction phase.

Mitigation of Project Environmental Effects

The following mitigation measures are proposed to effects related to change in protected areas during the construction phase:

- Employ measures listed for other potential Project effects;
- Establish a replacement protected area that performs the regional protection functions of the Pike Lake South Management area; and
- Pursue a Corporate Stewardship Agreement.

Many of the measures used to mitigate potential effects on Protected Areas as identified above for the construction phase are also applicable to the operation and maintenance phase, as well as the decommissioning and reclamation phase.

Characterization of Residual Effects

Clearing and other activities associated with the construction, operation and maintenance, and decommissioning and reclamation phases will result in the loss of a portion of the Pike Lake South Management Area. Once a replacement Protected Area is found, the regional protection functions currently being performed by the Pike Lake South Management Area will be maintained within the new Protected Area. Therefore, although the effects on change in protected areas will be adverse, the magnitude of adverse Project effects during the life of the Project will be low. Disturbance-related construction effects are anticipated to be long term, and permanent. A summary of residual project environmental effects is presented in Table 19.10.

There is a high degree of confidence that the level of effect will not be greater than predicted.

Table 19.10 Summary of Project Residual Environmental Effects: Birds, Other Wildlife and their Habitat; and Protected Areas

Project Phase	Mitigation/Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	
Change in Habitat											
Construction, Operation and Maintenance	• Minimize construction footprint (i.e., the PDA) to the extent feasible. • Avoid sensitive species and their habitats to the extent feasible. • Minimize disturbance and infilling within adjacent wetlands and maintain hydrological conditions to the extent feasible. • Rehabilitate access routes that are no longer needed. • Borrow pits will be located more than 100 m away from the high water mark of water bodies, where feasible. • Maintain natural buffers around wetlands and riparian zones. • Dispose of slash from clearing as specified in permits. • Restrict construction activities to the PDA.	A	L	S	LT	O	I	U/D	N	H	Monitor for compliance with mitigation measures.

Project Phase	Mitigation/Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	
	• Comply with provincial and federal legislation, permits, approvals and guidelines. • Erosion and sediment control. • Invasive species management. • Implement an Avifauna Management Plan • Progressive rehabilitation.										
Change in Distribution and Movement											
Construction, Operations and Maintenance, Decommissioning and Reclamation	• Implement an Avifauna Management Plan. • Minimize construction footprint (i.e., PDA) to the extent feasible. Avoid those locations of sensitive species to the extent feasible. • Restrict clearing activities to outside of the bird breeding season, whenever feasible. • Restrict clearing and other activities within 800 m of an active raptor nest, and within 200 m of an inactive nest. • Flag the boundaries of sensitive areas before commencing any work in the area.	A	L	S	LT	O	I	U/D	N	H	Monitor for compliance of mitigation measures.

Project Phase	Mitigation/Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	
	• Limit noise levels whenever feasible. • Allow wildlife to pass through construction sites without harassment. • Comply with all provincial and federal legislation, permits, approvals and guidelines. • Maintain hydrology at stream crossings through approved methods to install culverts. • Flag the boundaries of sensitive areas before commencing any work in the area; • Erosion and sediment control. • Invasive species management. • Progressive rehabilitation.										

Project Phase	Mitigation/Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	
Change in Mortality Risk											
Construction	• Prohibit hunting or harassment of wildlife on Project site. • Implement Avifauna Management Plan to address incidental take. • Limit situations leading to potential collisions. • Use welding mats from April 1 to November 15 to prevent forest fires. • Dispose of all waste appropriately. • Limit lighting to that required for safe operation. • Shield exterior lights from above. • Use motion sensors for security lighting.	A	L	S	ST	O	R	U/D	N	H	None.
Operation and Maintenance	• Prohibit hunting or harassment of wildlife on Project site. • Implement Avifauna Management Plan to address incidental take. • Limit situations leading to potential collisions. • Use welding mats from April 1 to November 15 to prevent forest	A	L	S	ST	O	R	U/D	N	H	None.

Project Phase	Mitigation/Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	
	fires. • Dispose of all waste appropriately. • Limit lighting to that required for safe operation. • Shield exterior lights from above. • Use motion sensors for security lighting.										
Decommissioning and Reclamation	• Prohibit hunting or harassment of wildlife on the Project site. • Limit situations leading to potential collisions.	A	L	S	ST	O	R	U/ D	N	H	None.
Change in Health											
Construction	• Consider clearing by mulching and mechanized forestry equipment. • Use best practices for fuels and other hazardous materials such as herbicides. • Implement various dust control measures.	A	L	S	ST	R	I	U/ D	N	H	None.
Operation and Maintenance	• Waste/garbage will not be buried in the pit during progressive reclamation activities. • Fuel trucks transporting fuel to on-site equipment will travel only on	A	L	S	ST	R	I	U/ D	N	H	None.

Project Phase	Mitigation/Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	
	approved access roads. • Ensure equipment arrives on site free from fluid leaks. • Inspect and maintain equipment on a regular schedule. • Establish a site for equipment maintenance, repair, and cleaning that is a minimum of 100 m from any lake, river, stream, or wetland. • Use best practices for fuels and other hazardous materials such as herbicides. • Implement various dust control measures.										
Decommissioning and Reclamation	• Use best practices for fuels and other hazardous materials such as herbicides. • Implement various dust control measures.	A	L	S	ST	R	I	U/D	N	H	None.

Project Phase	Mitigation/Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	
Change in Protected Areas											
Construction	• Measures listed for other potential Project effects will be employed. • Establish a replacement Protected Area that performs the regional protection functions of the Pike Lake South Management Area. • Pursue a Corporate Stewardship Agreement with the Province and Municipalities.	A	L	L	LT	C	I	U/ D	N	H	Monitor for compliance of mitigation measures.
Operation and Maintenance	• Measures listed for other potential Project effects will be employed. • Establish an alternative Protected Area that performs the regional protection functions of the Pike Lake South Management area, i.e., protects ponds, bogs and streams, and habitat for many waterfowl and upland birds. • Pursue a Corporate Stewardship Agreement with Province (EHJV) and municipalities.	A	L	L	LT	C	I	U/ D	N	H	Monitor for compliance of mitigation measures.
Decommissioning and Reclamation	• Employ measures listed for other potential Project effects.	A	L	L	LT	C	I	U/ D	N	H	

Project Phase	Mitigation/Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	

KEY

Direction:
P Positive.
A Adverse.
N Neutral.

Magnitude:
L Low - the residual Project effects (alteration/loss) are not expected to exceed 5 percent of the known population in the RSA, and are not measureable.
M Moderate - the residual Project effects (alteration/loss) are expected to be greater than 5 percent and not exceed 25 percent of the known population in the RSA and the effect can be measured.
H High - the residual Project effects to (alteration/loss) are expected to exceed 25 percent of the known population in the RSA; the effect can be easily observed, measured and described, and may be widespread.

Geographic Extent:
S Site-specific Effect confined to the Project footprint for all Project components (i.e., PDA), and limited to directly affected environmental components.
L Local: Effect extends beyond the Project footprint into the surrounding areas within the LSA
R Regional: Effect extends beyond the LSA into the RSA, where indirect or cumulative effects may occur.
B Beyond Regional: (provincial, national, and/or international extent) - Effect extends beyond the RSA, where indirect or cumulative effects may occur.

Duration:
ST Short-term Effect occurs during the site-preparation or construction phase of the Project (i.e., 1 to 2 years).
MT Medium-term Effect extends throughout the construction and operation phases of the Project (up to 17 years).
LT Long-term Effect is greater than 17 years
P Permanent – Effect persists.

Frequency:
O Once - Effect occurs once during the life of the Project (e.g., clearing).
S Sporadic Effect occurs sporadically, at irregular intervals, without any predictable pattern during the life of the Project (e.g., hydrocarbon spills).
R Regular Effect occurs at regular intervals during the life of the Project
C Continuous.

Reversibility:
R Reversible Effect is reversible during the life of the Project.
I Irreversible A long-term effect that is permanent (i.e., remains indefinitely as a residual effect).

Environmental or Socio-economic Context:
U Undisturbed: Area relatively or not adversely affected by human activity.
D Developed: Area has been substantially previously disturbed by human development or human development is still present.
N/A Not Applicable.

Significance:
S Significant.
N Not Significant.

Prediction Confidence:
Based on scientific information and statistical analysis, and effectiveness of mitigation or effects management measure
L Low level of confidence.
M Moderate level of confidence.
H High level of confidence.

19.7 Assessment of Cumulative Effects

Subsequent to the assessment of Project effects discussed previously, an assessment was conducted of the potential cumulative effects of the Project in combination with those of other past, present, and future projects and activities in the RSA. Other projects and activities considered in the cumulative effects scoping are discussed in Chapter 6.

Potential cumulative effects on may occur as a result of change in habitat, change in distribution and movement, change in mortality risk, change in health, and change in protected areas as a result of Project activities in combination with those of other projects or activities in the RSA.

The environmental effects of past and present projects and activities on Birds, Other Wildlife and their Habitat, and Protected Areas in the RSA are reflected in the baseline conditions. As many as 138 species of migratory birds and 25 species of non-migratory birds have been reported in the RSA, though 24 of these have been reported only once. Thirteen terrestrial wildlife species, including possible observation of coyote, and three amphibian species have been recorded in the RSA. Habitat for birds and wildlife, including indicator species, is not at maximum capacity within the RSA. In terms of Protected Areas, there are sixteen Wetland Stewardship Habitat Management Units within the RSA. Duley Lake Provincial Park Reserve is located north of the Rose North Waste Rock Disposal Area and has an area of approximately 7 km^2.

As presented in Table 19.10, Project-related effects on Birds, Other Wildlife and their Habitat, and Protected Areas are limited and will be mitigated through the use of well established and proven mitigation measures. Loss of habitat in the PDA will result in fewer individuals / populations of species in the immediate vicinity of the Project. However, the magnitude of adverse residual Project effects will be low because the amount of primary habitat lost for most species will be less than five percent of the total in the RSA.

Project activities will also result in changes to distribution and abundance, mortality risk (through direct loss, indirect loss associated with habitat loss, or through the effects of site lighting on migratory birds), and health (increase in stress leading to disease, or masking of auditory signals). However, the magnitude of Project adverse residual environmental effects will be low because the estimated number of individuals potentially affected is expected to be less than five percent of the local population.

To address the loss of a portion of the Pike Lake South Management Area, Alderon is in the process of pursuing a Corporate Stewardship Agreement with Wildlife Division, DOEC (EHJV) and the communities of Labrador City and Wabush. Therefore, the magnitude of these residual environmental effects will be low.

All other projects and activities identified in the EIS have the potential for cumulative effects with the Project with respect to Birds, Other Wildlife and their Habitat, and Protected Areas. There is insufficient information available regarding changes in habitat, distribution and movement, mortality risk, health, and Protected Areas as a result of existing projects prior to their development, and it is expected that development of older projects (e.g., IOC Labrador operations, Wabush Mines) would not have been subject to the same level of regulatory protection as exists today. However, it is known that the current area of disturbance of these projects totals approximately 250 km^2, and the Project will result in the alteration or loss of approximately 22 km^2 of habitat. Therefore, the Project is not expected to have adverse environmental effects that contribute significantly to the cumulative effects of the other projects and activities. Current and future projects are and will be subject to federal and provincial legislation and policies aimed at protecting migratory birds, wildlife, and their habitat, and it is assumed that current and future projects will implement effective mitigation with respect to associated issues.

A summary of the results of the cumulative effects assessment is provided in Table 19.11.

Table 19.11 Summary of Potential Cumulative Effects to Birds, Other Wildlife and their Habitat, and Protected Areas

VEC Existing Condition (Past & On-Going Activities)	• As many as 138 species of migratory birds and 25 species of non-migratory birds have been reported in the RSA. • Thirteen terrestrial wildlife species have been observed in the RSA. • Three amphibian species have been reported in the RSA. • There are sixteen Management Units within the RSA. Duley Provincial Park Reserve is located just north of the Rose North Waste Rock Disposal Area.		
Project Residual Environmental Effects	• The amount of primary habitat lost for most species will be 5% or less of the total in the RSA. • Project activities will also affect distribution and abundance, mortality risk, and health to birds and wildlife; however, the effects are considered not significant because the estimated number of individuals potentially affected following mitigation measures is expected to be less than 5% of the local population. • The Project will result in the loss of a portion of the Pike Lake South Management Area. Alderon is in the process of pursuing a Corporate Stewardship Agreement.		
Other Projects / Activities	**Likely Effect Interaction (Y/N)**	**Rationale**	**Cumulative Effects**
IOC Labrador Operations	Y	• The loss of habitat and disturbance to wildlife species could overlap within the RSA.	• Effects to birds and wildlife include habitat loss, changes in distribution and movement, changes in mortality risk, and changes in health. • There is no known loss / alteration of a Protected Area resulting from this project.
Wabush Mines (Cliffs Resources)	Y	• The loss of habitat and disturbance to wildlife species could overlap within the RSA.	• Effects to birds and wildlife include habitat loss, changes in distribution and movement, changes in mortality risk, and changes in health. • There is no known loss / alteration of a Protected Area resulting from this project.
Mont-Wright Mine (ArcelorMittal)	Y	• The loss of habitat and disturbance to wildlife species could overlap within the RSA.	• Effects to birds and wildlife include habitat loss, changes in distribution and movement, changes in mortality risk, and changes in health. • There is no known loss / alteration of a Protected Area resulting from this project.
Bloom Lake Mine and Rail Spur (Cliffs Resources)	Y	• The loss of habitat and disturbance to wildlife species could overlap within the RSA.	• Effects to birds and wildlife include habitat loss, changes in distribution and movement, changes in mortality risk, and changes in health. • There is no known loss / alteration of a Protected Area resulting from this project.

Schefferville Iron Ore Mine (Labrador Iron Mines)	Y	• The loss of habitat and disturbance to wildlife species could overlap within the RSA. Migratory avifauna could stage at the Project and breed at this location.	• Effects to birds and wildlife include habitat loss, changes in distribution and movement, changes in mortality risk, and changes in health. • There is no known loss / alteration of a Protected Area resulting from this project.
DSO Iron Ore Project (Tata Steel Minerals Canada)	Y	• The loss of habitat and disturbance to wildlife species could overlap within the RSA. Migratory avifauna could stage at the Project and breed at this location.	• Effects to birds and wildlife include habitat loss, changes in distribution and movement, changes in mortality risk, and changes in health. • There is no known loss / alteration of a Protected Area resulting from this project.
Lower Churchill Generation Project (Nalcor Energy)	Y	• The loss of habitat and disturbance to wildlife species could overlap within the RSA. Migratory avifauna could stage at the Project and breed at this location.	• Effects to birds and wildlife include habitat loss, changes in distribution and movement, changes in mortality risk, and changes in health. • There is no known loss / alteration of a Protected Area resulting from this project.
Infrastructure or other projects at Port of Sept-Îles	Y	• The loss of habitat and disturbance to wildlife species could overlap within the RSA. Migratory avifauna could stage at the Project and breed at this location.	• Effects to birds and wildlife include habitat loss, changes in distribution and movement, changes in mortality risk, and changes in health. • There is no known loss / alteration of a Protected Area resulting from this project.
Urbanization	Y	• The loss of habitat and disturbance to wildlife species could overlap within the RSA.	• Effects to birds and wildlife include habitat loss, changes in distribution and movement, changes in mortality risk, and changes in health. • There is no known loss / alteration of a Protected Area resulting from this project..

Cumulative Effects Summary (Project + relevant other projects and activities)	**Direction**	**Magnitude**	**Geographic Extent**	**Duration**	**Frequency**	**Reversibility**	**Significance**	**Confidence**
	A	L	R	LT	C	I	N	H

The potential residual environmental effects of the Project may have measurable interactions with other existing and planned projects and activities on the amount of habitat and the distribution and movement of bird and wildlife species in the RSA. Project residual effects for Birds, Other Wildlife and their Habitat, and Protected Areas are low in magnitude and not significant. Because of the low magnitude of effects on habitat, distribution and movement, mortality risk, health, and Protected Areas, and because it is assumed ad understood that other projects and activities will implement effective similar mitigation measures as those outlined for the Project, the cumulative effects of the Project in combination with other past, present, and future projects and activities are predicted to be not significant.

Note: Environmental effects descriptors and their definitions are as used in the assessment of Project-related environmental effects

19.8 Assessment of Accidents and Malfunctions

Although unlikely, three potential accident or malfunction scenarios could interact with Birds, Other Wildlife and their Habitat and Protected Areas. These are:

- Forest fire caused by the Project;
- Breach of the polishing pond dyke; and
- Train derailment and consequent spill of materials or contaminants.

An Emergency Response and Contingency Plan will be developed prior to initiation of construction activities and will include detailed measures for responding accidents and malfunctions.

Forest Fire

Although unlikely, a Project-related forest fire could occur during any phase of the Project due to natural causes (e.g., lightning strike resulting in a forest fire under dry conditions), equipment involving the use of heat or flame, or human carelessness, the potential for occurrence of which is greater during the construction phase and operations and maintenance phase of the Project due to increased human activity on the site. A fire in the Project area could alter the distribution of species, with the potential for a short to medium term loss of important habitat.

Factors influencing the extent and duration of a resulting fire would be dependent on response efforts and meteorological conditions, and may also include time of year, type of fire, degree of fuel loading, and fire extent.

The magnitude of the environmental effect is largely dependent on the scale and intensity of the forest fire. Reversibility of the physical effects of a fire is high, but would be anticipated to occur over a number of years. Restoration of important habitat would rely upon the reestablishment of vegetation communities through succession and the maintenance of those ecological conditions that existed prior to disturbance.

The potential for Project-related fires will be mitigated through proper planning, Project design, and the use of standard best management practices, including employee training, proper vigilance working with power equipment in forested areas (e.g., power saw mufflers), and equipment maintenance (e.g., vehicle exhaust systems). All Project activities will be completed in compliance with all appropriate regulation (e.g., *Forest Fire Regulations* under the provincial *Forestry Act*) and any burning of vegetative debris will be completed in accordance with permits obtained from the Newfoundland and Labrador Department of Natural Resources (DNR). Fire suppression water supply will be extracted from Long Lake and will be kept pressurized at the pumping station near the concentrator area. Staff will be trained to prevent and control fires. A plan for preventing and combating forest fires will be incorporated into the Emergency Response Plan. In the unlikely event of a large fire, local emergency response and fire-fighting capability will be called to respond to reduce the severity and extent of damage and to protect the safety of workers. The nearest district forest management unit office is in Wabush, which has staff and equipment to provide initial suppression activities. Two seasonal fire protection staff are stationed at Wabush from mid-May to September, complemented by three permanent staff that are available for fire suppression when needed. After regular hours, the Department maintains one district duty officer and one regional duty officer for receiving fire reports and dispatching staff and equipment. Therefore, in the event of a fire, the on-site response and proximity of provincial fire suppression will limit the size of any burn.

Temporary and localized significant adverse environmental effects on Birds, Other Wildlife and their Habitat, and Protected Areas could result due to forest fires; however, these accidents are unlikely to occur.

Polishing Pond Dyke Breach

Failure of the polishing pond or TMF control structures during construction and operations and maintenance activities includes a partial or total failure resulting in the release of wastewater, effluent, sediment and/or debris downstream. In the case where a large sudden breach occurred, failure of the Polishing Pond control structure could temporarily degrade habitat along the downstream portion of stream TDA-02, the shorelines of Riordan Lake, and adjacent wetlands. Loss of habitat could potentially influence the loss, or sustained presence of plant and wildlife species in the area of the release.

The polishing pond control structure will be engineered, designed and constructed to ensure that it meets accepted engineering practice and principles to avoid its potential failure. Standard acceptable engineering design considers and accounts for the associated loadings or stresses which will be prescribed for the polishing pond control structure. Mitigation measures include, but are not limited to, designing the polishing pond or TMF control structures to relevant codes (e.g., Canadian Dam Association (CDA) Dam Safety Guidelines) and scheduling of activities to accommodate weather interruptions, and regular inspections by the Project Engineer of the Polishing Pond control structure. Outlet structures will be designed to accommodate the 1 in 100-year flood event, and an emergency spillway will be incorporated into design to provide relief of larger runoff events such as from the Probable Maximum Precipitation event.

The extent of the environmental effect of a failure of the polishing pond control structure on birds and other wildlife species, and in particular their habitats, is predicted to be low, as the effects of accidental events of this nature will primarily occur in low-lying areas along the downstream portion of stream TDA-02, and the shorelines of Riordan Lake, such that the extent of effects will be limited. Reversibility of the physical effects of a dyke breach is high, but would be anticipated to occur over a number of years.

The Emergency Response Plan will include response measures to reduce the magnitude of effects resulting from Polishing Pond dyke breach.

Train Derailment

No. 2 diesel fuel will be transported along the rail line to the Project site and ore concentrate will be transported from the Project site to the QNS&L railway. A train derailment may occur during any phase of the Project resulting in the deposition of hazardous materials and/or iron ore concentrate into surrounding lands. Such spills are usually highly localized and can be effectively cleaned up by on-site crews using standard equipment and spill response materials. In the unlikely event of a large spill, soil, groundwater and surface water contamination could occur if not properly contained. The release of any of these materials or contaminants into surrounding lands could result in a degradation of terrestrial, wetland, and/or aquatic habitats with potential effects on populations, in particular where those lands provide habitat for these species (e.g., wetlands). Soil contamination, which affects soil productivity, could potentially occur when a hazardous substance is spilled or leaked. The magnitude and duration of any potential effects of accidental spills depends on the nature of material spilled, the quantity spilled, the location of the spill, and the time of year in which the incident occurs.

The Emergency Response Plan will address emergency preparedness measures necessary to provide effective response in the unlikely event of a spill. In addition to spill response procedures identified in the EPP and Emergency Response and Contingency Plan, the transportation of dangerous goods is strictly regulated in Newfoundland and Labrador, and across Canada, and the regulatory spill response system is highly coordinated and effective means of dealing with such events. Additionally, track inspections (both manual and electronic) to be carried out in accordance with Transport Canada regulations to identify track defects that could lead to derailment. As identified above, the magnitude of the environmental effect of a train derailment and subsequent spill of materials or contaminants would be dependent on a number of factors that are often difficult to predict. Given the aforementioned mitigation, the magnitude of the environmental effects attributable to these infrequent and unlikely accidents and malfunctions is considered low, or under potentially worse case scenarios medium. Reversibility of the environmental effects will depend on the specific habitat involved, and the proportion of habitat affected, and the potential for those habitats to be utilized by species, but would be anticipated to occur naturally over a number of years.

A summary of potential environmental effects resulting from accidents and malfunctions is presented in Table 19.12.

Table 19.12 Summary of Residual Environmental Effects for Birds, Other Wildlife and their Habitat, and Protected Areas – Accidents and Malfunctions

Accidental Event / Malfunction	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	
Forest Fire	• Implement EPP. • Implement Emergency Response Plan. • Employee training.	A	H	L/R	ST	U	R	U	S	H	None recommended.
Polishing Pond Dyke Breach	• Design polishing pond to handle 1 in 100 year peak discharge event. • Include emergency spillway. • Implement EPP. • Implement Emergency Response Plan. • Employee training.	A	L-M	L/R	ST-MT	U	R	U	N	H	Monitor success of response measures.
Train Derailment	• Implement EPP. • Implement Emergency Response Plan. • Employee training.	A	L	L	MT-LT	U	I	U/D	N	H	Monitor success of response measures.

Accidental Event / Malfunction	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	

KEY

Direction:
- P Positive.
- A Adverse.
- N Neutral.

Magnitude:
- L Low - the residual Project effects (alteration / loss) are not expected to exceed 5% of the known population in the LSA. No measurable effect on flora and fauna as a whole.
- M Moderate - the residual Project effects (alteration / loss) are expected to be greater than 5% and not exceed 25% of the known population in the LSA and the effect can be measured.
- H High - the residual Project effects to (alteration / loss) are expected to exceed 25% of the known population in the LSA; the effect can be easily observed, measured and described, and may be widespread.

Geographic Extent:
- S Site-specific (PDA).
- L Local: within the LSA.
- R Regional: within the RSA.
- B Beyond Regional: beyond the RSA.

Duration:
- ST Short-term.
- MT Medium-term.
- LT Long-term.
- P Permanent – will not change back to original condition.

Frequency:
- U Unlikely.
- O Occasionally, once per month or less.
- S Occurs sporadically at irregular intervals.
- R Occurs on a regular basis and at regular intervals.
- C Continuous

Reversibility:
- R Reversible.
- I Irreversible.

Environmental or Socio-economic Context:
- U Undisturbed: Area relatively or not adversely affected by human activity.
- D Developed: Area has been substantially previously disturbed by human development or human development is still present.
- N/A Not Applicable.

Significance:
- S Significant.
- N Not Significant.

Prediction Confidence:

Based on scientific information and statistical analysis, and effectiveness of mitigation or effects management measure.
- L Low level of confidence.
- M Moderate level of confidence.
- H High level of confidence.

19.9 Determination of Significance of Residual Adverse Environmental Effects

19.9.1 Project-related Residual Environmental Effects

The residual adverse environmental effects on Birds, Other Wildlife and their Habitat, and Protected Areas are not likely significant because there are no unique habitats within the PDA, and these species are likely to maintain sustainable populations outside the PDA. A high level of confidence is associated with this prediction because of existing information on the distribution and abundance of species in the PDA and LSA, including Project-specific surveys.

19.9.2 Cumulative Effects

Although there are no projects or activities that overlap spatially with the PDA, the Project could act in combination with past, present, and future projects and activities to result in cumulative effects to Birds, Other Wildlife and their Habitat, and Protected Areas within the RSA. The Project will affect less than five percent of primary habitat contained in the RSA for most species. And, with the implementation of mitigation measures, less than five percent of local populations will be affected by the Project. Current and future projects will be subject to federal and provincial regulatory requirements and policies that protect migratory birds, wildlife, and their habitat, and it is assumed that other current and future projects will be subject to the same requirements. Alderon is in the process of pursuing a Corporate Stewardship Agreement to mitigate adverse environmental effects, including loss, on affected Management Units. Therefore, the environmental effects of the Project in combination with past, present, and future projects are likely to be not significant with respect to Birds, Other Wildlife and their Habitat, and Protected Areas.

19.9.3 Accidents and Malfunctions

Design features and procedures will be incorporated to minimize the probable occurrence of accidents, malfunctions, and unplanned events. Proven engineering techniques are available to prevent these accidents and will be employed for the Project. Safety, spill response and contingency plans will be developed and implemented to reduce adverse environmental effects of such unlikely event incidents. All safety procedures will be documented and in place prior to the commencement of routine operations.

An Emergency Response Plan will further reduce the magnitude of effects resulting from forest fire, polishing pond dyke breach, or train derailments. In addition, design features and safety precautions at the Project will minimize the likelihood of significant effects due to accidents and malfunctions. Depending on the timing and extent, a forest fire could have a significant effect on Birds, other Wildlife and their Habitats, and Protected Areas. Other significant effects resulting from accidents and malfunctions are not likely.

19.9.4 Overall Residual Effects Conclusion

While the Project will affect fauna and/or their habitats, the residual effects are not likely to be significant as those habitats that will be disturbed are representative of those considered generally available throughout western Labrador, and the Project will not affect the sustainability of the populations.

19.10 Follow-up and Monitoring

Compliance monitoring will be conducted to confirm that mitigation measures are appropriately implemented.

19.11 Next Steps

Environmental protection measures for Birds, Other Wildlife and their Habitat, and Protected Areas will be incorporated into the EPP prior to construction. An Avifauna Management Plan will be prepared to mitigate adverse effects on migratory birds. Alderon is in the process of pursuing a Corporate Stewardship Agreement with the municipalities and the Province (through the EHJV) to address the effects of the Project on Management Units, including the Pike Lake South Management Unit.

19.12 Summary

Effects to Birds, Other Wildlife and their Habitat, and Protected Areas will be mitigated through a series of measures designed to limit the area disturbed by the Project, to avoid sensitive areas (e.g., raptor nests) where possible, and to manage emissions and discharges. Site-specific procedures will be outlined in an EPP, and an Avifauna Management Plan. Significant adverse effects from change in habitat, change in distribution and movements, change in mortality risk and change in health are therefore not likely.

Alderon is in the process of pursuing a Corporate Stewardship Agreement with the municipalities and the Province (through the EHJV) to address the effects of the Project on Management Units, including the Pike Lake South Management Unit.

20.0 SPECIES AT RISK AND SPECIES OF CONSERVATION CONCERN

20.1 Valued Ecosystem Component Definition and Rationale for Selection

Species at Risk (SAR) and Species of Conservation Concern (SOCC) was selected as a VEC because of concerns about the vulnerability of these species and/or their habitats to potential Project-related effects. They contribute to overall species diversity in an area and, in terms of vascular plant species, are often found in unusual or uncommon habitats, and thus many rare plants reflect the presence of rare habitats (e.g., calciphiles [calcium-loving species] occupying calcium-rich bedrock or soils). Therefore, recognition of rare plant species can help in the identification of those habitats requiring special attention.

For this environmental assessment, SAR / SOCC were defined on the basis of the component meeting one or more of the following criteria:

- A species and/or its critical habitat is of provincial, national or international importance;
- A species and/or its critical habitat is afforded some level of protection under federal or provincial legislation (i.e., *Newfoundland and Labrador Endangered Species Act* (NLESA), *Species at Risk Act* (SARA), or have special designation by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC));
- A "listed" species and/or its critical habitat as referred to in Schedule 1 of SARA and includes species designated as extirpated, endangered, threatened or of special concern;
- A species and/or its critical habitat that may be under consideration for such legislative protection (i.e., Schedule 2 and 3 of SARA) as assessed by COSEWIC;
- A species not protected under federal or provincial regulatory frameworks, but considered rare, disjunct, or at risk throughout its range in Newfoundland and Labrador (Labrador) and considered unique or unusual (i.e., all SH, S1, S2 or combinations thereof), either locally or regionally, by the Newfoundland and Labrador Department of Environment and Conservation (DOEC) Wildlife Division as recorded by the ACCDC;
- Species not previously reported from Newfoundland and Labrador (Labrador); and
- Important component to the function of other ecosystem elements or functions.

The SAR / SOCC VEC was selected to address government policies regarding the conservation of rare and/or sensitive flora and fauna.

20.1.1 Approach to Assessment of Effects

The assessment considers the environmental effects of the Project on SAR / SOCC identified in the vicinity of the PDA. An assessment (including background research, field studies, and interviews), which includes consideration of the federal SARA and the NLESA, was undertaken to determine the Project effects and technically and economically feasible mitigation measures, as required. The assessment of environmental effects was discussed with the provincial regulator (DOEC), most notably at a meeting on March 1, 2012, attended by:

- Environmental Assessment Division, Newfoundland and Labrador Department of Environment and Conservation;
- Wildlife Division, Newfoundland and Labrador Department of Environment and Conservation;
- Endangered Species & Biodiversity, Wildlife Division, Newfoundland and Labrador Department of Environment and Conservation;
- Executive VP - Environmental and Aboriginal Affairs, Alderon Iron Ore Corp. (Alderon);
- Manager of Environmental Assessment, Alderon; and
- Stantec Consulting Ltd. (Stantec)

The meeting included an outline of the results of the baseline studies and a presentation and discussion of the methodology for environmental effects. The DOEC expressed satisfaction with the overall approach and suggested some additional data sources relevant to the background research program. Other issues included ongoing consultation with relevant stakeholders, as well as the need for review, and potentially, field assessment, of any pre-construction activities that might entail Project-related effects to existing, known rare plant or fauna locations.

Information used to determine the known or likely presence of each identified SAR / SOCC and their important habitats within or in proximity to the PDA was derived from reviews of local historical records and other data sources, including:

- SARA, NLESA, COSEWIC Status Reports, Recovery and Management Plans (if available);
- Government and non-governmental sources, (i.e., Atlantic Canada Conservation Data Centre 2010 Provisional Status Ranks (Labrador), DOEC General Status Rankings (Labrador), eBird);
- Published and unpublished literature by the Study Team and others, including peer-reviewed academic journals, research project reports, government publications;
- Regional floras (Gray's Manual of Botany (Fernald 1950), Flora of Canada (Scoggan 1978) and available volumes of the Flora of North America (FNA; 1993, 1997, 2002, 2006, 2007));
- Project field data collected (2011-2012) as a part of the environmental baseline program for the Project; and
- Recent aerial photographs and topographical maps that could indicate the presence of potentially rare plant species or habitats.

Status of Information for Species at Risk and Species of Conservation Concern in Labrador

Botanical studies, particularly floristic surveys, provide documentation of all the taxa (species, subspecies, varieties) for a particular geographic region and determination of their distribution and abundance within that area. Rare, endemic, and disjunct taxa (i.e., listed, rare, or potentially uncommon plants) have a special place in such studies as they typically contribute to the diversity and uniqueness of flora. Spatial analysis of SAR / SOCC relies on recorded occurrences of rare, endemic, and disjunct taxa within the LSA being evaluated. Therefore, if species contained within the provincial database (ACCDC 2011) are not recorded for the area, this could simply indicate that few inventories or surveys have been conducted in this part of the province and does not preclude the potential for SAR / SOCC within the LSA. Results of the SARA Public Registry and ACCDC database search are not intended as a final statement on the presence, absence, or condition of rare or plant SOCC within a given area, or as a substitute for on-site surveys that may be required.

Since Labrador has not been as extensively botanically studied as insular Newfoundland, information, including literature, on the current known distribution of listed plant species (i.e., SAR) afforded protection under the federal SARA and provincial *Endangered Species Act* (NLESA), or those plant species deemed of conservation concern to the DOEC (i.e., provincially ranked SH, S1, S2, or combinations thereof) (ACCDC 2010), and located at or near the Project, is limited. As the Project proceeds, SAR / SOCC and their habitats may be discovered within the LSA, and more importantly PDA for the Project.

The abundance of some rare or potentially uncommon plant species identified through field studies and a literature review of other Labrador plant surveys suggests that the current S Ranks as provided by the ACCDC for several of those species identified within the LSA may be conservative. That is, some species thought to be rare may in fact not be rare; the scarcity ranking may be the result of the lack of information on the distribution of Labrador plant species. Lack of adequate information on the distribution of some Labrador plant species also contributes to conservative scarcity rankings.

As new information becomes available through future botanical surveys performed throughout western Labrador these species and their scarcity ranks will be adjusted accordingly by DOEC.

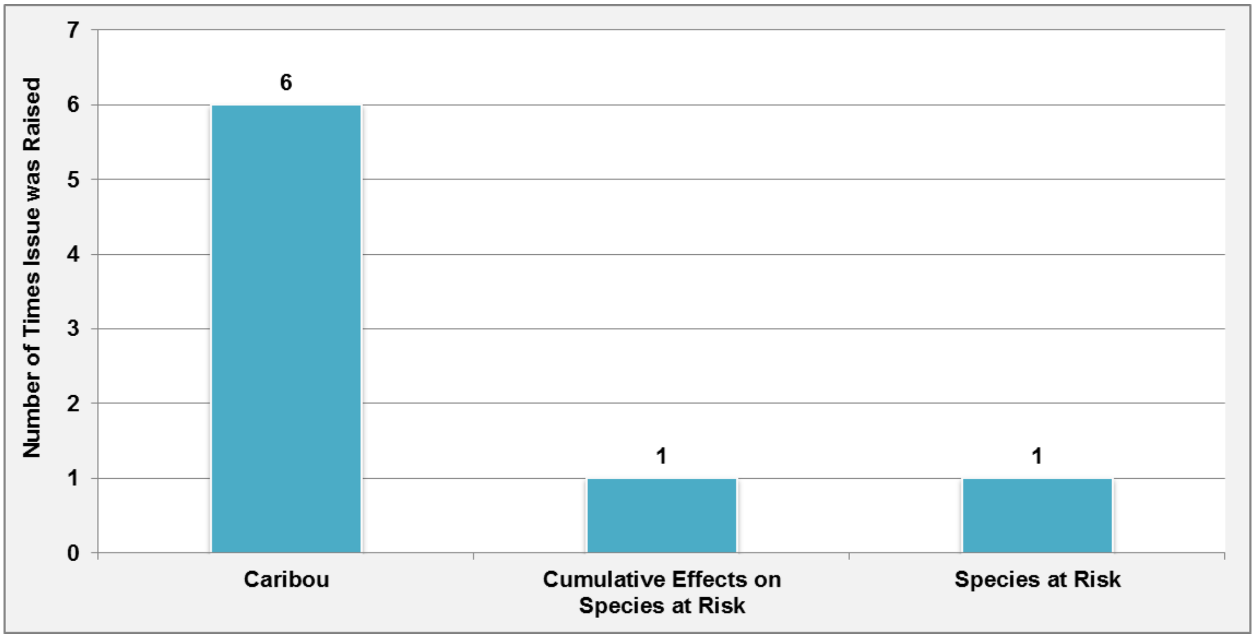
20.1.2 Issues

The issues that were raised regarding SAR during Aboriginal, public, and stakeholder consultations are shown in Table 20.1 and the number of times an issue was raised is shown in Figure 20.1.

Table 20.1 Issues Raised by Aboriginal Groups and Stakeholders

Issue	Community / Organization	Summary of Comments Raised During Consultation and Engagement Activities	Response / Location in the EIS
Potential Effects on Species at Risk	Labrador City / Wabush	Specific wildlife sightings reported by community members: Harlequin duck are in Jean Lake and Wabush Pond during migration bird count; and Gray-cheeked thrush (sightings to the east).	A description of existing wildlife is provided in Section 19.5. Baseline data collection for the EIS included aerial surveys for waterfowl completed in 2011, songbird survey completed in 2011 and 2012, and winter aerial surveys in 2012. Harlequin Duck was not observed during these surveys but was reported at Jean Lake Rapids by a stakeholder. Section 20.5 includes a description of species at risk and of conservation concern within the Project area. Potential effects to species at risk and mitigation measures are identified in Section 20.6.
Potential Effects on Caribou	Innu Nation	Alderon should put a fence around the tailings and the pit to prevent wildlife (e.g. caribou and partridge) that go in these areas from eating the tailings.	The TMF will be contained by a series of natural ridges and containment dams/dykes. Key consideration in the design and planning of the TMF are described in Section 2.5.4. Sedentary herds of caribou are not present within the Project area and are therefore not anticipated to be affected by the Project. Section 20.5 includes a description of existing species at risk and of conservation concern that are found within the Project area.
	NNK	Community members have followed caribou into Labrador in the past and may again in the future. The caribou once came through the community but not anymore (there were 900,000 caribou, now there are around 80,000). One caribou come into the community over Christmas, and this was the first in 6 years.	Sedentary herds of caribou are not present within the Project area and are therefore not anticipated to be affected by the Project. Section 20.5 includes a description of existing species at risk and of conservation concern that are found within the Project area.
	NNK	There is a third herd of caribou that has been identified by a Québec biologist Natalie d'Astous near the Québec - Labrador border. This herd could be affected by the Project.	

Figure 20.1 Frequency of Issue Type related to SAR / SOCC



20.2 Environmental Assessment Boundaries

20.2.1 Spatial Boundaries

Local Study Area (LSA)

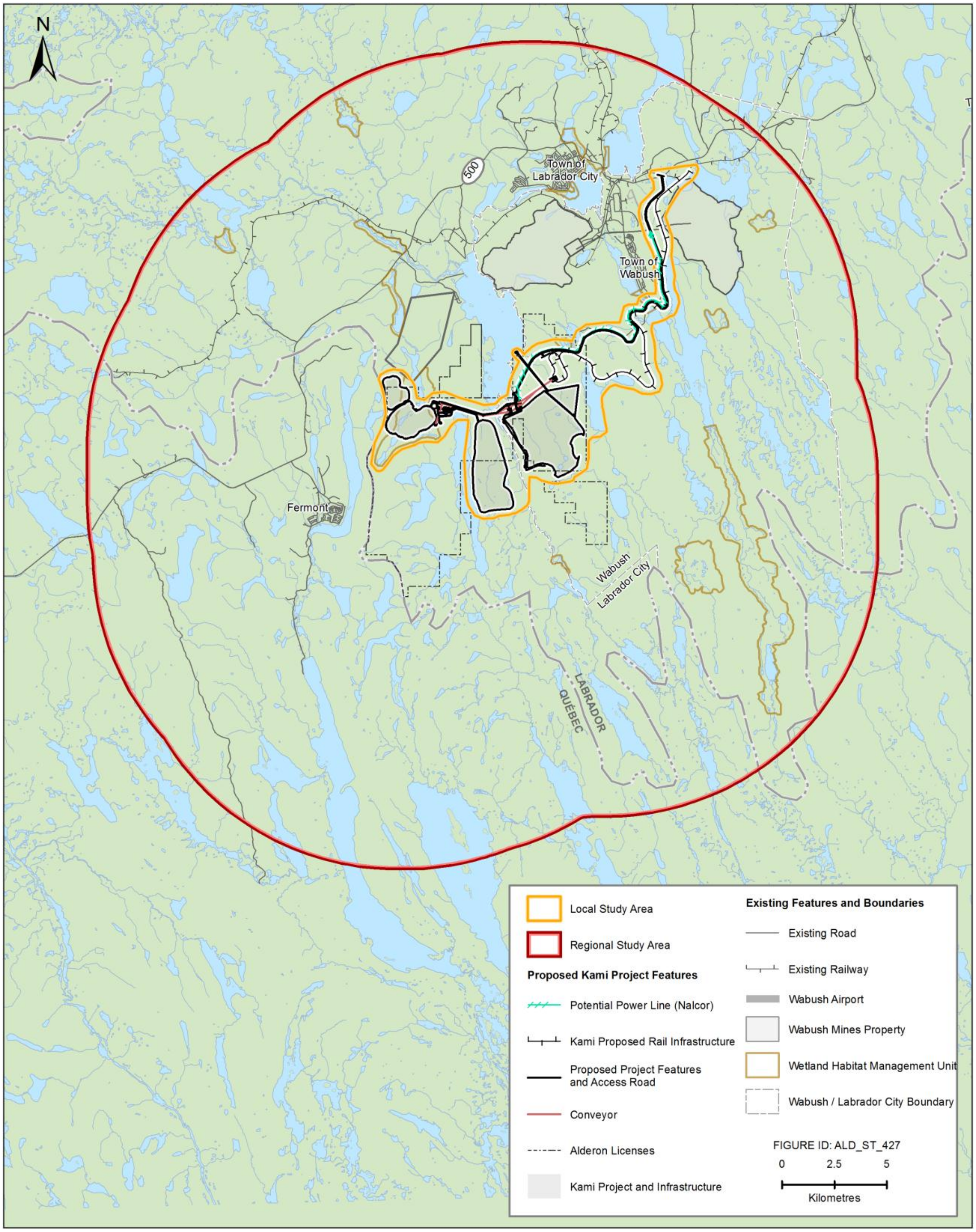
For the EA of SAR / SOCC, the LSA includes all proposed Project infrastructure (i.e., Rose Pit mine site, Tailings Management Facility (TMF), waste rock disposal areas, concentrator buildings, office buildings, access road, rail infrastructure, and powerline components), with a 500 m buffer placed around these Project components. The LSA includes the area that will be directly affected by surface disturbance activities (i.e., the Project footprint), in addition to the buffer which represents a zone of other potential effects (e.g., air emissions or particulates, dust).

The spatial boundary for the SAR / SOCC LSA is approximately 71 km^2 (Figure 20.2).

Regional Study Area (RSA)

The RSA includes the LSA and surrounding area to provide a regional context for understanding SAR / SOCC that could potentially interact with the Project. The RSA was defined to capture the farthest measurable effect of the Project on SAR / SOCC. It is the area within which cumulative effects for the SAR / SOCC VEC may occur. The RSA is the area within which the significance of Project effects is predicted. The RSA boundary encompasses an area of approximately 1,193 km^2 (Figure 20.2).

Figure 20.2 Local and Regional Study Areas for SAR / SOCC



20.2.2 Temporal Boundaries

The temporal boundaries for the assessment of potential environmental effects of the Project on SAR / SOCC include the Project phases of construction (approximately two years), operation and maintenance (approximately 17 years), and decommissioning / reclamation (approximately one year after operations cease).

Most potential Project environmental effects on SAR / SOCC will begin and peak during construction, and diminish during operation and maintenance of the Project. In addition to the time required for reclamation, the decommissioning and reclamation phase includes any monitoring or active site management required in perpetuity to ensure that an appropriate end land use has been established. During construction and operation and maintenance, Project-related effects are considered to be temporary, while effects that persist after decommissioning and reclamation (e.g., maintenance of TMF) are considered to be permanent.

All flora and some of the fauna SAR / SOCC are resident in the Project area throughout the year, while others are present only seasonally, either during the breeding season, or in passage during spring and fall migration.

20.2.3 Administrative Boundaries

SAR / SOCC are protected under federal and provincial legislation, regulations, policies, and guidelines. A thorough assessment of Project-related effects on SAR / SOCC, and their significance, is required under CEAA, and all appropriate mitigation measures will be identified. This SAR / SOCC VEC will be developed in accordance with applicable provincial and federal acts and associated regulations and may include the following:

- Newfoundland and Labrador *Environmental Protection Act*;
- Newfoundland and Labrador *Endangered Species Act*;
- Newfoundland and *Labrador Wildlife Act;*
- *Canadian Environmental Assessment Act* (CEAA);
- *Species at Risk Act* (SARA); and
- *Canada Wildlife Act*.

In addition to regulatory requirements, the Project will also be subject to the applicable federal, provincial and non-governmental policy and guidelines:

- COSEWIC management and recovery plans;
- Species Status Advisory Committee (SSAC);
- Accord for the Protection of Species at Risk; and,
- Wild Species: The General Status of Wild Species in Canada.

Other provincial and national programs that can incorporate SAR / SOCC VEC as the main feature include:

- Atlantic Canada Conservation Data Centre Status Rankings.

20.2.3.1 Federal and Provincial Legislation

In recognition of the aesthetic, cultural, spiritual, recreational, educational, historical, economic, medical, ecological, and scientific values provided by our natural resources including wildlife and plants, the Newfoundland and Labrador and Canadian governments enacted legislation that includes the protection of individual species or populations as well as rare or sensitive habitats they occupy.

The federal and provincial legislation applicable to the Project includes:

- *Species at Risk Act* 2002, c. 29 (Assented to December 12, 2002) of Canada; and,
- *Endangered Species Act* S.N.L. 2001, c.E.-10.1. (Assented to December 13, 2001) of Newfoundland and Labrador.

The federal SARA provides protection to species at the national level to prevent extinction and extirpation, facilitate the recovery of endangered and threatened species, and to promote the management of other species to prevent them from becoming at risk in the future. The Newfoundland and Labrador *Endangered Species Act* (NLESA) provides protection for species considered to be endangered, threatened, or vulnerable within the province.

Canada

Canada's indigenous species, subspecies, and distinct populations that are considered "at risk" are protected under SARA. Proclaimed in 2003, SARA provides legal protection to species and the conservation of their biological diversity. The purposes of the Act are to prevent species from becoming extirpated or extinct, to provide for the recovery of endangered or threatened species, and encourage the management of other species to prevent them from becoming at risk (Committee on the Status of Endangered Wildlife in Canada 2010). Designation under the Act follows recommendation and advice provided by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) to the Government of Canada. COSEWIC is responsible under SARA for assessing the biological status of each rare species in Canada. Under SARA, the Governor in Council may accept the assessment and add the species to Schedule 1 of SARA, decide not to add the species to Schedule 1, or may refer the assessment back to COSEWIC for further information or consideration.

Subsection 79(1) of SARA (SARA 2002) stipulates that every person who is required by or under an Act of Parliament to ensure that an assessment of the environmental effects of a project is conducted must, without delay, notify the competent minister or ministers in writing of the project if it is likely to affect a listed wildlife species or its critical habitat. Additionally, SARA subsection 79(2) (SARA 2002) states that where a federal environmental assessment is being carried out in relation to a project that may affect a listed wildlife species or its critical habitat, the person responsible for ensuring the assessment is conducted must:

- Identify potential adverse effects on the listed wildlife species and its critical habitat; and,
- If the project is carried out:
  - Ensure that measures are taken to avoid or lessen those adverse effects and to monitor them, and
  - Ensure that such measures are consistent with any applicable recovery strategy and action plans.

Under the SARA, there are three schedules; species officially protected are listed under Schedule 1 of SARA (Government of Canada 2011) and designated as “extinct, extirpated, endangered, threatened and special concern” by COSEWIC are protected by that Act. SARA-listed species designated as “special concern” are not protected by the prohibitions of Sections 32 to 36 of SARA; however; they do require that provincial or regional management plans are developed to protect the species. Table 20.2 shows the conservation status categories for the SARA and COSEWIC.

“Listed species” refers to species listed in Schedule 1 of SARA and includes species designated as extirpated, endangered, threatened or of special concern. Listed species are identified on the Species at Risk Public Registry at www.sararegistry.gc.ca/species/default_e.cfm.

Schedule 1 of SARA is the official list of wildlife Species at Risk. Once a species is “listed”, the measures to protect and recover a listed wildlife species are implemented. Species that were designated at risk by the COSEWIC prior to the existence of the SARA require reassessment before being placed on Schedule 1. These species are listed on Schedule 2 if they were previously assessed by COSEWIC as endangered or threatened, and on Schedule 3 if they were previously assessed by COSEWIC as special concern. Both Schedules 2 and 3 are not provided with legal protection under the SARA. The differentiation by schedule under the SARA will be eliminated following all reassessments.

Table 20.2 COSEWIC and SARA Conservation Status Category Descriptions

Rank*	Description*
Extinct (X)	A wildlife species that no longer exists.
Extirpated (XT)**	A wildlife species that no longer exists in the wild in Canada, but exists elsewhere in the wild.
Endangered (E)**	A wildlife species that is facing imminent extirpation or extinction in Canada.
Threatened (T)**	A wildlife species that is likely to become an endangered species if nothing is done to reverse the factors leading to its extirpation or extinction.
Special Concern** (SC)	A wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.
Not at Risk (NAR)	A wildlife species that has been evaluated and found to be not at risk of extinction given the current circumstances.

Rank*	Description*
Data Deficient (DD)	A category that applies when the available information is insufficient (a) to resolve a wildlife species' eligibility for assessment or (b) to permit an assessment of the wildlife species' risk of extinction.
Notes: * COSEWIC 2011. Excerpt from web site - http://www.speciesatrisk.gc.ca/legislation/default_e.cfm. ** denotes a COSEWIC risk category. Note Wildlife Species is "a species, subspecies, variety or geographically or genetically distinct population of animal, plant or other organism, other than a bacterium or virus, that is wild by nature and is either native to Canada or has extended its range into Canada without human intervention and has been present in Canada for at least 50 years" (COSEWIC 2011).	

Newfoundland and Labrador

Proclaimed in 2001, the NLESA was enacted to ensure the protection and survival of endangered and threatened species in the province; enable the reintroduction of extirpated species into the province; and designate species as endangered, threatened, or vulnerable. The NLESA applies to indigenous species, sub-species, and populations (but it does not include marine fish, bacteria, and viruses, and non-indigenous species are only considered under the NLESA under extraordinary circumstances). Designation follows recommendations from the national COSEWIC and/or the provincial SSAC on the appropriate assessment of a species. Both COSEWIC and SSAC are independent committees and consist of government and non-government scientists who determine the status of species, subspecies and significant populations considered to be at risk of extinction or extirpation both nationally and provincially, respectively. The evaluation processes of both are independent, open and transparent, and based on the best available information on the biological status of species including scientific, community and traditional knowledge. Various species protected under the NLESA are also protected under the SARA. Differences in designation are likely to be observed when a species is at risk in a province, and is more common from a national perspective.

Provincially, there are three designations:

- **Endangered:** a wildlife species that is facing imminent extirpation or extinction;
- **Threatened:** a wildlife species that is likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction; and
- **Vulnerable:** a wildlife species that has characteristics which make it particularly sensitive to human activities or natural events.

Habitat that is important to the recovery and survival of endangered or threatened species can be designated as critical habitat or recovery habitat, and thereby protected under the NLESA. Critical habitat is a key contributor to the survival of a species and can include all, or a portion of, suitable habitat for some or all known locations of the species. Critical habitat must include an appropriate amount of habitat to support individuals of a species to ensure the survival of the species. The NLESA also identifies recovery habitat that is not considered to be critical to the survival of the species, however it may serve in helping the species become self-sustaining.

Upon legal listing of the species designated as "threatened" or "endangered" under NLESA, a recovery team of qualified professionals (e.g., species experts, researchers, industry representatives, community representatives, and wildlife managers) is established, the mandate of which is the preparation of a recovery plan for the species. Under the NLESA, recovery plans are required for a species within one year from the date that a species is designated as "endangered" and within two years from the date that a species is designated as "threatened", unless it is determined by the appropriate regulatory authority that the recovery of the species is not feasible. In the case of "vulnerable" species, management plans are required within three years of the species being so designated. Although some of the specific requirements in the NLESA differ from those in SARA, the intent and purpose of both acts regarding recovery planning is analogous.

There are currently 35 species, subspecies, and populations designated under the NLESA. Thirteen of these species are listed as endangered, nine as threatened, and 13 as vulnerable.

To ensure consideration of all relevant SAR / SOCC, those currently recommended for status, previously considered to be of special conservation concern, and those yet to be re-assessed for formal status have also been included in this report (i.e., Schedule 2 and Schedule 3 species, COSEWIC designated, and SSAC designated) (Table 20.3).

Table 20.3 Newfoundland and Labrador *Endangered Species Act* Conservation Status Category Descriptions

Rank	Description
Endangered	A wildlife species that is facing imminent extirpation or extinction.
Threatened	A wildlife species that is likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction.
Vulnerable	A wildlife species that has characteristics which make it particularly sensitive to human activities or natural events.

Additionally, the DOEC Wildlife Division also makes use of a different ranking system known as *The General Status of Species in Canada*. The *Wild Species* series on the general status of species in Canada is a requirement of the *Accord for the Protection of Species at Risk*, an agreement in principle established in 1996 by provincial, territorial, and federal ministers responsible for wildlife. The goal of the Accord is to prevent species in Canada from becoming extinct or extirpated because of human impact (CESCC 2010). *The General Status of Species in Canada* presents the results of general status assessments for a broad cross-section of Canadian species.

Under this system, each species assessed in the *Wild Species* reports received a general status rank in each province, territory, or ocean region in which they are known to be present, as well as an overall Canada General Status Rank (Canada rank). The provincial General Status assessment process serves as a first alert tool for identifying species in the province that are potentially at risk. Under this process, populations of species that are native to the province are classified to be either "At Risk", "May be at Risk", "Sensitive" to human activities or natural events, “Secure”, or “Undetermined” should there be insufficient data, information, or knowledge available to assess their status.

Although species listed under this process are not granted legislative protection, the presence of species whose populations are considered to be At Risk, May be at Risk, or Sensitive are an issue of concern for provincial regulators. They are different from status designations assigned after detailed assessments done by some provincial committees (i.e., SSAC) on Species at Risk or by COSEWIC and this difference is reflected in the ranks' names and in their definition. Definitions of the General Status rankings are provided in Table 20.4.

The DOEC Wildlife Division, in conjunction with the ACCDC, maintains a comprehensive list of vascular plant species which it considers to be rare (i.e., species of special conservation concern). The ACCDC ranks species on the basis of their global (G), national (N) and provincial status (S) a system developed by the Nature Conservancy (Nature Conservancy 2011) and used by all Conservation Data Centres and Natural Heritage Programs throughout North America. These ranks are used to determine species protection and are assigned a numeric rank ranging from 1 (extremely rare) to 5 (demonstrably secure) for each species. This reflects the species’ relative endangerment and is based on the number of occurrences of that species globally or within the province (ACCDC 2010). Plant species considered rare, uncommon, unique or unusual, either locally or regionally, by the DOEC Wildlife Division as recorded by the ACCDC include all SH, S1 and S2 species. A combined rank (e.g., S1/S2) is given for species whose status is uncertain; the first rank indicates the rarity status given current documentation, and the second rank indicates the rarity status that will most likely be assigned after all historical data and likely habitats have been checked. While S3 species are of concern from a provincial biodiversity perspective, they have not been included as their populations are considered less sensitive. ACCDC status ranks for Labrador were used to identify species of special conservation concern within the LSA and RSA. Definitions of the ACCDC rankings are provided in Table 20.5.

Table 20.4 Definitions of General Status of Wild Species in Canada

Rank	General Status Category	Category Description
0.2	Extinct	Species that are extirpated worldwide (i.e., they no longer exist anywhere).
0.1	Extirpated	Species that are no longer present in a given geographic area, but occur in other areas.
1	At Risk	Species for which a formal, detailed risk assessment (COSEWIC status assessment or provincial or territorial equivalent) has been completed and that have been determined to be at risk of extirpation or extinction (i.e. Endangered or Threatened). A COSEWIC designation of Endangered or Threatened automatically results in a Canada General Status Rank (Canada rank) of At Risk. Where a provincial or territorial formal risk assessment finds a species to be Endangered or Threatened in that particular region, then, under the general status program, the species automatically receives a provincial or territorial general status rank of At Risk.
2	May Be At Risk	Species that may be at risk of extirpation or extinction and are therefore candidates for a detailed risk assessment by COSEWIC, or provincial or territorial equivalents.

Rank	General Status Category	Category Description
3	Sensitive	Species that are not believed to be at risk of immediate extirpation or extinction but may require special attention or protection to prevent them from becoming at risk.
4	Secure	Species that are not believed to belong in the categories Extinct, Extirpated, At Risk, May be at Risk, Sensitive, Accidental or Exotic. This category includes some species that show a trend of decline in numbers in Canada but remain relatively widespread or abundant.
5	Undetermined	Species for which insufficient data, information, or knowledge are available with which to reliably evaluate their general status.
6	Not Assessed	Species that are known or believed to be present regularly in the geographic area in Canada to which the rank applies, but have not yet been assessed by the general status program.
7	Exotic	Species that have been moved beyond their natural range as a result of human activity. In this report, exotic species have been purposefully excluded from all other categories.
8	Accidental	Species occurring infrequently and unpredictably, outside their usual range.
Source 'Wild Species: The General Status of Wild Species in Canada' website Available at: http://www.wildspecies.ca/ranks.cfm?lang=e (DOEC 2010)		

Table 20.5 Definitions of the Atlantic Canada Conservation Data Centre S Rankings

Provincial Ranking	Frequency / Comments
S1	Extremely rare throughout its range in the province (typically five or fewer occurrences or very few remaining individuals). May be especially vulnerable to extirpation.
S2	Rare throughout its range in the province (6 to 20 occurrences or few remaining individuals). May be vulnerable to extirpation due to rarity or other factors.
S3	Uncommon throughout its range in the province, or found only in a restricted range, even if abundant in some locations (21 to 100 occurrences).
S4	Usually widespread, fairly common throughout its range in the province and apparently secure with many occurrences, but the species is of long-term concern (e.g., watch list) (100+ occurrences).
S5	Demonstrably widespread, abundant and secure throughout its range in the province, and essentially ineradicable under present conditions.
S#/S#	Numeric range rank: A range between two consecutive numeric ranks. Denotes uncertainty about the exact rarity of the species (e.g., S1/S2).
?	Inexact or uncertain: for numeric ranks, denotes inexactness (e.g., SE? denotes uncertainty of exotic status). (The? Qualifies the character immediately preceding it in the S Rank).
SU	Unrankable: Possibly in peril, but status is uncertain - more information is needed.
SR	Reported but without persuasive documentation (e.g., misidentified specimen).
SE	Exotic / introduced species.
Hybrid	Hybrid of two similar species.
Source: ACCDC 2010	

For Labrador, the ACCDC currently uses both an official and draft ranking system. For many of the species identified in this survey, an official rank of S? has been assigned along with a different draft rank. An S? identifies a species that has not yet been thoroughly assessed for the jurisdiction. A rare plant species is defined in this study as those assigned S Ranks of S1, S2, S2/S3 or SU by the provincial DOEC Wildlife Division and as recorded by the ACCDC. While S3 species are of concern from a provincial biodiversity perspective, they have not been included as their populations are considered less sensitive.

20.3 Establishing Standards or Thresholds for Determining the Significance of Environmental Effects

The likely effects of the Project on SAR / SOCC are described using the following attributes that are based on standard environmental assessment practice and the EIS Guidelines. Significance of environmental effects is assessed in accordance with CEA Agency guidelines. The following terms are used to characterize residual environmental effects for the SAR / SOCC VEC, direction, magnitude, geographical extent, frequency, duration, reversibility and ecological context. These descriptors, and definitions for each of their associated ratings, are defined below.

- **Direction:**
  - Positive – Beneficial or desirable change in the environment;
  - Neutral – No detectable or measureable change in the environment; and
  - Adverse – Worsening or is undesirable change in the environment.
- **Magnitude:**
  - Low – the residual Project effects (alteration or loss) are not expected to exceed 5 percent of the known population in the RSA. No measurable effect on SAR / SOCC;
  - Moderate – the residual Project effects (alteration / loss) are expected to be greater than 5 percent and not exceed 25 percent of the known population in the RSA and the effect can be measured; and
  - High – the residual Project effects to (alteration / loss) are expected to exceed 25 percent of the known population in the RSA; the effect can be easily observed, measured and described, and may be widespread.
- **Geographic Extent:**
  - Site-specific – Effect confined to the Project footprint for all Project components (i.e., PDA), and limited to directly affected environmental components;
  - Local – Effect extends beyond the Project footprint into the surrounding areas within the LSA;

  - Regional – Effect extends beyond the LSA into RSA, where indirect or cumulative effects may occur; and
  - Beyond Regional (provincial, national, and/or international extent) - Effect extends beyond the RSA. Area where indirect or cumulative effects may occur.
- **Frequency:**
  - Once – Effect occurs once during the life of the Project (e.g., clearing);
  - Sporadic – Effect occurs sporadically, at irregular intervals, without any predictable pattern during the life of the Project (e.g., hydrocarbon spills);
  - Regular – Effect occurs on a regular basis and at regular intervals during the life of the Project; and
  - Continuous – Effect occurs continuously.
- **Duration:**
  - Short term – Effect occurs during the site-preparation or construction phase of the Project (i.e., 1 to 2 years);
  - Medium term – Effect extends throughout the construction and operation phases of the Project (up to 15 years);
  - Long term – Effect is greater than 15 years; and
  - Permanent – Effect persists.
- **Reversibility:**
  - Reversible – Effect is reversible during the life of the Project; and
  - Irreversible – A long-term effect that is permanent (i.e., remains indefinitely as a residual effect).
- **Ecological Context:**
  - Undisturbed – Area relatively or not adversely affected by human activity; and
  - Disturbed – Area has been substantially previously disturbed by human development or human development is still present.

Although there are no thresholds to assess the potential alteration / loss of individual listed plants or plant populations, an accepted guideline in the collection of vascular and non-vascular plant voucher specimens is that an immediate population can withstand the loss of 1 in 20 individuals or 5 percent of a population (Alberta Native Plant Council [ANPC] Native Plant Collection and Use Guidelines 2000). For the purposes of this assessment, 5 percent will be used as a benchmark to address the magnitude of effects on rare plant populations.

A significant adverse residual environmental effect for flora or fauna Species at Risk is one that affects a species federally listed under Schedule 1 of SARA as “Endangered” or “Threatened” or provincially listed under Newfoundland and Labrador *Endangered Species Act* (NLESA) as “Endangered”, “Threatened” or “Vulnerable” and results in a non-permitted contravention of any of the prohibitions stated in Sections 32-36 of SARA, or in contravention of any of the prohibitions stated in Section 3 of the NLESA (i.e., loss of more than 5 percent of a SARA or NLESA-listed plant population).

A significant adverse residual environmental effect for SOCC is defined as a Project-related environmental effect on flora or fauna species not currently under the protection of SARA or the *Endangered Species Act* (i.e., listed as “Special Concern” in Schedule 1 of SARA; listed in Schedule 2 or 3 of SARA); ranked as SH, S1, or S2 by ACCDC for vegetation; and/or ranked “May Be At Risk”, “Sensitive” or “Undetermined” by the NLDEC. It is one that:

- Results in direct mortality of individuals or communities such that the likelihood of the long-term survival of these rare or sensitive plant or fauna species within the RSA is substantially reduced; or
- Results in degradation, alteration or loss of critical or important habitat within the PDA, either physically, chemically, or biologically; in quality or extent, in such a way as to cause a change or decline in the distribution or abundance of a rare or sensitive species that is dependent upon that habitat, such that the likelihood of the long-term viability or survival of the population within the RSA is substantially reduced as a result.

An environmental effect that does not meet any of the above criteria is rated as not significant.

20.4 Potential Project-VEC Interactions

The environmental assessment of the SAR / SOCC VEC is focused on the following environmental effects:

- Change in habitat (critical or important primary habitat);
- Change in distribution and movement (movement relevant for fauna only);
- Change in mortality risk (can infer abundance for flora); and
- Change in health (relevant for fauna only).

Plant and wildlife SOCC are known to be present in the Project area based on field surveys conducted in 2011 and 2012.

Table 20.6 provides a list of Project activities and physical works and whether or not an interaction is expected to occur with each identified potential environmental effect. The interactions will be ranked either as a 0, no interaction occurs, 1, interaction occurs however the resulting effect can be managed through proven mitigation and codified practice, or as a 2, an interaction occurs and requires further assessment. Those interactions ranked as 0 or 1 are discussed in this section, whereas those that are ranked as 2 are further assessed in Section 20.6.

Table 20.6 Potential Project Environmental Effects to SAR / SOCC

Project Activities and Physical Works	Potential Environmental Effect			
	Change in Habitat	Change in Distribution and Movement	Change in Mortality Risk	Change in Health
Construction				
Site Preparation (including clearing, excavation, material haulage, grading, removal of overburden and stockpiling)	2	2	2	2
Construction of Roads	2	2	2	2
Construction of Site Buildings and Associated Infrastructure (maintenance facilities, offices, plant, crushers, concentrator, conveyors, gatehouse, pumphouses, substation, security fencing, sanitation system)	1	2	1	1
Construction of Mine Tailings Management Facility (TMF)	2	2	1	2
Construction of Railway and Load-out Facilities (silos)	2	2	1	1
Construction of Power Line	2	2	1	1
Construction of Stream Crossings	2	2	1	1
Installation of Water Supply Infrastructure (wells, pumps, pipes)	2	2	1	1
Onsite Vehicle / Equipment Operation	1	2	2	1
Waste Management	1	2	2	1
Transportation of Personnel and Goods to Site	1	2	2	1
Expenditures	0	0	0	0
Employment	0	0	0	0
Operation and Maintenance				
Open Pit Mining (including drilling, blasting, ore and waste haulage, stockpiling, dewatering)	1	2	1	2
Ore Processing (including crushing, conveying, storage, grinding, screening)	1	2	1	2
Concentrator Operations (gravity and magnetic separation, tailings dewatering, tailings thickener, concentrate conveyance to load-out)	1	1	1	1
Tailings Disposal in TMF	1	2	2	2
Waste Rock Disposal on Surface	1	2	1	2
Water Treatment (including mine water and surface runoff) and Discharge	1	1	2	2
Rail Load-Out by Silo Discharge	1	1	1	2
Rail Transport	1	2	2	1

Project Activities and Physical Works	Potential Environmental Effect			
	Change in Habitat	**Change in Distribution and Movement**	**Change in Mortality Risk**	**Change in Health**
Onsite Vehicle / Equipment Operation and Maintenance	1	2	2	1
Waste Management	1	1	1	1
Transportation of Personnel and Goods to Site	1	1	2	1
Fuel Storage and Dispensing	1	1	1	1
Progressive Rehabilitation	2	2	1	2
Expenditures	0	0	0	0
Employment	0	0	0	0
Decommissioning and Reclamation				
Site Decommissioning	1	1	1	1
Site Reclamation (building demolition, grading, scarifying, hydroseeding)	2	2	2	2
Accidents and Malfunctions				
Train Derailment	2	2	2	2
Forest Fires	2	2	2	2
Polishing Pond Dyke Breach	2	2	2	2

KEY

0 No interaction.

1 Interaction occurs; however, based on past experience, the resulting effect can be managed to acceptable levels through standard operating practices and/or through the application of best management or codified practices. No further assessment is warranted.

2 Interaction occurs, and resulting effect may exceed acceptable levels without implementation of specific mitigation. Further assessment is warranted.

As summarized in Table 20.6, a number of potential interactions are not expected to occur (0) or might occur, but do not warrant further assessment because the resulting effect can be limited to acceptable levels through standard approaches. In terms of no interaction with the effects and the Project, expenditures or employment during either construction or operation and maintenance would be considered to have no measurable influence on this VEC.

There are several Project activities that will have interactions with change in habitat for flora or fauna that can be easily limited to acceptable levels. Construction of site buildings and associated infrastructure, onsite vehicle / equipment operation, waste management, and transportation of personnel and goods to site are expected to be within the area already cleared (i.e., no additional clearing required). During operation and maintenance all of the remaining Project activities except progressive rehabilitation will occur within an area that is already disturbed habitat. Site decommissioning will result in changes, but all the areas affected are likely to be previously disturbed, and the net change in wildlife habitat availability is expected to be positive.

During construction, most Project activities (except those identified as 0 above) will influence the change in distribution and movement. However, a number of Project activities during operation and maintenance are expected to have minor interactions with distribution and movement of fauna. Concentrator operations, water treatment and discharge, rail load-out, waste management, transportation of personnel and goods to site, and fuel storage and dispensing may, through sensory disturbance have an effect on distribution and movement of wildlife SAR / SOCC. Site decommissioning will result in changes, but for most species will likely results in a net increase in occurrence.

No mortality risk is expected as a result of expenditures or employment, during construction or operation and maintenance.

A variety of Project activities have the potential to increase risk of mortality, but to an extent that would be acceptable. During construction, these include construction of site buildings and associated infrastructure, construction of the TMF, construction of railway and load-out facilities, construction of power line, construction of stream crossings, and installation of water supply infrastructure. During operation and maintenance, activities that may result in a minor increase in mortality include open pit mining, ore processing, concentrator operations, waste rock disposal on surface, rail load-out by silo discharge, waste management, fuel storage and dispensing, and progressive rehabilitation since all these activities have potential to cause mortality through collisions or other direct effects, but few species of wildlife are expected to be present in proximity to these activities due to previous displacement and ongoing sensory disturbance. During progressive rehabilitation and site decommissioning there is also a small risk of mortality associated with operations.

No change in health is expected during construction or operation and maintenance as a result of expenditures or employment. Changes in health are anticipated to be largely related to generation of dust. However, some of the Project activities are expected to be local and/or short-term and generate relatively little dust and therefore their effect on health of wildlife is expected to be managed to acceptable levels. During construction, these include construction of site buildings and associated infrastructure, construction of the TMF, construction of railway and load-out facilities, construction of power line, construction of stream crossings, installation of water supply infrastructure, onsite vehicle / equipment operation, waste management, and transportation of personnel and goods to site. During operation and maintenance, activities expected to cause a minor change in the health of wildlife species in this VEC are concentrator operations, rail transport, onsite vehicle / equipment operation and maintenance, waste management, transportation of personnel and goods to site, and fuel storage and dispensing. Site decommissioning is also expected to generate some change in health, through generation of dust that would be controlled through mitigation and appropriate codified practices.

Selection of Environmental Effects and Measurable Parameters

The measurable parameters used for the assessment of the environmental effects presented above and the rationale for their selection is provided in Table 20.7.

Table 20.7 Measurable Parameters for SAR / SOCC

Environmental Effect	Measurable Parameter	Rationale for Selection of the Measurable Parameter
Change in Habitat	• Primary or other sensitive or limiting habitat (km^2) (physical change) that will be altered or lost. • Alteration or loss of critical or important habitat due to altered hydrology (km^2).	Habitat loss or alteration can lead to changes in wildlife abundance, behaviour and/or species mortality and breeding success. The *Migratory Birds Convention Act*, SARA and Newfoundland and Labrador *Endangered Species Act* afford protection to habitat for species of migratory birds or SOCC. Habitat lost or altered is characterized as a proportion of habitat (ha) in the RSA. Critical habitat as identified in a recovery plan could also apply in this situation.
Change in Distribution and Movement	• Density and distribution of individuals on the landscape; • Sensory disturbance (noise – sound pressure levels measured in dBA; light; other stimuli).	Listed rare plant species are afforded legal protection under SARA and *Newfoundland and Labrador Endangered Species Act* (NLESA). Populations of rare or sensitive flora and fauna may be vulnerable to the loss of individuals, sensitive to changes in their habitat(s), and are of conservation concern to the Newfoundland and Labrador Department of Environment and Conservation (Wildlife Division). Sensory disturbance to wildlife behaviour can result in potential change of behaviour including feeding, breeding, migration and movement, in response to: • Physical hazards and attractants for wildlife (e.g., roads, pits, and other structural features); • Chemical hazards and attractants for wildlife (e.g., identified contaminants of potential concern); and • Sensory disturbance causing wildlife attraction or deterrence (e.g., noise, light, and human presence).
Change in Mortality Risk	• Mortalities. • Amount of new access. • Volume of air emissions.	Direct mortality can occur through collision with trains or construction vehicles. Indirect mortality can result from an increase in predation, hunting and/or poaching because of improved access or other habitat changes. Loss of individuals is characterized as a proportion of the population in the RSA. A change in mortality risk may occur as a result of contamination from emissions.
Change in Health	• Reproductive output and success.	Physiological effects from contamination could cause lowered fitness amongst animals breeding in the LSA.

20.5 Existing Environment

20.5.1 Information Sources

Information used to determine the known or likely presence of SAR and/or SOCC in or near the PDA was derived from a variety of baseline data sources, including traditional knowledge, reviews of literature and other information sources, wildlife and rare plant field surveys, and an ELC habitat analysis.

Local and Aboriginal Traditional Knowledge

Aboriginal traditional knowledge has been collected through engagement activities. Currently, there is no known published source of Aboriginal traditional knowledge collected at or near the Project area. In the absence of this, Aboriginal traditional knowledge was also collected through published sources from other areas. This information is presented in Table 20.8.

Table 20.8 Aboriginal Traditional Knowledge – SAR / SOCC

Group	Source	Comment or Excerpt
Naskapi Nation of Kawawachikamach	Weiler, M. 2009. Naskapi Land Use in the Schefferville, Quebec, Region. Prepared as an Appendix to the Environmental Assessment of the Direct Shipping Ore Project.	Trapping activities were reported to occur throughout the Study Area. The two main areas are located in the Swampy Bay River basin portion of the Study Area, the other in the Howells River valley, including its eastern slope. Both these areas are forested habitats interspersed with water bodies. Most of the furbearer species of interest to trappers are indeed either primarily forest dwellers (e.g. marten, weasel, ermine, wolverine, lynx, squirrel) or riparian (beaver, muskrat, mink, otter). However, red and arctic foxes as well as wolves may be encountered anywhere. That includes the fairly barren Ridge, which had become a resource area since the termination of IOC mining activities.
Naskapi Nation of Kawawachikamach	Weiler, M. 2009. Naskapi Land Use in the Schefferville, Quebec, Region. Prepared as an Appendix to the Environmental Assessment of the Direct Shipping Ore Project.	Wolves and (red) foxes are plentiful in the valley and both are harvested in good numbers. The number of wolves tends to increase during the time of the caribou migration. Wolverines are reported to be present in this area, and are sought after by trappers. Sightings of wolverine tracks and the animal itself have been indicated, but none of the interviewees reported a wolverine catch.

Literature and Information Review

A literature and information review was conducted to describe the existing environment and determine the likelihood of presence for various SAR / SOCC within the RSA. Relevant data from the ACCDC data, and other non-governmental and provincial conservation programs were also used to describe the existing environment. A search of the ACCDC (2011) database for element occurrences of rare plants (i.e., those listed under Schedule 1 of the SARA, ranked as SH, S1, S2, or combinations thereof by the ACCDC, and/or considered as 'May Be At Risk' or 'Sensitive' by the DOEC, identified 23 rare vascular plant species with the potential to occur at or near the proposed Project activity (i.e., within the LSA). This list was then evaluated based on the specific ecological requirements of the identified species.

Ecological Land Classification Habitat Analysis

Not all habitat is equal for all wildlife species. Depending on what it can provide for a particular species, habitat can generally be classified as primary, secondary, or tertiary. Primary habitat is habitat that a species may be dependent on or strongly prefers, and is defined as that which provides the main requirements for a species, such as breeding (nesting), foraging, protection, and resting opportunities. Secondary habitat may provide some but not all of these requirements, and would not be used exclusively. Tertiary habitat provides little for a species, though they may occasionally be found there. As wildlife species mainly occupy primary habitat as it best meets their needs, primary habitat can be viewed as a reflection of the population, and is used as such in this VEC in the absence of strong population data throughout the entirety of the RSA.

To quantify and qualify the habitat for species in this VEC with potential to interact with the Project, an ELC habitat analysis was completed, and a series of habitat maps were prepared. The ELC habitat analysis approach was to qualify ELC ecotypes and assign them as constituting primary, secondary, or tertiary habitat for each species.

Vascular Plant and Wildlife Field Surveys

The majority of relevant data were collected through surveys completed during the 2011 and 2012 field seasons. The field surveys included detailed vegetation surveys (Ecological Land Classification), wetland surveys, targeted rare plant surveys (local study area and regionally), aerial and ground based avifauna and other wildlife surveys. Recent aerial photographs and topographical maps were also used to indicate the presence of habitats with high potential for rare plants (i.e., wetlands, floodplains of slow-moving rivers and streams, cliff faces) .

The phenologies of vascular plant species observed on-site suggest that a number of these plant taxa may be identified at various times during the growing season. Although many of the species have restricted flowering periods, most are readily identified by their inflorescence, seeds and/or general morphological characteristics, such as leaf shape, throughout the growing season. Field surveys were conducted by experienced botanists during mid-summer in 2011 and 2012. Timing coincided with the period when the probability of encountering both cool and warm season perennials was highest, when rare or sensitive vascular plant taxa including diagnostic features were most identifiable, and the detectability of the majority of species maximized.

A total of 271 vascular plant taxa were observed through surveys of the proposed Project development, in particular from within the LSA for the Project. Overall species richness and, therefore, diversity may be considered low (based on number of species present, as well as distribution of individuals among those species). This may be attributable mainly to the poor growing conditions in the Study Area (infertile sandy and/or organic soils and cool summers), as well as a reflection of the limited variety of habitat types being encountered as more homogeneous environments (e.g., mature black spruce forests) provide less variety of microclimates, microhabitats, habitat diversity, and/or fewer niches.

Currently*,* American eel (*Anguilla rostrata)*, banded killifish (*Fundulus diaphanous)* (Newfoundland population), and fourhorn sculpin (freshwater form) (*Myoxocephalus quadricornis)* are listed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). None of these listed freshwater species is found near or within the RSA. Additional information is provided in Chapter 18.

Wildlife surveys to date have confirmed the presence of some fauna species at risk. Forest songbird surveys were conducted in and around the Kami Iron Ore Property in 2011 and 2012. Point count surveys of forest song birds were focused around several areas of interest including locations of proposed infrastructure and adjacent habitats. Complete results of this study are provided in Section 20.5.2. Among the 30 songbird species observed, there was just one federally and provincially listed (threatened) species: Olive-sided Flycatcher (*Contopus cooperi*). Olive-sided Flycatcher was detected in three forested ecotypes (Black Spruce-Lichen and both the Hardwood and Softwood Burn / Regeneration ecotypes), and in the non-forested wetland (fen) ecotypes.

Rusty Blackbird (*Euphagus carolinus*), a species of special concern under SARA, was observed during baseline surveys associated with the ELC. Harlequin Duck (*Histrionicus histrionicus*), also a species of special concern under SARA, was not observed during nine waterfowl surveys of the RSA in 2011, but has been reported (in the LSA) on at least one occasion (C. Porter, pers. com.) in recent years. Common Nighthawk (*Chordeiles minor*), a threatened species under SARA, is suspected to occur in the area.

Winter and other baseline surveys have not identified woodland caribou in the RSA. Although there are reports of wolverine in Labrador in recent years (Knox 2000), none of these are confirmed in the RSA or elsewhere in Labrador. The species is considered to be at low density if it exists at all, in Labrador.

20.5.2 Species at Risk

There were no observations of any vascular plant species listed under Schedule 1 of SARA or pursuant to the NLESA during surveys of the PDA, and in part LSA. Observations of fauna species listed under Schedule 1 of SARA or pursuant to the NLESA during the field surveys were of two species, Olive-sided Flycatcher and Rusty Blackbird. Four other avian Species at Risk are considered to have potential to be within the PDA, though they were not directly observed during recent field surveys conducted in support of the Project.

20.5.3 Species of Conservation Concern

Vascular Plant Species of Conservation Concern

A number of vascular plant SOCC have previously been recorded in western Labrador (ACCDC 2011) whose preferred habitat may occur within the proposed Project footprint (i.e., PDA). A search of the ACCDC database (ACCDC 2011) and a review of relevant literature revealed the "potential" for element occurrences of some 23 plant SOCC from within or adjacent the RSA as identified for the Project.

Floristic vascular plant surveys were completed in conjunction with targeted surveys of the proposed Project footprint (i.e., PDA) and within 250 m of the proposed rail and road corridor in 2011. A total of 271 vascular plant taxa were recorded within the Project area during the surveys, resulting in observations of some 33 potential plant SOCC from within the RSA, LSA, and within or in proximity to the PDA, including:

- **Six species ranked as "May be at Risk":**
  - Northern valerian (*Valeriana dioica* subsp. *sylvatica*);
  - Green false hellebore (*Veratrum viride* var. *viride*);
  - Chestnut sedge (*Carex castanea*);
  - Alpine hedysarum (*Hedysarum alpinum*);
  - Tall northern green orchid (*Platanthera aquilonis*); and
  - Jack pine (Pinus banksiana).
- **Seven as status "Sensitive":**
  - Mistassini primrose (*Primula mistassinica*);
  - Trailing arbutus (*Epigaea repens*);
  - Bog willow (Salix pedicellaris);
  - Buxbaum's sedge (*Carex buxbaumii*);
  - Variegated scouring-rush (*Equisetum variegatum* subsp. *variegatum*); and
  - Lapland buttercup (*Coptidium lapponicum*), and horned dandelion (Taraxacum ceratophorum).
- **Eighteen as status "Sensitive" or status "Undetermined" and assigned provincial rankings (ACCDC) varying from "S1S2" to "S3" and "SU":**
  - Umbellate bastard toad-flax (*Comandra umbellata*) ;
  - Lesser panicled sedge (*Carex diandra*);
  - Inland sedge (*Carex interior*);
  - Swamp thistle (*Cirsium muticum*);
  - Beautiful cottongrass (*Eriophorum callitrix*);
  - Toad rush (Juncus bufonius var. bufonius);
  - American moor rush (*Juncus stygius* var. *americanus*);
  - Golden groundsel (*Packera aurea*);
  - Kotzebue's grass-of-parnassus (Parnassia kotzebuei);
  - Northern pondweed (*Potamogeton alpinus*);
  - Whitestem pondweed (*Potamogeton praelongus*);
  - Pink pyrola (*Pyrola asarifolia*);

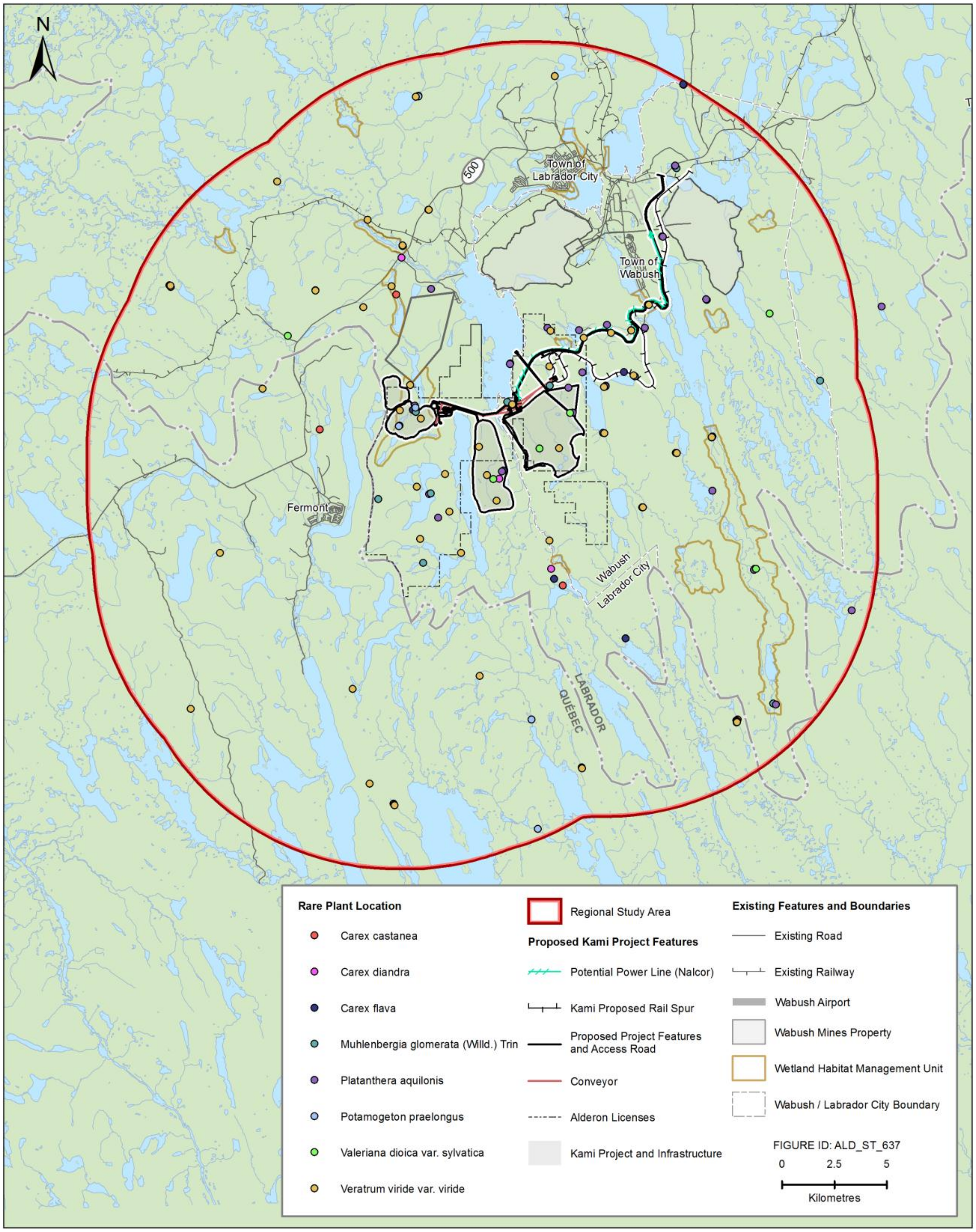
- Greenish-flowered wintergreen (*Pyrola chlorantha*);
- Purple false melic (*Schizachne purpurascens*);
- Small-fruit bulrush (*Scirpus microcarpus*);
- Alpine threadleaf pondweed (*Stuckenia filiformis* subsp*. alpina*);
- Sticky tofieldia (*Triantha glutinosa*); and
- Kidney-leaf white violet (*Viola renifolia*).

Two additional species, spike muhly (*Muhlenbergia glomerata*) and yellow sedge (*Carex flava*), have not been previously recorded for Labrador and are therefore considered rare.

Further surveys from within the RSA, LSA, and within or in proximity to the PDA conducted within high potential habitats in 2012 resulted in four additional plant SOCC (small yellow lady-slipper (*Cypripedium parviflorum*), beautiful sedge (*Carex concinna*), daisy fleabane (*Erigeron hyssopifolius*), and northeastern white water-crowfoot (*Ranunculus trichophyllus*) being added for a total of thirty-seven species of vascular plant SOCC within or in proximity of the proposed Project footprint (i.e., PDA).

Of these thirty-seven species of plants, eight SOCC, as identified by DOEC General Status Species and/or subsequent reviews of recently acquired information and discussions between Alderon and the DOEC (C. Hanel, pers. comm.) were observed from within the RSA, LSA, and within or in proximity to the PDA. In increasing order of importance, they include: spike muhly, green false hellebore, chestnut sedge, northern valerian, whitestem pondweed, lesser panicled sedge, tall northern green orchid and yellow sedge. Consultation with DOEC is continuing to determine if additional species are to be considered as SOCC. Figure 20.3 shows the locations of plant SOCC identified during the vegetation surveys.

Figure 20.3 Locations of Plant SOCC within the RSA, LSA, and in Proximity to the PDA



Scarcity ranks for the aforementioned plant species were determined by the DOEC, and the ACCDC based on known distributions as recorded in the literature and through herbarium records. Since Labrador has not been as extensively surveyed botanically as insular Newfoundland (Stantec, unpublished data), many vascular plant species were originally classified conservatively due to a lack of distributional information. As new information becomes available through botanical surveys, species scarcity ranks are adjusted accordingly.

The Project will result in the alteration or loss of approximately 6 percent (572 ha of 8,918 ha) of available wetland habitat in the RSA that may result in some of the identified locations supporting SOCC being affected by surface disturbance activities as a result of the Project. In general, the examination of existing information and the results of field studies illustrated that habitat(s) in the RSA and LSA generally support a diversity of flora and fauna species common to Labrador. Habitat for many of these common species is widespread throughout the adjacent landscape and in particular throughout western Labrador. Alternatively, of the eight species identified above, the floristic affinities of five of these species indicate that they are, or may be considered, obligate calciphiles (calcium-loving species) occurring only in calcareous fens or on exposed limestone or dolomite bedrock. The occurrence of so many of these rare plant species would imply the presence of calcium-rich bedrock or soils in the LSA, and therefore PDA. Due to the low number of areas where calcium-rich base materials are present, other possible range locations for the identified potentially rare plant species may be limited. Many of the species which occur in these alkaline peatlands have narrow ecological tolerances and are restricted to fens and other highly alkaline habitats known only from southeastern and western Labrador. As such, Project effects will focus on these eight SOCC known, or thought to be present within, or in close proximity to, the PDA. None are protected by SARA or NLESA.

Additionally, two fauna SOCC were recorded in the vicinity of the PDA based on Project planning and design provided by Alderon at the time of the 2011 in-field surveys.

SAR / SOCC observed within the PDA and of interest to the DOEC are listed in Table 20.9. Species that are not on SARA Schedule 1, but that have been designated as endangered, threatened, or special concern species by COSEWIC and could potentially occur in the LSA are also listed. The likelihood of occurrence is provided in the table based on available a review of available literature and the results of prior surveys.

Table 20.9 'At Risk' Species Included on Schedule 1 of SARA or Ranked S1, S2, or Combinations Thereof (ACCDC) that have Potential to Interact with the Project

Scientific Name	Common Name	Status (SARA Schedule 1/ COSEWIC / ACCDC / General Status)	Habitat	ELC Ecotype	Occurrence in Relation to Project (i.e., RSA, LSA, PDA)	Likelihood of Occurrence
Mammals						
Rangifer tarandus caribou	Sedentary Woodland Caribou	Threatened under SARA and NLESA			Adjacent to RSA	Low
Gulo gulo	Wolverine	Endangered under SARA and NLESA			Not observed	Low
Birds and Other Wildlife						
Contopus cooperi	Olive-sided Flycatcher	Threatened under SARA	Open areas containing tall live trees or snags for perching. Open areas include forest clearings, forest edges located near natural openings (such as wetlands, rivers or streams), burned forest or openings within old-growth forest stands characterized by mature trees and large numbers of dead trees or human-made openings (such as logged areas).		Species documented in the RSA (observed during field studies conducted between July 25 and August 4, 2011) and has been documented as potentially occurring within the surrounding regions based on presence of habitat and known ACCDC occurrences. Suitable habitat may be present in the PDA.	Moderate to High

Scientific Name	Common Name	Status (SARA Schedule 1/ COSEWIC / ACCDC / General Status)	Habitat	ELC Ecotype	Occurrence in Relation to Project (i.e., RSA, LSA, PDA)	Likelihood of Occurrence
Euphagus carolinus	Rusty Blackbird	Special Concern under SARA, Vulnerable under NLESA	Breeding habitat corresponds closely to with the boreal forest. Primarily occupies forest wetlands, such as slow-moving streams, peat bogs, sedge meadows, marshes, swamps, beaver ponds and pasture edges.		Species documented in the RSA (observed during field studies conducted between July 25 and August 4, 2011) and has been is documented as potentially occurring within the surrounding regions based on presence of habitat and/or known ACCDC occurrences. Suitable habitat may be present in the PDA.	Moderate to High
Chordeiles minor	Common Nighthawk	Threatened under SARA and NLESA			Not observed.	Low
Histrionicus histrionicus	Harlequin Duck	Special Concern under SARA, Vulnerable under NLESA			Observed in Jean Lake Rapids in recent years.	Low
Bucephala islandica	Barrows Goldeneye	Special Concern under SARA, Vulnerable under NLESA			Not observed.	Low
Catharus minimus	Gray-cheeked Thrush	Vulnerable under NLESA			Not observed.	Low
Vascular Plants						
Muhlenbergia glomerata (Willd.) Trin.	Spike muhly	Not Ranked	Open wetlands on wet, peaty soils.	Non-Patterned Shrub Fen	Species documented in the PDA (i.e., Rose Pit, rail line), LSA and RSA, as observed during field studies conducted between July 25 and August 4, 2011 and July 17 to 26, 2012. Suitable habitat present in the LSA and RSA.	Moderate

Scientific Name	Common Name	Status (SARA Schedule 1/ COSEWIC / ACCDC / General Status)	Habitat	ELC Ecotype	Occurrence in Relation to Project (i.e., RSA, LSA, PDA)	Likelihood of Occurrence
Veratrum viride Aiton var. viride	Green false hellebore	S1 / May be at Risk	Calcareous or basic substrates (calciphile); woodland habitats; on subhygric soils.	Black Spruce-Labrador Tea-Feathermoss, Black Spruce / Tamarack-Sphagnum Woodland, Tamarack / Black Spruce-Feathermoss (Water Track) and Non-Patterned Shrub Fen	Species documented in the PDA (i.e., Rose Pit, TMF, Rose South Waste Disposal, access road and rail line), LSA and RSA, as observed during field studies conducted between July 25 and August 4, 2011 and July 17 to 26, 2012. Suitable habitat present in the LSA and RSA.	High
Carex castanea Wahlenb.	Chestunut sedge	S1S2 / May be at Risk	Wet meadows; calcareous or basic substrates (calciphile).	Larch Woodland	No observations within suitable habitats surveyed within the PDA. Species documented in the LSA and RSA as observed during field studies conducted between July 25 and August 4, 2011 and July 17 to 26, 2012. Suitable habitat present in the LSA and RSA.	High
Valeriana dioica subsp. sylvatica (S.Watson) F.G.Mey.	Northern valerian	S1	Floodplains of small rivers and stream, in seepage areas, on subhygric soils; calcareous or basic substrates (calciphile).	Tamarack / Black Spruce-Feathermoss (Water Track)	Species documented in the PDA (i.e., Rose South Waste Disposal and TMF), LSA and RSA, as observed during field studies conducted between July 25 and August 4, 2011 and July 17 to 26, 2012. Suitable habitat present in the LSA and RSA.	High

Scientific Name	Common Name	Status (SARA Schedule 1/ COSEWIC / ACCDC / General Status)	Habitat	ELC Ecotype	Occurrence in Relation to Project (i.e., RSA, LSA, PDA)	Likelihood of Occurrence
Potamogeton praelongus Wulfén	Whitestem pondweed	S2S4 / Undetermined	Submerged in shallow wetland pool (halophytic); often from calcareous or basic substrates (calciphile).	Non-Patterned Shrub Fen	Species documented in the PDA (i.e., Rose Pit, rail infrastructure), LSA and RSA, as observed during field studies conducted between July 25 and August 4, 2011 and July 17 to 26, 2012. Suitable habitat present in the LSA and RSA.	High
Carex diandra Schrank	Lesser panicled sedge	S2S4 / Undetermined	Open wetlands and seepage areas.	Non-Patterned Shrub Fen and Riparian Marsh (Fen)	Species documented in the PDA (i.e., Rose Pit, Rose South Waste Disposal), LSA and RSA, as observed during field studies conducted between July 25 and August 4, 2011 and July 17 to 26, 2012. Suitable habitat present in the LSA and RSA.	High
Platanthera aquilonis Sheviak	Tall northern green orchid	S2S3 / May be at Risk	Open wetlands.	Non-Patterned Shrub Fen	Species documented in the PDA (i.e., Rose South Waste Disposal and TMF), LSA and RSA, as observed during field studies conducted between July 25 and August 4, 2011 and July 17 to 26, 2012. Suitable habitat present in the LSA and RSA.	High
Carex flava L.	Yellow sedge	Not Ranked / Not Ranked	Open wetlands on wet, peaty soils.	Non-Patterned Shrub Fen	Species documented in the PDA (i.e., Rose Pit, Rose South Waste Disposal, and rail infrastructure), LSA and RSA, as observed during field studies conducted between July 25 and August 4, 2011 and July 17 to 26, 2012. Suitable habitat present in the LSA and RSA.	Moderate

20.5.4 ELC Habitat Analysis

An ELC habitat analysis approach was taken to qualify ELC ecotypes and assign them as constituting primary, secondary, or tertiary habitat for each avifauna SAR or SOCC with potential to be found in the PDA, excluding Harlequin Duck. Harlequin Duck was not included in this exercise as the parameters of its preferred habitat are not discernible within the ELC. The ELC habitat analysis was completed using a summary of original field data collected through the baseline program, literature review, and professional experience. Primary, secondary and tertiary habitat within the RSA was then displayed in a GIS to describe habitat potential within the RSA (Table 20.10; Appendix Y).

Table 20.10 Percentage of Primary, Secondary, and Tertiary Habitat of the RSA within the PDA for Wildlife

Species	Primary	Secondary	Tertiary
Olive-sided Flycatcher	5.0	1.3	1.2
Gray-cheeked Thrush	0.5	2.0	2.0
Rusty Blackbird	3.2	2.4	1.8
Common Nighthawk	3.1	0.5	1.6
Barrow's Goldeneye	0	1.1	3.6
Short-eared Owl	2.5	4.6	1.3

20.6 Assessment of Project-related Environmental Effects

The residual environmental effects on abundance and distribution, critical or important (primary) habitat, health / condition, and movement in the immediate vicinity of the PDA are assessed. Mitigation measures will be implemented to minimize environmental effects. These measures will be outlined in the Project-specific EPP and include such mitigation as the minimizing of Project footprint, minimizing the disturbance to environmentally sensitive areas (e.g., wetland habitat), and, where possible, avoiding known locations of species having special status.

There are no plant species at risk within the PDA or LSA. Plant SOCC are spike muhly, green false hellebore, chestnut sedge, northern valerian, whitestem pondweed, lesser panicled sedge, tall northern green orchid and yellow sedge. Two avian species at risk, Olive-sided Flycatcher and Rusty Blackbird, were observed within the PDA.

The assessment will consider the environmental effects of the Project on SAR / SOCC identified in the PDA that cannot be reasonably avoided. Where the Project disturbs rare or sensitive plant species, an assessment (including background research, field studies, and informant interviews), which includes consideration of the SARA and NLESA, will be undertaken to help determine the application of technically and economically feasible mitigation strategies or compensation (or both) to address any likely adverse residual environmental effects as required.

20.6.1 Change in Habitat

Construction

Site preparation and construction activities related to the Project will result in the most important adverse effects of the Project on vegetation and wildlife through the loss or alteration of important habitat for a variety of species; including those whose populations are considered either at risk or of conservation concern. Site preparation and construction activities will affect SAR / SOCC because ground disturbance, clearing, grubbing, grading, infilling, and/or excavation, the removal of overburden, material haulage, and stockpiling will result in the loss or alteration of habitat for plants and wildlife species, or the direct loss of individual plants.

A number of uncommon and/or sensitive species of plants and birds were found within wetlands encompassed by the Project during field surveys. Wetland habitats, specifically fens (Appendix I), are considered to be of greatest importance as a result of providing habitat for a higher number of vascular plant SAR / SOCC across the LSA. Wetlands and riparian areas, as a representative of specific habitat for a number of these species, are present throughout the PDA and their avoidance, to the extent possible, of this habitat will reduce interactions with plants and wildlife reliant on this type of habitat. Within the LSA, and in particular PDA, each of the plant SOCC was found to be primarily associated with either wetlands or the roadside shoulder of the existing highway. The Project effects on hydrological, biogeochemical, and ecological function of wetlands is assessed in Chapter 16 and Chapter 17. Natural drainage patterns will be maintained to the extent possible.

Clearing of upland forest areas can also change the quality of the habitat along the edge of the Project footprint as a result of increased side lighting or drying of what was previously forest interior habitat. This may enable more light-tolerant and disturbance-tolerant plant species and more disturbance-tolerant and edge wildlife species to inhabit adjacent forest habitat. Indirect effects may also occur due to changes in substrate composition, moisture, drainage and temperature. Alteration or loss of habitat for plants and wildlife species, and/or loss of individual plants and animals could also occur due to changes in other environmental conditions and increased human activity (i.e., indirect effects), including dust generation. However, the magnitude of these effects will be low, and they will be localized. Therefore significant adverse residual effects are not likely.

Wetlands located within Rose Pit were found to support spike muhly, whitestem pondweed, lesser panicled sedge, and yellow sedge. A substantial portion of these wetlands are slated to be directly affected by excavation of Rose Pit, the current location of which suggests that direct effects to these species may be unavoidable. As such, it is recommended that construction activities minimize disturbance and infilling practices within adjacent wetlands and that existing hydrological conditions within those wetlands be maintained through the use of appropriate mitigative measures.

Alternatively, transitional and upland areas were observed to provide habitat for a number of populations of green false hellebore, northern valerian and chestnut sedge across the LSA and in association with various Project components, including the TMF, polishing pond, access road, and rail infrastructure. Due to the location of the various Project components, avoidance of

SOCC along the is not possible. However, because the environmental properties (particularly substrate type and moisture levels) directly adjacent to and/or outside the PDA are very similar, it is very likely that habitats and thus occurrences of these plants of conservation concern outside the LSA, in the area of the RSA be investigated.

As wildlife species mainly occupy primary habitat as it best meets their needs, primary habitat can be viewed as a reflection of the population. In this respect, change in habitat resulting from the Project can be evaluated by measuring loss of primary habitat within the RSA for indicator wildlife species. Change in habitat resulting from the Project is expected to result in limited adverse environmental effects. Change in primary habitat loss associated with construction activities for those rare and sensitive wildlife species for which an ELC habitat analysis was completed will generally be low (i.e., averaging approximately 3 percent of the RSA), with the exception of Olive-sided Flycatcher.

Olive-sided Flycatcher, a migratory passerine, is a relatively large flycatcher that is listed as threatened under Schedule 1 of SARA and NLESA. Despite the status of this species, a recovery plan has yet to be developed, and therefore, critical habitat has not been identified. ELC ecotypes identified as primary habitat for this species includes: hardwood burn and regenerating forest, mixedwood burn and regenerating forest, softwood burn and regenerating forest, non-patterned shrub fen (including graminoid fen), and patterned shrub fen. These habitats are generally well represented in the greater landscape, accounting for approximately 21 percent of the RSA, but are even more concentrated within the PDA, representing approximately 48 percent. Within the PDA, the majority of primary habitat (approximately 42 percent) is located in the Tailing Impoundment Area. The amount of these ELC ecotypes that will be lost or changed in the PDA represents approximately 7 percent of the RSA.

Operation and Maintenance

Project effects on habitat will occur primarily if not exclusively during the construction phase, and are assessed in that section. The environmental effects of open pit mining on SAR / SOCC is addressed fully in the construction phase, where a conservative approach is taken to assess the complete footprint of the open pit.

Decommissioning and Reclamation

Project effects on habitat will occur primarily if not exclusively during the construction phase. A Rehabilitation and Closure Plan will be developed in accordance with the applicable regulations at the time of decommissioning. The Rehabilitation and Closure Plan will specify the procedures that will be followed with respect to the decommissioning, removal, and disposal of site equipment and structures, and for site remediation, where required. Potential environmental effects of decommissioning activities will also be managed following the Project-specific EPP Owing to the open pit nature of the Project restoration of the mine footprint upon decommissioning is unlikely to result in the complete reversal of a number of the effects associated with the Project. Most vegetated communities within the Project footprint are not expected to return to pre-Project conditions allowing SAR / SOCC and their habitats to return to their previously undisturbed condition.

Mitigation of Project Environmental Effects

Project planning, design, and the application of known and proven mitigation measures will be implemented as part of the Project to avoid or minimize environmental effects on rare species or SOCC and/or their habitats. Final decisions on mitigative measures will be made by Alderon in consultation with botanical experts, and where appropriate, the regulatory authority (i.e., DOEC). Where feasible, locations of plant species of conservation will be avoided. Where this is not possible, transplantation to alternate suitable habitat will be investigated.

Standard practices and general environmental protection measures for mining projects will address most outstanding issues likely to arise during the Project. General measures to minimize the effects of such activities as temporary access trails, borrow areas, clearing of the RoW, and working in and around waterbodies / wetlands, equipment maintenance, and work site cleanup and decommissioning and reclamation will also be addressedin the EPP. A Project-specific EPP will be developed for the Project prior to start of the construction phase. Activities such as handling and storage of fuel and other hazardous materials are regulated by law and will comply with all applicable standards and regulations, guidelines and reference documents.

In summary, Alderon will construct the Project using accepted and proven best practices and procedures. Mitigation measures will be employed to reduce the potential effects of Project construction on SOCC within the LSA, wherever possible. This includes the use of appropriate, accepted best practices to limit activities resulting in disturbance to ground vegetation, to the extent practical. Surface disturbance activities will comply with the requirements (e.g., buffer widths and permitted activities at these locations) of applicable permits. Reclamation plans, developed by Alderon in co-ordination with regulators will be implemented, where practical, to limit potential Project effects.

The following measures are proposed to mitigate Project-related effects related to change in habitat for SAR / SOCC during the construction phase. Note that some of these mitigation measures would also address issues associated with other effects:

- Rare or sensitive plant species and/or their habitats will be avoided, where possible. Where avoidance is not practical, mitigation to reduce the magnitude of adverse effects will be implemented.
- Transplantation of plant species of conservation concern to alternate sites of suitable habitat will be undertaken where feasible.
- SAR or SOCC and/or their habitats will be avoided to the extent feasible.
- Natural buffers will be maintained around watercourses, wetlands and riparian zones.
- When access routes are no longer needed, they will be rehabilitated.
- Progressive reclamation will be implemented.
- Borrow pits will be located more than 100 m away from the high-water mark of water bodies, where feasible.

- Minimize disturbance and infilling within adjacent wetlands and maintain hydrological conditions to the extent feasible.
- Dispose of slash from clearing as specified in permits.
- Erosion and sediment control will be implemented.
- Dust control measures will be implemented.

Many of the measures used to mitigate potential effects on SAR / SOCC as identified above for the construction phase also apply to the operation and maintenance phase. During the Project operations and maintenance phase, the only additional ground disturbance beyond those areas affected during Project construction will result from development of the Rose Pit, and through disposal of waste rock and tailings. As part of infrastructure maintenance, access roads will be periodically graded and ditched to improve water flow, reduce erosion and/or to deter excessive vegetative growth. The effects of the Project on wetlands is assessed in Chapter 17.

Vegetation management will be periodically required adjacent to the access road and rail line. Vegetation management will consist primarily of mechanical control of vegetation, although the use of herbicides may be considered where undesirable species persist.

When the Project is decommissioned Alderon will prepare a Rehabilitation and Closure Plan for remediating the mine site, and associated RoW. Established procedures are available for decommissioning temporary infrastructure or facilities (e.g., access roads, rail beds, transmission lines, marshalling areas). Owing to the open pit nature of the Project, restoration of the mine footprint upon decommissioning is unlikely to result in complete reversal of a number of the effects associated with the Project.

The following mitigation measure is proposed to address Project-related effects related to change in habitat for SAR / SOCC during the decommissioning and reclamation phase:

- Transplantation of plant species of conservation concern to alternate sites of suitable habitat will be undertaken where feasible.

The success of revegetation will be monitored annually for the first three years after progressive reclamation or until re-vegetation is successful.

Similar to the construction phase, all decommissioning and reclamation activities will comply with all applicable standards and regulations, guidelines and reference documents.

Characterization of Residual Effects

Habitat alteration or loss during the construction phase may result in fewer individuals or populations of SAR / SOCC and their habitats in the immediate vicinity of the Project. Plant SOCC will show a decline in cleared areas, particularly where a species habitat affinity is affected by changes in the availability or physical characteristics (i.e., dolomite/limestone substrates) of those habitats. Given that many of the plant SOCC identified have an affinity for the calcareous substrates and nutrient-poor conditions, potential adverse effects to important habitats for these species are likely. Another factor influencing important habitats is vegetation management, which will continue over the life of the Project, and will be the biggest potential interaction with SOCC in the area during operation and maintenance. However, this is unlikely to cause further disruption of habitat, as clearing activities are short-lived and occur within the existing PDA. For most SOCC, potential effects to important habitats are geographically limited, therefore, adverse residual effects will not be seen on sustainability or populations in the RSA as a whole.

As for effects on change in habitat, the effects of Project construction on important habitat for flora and fauna SOCC are predicted to be adverse, because there is a permanent alteration and/or reduction in the amount of available habitat. For the majority of species, this is a relatively small change in habitat availability and resulting displacement of individuals or populations from across the RSA; however, for Olive-sided Flycatcher, primary habitat loss represents approximately 5 percent of the primary habitat within the RSA.

Although the initial estimated loss of primary habitat, is 7 percent, additional primary habitat (hardwood forest burn/regeneration, mixedwood forest burn/regeneration and softwood forest burn/regeneration) will be created following decommissioning and reclamation of the Project. Given its association with edge habitat, the initial estimation of change or loss of primary habitat for Olive-sided Flycatcher is likely an overestimate. In addition, because Olive-sided Flycatcher is so uncommon in the region and its primary habitat represents such a large proportion of both the PDA and RSA, it is unlikely that all of the primary habitat for this species is currently occupied. Loss of primary habitat is therefore not believed to represent a similar potential loss to the population. This species is experiencing declines throughout its range, and although factors influencing population declines are not well understood, loss of habitat in southern wintering grounds, not northern breeding grounds, is believed to be a major contributing factor (COSEWIC 2007).

The PDA represents a potential “worst case scenario” for area of actual disturbance and habitat loss. With careful Project planning and implementation, such as limiting the footprint to only those areas that need to be cleared (particularly in non-treed fen habitats), and considering timing of Project activities and reclamation schedules so that not all habitat is disturbed simultaneously and areas are rehabilitated as soon as activities have ceased, the actual amount of primary habitat lost at any one time is likely to be less than what is currently estimated.

Additional standard mitigation measures to protect rare species and/or their habitats from direct disturbance, primarily involving site preparation, will be adequate to effectively reduce or eliminate residual effects.

Therefore, the magnitude of adverse Project effects during construction and operations and maintenance on SAR / SOCC will be moderate because the amount of habitat of the RSA and the estimated number of rare species of the local population potentially lost will be 7 percent or less once mitigation measures are implemented. Disturbance-related construction effects are anticipated to be long term. Removal of habitat from some areas of the PDA (e.g., open pit) will be permanent, and will be medium term for other areas (e.g., access roads) as these areas will be rehabilitated.

There is a high degree of confidence that the level of effect will not be greater than predicted.

20.6.2 Change in Distribution and Movement

Construction

Site preparation and construction activities related to the Project will result in the most important adverse effects of the Project in terms of the distribution and movement of wildlife and plant SAR / SOCC. Site preparation and construction activities, including ground disturbance, clearing, grubbing, grading, infilling, and/or excavation, the removal of overburden, material haulage, and stockpiling, may result in the direct loss of individual or populations of wildlife and plant SAR / SOCC resulting in a change in distribution, and/or the displacement of wildlife species. Of the eight vascular plants SOCC identified from within the RSA, LSA, and within or in proximity to the PDA , all but one, chestnut sedge, are found from within the PDA for the Project and may therefore be directly affected by the aforementioned construction activities (Table 20.11).

Table 20.11 Interactions between the Project and SOCC

Species	Number of Occurrences* within PDA	Number of Occurrences* by Project Component	Number of Occurrences* Outside PDA but Within LSA	Number of Occurrences* in RSA
Muhlenbergia glomerata	2	Rose Pit (1); Rail Infrastructure (1)	4	11
Veratrum viride var. viride	8	Rose Pit (2); Rose South Waste Rock Disposal (3); TMF (1); Access Road (1); Rail Infrastructure (1)	7	31
Carex castanea	0	-	2	11
Valeriana dioica	3	Rose South Waste Rock Disposal (1); TMF (2)	1	7
Potamogeton praelongus	2	Rose Pit (1); Rail Infrastructure (1)	1	5
Carex diandra	2	Rose Pit (1); Rose South Waste Rock Disposal (1)	1	3
Platanthera aquilonis	2	Rose South Waste Rock Disposal (1); TMF (1)	5	18
Carax flava	3	Rose Pit (1); Rose South Waste Rock Disposal (1); Rail Infrastructure (1)	1	14

Notes:
* An Occurrence is “an area of land or water in which a species is, or was present. According to NatureServe, the default separation distance between plant occurrences is 1 km, therefore for the purposes of this EIS sites less than 1 km apart have been considered as the same occurrence.

The locations of plant SOCC within the PDA are shown on Figure 20.4.

In addition, site preparation and construction activities may cause the displacement of wildlife species as a result of sensory disturbance. Construction activities may also result in habitat fragmentation, i.e., discontinuity in preferred habitat, leading to the reduction or loss of movement between such patches. Change in habitat through fragmentation may be substantial for species that are found in the vicinity of the Project Area and currently move through and within the Project Area to access preferred habitat.

Construction of the access road and rail line will require installation of several watercourse crossings. Standard and proven mitigation will be employed to minimize the environmental effects of stream crossings. Culverts will be designed and installed using Best Available Control Technology (including DFO and DOEC Water Resources guidelines) to maintain the natural hydrology, and to prevent ponding or dewatering.

Noise associated with construction (and later, operation and maintenance) activities can cause the displacement of individuals to less productive habitats, and can affect the flight patterns of migratory birds.

Operation and Maintenance

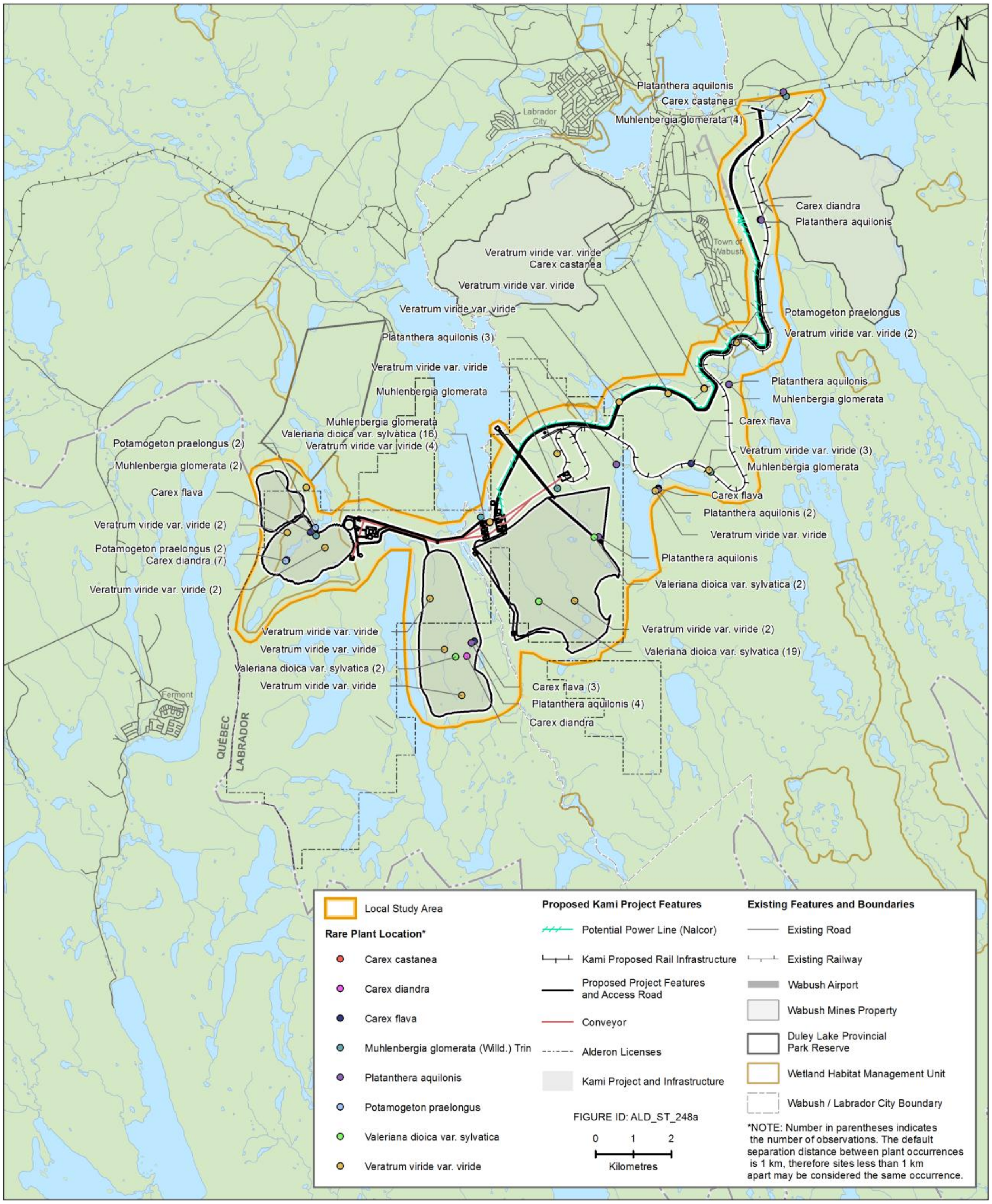
The primary effects to wildlife SAR / SOCC will occur primarily, if not exclusively, during the construction phase. Some noise-related effects will continue throughout operation and maintenance, but are expected to be reduced, relative to the construction phase.

The primary effects to plant SOCC will occur primarily, if not exclusively during the construction phase. The effects due to operational maintenance activities (access road grading and ditching) will be managed so that erosion and sediment run-off are controlled. Any resulting effects would be low in magnitude and localized.

Decommissioning and Reclamation

Project effects on SAR / SOCC will occur exclusively during the construction phase. A Rehabilitation and Closure Plan will be developed in accordance with the applicable regulations at the time of decommissioning. The Plan will specify the procedures that will be followed with respect to the decommissioning, removal, and disposal of site equipment and structures, and for site remediation, where required. Potential environmental effects of decommissioning activities will also be managed following the Project-specific EPP. Owing to the open pit nature of the Project, restoration of the mine footprint upon decommissioning is unlikely to result in the complete reversal of a number of the effects associated with the Project. Most vegetated communities within the Project footprint are not expected to return to pre-Project conditions allowing SAR / SOCC and their habitats to return to their previously undisturbed condition.

Figure 20.4 Locations of Plant SOCC within the PDA



Mitigation of Project Environmental Effects

The following mitigation measures are proposed to effects related to change in distribution and movement during the construction phase:

- Project design minimizes construction footprint (i.e., PDA) to the extent feasible
- Implement an Avifauna Management Plan;
- Boundary lines of sensitive areas will be flagged before beginning work in the area. Areas identified for selective clearing (e.g., buffer zones, sensitive sites) will be accurately flagged and appropriate mitigation measures identified and applied;
- Waterbodies and wetland buffers (e.g., extra work area setbacks, refueling restrictions) will be clearly marked with signs or highly visible flagging until construction-related ground disturbing activities are complete;
- Prior to any blasting activities, a survey of the area will be completed so that no wildlife SAR / SOCC are present;
- Mange noise levels;
- Wildlife SAR / SOCC will be allowed to pass through construction sites without harassment; and
- Delineate locations where plant SOCC occur, and avoid those locations to the extent feasible.

Many of the measures used to mitigate potential effects on distribution and movement on SAR / SOCC as identified above for the construction phase are also applicable to the operation and maintenance phase. The most substantive Project-related effects during operation and maintenance are likely due to the ongoing activities that will possibly continue to displace wildlife. Additionally, maintenance of the Project infrastructure and related vegetation management initiatives will have the potential to adversely affect fauna supported by this vegetation. Mitigation measures listed above for the construction phase will continue to be implemented as appropriate.

All relevant mitigation measures enacted during construction or operations and maintenance will also apply during decommissioning and reclamation.

Characterization of Residual Effects

Clearing and other activities, as well as noise associated with the construction, operation and maintenance, and decommissioning and reclamation phases, will result a change in distribution and movement for plant and wildlife SAR / SOCC. These activities will continue over the life of the Project. The effects of Project construction and other activities on change in distribution and movement for plant or fauna SAR / SOCC are predicted to be adverse. The magnitude of adverse effects during construction and operation and maintenance phases on SAR / SOCC will be low because the estimated number of species potentially redistributed or lost due to construction and other activities following implementation of mitigative measures is expected to be less than 5 percent of the local population. For those locations where plant SOCC cannot be avoided, transplantation to alternate suitable habitat will be investigated. There is a high degree of confidence that the level of effect will not be greater than predicted.

20.6.3 Change in Mortality Risk

Construction

Site preparation and construction activities related to the Project will result in the most important adverse effects of the Project on wildlife SAR / SOCC through the loss or alteration of habitat for wildlife species, and/or the direct loss of individual wildlife SAR / SOCC. Direct mortality could occur mainly to small species such as herpetiles, small mammals, and the eggs or flightless young of birds. Most birds and mammals would leave the cleared and grubbed areas and would move to adjacent undisturbed habitats. Indirect mortality could occur to these animals if they are unable to find suitable unoccupied habitat.

Some wildlife species are attracted to open disturbed sites such as those created by clearing and grubbing. Birds such as Common Nighthawk and Short-eared Owl use habitats such as this for nesting. Subsequent construction of mine site infrastructure on these sites can result in the destruction of the eggs and unfledged young of these species.

Operation and Maintenance

Although the majority of Project effects on mortality risk will occur primarily, if not exclusively, during the construction phase and are assessed in that section, site lighting can lead to mortality of migrating birds. Under certain conditions, such as nights with fog or mist, migrating birds may be attracted to lights. They may collide with the light or structures near the light or circle around the light until they become exhausted, making them easy prey for predators.

Various factors affect the level of attraction to lights including intensity, spectral characteristics and the manner in which lights are placed in the environment. Typically more intense lights are more attractive to birds (Jones and Francis 2003). White light and red light are far more attractive than green or blue light (Poot et al. 2008). Lights that are shielded from above are generally less attractive than those that are visible from above. Strobe lighting is less attractive to birds than continuous lighting since the strobe allows birds that are attracted to the light to disengage (Jones and Francis 2003).

Decommissioning and Reclamation

Project effects on change in mortality risk will occur primarily, if not exclusively, during the construction phase. A Rehabilitation and Closure Plan will be developed in accordance with the applicable regulations at the time of decommissioning. The Plan will specify the procedures that will be followed with respect to the decommissioning, removal, and disposal of site equipment and structures, and for site remediation, where required. Potential environmental effects of decommissioning activities will also be managed following the Project-specific EPP Owing to the open pit nature of the Project restoration of the mine footprint upon decommissioning is unlikely to result in the complete reversal of a number of the effects associated with the Project. Most vegetated communities within the Project footprint are not expected to return to pre-Project conditions allowing SAR / SOCC and their habitats to return to their previously undisturbed condition.

Mitigation of Project Environmental Effects

The following mitigation measures are proposed to effects related to change in mortality risk during the construction phase:

- Risk of incidental take will be addressed through the design and implementation of an Avifauna Management Plan for any area to be cleared;
- No hunting, or other harassment of wildlife on Project site; and
- Blasting areas will be surveyed for SAR or SOCC prior to any blasting activities.

Many of the measures used to mitigate potential effects on Mortality Risk to SAR and SOCC identified above for the construction phase are also applicable to the operation and maintenance phase:

- No hunting, harvesting or other harassment of wildlife on Project site;
- Waste (construction, domestic, and sewage) will be disposed of appropriately;
- Only the amount of lighting required for safe operation of the mine will be installed;
- Exterior lights will be shielded from above; and
- Security lighting will be turned on by motion sensors rather than left on all night.

All relevant mitigation measures enacted during construction or operations and maintenance will also apply during decommissioning and reclamation.

Characterization of Residual Effects

Project activities associated with the construction phase will result a change in mortality risk for wildlife SAR / SOCC either through direct loss, or indirect loss associated with habitat loss. Project activities associated with operation and maintenance, and decommissioning and reclamation phases, could result in a change in mortality risk through the effects of site lighting on migratory birds. These activities will continue over the life of the Project. The effects of Project construction and other activities on change in mortality risk for wildlife Species at SAR / SOCC are predicted to be adverse. The magnitude of adverse effects will be low, as the estimated number of wildlife species potentially affected by Project activities following implementation of mitigative measures is expected to be less than 5 percent of the local population. Disturbance-related construction effects are anticipated to be long term. Removal of habitat from some areas of the PDA (e.g., open pit) will be permanent, and will be medium term for other areas (e.g., access roads) as these areas will be rehabilitated.

20.6.4 Change in Health

Construction

Site preparation and construction activities related to the Project will result in the most important adverse effects of the Project on wildlife SAR / SOCC through the increase in stress levels leading to the possible introduction of disease, and the masking of key auditory signals.

Noise associated with construction (and later, operation and maintenance) activities can cause increased stress levels, leading to behavioral changes, and possibly, disease. Noise can also mask important auditory signals, such as mating and distress calls, and prey sounds. Breeding and hunting success may be decreased as a result. Noises associated with the Project are expected to be short in duration, or for sustained noise, animals are likely to be displaced from areas with excessive noise levels and are not likely to experience significant adverse environmental effects.

Operation and Maintenance

The primary effects to wildlife species will occur primarily, if not exclusively, during the construction phase.

Decommissioning and Reclamation

Project effects on change in mortality risk will occur primarily, if not exclusively, during the construction phase. A Rehabilitation and Closure Plan will be developed in accordance with the applicable regulations at the time of decommissioning. The Plan will specify the procedures that will be followed with respect to the decommissioning, removal, and disposal of site equipment and structures, and for site remediation, where required. Potential environmental effects of decommissioning activities will also be managed following the Project-specific EPP Owing to the open pit nature of the Project restoration of the mine footprint upon decommissioning is unlikely to result in the complete reversal of a number of the effects associated with the Project. Most vegetated communities within the Project footprint are not expected to return to pre-Project conditions allowing SAR / SOCC and their habitats to return to their previously undisturbed condition.

Mitigation of Project Environmental Effects

The following mitigation measures are proposed to effects related to change in health for fauna SAR / SOCC during the construction phase:

- Equipment preventative maintenance programs;
- Various dust control measures will be implemented; and
- Availability of spill containment and clean up supplies and materials.

Many of the measures used to mitigate potential effects on Health as identified above for the construction phase are also applicable to the operation and maintenance phase:

- Waste and garbage will not be buried in the pit during progressive reclamation activities;
- Fuel trucks transporting fuel to on-site equipment will travel only on approved access roads;
- All equipment will arrive on site in clean condition free from fluid leaks. All equipment will be inspected and maintained on a regular schedule;
- A specific site will be chosen to conduct equipment maintenance and repairs. This site will be located a minimum of 100 m from any lake, river, stream or wetland;
- All petroleum products will be transported / handled in accordance with the Provincial *Transportation of Dangerous Goods Act*;
- All petroleum products will have correct placards and labelling and stored and handled in accordance with appropriate Provincial Regulation respecting the *Storage and Handling of Gasoline and Associated Products Regulations*, 2003;
- Fueling will take place at an appropriate distance from waterbodies; and
- Use best practices for fuels and other hazardous materials such as herbicides.

All relevant mitigation measures enacted during construction or operations and maintenance will also apply during decommissioning and reclamation.

Characterization of Residual Effects

Project activities associated with the construction, operation and maintenance, and decommissioning and reclamation phases will result a change in health for wildlife SAR / SOCC either through an increase in stress possibly leading to disease, or masking of auditory signals. These activities will continue over the life of the Project. The effects of Project construction and other activities on change in health for wildlife SAR / SOCC are predicted to be adverse. The magnitude of adverse effects will be low, as the estimated number of wildlife species potentially affected by Project activities following implementation of mitigative measures is expected to be less than 5 percent of the local population. Disturbance-related construction effects are anticipated to be long term. Removal of habitat from some areas of the PDA (e.g., open pit) will be permanent, and will be medium term for other areas (e.g., access roads) as these areas will be rehabilitated.

Table 20.12 Summary of Project Residual Environmental Effects: SAR / SOCC

Project Phase	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	
Change in Habitat											
Construction	• Project design minimizes construction footprint (i.e., PDA) to the extent feasible. • Avoid SAR / SOCC or their habitats to the extent feasible. • Delineate locations where plant SAR / SOCC occur, and avoid those locations to the extent feasible. • Minimize disturbance and infilling within adjacent wetlands and maintain hydrological conditions to the extent feasible. • Rehabilitate access routes that are no longer needed. • Locate borrow pits more than 100 m away from the high water mark of water bodies, where feasible. • Maintain natural buffers around wetlands and riparian zones.	A	M	S	LT	O	I	U/D	N	H	Monitor for compliance with mitigation measures.

Project Phase	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	
	• Dispose of slash from clearing as specified in permits. • Restrict construction activities to the PDA. • Comply with all provincial and federal legislation, permits, approvals and guidelines. • Maintain hydrology at stream crossings. • Employ erosion and sediment control. • Implement progressive reclamation. • To preserve growth medium, the topsoil will be stripped and stored for later reclamation (seed source), where feasible.										

Project Phase	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	
Operation and maintenance	• Comply with all provincial and federal legislation, permits, approvals and guidelines. • Implement erosion and sediment control. • Invasive species management. • Implement progressive rehabilitation.	A	L	S	LT	O	I	U/D	N	H	Monitor for compliance with mitigation measures
Change in Distribution and Movement											
Construction and Operations and Maintenance and Decommissioning and Reclamation	• Project design minimizes construction footprint (i.e., PDA) to the extent feasible. • Restrict clearing activities to outside of the bird breeding season, whenever feasible. • Flag the boundaries of sensitive areas before commencing any work in the area. • Survey blasting areas for SAR or SOCC prior to any blasting activities. • Limit noise levels whenever feasible.	A	L	S	LT	O	I	U/D	N	H	Monitor for compliance of mitigation measures.

Project Phase	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	
	• Allow wildlife to pass through construction sites without harassment. • Comply with provincial and federal legislation, permits, approvals and guidelines. • Maintain hydrology at stream crossings through approved methods for culvert installation. • Implement erosion and sediment control. • Invasive species management. • Implement progressive reclamation and restoration.										
Change in Mortality Risk											
Construction	• No hunting or harassment of wildlife at the Project site. • Implement Avifauna Management Plan to address incidental take. • On-site vehicle speed limits.	A	L	S	LT	O	I	U/D	N	H	Monitor for compliance of mitigation measures.
Operation and Maintenance and Decommissioning and Reclamation	• No hunting or harassment of wildlife on the Project site personnel. • On-site vehicle speed limits.	A	L	S	LT	O	I	U/D	N	H	Monitor for compliance of mitigation measures.

Project Phase	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	
	• Use welding mats from April 1 to November 15 to prevent forest fires. • Dispose of all waste appropriately. • Limit lighting to that required for safe operation. • Shield exterior lights from above.										
Change in Health											
Construction	• Consider clearing by mulching and mechanized forestry equipment. • Use best practices for fuels and other hazardous materials such as herbicides. • Implement various dust control measures.	A	L	S	LT	O	I	U/D	N	H	Monitor for compliance of mitigation measures.

Project Phase	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	
Operation and Maintenance	• Do not bury waste during progressive reclamation activities. • Confirm equipment arrives on site free from fluid leaks. • Inspect and maintain equipment on a regular schedule. • Establish a site for equipment maintenance, repair, and cleaning that is a minimum of 100 m from any lake, river, stream, or wetland. • Use best practices for fuels and other hazardous materials such as herbicides. • Implement various dust control measures.	A	L	S	LT	O	I	U/D	N	H	Monitor for compliance of mitigation measures.
Decommissioning and Reclamation	• Use best practices for fuels and other hazardous materials such as herbicides. • Implement various dust control measures.	A	L	S	LT	O	I	U/D	N	H	Monitor for compliance of mitigation measures.

Project Phase	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	

KEY

Direction:
P Positive - Beneficial or desirable change in the environment.
A Adverse - Worsening or is undesirable change in the environment.
N Neutral - No detectable or measureable change in the environment.

Magnitude:
L Low - the residual Project effects (alteration or loss) are not expected to exceed 5 percent of the known population in the RSA. No measurable effect on VEC as a whole.
M Moderate - the residual Project effects (alteration or loss) are expected to be greater than 5 percent and not exceed 25 percent of the known population in the RSA and the effect can be measured.
H High - the residual Project effects to (alteration or loss) are expected to exceed 25 percent of the known population in the RSA; the effect can be easily observed, measured and described, and may be widespread.

Frequency:
O Once - Effect occurs once during the life of the Project (e.g., clearing).
S Sporadic - Effect occurs sporadically, at irregular intervals, without any predictable pattern during the life of the Project (e.g., hydrocarbon spills).
R Regular - Effect occurs on a regular basis and at regular intervals during the life of the Project.
C Continuous - Effect occurs continuously.

Duration:
ST Short-term - Effect occurs during the site-preparation or construction phase of the Project (i.e., 1 to 2 years).
MT Medium-term - Effect extends throughout the construction and operation phases of the Project (up to 15 years).
LT Long-term – Effect is greater than 15 years.
P Permanent – Effect persists.

Frequency:
O Occasionally, once per month or less.
S Occurs sporadically at irregular intervals.
R Occurs on a regular basis and at regular intervals.
C Continuous.

Reversibility:
R Reversible – effect is reversible during the life of the Project.
I Irreversible – a long-term effect that is permanent (i.e., remains indefinitely as a residual effect).

Environmental or Socio-economic Context:
U Undisturbed - Area relatively or not adversely affected by human activity.
D Developed - Area has been substantially previously disturbed by human development or human development is still present.
N/A Not Applicable.

Significance:
S Significant.
N Not Significant.

Prediction Confidence:
Based on scientific information and statistical analysis, and effectiveness of mitigation or effects management measure
L Low level of confidence.
M Moderate level of confidence.
H High level of confidence

Project Phase	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	

Geographic Extent:

S Site-specific - Effect confined to the Project footprint for all Project components (i.e., PDA), and limited to directly affected environmental components.

L Local - Effect extends beyond the Project footprint into the surrounding areas within the LSA.

R Regional - Effect extends beyond the LSA into RSA, where indirect or cumulative effects may occur.

B Beyond Regional (provincial, national, and/or international extent) - Effect extends beyond the RSA. Area where indirect or cumulative effects may occur.

Note: (a) Although there are no thresholds to assess the potential alteration / loss of individual listed plants or plant populations, an accepted guideline in the collection of vascular and non-vascular plant voucher specimens is that an immediate population can withstand the loss of 1 in 20 individuals or 5 percent of a population (Alberta Native Plant Council [ANPC] Native Plant Collection and Use Guidelines 2000).

20.7 Assessment of Cumulative Effects

In association with the Project environmental effects identified above, an assessment was conducted of potential cumulative effects of the Project in combination with other projects and activities. Because SAR / SOCC rankings are based on populations at geographic scales far greater in extent than the PDA, LSA, or RSA, the cumulative effects assessment of SAR / SOCC was modified to consider all identified projects and activities within western Labrador and nearby portions of Quebec. Where appropriate, consideration was also given to activities in regions far removed from the Project, where the effects of those activities are known to be primary contributing factors to the rankings of these species (e.g., as with migratory birds that winter in distant locations). The potential for the Project and other planned projects and activities to have cumulative effects on SAR / SOCC is identified in Table 20.13.

The environmental effects of past and present projects and activities on SAR / SOCC in the RSA are reflected in the characterization of baseline conditions. As described in Table 20.9, there is moderate to high potential for the following two bird SAR / SOCC and seven plant SOCC to occur in the PDA:

- **Birds:**
  - Olive-sided Flycatcher (Threatened and on Schedule 1 of SARA); and
  - Rusty Blackbird (Special Concern and on Schedule 1 of SARA).
- **Plants:**
  - Spike muhly (not ranked);
  - Green false hellebore (S1, May be At Risk);
  - Northern valerian (S1);
  - Tall green northern orchid (S2S3, May be At Risk);
  - Whitestem pondweed (S2S4, Undetermined);
  - Lesser panicled sedge (S2S4, Undetermined); and
  - Yellow sedge (not ranked).

There are no known plant or fish SAR or fish SOCC within the PDA. Mammal SAR with the potential to occur within the RSA include woodland caribou (Threatened under SARA) and wolverine (Threatened under SARA); however, these species have not been observed for several years and were not observed during Project-specific surveys.

The Project will result in the alteration or loss of approximately 22 km^2 of habitat, which will result in the loss of some plant SOCC and loss of habitat (i.e., less than five percent in the RSA) for SAR / SOCC. However, as identified in Table 20.12, Project-related effects on SAR / SOCC will be mitigated with well-established and proven mitigation measures, and Alderon will comply with all provincial and federal legislation, permits, approvals, and guidelines.

Characterization of Cumulative Effects on Species at Risk

The only species at risk that may be affected by the Project is the Olive-sided Flycatcher, which although not recorded in the PDA, was recorded in the RSA in close proximity to the PDA. There is a high probability that it could use habitat within the PDA.

The Olive-sided Flycatcher breeds throughout most of forested Canada and the northern United States, and winters in Panama and the Andes Mountains of South America (COSEWIC 2008). In boreal areas, where it is not as common in Canada, this bird prefers edge habitats associated with wetlands and watercourses. Elsewhere, it prefers forest-edge habitat. The primary threats to the Olive-sided Flycatcher occur outside of the RSA for SAR / SOCC and are understood to be the result of losses of winter habitat (up to 85 percent in the Andes Mountains) and losses of natural forest edge habitat in North America due to forestry practices and forest fire control. The Project is not affecting the habitat types that are limiting for this species, will not result in mortality of an individual, and standard mitigation will restrict clearing activities to outside the breeding bird season, where feasible.

The IOC Labrador Operations project, Wabush mining project, Bloom Lake rail infrastructure, and urbanization have the potential to result in cumulative effects in combination with those of the Project. Construction of older projects (e.g., IOC Labrador Operations, which has been in operation since 1962, Wabush Mines, which has been in operation since 1965, and historical development of the towns of Labrador City and Wabush) was not subject to regulatory or policy protection for SAR. There is insufficient information available regarding the existence of the noted SAR in the locations of the existing projects prior to their development; however, it is known that the current area of disturbance of these projects totals approximately 130 km^2. As such, these projects may have resulted in the loss of SAR individuals or habitat in the RSA. However, non-winter habitat for Olive-sided Flycatcher, as provided in part by the PDA, remains common in the RSA.

Characterization of Cumulative Effects on Species of Conservation Concern

The Rusty Blackbird was not found in the PDA, but in close proximity with a high probability that it could use habitat within the PDA. The Rusty Blackbird breeds throughout most of boreal Canada and Alaska, and some northern portions of the United States, and winters in the central and eastern United States (COSEWIC 2006). In boreal areas, the Rusty Blackbird prefers to nest on the shores of wetlands or other slow-moving water bodies. The primary threat to the Rusty Blackbird is the loss of winter habitat, or as an unintended casualty of agricultural nuisance blackbird control efforts in the southern part of its winter range. The Project is not affecting the habitat types that are limiting for this species, will not result in mortality of an individual, and standard mitigation will restrict clearing activities to outside the breeding bird season, where feasible. Non-winter habitat for this species, as provided in part by the PDA, remains common in the RSA.

Vascular plant species can be deemed as rare or of conservation concern for a variety of reasons. Broadly speaking, however, a species is rare either because it lives in a very limited habitat or because its habitat has been converted by human activity (anthropogenic) to other uses. A rare taxon can be a) widely distributed, but never abundant where found (e.g., small yellow lady-slipper); b) narrowly distributed or clumped, and abundant where found (e.g., green false hellebore); or c) narrowly distributed or clumped, and not abundant where found. In general, the majority of rare plants potentially interacting with the Project are considered SOCC because their geographic distribution in Labrador is not well understood. Vascular plant SOCC interacting with the Project with the potential to be directly affected (i.e., reduction in distribution and abundance) and/or permanently lost as a result of the Project include: spike muhly, green false hellebore, northern valerian, whitestem pondweed, lesser panicled sedge, tall green northern orchid, and yellow sedge. A number of these species occupy a rather narrow ecological niche, occurring almost entirely in areas characterized by calcareous substrates (calciphiles), however, their distribution and abundance (in excess of 5 populations) has been verified from widely separated occurrences located throughout the LSA and RSA. As such, the Project is not anticipated to affect habitat types considered limiting for these species, will not result in the loss of any individual species, and standard mitigation used to assess plant statuses on a regional basis have been deemed successful. As discussed in the Chapter 17, the Project will not result in the loss of limiting wetland habitat within the RSA, or habitat that is important to the long-term survival of these species.

As noted above, several existing mining projects and towns are located within the RSA; the effects of which are reflected in baseline conditions. There is insufficient information available regarding the existence of SOCC in the locations of the existing projects prior to their development; however, it is known that the current area of disturbance of these projects totals approximately 130 km^2. Development of these projects may have resulted in the loss of individuals and habitat for SOCC.

Current and future projects are subject to federal and provincial legislation and policies to protect SAR their habitat. As such, it is not expected that future projects will have significant adverse effects on SAR / SOCC.

For mobile species such as migratory birds, Project effects (including loss of habitat in the PDA) are not predicted to act cumulatively with other past, present, or future projects or activities that would result in the degradation, alteration, or loss of important habitat for those species, in quality or extent, in such a way as to cause a change or decline in the distribution or abundance such that the likelihood of the long-term viability or survival of the population within the RSA for SAR / SOCC is substantially reduced as a result. Similarly, it is anticipated that the loss of individual plant SOCC and their habitats within the PDA will not act cumulatively with losses from other past, present or planned projects and activities so that a significant effect will occur. Therefore, the cumulative effects of the Project acting in combination with other past, present, and planned projects and activities on SAR / SOCC are determined to be not significant.

The potential for the Project and other planned projects and activities to have cumulative effects on SAR / SOCC is summarized in Table 20.13.

Table 20.13 Summary of Potential Cumulative Effects on SAR / SOCC

VEC Existing Condition (Past & On-Going Activities)	• There are no known plant SAR within the PDA. • There are seven plant SOCC with a moderate to high likelihood of being found within the PDA (i.e., northern valerian, green false hellebore, chestnut sedge, yellow sedge, lesser panicled sedge, spike muhly,and whitestem pondweed). • There is one bird SOCC, the Rusty Blackbird (Schedule 1 SARA, Special Concern), that occurs within the RSA and has moderate to high likelihood of occurrence within the PDA (not observed). • There is one bird SAR, the Olive-sided Flycatcher (Schedule 1 SARA, Threatened), that occurs within the RSA and has moderate to high likelihood of occurrence within the PDA (not observed). • There are no known other wildlife or fish SAR / SOCC within the PDA.		
Project Residual Environmental Effects	• The Project will result in the permanent loss of known plant SOCC within the PDA. • The Project will result in the loss of non-critical, non-limiting habitat (<5 percent in that RSA) for Rusty Blackbird and Olive-sided Flycatcher within the PDA. • The Project will result in the loss of approximately 22 km^2 ha of potential habitat, though not all of that area is suitable to all of the noted species. • Project-related effects on SAR / SOCC will be mitigated with well-established and proven mitigation measures, and Alderon will comply with all provincial and federal legislation, permits, approvals, and guidelines. As such, the environmental effects of the Project on SAR / SOCC are rated not significant.		
Other Projects / Activities	**Likely Effect Interaction (Y/N)**	**Rationale**	**Cumulative Effects**
IOC Labrador Operations	Y	• The loss of habitat and disturbance to wildlife species could overlap within the RSA.	• The construction of the IOC Labrador mine, which disturbed approximately 33 km^2 of potential habitat, may have resulted in the loss of individuals or habitat for SAR / SOCC. Expansion plans have the potential to affect SAR / SOCC.
Wabush Mines (Cliffs Resources)	Y	• The loss of habitat and disturbance to wildlife species could overlap within the RSA.	• The construction of Wabush Mines, which disturbed approximately 21 km^2 of potential habitat, may have resulted in the loss of individuals or habitat for SAR / SOCC. Expansion plans have the potential to affect SAR / SOCC .
Mont-Wright Mine (Arcelor Mital)	Y	• The loss of habitat and disturbance to wildlife species could overlap within the RSA.	• The construction of the Mont-Wright Mine, which disturbed approximately 47 km^2 of potential habitat, may have resulted in the loss of individuals or habitat for SAR / SOCC.
Bloom Lake Mine and Rail Spur (Cliffs Resources)	Y	• The loss of habitat and disturbance to wildlife species could overlap within the RSA.	• The construction of the Bloom Lake Mine and Rail Spur, which disturbed approximately 0.5 km^2 of potential habitat, may have resulted in the loss of individuals or habitat for SAR / SOCC.

<table>
<tr><td>Schefferville Iron Ore Mine (Labrador Iron Mines)</td><td>Y</td><td colspan="3">• The loss of habitat and disturbance to wildlife species could overlap within the RSA.</td><td colspan="4">• The construction of the Schefferville Iron Ore Mine, which disturbed approximately 9 km^2 of potential habitat, may have resulted in the loss of individuals or habitat for SAR / SOCC.</td></tr>
<tr><td>DSO Iron Ore Project (Tata Steel Minerals Canada)</td><td>Y</td><td colspan="3">• The loss of habitat and disturbance to wildlife species could overlap within the RSA.</td><td colspan="4">• The construction of the DSO Iron Ore Project, which disturbed approximately 9 km^2 of potential habitat, may have resulted in the loss of individuals or habitat for Species at Risk or Species of Conservation Concern. Expansion plans have the potential for effects on SAR / SOCC.</td></tr>
<tr><td>Lower Churchill Generation Project (Nalcor Energy)</td><td>N</td><td colspan="3">• The Lower Churchill Generation Project is not in western Labrador and will therefore not reduce the habitat for these species in the RSA.</td><td colspan="4">• None</td></tr>
<tr><td>Infrastructure or other projects at Port of Sept-Îles</td><td>N</td><td colspan="3">• Port of Sept-Îles is not in western Labrador and will therefore not reduce the habitat for these species in the RSA.</td><td colspan="4">• None</td></tr>
<tr><td>Urbanization</td><td>Y</td><td colspan="3">• The towns of Labrador City, Wabush, and Fermont are located within the RSA.</td><td colspan="4">• Development of the towns of Labrador City, Wabush, and Fermont, which has disturbed approximately 9.5 km^2 of potential habitat, may have resulted in the loss of individuals or habitat for SAR / SOCC. Future development has the potential to affect SAR / SOCC.</td></tr>
<tr><th rowspan="2">Cumulative Effects Summary (Project + All Relevant Projects / Effects)</th><th>Direction</th><th>Magnitude</th><th>Geographic Extent</th><th>Duration</th><th>Frequency</th><th>Reversibility</th><th>Significance</th><th>Confidence</th></tr>
<tr><td>A</td><td>L</td><td>R</td><td>P</td><td>O</td><td>I</td><td>N</td><td>H</td></tr>
<tr><td colspan="9">The Project will not directly affecting SAR, though it may indirectly affect Olive-sided Flycatcher which may use existing habitat within the PDA. The Project will affect up to five plant SOCC, and may affect one bird SOCC (the Rusty Blackbird). The Project will result in the alteration or loss of approximately 22 km^2 of habitat, which will result in the loss of some plant SOCC and minimal loss of habitat (i.e., less than 5 percent in the RSA) for SAR / SOCC. However, Project-related effects on SAR / SOCC will be mitigated with well-established and proven mitigation measures, and Alderon will comply with all provincial and federal legislation, permits, approvals, and guidelines. Six mining projects and three towns are located within the RSA. There are no planned projects or activities that overlap spatially with the PDA and current and future projects are subject to federal and provincial legislation and policies aimed at protecting SAR and their habitat. For mobile species such as migratory birds, Project effects are not predicted to act cumulatively with other past, present, or future projects or activities to cause the degradation, alteration, or loss of important habitat for those species in such a way as to cause a change or decline in the distribution or abundance such that the likelihood of the long-term viability or survival of the population within the RSA is substantially reduced as a result. Similarly, it is anticipated that the loss of individual plant SOCC and their habitat within the PDA will not act cumulatively with losses from other past, present or planned projects and activities so that an effect is significant. Therefore, the cumulative effects of the Project acting in combination with other past, present, and planned projects and activities on SAR / SOCC are determined to be not significant.
Note: Environmental effects descriptors and their definitions are as used in the assessment of Project-related environmental effects.</td></tr>
</table>

20.8 Assessment of Accidents and Malfunctions

Although unlikely, three potential accident or malfunction scenarios could interact with SAR / SOCC. These are:

- Forest fire caused by the Project;
- Breach of the polishing pond dyke; and
- Train derailment and consequent spill of materials or contaminants.

An Emergency Response Plan will be developed prior to initiation of construction activities and will include detailed measures for responding to the accidents and malfunctions listed above.

Forest Fire

Although unlikely, a Project-related forest fire could occur during any phase of the Project due to natural causes (i.e., lightning strike resulting in a forest fire under dry conditions), equipment involving the use of heat or flame, or human carelessness, the potential for occurrence of which is greater during the construction phase and operations and maintenance phase of the Project due to increased human activity on the site. A fire in the Project area could alter the distribution of rare species or SOCC (particularly vascular plants), with the potential for a short to medium term loss of important habitat.

Factors influencing the extent and duration of a resulting fire would be dependent on response efforts and meteorological conditions, and may also include time of year, type of fire, degree of fuel loading, and fire extent.

The magnitude of the environmental effect on SAR / SOCC is largely dependent on the scale and intensity of the forest fire. Reversibility of the physical effects of a fire is high, but would be anticipated to occur over a number of years. Restoration of important habitat would rely upon the reestablishment of vegetation communities through succession and the maintenance of those ecological conditions that existed prior to disturbance.

The potential for Project-related fires will be mitigated through proper planning, Project design, and the use of standard best management practices, including employee training, proper vigilance working with power equipment in forested areas (e.g., power saw mufflers), and equipment maintenance (e.g., vehicle exhaust systems). All Project activities will be completed in compliance with all appropriate regulation (e.g., *Forest Fire Regulations* under the provincial *Forestry Act*) and any burning of vegetative debris will be completed in accordance with permits obtained from the Newfoundland and Labrador Department of Natural Resources (DNR). Fire suppression water supply will be extracted from Long Lake and will be kept pressurized at the pumping station near the concentrator area. Staff will be trained to prevent and control fires. A plan for preventing and combating forest fires will be incorporated into the Emergency Response Plan. In the unlikely event of a large fire, local emergency response and fire-fighting capability will be called to respond to reduce the severity and extent of damage and to protect the safety of workers. The nearest district forest management unit office is in Wabush, which has staff and equipment to provide initial suppression activities. Two seasonal fire protection staff are stationed at Wabush from mid-May to September, complemented by three permanent staff that are available for fire suppression when needed. After regular hours the Department maintains one district duty officer and one regional duty officer for receiving fire reports and dispatching staff and equipment. Therefore, in the event of a fire, the on-site response and proximity of provincial fire suppression will limit the size of any burn.

Temporary and localized significant adverse environmental effects on SAR / SOCC could result due to forest fires; however, these accidents are unlikely to occur.

Polishing Pond Dyke Breach

The dykes located at the TMF will be designed to standards of the Canadian Dam Association (CDA) Dam Safety Guidelines. The CDA Dam Safety Guidelines will be used to guide the hazard consequence assessment process and associated design standards for the dykes at the TMF. The hazard consequence class for rockfill dams is determined through hydrotechnical, seismic, and geotechnical assessments of a dam breach failure. The dam design and hazard consequence classification process is subject to a risk assessment process to minimize and reduce risk of breach and, subsequently, to reduce risk to acceptable levels. The outlet structures and TMF are being designed to accommodate a 100-year storm. In addition, an emergency spillway will be incorporated into design to provide relief of larger runoff events such as the from the Probable Maximum Precipitation event.

The proposed tailings impoundment will be a dynamic water feature whose location and shape will move and adjust over the life-of-mine due to the proposed upstream tailings deposition method. Tailings will be deposited starting from the tailings dam crest and form a tailings beach extending within the TMF away from the dam. The standing tailings impoundment water is therefore always upstream of the tailings beach. This deposition method progressively moves the tailings impoundment water farther away from the tailings dam and subsequently lowers the risk of a flooding breach of the tailings dam. In the event of a tailings dam breach, tailings impoundment water would have to migrate through the tailings beach to the breach and in the process peak flows would be expected to be attenuated to low consequence levels.

The proposed polishing pond dyke will maintain its location throughout the life-of-mine. A breach of the polishing pond dyke would result in the release of impounded water to the downstream stream (TDA-02). As the TMF and polishing pond effectively remove the upstream portion of TDA-02, much less water would route through the watercourse in the event of a dyke breach than if the polishing pond were an on-line system. A polishing pond dyke breach would be expected to cause localized flooding and may cause some erosion and sedimentation near the breach point. However, these effects would be temporary and the downstream watercourse is expected to recover naturally. Polishing pond water quality is expected to be ≤ 100 mg/L TSS, which is the criterion for reclaim water intake from the tailings impoundment. Further, installation of a system to treat red water is expected to improve resident water quality in the polishing pond. Therefore, water quality in TDA-02 in the immediate vicinity of a dyke breach may exceed MMER TSS guidelines; however, TSS concentrations are expected to be moderate and not greater than the maximum TSS concentrations that can occur naturally. This effect would also be temporary and one from which the receiving watercourse would be expected to recover naturally.

The extent of the environmental effect of a failure of the Polishing Pond control structure on wetlands, and in particular wetland function is predicted to be low, as the effects would primarily occur in low-lying areas along the shorelines of Long Lake, such that the extent of effects will be limited. Reversibility of the physical effects of a dyke breach is high, but would be anticipated to occur over a number of years. Restoration of wetland quality or function would depend upon the reestablishment of vegetation communities through succession.

Train Derailment

No. 2 diesel fuel will be transported along the rail line to the Project site and ore concentrate will be transported from the Project site to the QNS&L railway. A train derailment may occur during any phase of the Project resulting in the deposition of hazardous materials and/or iron ore concentrate into surrounding lands. Such spills are usually highly localized and can be effectively cleaned up by on-site crews using standard equipment and spill response materials. In the unlikely event of a large spill, soil, groundwater and surface water contamination could occur if not properly contained. The release of any of these materials or contaminants into surrounding lands could result in a degradation of terrestrial, wetland, and/or aquatic habitats with potential effects on populations of SOCC, in particular where those lands provide habitat for these species (e.g., wetlands). Soil contamination, which affects soil productivity, could potentially occur when a hazardous substance is spilled or leaked. The magnitude and duration of any potential effects of accidental spills depends on the nature of material spilled, the quantity spilled, the location of the spill, and the time of year in which the incident occurs.

The Emergency Response Plan will address emergency preparedness measures necessary to provide effective response in the unlikely event of a spill. In addition to spill response procedures identified in the EPP and Emergency Response Plan, the transportation of dangerous goods is strictly regulated in Newfoundland and Labrador, and across Canada, and the regulatory spill response system is highly coordinated and effective means of dealing with such events. Additionally, track inspections (both manual and electronic) to be carried out in accordance with Transport Canada regulations to identify track defects that could lead to derailment. As identified above, the magnitude of the environmental effect of a train derailment and subsequent spill of materials or contaminants would be dependent on a number of factors that are often difficult to predict. Given the aforementioned mitigation, the magnitude of the environmental effects attributable to these infrequent and unlikely accidents and malfunctions is considered low, or under potentially worse case scenarios medium. Reversibility of the environmental effects will depend on the specific habitat involved, and the proportion of habitat affected, and the potential for those habitats to be utilized by plant SOCC, but would be anticipated to occur naturally over a number of years.

The residual environmental effects of Project-related accidents and malfunctions on SAR / SOCC are summarized in Table 20.14.

Table 20.14 Summary of Residual Environmental Effects on SAR / SOCC – Accidents and Malfunctions

Accidental Event / Malfunction	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	
Forest Fire	• Implement EPP. • Implement Emergency Response Plan. • Employee training.	A	H	L/R	ST	U	R	U	S	H	None recommended.
Polishing Pond Dyke Breach	• Design polishing pond to handle 1 in 100 year peak discharge event. • Include emergency spillway. • Implement EPP. • Implement Emergency Response Plan. • Employee training.	A	L-M	L/R	ST-MT	U	R	U	N	H	Monitor success of response measures.
Train Derailment	• Implement EPP. • Implement Emergency Response and Contingency Plan. • Employee training.	A	L	L	MT-LT	U	I	U/D	N	H	Monitor success of response measures.

Accidental Event / Malfunction	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	

KEY

Direction:
- P Positive - Beneficial or desirable change in the environment.
- A Adverse - Worsening or is undesirable change in the environment.
- N Neutral - No detectable or measureable change in the environment.

Magnitude:
- L Low - the residual Project effects (alteration or loss) are not expected to exceed 5 percent of the known population in the LSA. No measurable effect on VEC as a whole.
- M Moderate - the residual Project effects (alteration or loss) are expected to be greater than 5 percent and not exceed 25 percent of the known population in the LSA and the effect can be measured.
- H High - the residual Project effects to (alteration or loss) are expected to exceed 25 percent of the known population in the LSA; the effect can be easily observed, measured and described, and may be widespread.

Geographic Extent:
- S Site-specific (PDA).
- L Local: within the LSA.
- R Regional: within the RSA.
- B Beyond Regional: beyond the RSA.

Geographic Extent:
- S Site-specific - Effect confined to the Project footprint for all Project components (i.e., PDA), and limited to directly affected environmental components.
- L Local - Effect extends beyond the Project footprint into the surrounding areas within the LSA.
- R Regional - Effect extends beyond the LSA into RSA, where indirect or cumulative effects may occur.
- B Beyond Regional (provincial, national, and/or international extent) - Effect extends beyond the RSA. Area where indirect or cumulative effects may occur.

Duration:
- ST Short term - Effect occurs during the site-preparation or construction phase of the Project (i.e., 1 to 2 years).
- MT Medium term - Effect extends throughout the construction and operation phases of the Project (up to 15 years).
- LT Long term – Effect is greater than 15 years.
- P Permanent – Effect persists.

Frequency:
- U Unlikely.
- O Once - Effect occurs once during the life of the Project (e.g., clearing).
- S Sporadic - Effect occurs sporadically, at irregular intervals, without any predictable pattern during the life of the Project (e.g., hydrocarbon spills).
- R Regular - Effect occurs on a regular basis and at regular intervals during the life of the Project.
- C Continuous - Effect occurs continuously.

Reversibility:
- R Reversible.
- I Irreversible.

Environmental or Socio-economic Context:
- U Undisturbed: Area relatively or not adversely affected by human activity.
- D Developed: Area has been substantially previously disturbed by human development or human development is still present.
- N/A Not Applicable.

Significance:
- S Significant.
- N Not Significant.

Prediction Confidence:
Based on scientific information and statistical analysis, and effectiveness of mitigation or effects management measure
- L Low level of confidence.
- M Moderate level of confidence.
- H High level of confidence.

20.9 Determination of Significance of Residual Adverse Environmental Effects

20.9.1 Project-related Residual Environmental Effects

The Project is being designed, and will be constructed and operated to minimize potential environmental effects on SAR / SOCC that could result during the normal course of the Project as well as those that could result from accidents and malfunctions. The implementation of an EPP and an Emergency Response Plan will minimize the likelihood, extent, and magnitude of residual environmental effects.

Plants

The construction, operation and maintenance, and decommissioning and reclamation of the mine site and its associated Project components has potential to physically alter or result in the loss of rare plant species. This EIS considers the effect of mine construction, operation and maintenance, and decommissioning and reclamation on plant SOCC. Interaction between the Project and plant species, considered by the Province to be species of conservation concern, will occur within the PDA, primarily during the construction phase, and as a result of ground disturbance activities.

As many as seven SOCC are known to occur within the PDA. Alternatively, occurrences of a total 8 species (includes chestnut sedge which was observed in proximity to the PDA) were also observed to occur in the LSA and RSA adjoining the PDA. Rare plants in the PDA by their nature occur in localized areas usually in association with wetlands (shrubby and treed fens) and floodplains of slow-moving rivers and streams underlain by soils containing a lot of calcium carbonate from underlying bedrock (e.g., dolomite) and rock outcrops/cliff faces. The greatest threat to rare plants and/or their habitats from the proposed Project is through damage, destruction and/or loss resulting from site preparation activities related to construction of the mine site, waste rock disposal areas, TMF, and other such components as the access road and rail infrastructure (i.e., where vegetation will be removed, deep root damage may occur and/or topsoils are excavated).

A number of provincially ranked vascular plant species that could potentially be disturbed by the Project have only been recorded in the PDA and/or have not previously been recorded regionally (i.e., RSA) or in Labrador on the whole. As such, additional surveys were conducted in mid-summer 2012 to evaluate the presence or absence of rare plant species, particularly SOCC, from within the RSA. Habitats with high potential for rare plants with early season phenology (i.e., wetlands, floodplains of slow-moving rivers and streams) and those with optimal phenology typical of later in the growing season (including late flowering plants, grasses, sedges and aquatic plants) were surveyed during this period. Results of these surveys indicate that the majority of species identified to be of conservation concern to the Province are well represented regionally, and none of the vascular plants species identified are listed as SAR as defined by federal authorities. In all probability, future regional botanical studies will identify further additional occurrences of these species throughout western Labrador, and a delisting of some species from S1, S2, or S1/S2 rankings to a more common status rank may occur.

In cases where occurrences of plant SOCC cannot be avoided, transplantation to alternate suitable habitat will be investigated. Although the Project will alter habitat of plant SOCC, the populations of these species are predicted to remain in the adjoining LSA upon decommissioning of the Project.

The residual adverse environmental effects on plant SOCC are not likely significant because there are no unique habitats within the PDA, and these species are likely to maintain sustainable populations outside the PDA. A high level of confidence is associated with this prediction because of the historic (ACCDC) database and current (field studies) information on the distribution and abundance of plant SOCC in the PDA and LSA.

None of the plant species listed under SARA or under the Newfoundland and Labrador *Endangered Species Act* were found within the PDA. Therefore, there are no likely significant effects to plant species at risk.

Wildlife

The residual adverse environmental effects on wildlife SAR / SOCC are not likely significant because although these species occur within the LSA and could be affected by the Project, there are no unique habitats with which they are associated within the LSA or PDA, and sustainable populations are likely to be maintained outside the LSA and PDA. A high level of confidence is associated with this prediction because of existing information on the distribution and abundance of species in the PDA and LSA, including Project-specific surveys.

As described above, any potential adverse residual effects of the Project on SAR / SOCC would occur primarily, if not exclusively, as a result of first-time ground disturbance during Project construction. Any such effects, if they did occur, would therefore be primarily restricted to the PDA for the specific habitat preferences of select wildlife species.

Mitigation includes limiting the area of disturbance within the PDA, developing site-specific EPPs for environmentally sensitive areas (including avoidance, minimization), and personnel awareness training.

20.9.2 Cumulative Effects

The Project will result in the alteration or loss of approximately 22 km^2 of habitat, which will result in the loss of some plant SOCC and minimal loss of habitat (i.e., less than five percent in the RSA) for SAR / SOCC. However, Project-related effects on SAR / SOCC will be mitigated with well-established and proven mitigation measures, and Alderon will comply with all provincial and federal legislation, permits, approvals, and guidelines. There are no planned projects or activities that overlap spatially with the PDA and current and future projects are subject to federal and provincial legislation and policies aimed at protecting SAR and their habitat. For mobile species such as migratory birds, Project effects, are not predicted to act cumulatively with other past, present, or future projects or activities to cause the alteration or loss of important habitat for those species in such a way as to cause a decline in the distribution or abundance such that the likelihood of the long-term viability or survival of the population within the RSA is substantially reduced as a result. Similarly, it is anticipated that the loss of individual plant SOCC and their habitat within the PDA will not act cumulatively with losses from other past, present or planned projects and activities so that a significant effect will occur. Therefore, the cumulative effects of the Project acting in combination with other past, present, and planned projects and activities on SAR / SOCC are determined to be not significant.

20.9.3 Accidents and Malfunctions

Design features and procedures will be incorporated to minimize the probable occurrence of accidents, malfunctions, and unplanned events. Proven engineering techniques are available to prevent these accidents and will be employed for the Project. Safety, spill response and contingency plans will be developed and implemented to reduce adverse environmental effects of such unlikely event incidents. All safety procedures will be documented and in place prior to the commencement of routine operations.

An Emergency Response Plan will further reduce the magnitude of effects resulting from forest fire, polishing pond dyke breach, or train derailments. In addition, design features and safety precautions at the Project will minimize the likelihood of significant effects due to accidents and malfunctions.

Forest Fire

Although the effects of a fire on plant and wildlife SOCC would be temporary, depending on the extent of a fire, the magnitude of the resulting effects could be high. The likelihood of a forest fire will be reduced through employee training and other mitigation measures. In the event of a fire, response measures to be detailed in the Emergency Response Plan would be implemented. The potential environmental effects of a Project-induced forest fire on SAR / SOCC could be significant in the unlikely event it should occur.

Breach of Polishing Pond Dyke

Based on the temporary nature and limited geographic extent of the potential interactions, and in consideration of the mitigation (e.g., engineering design and Emergency Response Plan) and potential receiving environment (i.e., Long Lake), the potential environmental effects of a polishing pond dyke breach on SAR / SOCC are not likely to be significant in the highly unlikely event should it occur.

Train Derailment

Based on the temporary nature and limited geographic extent of the potential interactions and the natural reversibility of effects, and in consideration of the mitigation (e.g., Emergency Response Plan measures and provincial and federal regulatory spill response system), the potential environmental effects of a Project-related train derailment on SAR / SOCC are not likely to be significant in the highly unlikely event should it occur.

20.9.4 Overall Residual Effects Conclusion

While the Project will affect rare species or SOCC and their habitats, the residual effects are not likely to be significant as those habitats that will be disturbed are representative of habitat generally available throughout western Labrador. The Project will not affect the sustainability of the populations.

20.10 Follow-up and Monitoring

Plants

Compliance with mitigation measures, such as delineating locations of plant SOCC will be implemented.

As there is some level of uncertainty regarding the actual abundance of SOCC in the area due to the paucity of rare plant species data in Labrador, Alderon has conducted additional rare plant surveys outside the PDA in 2012, focusing on those habitats with a high potential of harboring rare plant taxa across the RSA. If rare species are identified avoidance will be implemented. It is possible that in exceptional circumstances additional mitigation measures may be required if avoidance is not feasible. Where necessary, and through consultation with DOEC, Alderon will investigate possible mitigation options (i.e., transplanting) in those instances where a significant percentage of a specific rare plant species or population may be removed by the Project (i.e., surveys do not result in the identification of additional rare plant species populations in the RSA) or fragmented by the disturbance footprint.

20.11 Next Steps

Protection measures for SAR / SOCC will be incorporated into the EPP prior to construction. Locations of plant SOCC will be delineated prior to construction for avoidance, if possible. Where occurrences of plant SOCC cannot be avoided, transplantation to alternate sites of suitable habitat will be investigated.

20.12 Summary

The identification of SOCC will support Alderon in the implementation of policies, procedures and protocols (e.g., EPP) intended to protect species at risk, significant wildlife habitat, and the biodiversity and ecological integrity in proximity to the Kami Project.

Effects to SAR / SOCC will be mitigated through a series of measures designed to limit the area disturbed by the Project and to manage emissions and discharges. In cases where occurrences of plant SOCC cannot be avoided, transplantation of the populations will be investigated. Site-specific mitigation measures will be detailed in an EPP. Significant adverse effects to SAR / SOCC are therefore not likely.

21.0 HISTORIC AND CULTURAL RESOURCES

21.1 Valued Ecosystem Component Definition and Rationale for Selection

Historic and Cultural Resources include sites, materials and, in certain instances, landscapes or places of historic, archaeological, cultural / spiritual, palaeontological, and architectural importance. Such resources can date to the very distant past or to the Pre-contact, Historic or Contemporary periods[1], and are valued for their cultural, spiritual, natural, and scientific importance. In the province of Newfoundland and Labrador, these resources are protected under the provincial *Historic Resources Act* (1985) administered through the Provincial Archaeology Office (PAO) of the Department of Tourism, Culture and Recreation (DTCR). Historic and Cultural Resources have been identified as a VEC because they comprise the only physical information on Aboriginal lifeways prior to the arrival of Europeans in Newfoundland and Labrador and help contemporary society to understand the history, land-use, fossil record, and architecture of a region. Moreover, they can provide insight into the interactions that took place between different cultural groups and the connections each had with the environment in which they lived.

Typically, the three broad categories comprising Historic and Cultural Resources include:

- Archaeological and Cultural Resources (such as the remains of campsites or stone tools pre-dating 1960, as well as Aboriginal and non-Aboriginal burials sites and other sacred places);
- Palaeontological Resources (fossils); and,
- Architectural Resources (such as historic buildings and properties).

Archaeological sites (defined as locations containing material-evidence of human interaction with the environment pre-dating 1960) identified during field research in the province of Newfoundland and Labrador are recorded, inventoried, and assigned numbers under the Borden System (the Canadian registry for archaeological remains) in accordance with the provincial *Historic Resources Act* (1985) (Government of Newfoundland and Labrador 2011). In addition, under current regulatory policy for Labrador, all material evidence of contemporary land use (defined as land use occurring after 1960) is recorded, inventoried, and assigned provincial ethnographic registration numbers. Contemporary sites can include, for example, evidence of campsites or tilts, or remains suggestive of hunting, fishing, or trapping locations. Although recorded by provincial regulators, contemporary sites are not assigned numbers under the Borden System, are not classified or inventoried as archaeological sites as such, and are not normally the subject of mitigation measures.

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[1] The Pre-contact Period refers to the time prior to the arrival of Europeans in North America circa 500 years ago and first "contact" with Aboriginal peoples. The Historic Period covers the time from first contact (and the beginning of written records in the "New World") to AD 1960. The Contemporary Period begins at AD 1960 and continues to present.

Also taken into account under the category Archaeological and Cultural Resources are cultural / spiritual sites, which include Aboriginal and non-Aboriginal sacred places and structures, such as birth and burial sites, and landscape features.

Palaeontological resources are defined and managed pursuant to the *Historic Resources Act* (1985) and Palaeontological Resources Regulations. Under the current regulatory framework for the province of Newfoundland and Labrador, a field survey of areas proposed for development is not required for palaeontological resources, although depending on the type of remains identified within a region, zones can be designated as significant fossil sites and afforded protection under the *Historic Resources Act* (1985). Moreover, in areas where finds of significance may be anticipated, due to the presence of specific geological deposits (e.g., sedimentary rock), an assessment can be called for by the PAO under Section 13 of the Act.

Background research results indicated that, due to the age (Proterozoic) and high degree of metamorphism of the geological deposits in western Labrador, there is little potential for common fossil-types to be present. To assess the likelihood of any such significant fossils being present in the PDA and areas adjacent to it, geologists at the Geological Survey Division of the Newfoundland and Labrador Department of Mines and Energy were consulted. According to staff within these agencies, there may be limited potential for the presence of primitive fossils, similar to algae or bacteria, in the Labrador City and Wabush area, but these would not be widespread and thus would be difficult to locate and identify (Dr. W. Lawson Dickson: pers. comm., 2011). Additionally, there are some Cretaceous plants and insects known from the Schefferville area, but again, these are not thought to be widespread (D. Boyce: pers. comm., 2011). There are no known fossils or sites within the PDA and no areas adjacent to the Project currently protected under the Palaeontological Resources Regulations within or near the PDA. On the basis of these results, palaeontological resources are not considered further in this EIS.

Architectural resources are not managed under provincial legislation, although there are provisions in the *Historic Resources Act* (1985) to protect buildings, properties, or landscapes that have been designated as Provincial Historic Sites (Government of Newfoundland and Labrador 2011d). To establish if any such resources exist within the PDA and areas adjacent to it, a search of the on-line database of the Heritage Foundation of Newfoundland and Labrador was completed (Heritage Foundation of Newfoundland and Labrador 2012). The search did not identify any architectural resources within the PDA or adjacent areas. On the basis of these results, architectural resources are not considered further in this EIS.

There are linkages between Historic and Cultural Resources and Chapter 22: Current Use of Lands and Resources for Traditional Purposes by Aboriginal Persons, and Chapter 23: Other Current Use of Lands and Resources included in this EIS.

21.1.1 Approach to Assessment of Effects

The assessment of Project-related environmental effects included a Stage 1 Historic Resources Overview Assessment (Stage 1 HROA), completed in accordance with provincial guidelines (Government of Newfoundland and Labrador 1992), to characterize Historic and Cultural Resources baseline conditions. The Stage 1 HROA involved background research and a field survey of Project infrastructure as defined in August 2011, and informant interviews with 20 current land users from western Labrador and Fermont, Québec. The interactions between the Project and Historic and Cultural Resources were analyzed, the need for mitigation was considered, and the significance of residual environmental effects was determined.

The assessment of environmental effects has been discussed with the regulator, most notably at a meeting with the PAO on March 20, 2012, attended by representatives of the PAO, Environmental Assessment Division, Alderon, and Stassinu Stantec. The meeting included an outline of the results of the Historic and Cultural Resources baseline study and a presentation and discussion of the methodology followed for assessment of any Project environmental effects. The regulator expressed satisfaction with the overall approach and suggested some additional data sources relevant to the background research component of the Stage 1 HROA. Other issues raised at the meeting included ongoing consultation with relevant Aboriginal groups to secure data on traditional land use, as well as the need for review and, potentially, field assessment of any pre-construction activities involving ground disturbance.

21.1.2 Issues

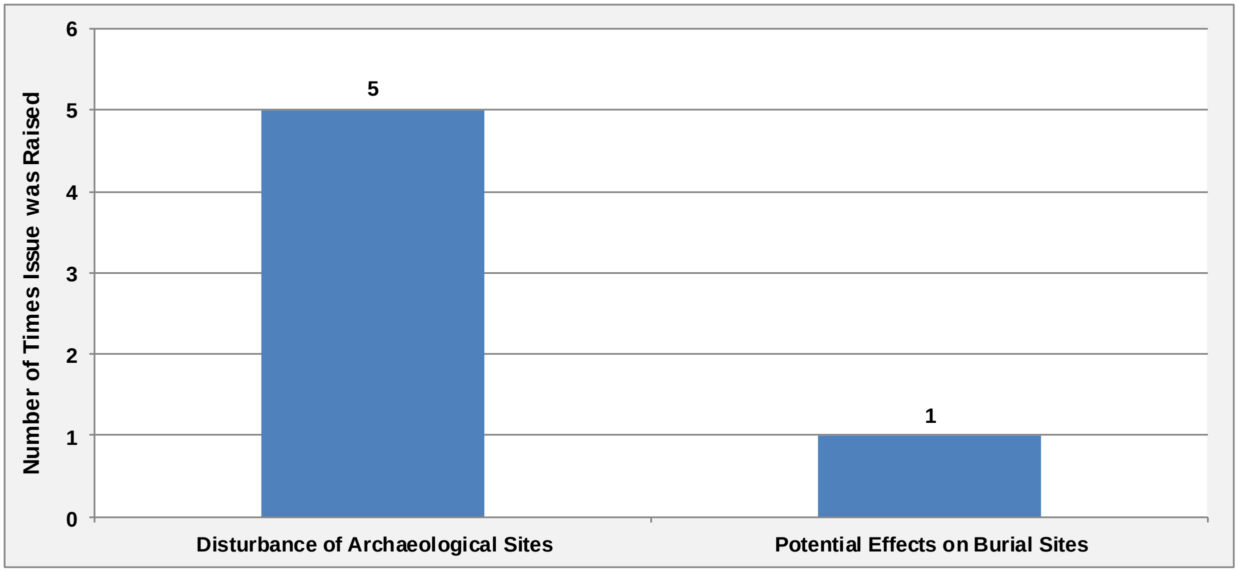
A list of issues identified by stakeholders during consultation efforts, and the manner in which these issues are addressed within the EIS, are presented in Table 21.1.

The frequency of issue type is summarized in Figure 21.1.

Table 21.1 Issues Raised by Aboriginal Groups and Stakeholders

Issue	Community / Organization	Summary of Comments Raised During Consultation and Engagement Activities	Response / Location in the EIS
Disturbance of Archaeological Sites	Fermont	Arrow heads were reported to have been found at an unconfirmed location on Lac d'Aigle near Fermont, Québec. It was reported by the informant that the artifacts were analyzed and dated to the first Innu.	Section 21.5 includes a description of historical and cultural resources in the vicinity of the Project. The closest point on Lac d'Aigle to the Project is approximately 7.3 km away and therefore is not anticipated to be affected by the Project. Section 21.6 includes the assessment of effects from the Project on archaeological sites.
Potential Effects on Burial Sites	Labrador City	Concern that there is a cemetery on the route.	Section 21.5 includes a description of historical and cultural resources in the vicinity of the Project. Background research and informant interviews did not identify any information to suggest there is a cemetery in the vicinity. However, there is a cemetery with a cross located south of the Project area that is a registered archaeological site with the Provincial Archaeology Office. The Innu visit the site frequently and maintain the cemetery, which is located approximately 70 km southeast of the Project. This site is not anticipated to be affected by the Project. Section 21.6 includes the assessment of effects from the Project on burial sites.

Figure 21.1 Frequency of Issue Type related to Historic and Cultural Resources



21.2 Environmental Assessment Boundaries

21.2.1 Spatial Boundaries

Spatial boundaries for the environmental effects assessment of Archaeological and Cultural Resources are defined below.

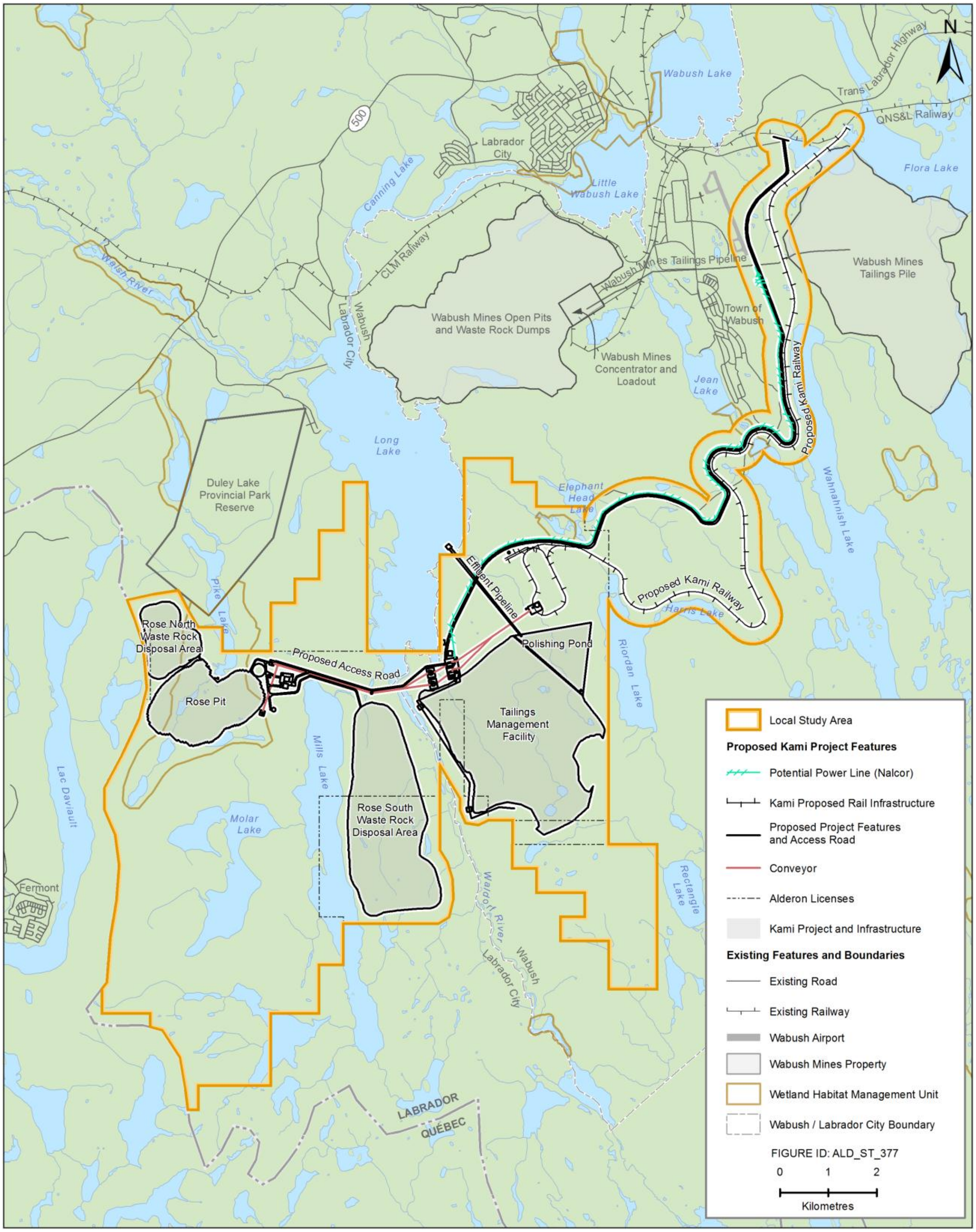
Project Development Area

The Project Development Area (PDA) comprises the footprint of the proposed Rose Pit, the Rose North Waste Rock Disposal Area, the Rose South Waste Rock Disposal Area, the Tailings Management Facility (TMF), and associated infrastructure (Figure 21.2). The PDA is comprised of areas where Archaeological and Cultural Resources may be physically disturbed through Project-related activities such as land clearing, ground excavation and/or grading.

Local Study Area

For the environmental assessment of Archaeological and Cultural Resources, the Local Study Area (LSA) includes earlier and current versions of the PDA, as well as the Project's mineral license area (Figure 21.2). The LSA was the area within which archeological potential mapping was completed.

Figure 21.2 Local Study Area



21.2.1.1 Regional Study Area

Although Archaeological and Cultural Resources are stationary, and any direct environmental effects of the Project on them would not extend beyond the PDA, the potential environmental effects nevertheless includes assessment within a Regional Study Area (RSA), which takes into account the overall cultural history of the region in which the PDA is located, and how any Archaeological and Cultural Resources that may be affected by the Project relate to this larger regional context (Figure 21.3). The RSA is focused on previously-investigated areas in western Labrador, but extends to encompass previously investigated areas to the west in Nouveau-Québec, and to the south, along the North Shore of the St. Lawrence in Québec. Review of data pertaining to the RSA enables prediction of the nature and extent of Archaeological and Cultural Resources that may be present within the PDA. Moreover, findings from the RSA provide a background and context within which the potential of the PDA as a whole for Archaeological and Cultural Resources may be assessed.

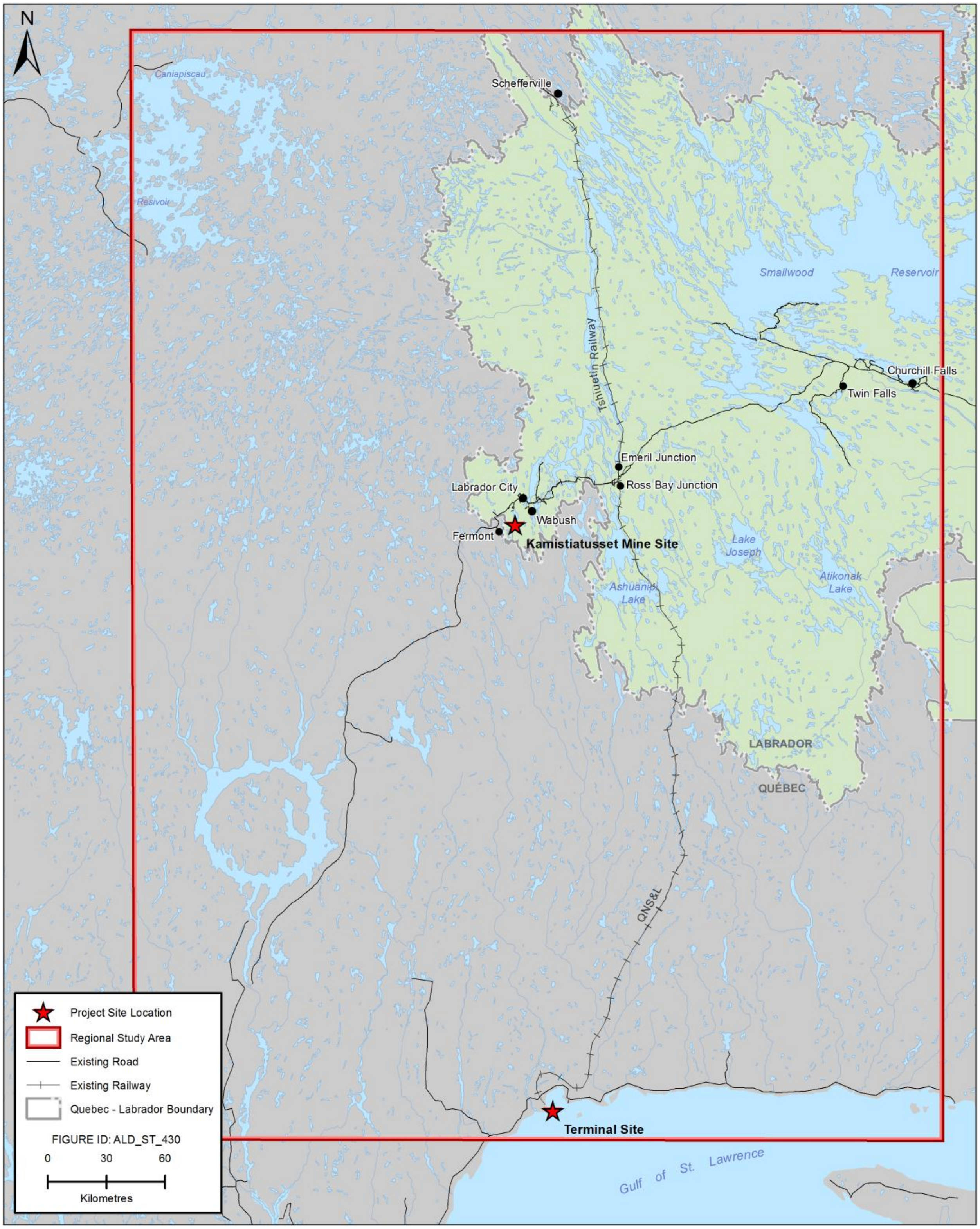
21.2.2 Temporal Boundaries

The temporal boundaries for the assessment of potential environmental effects of the Project on Archaeological and Cultural Resources include the Project phases of construction (approximately two years), operation and maintenance (approximately 17 years), and decommissioning / reclamation (approximately two years).

21.2.3 Administrative Boundaries

The protection and management of Archaeological and Cultural Resources in Newfoundland and Labrador is the responsibility of the PAO. The PAO administers its mandate through the Newfoundland and Labrador *Historic Resources Act* (1985), which has its own distinct regulatory requirements in addition to those of the broader EA process.

Figure 21.3 Regional Study Area



21.3 Establishing Standards or Thresholds for Determining Significance of Environmental Effects

Environmental Effects Descriptors

The likely environmental effects of the Project on Archaeological and Cultural Resources are described using the following attributes, which are based on standard environmental assessment practice, as well as the provisions of the Newfoundland and Labrador *Historic Resources Act* (1985) and the EIS Guidelines.

- **Direction:**
  - Neutral (N) - no effect on Archaeological and Cultural Resources; or
  - Adverse (A) - loss or disturbance of Archaeological and Cultural Resources.
- **Magnitude:**
  - Negligible (N) - no likely effect on Archaeological and Cultural Resources;
  - Low (L) - disturbance of Archaeological and Cultural Resources but with prior retrieval of the resource and associated information, and with all necessary regulatory approvals;
  - Moderate (M) - disturbance or loss of a portion of an Archaeological and Cultural Resource, with retrieval of a portion of the resource and its associated information, or a direct effect on a known Archaeological and Cultural Resource that is of interest and concern to the associated community, but that does not reduce the overall integrity and cultural value of the site; or
  - High (H) - disturbance or loss of an Archaeological and Cultural Resources, with no retrieval of the resource and its associated information, or a direct effect on Archaeological and Cultural Resources, which reduces the overall integrity and cultural value of the site.
- **Geographic Extent:**
  - Site (S) - Effect confined to the PDA;
  - Local (L) - any effect will be limited to the LSA; or
  - Regional (R) - effects may extend beyond the LSA.
- **Frequency:**
  - Once (O) - Effect occurs once;
  - Sporadically (S) - Effect occurs occasionally but not consistently throughout the life of the Project;
  - Regularly (R) - Effect occurs at regular intervals throughout the life of the Project; or
  - Continuous (C) - effect will occur continuously.

- **Duration:**
  - Temporary - effect will occur but measures are taken to salvage and retrieve information from the resources, and/or move / rehabilitate the site; or
  - Permanent (P) - effect will be permanent and irreversible.
- **Reversibility:**
  - Reversible (R) - Will likely recover to baseline conditions after the end of Project decommissioning; or
  - Irreversible (I) - Unlikely to recover to baseline conditions after the end of Project decommissioning.
- **Ecological Context:**
  - Undisturbed (U) – Area has been relatively or not adversely affected by recent human activity; or
  - Disturbed (D) - Area has been substantially previously disturbed by recent human development or human development is still present.

Threshold for Determining the Significance of Residual Environmental Effects

Significance criteria for Archaeological and Cultural Resources are largely defined by the Newfoundland and Labrador *Historic Resources Act* (1985). A significant adverse residual environmental effect on Archaeological and Cultural Resources is defined as a Project-related environmental effect that results in the loss or disturbance of known Archaeological and Cultural Resources without the appropriate documentation, or salvage and retrieval of the material culture and the information it contains, and without prior approval from the regulatory agency.

An adverse environmental effect that does not meet the above definition is rated as not significant.

21.4 Potential Project-VEC Interactions

Each Project activity or physical work is listed in Table 21.2. Each interaction is ranked as 0, 1, or 2 based on the level of interaction each activity or physical work could have with Archaeological and Cultural Resources.

Table 21.2 Potential Project-related Environmental Effects to Archaeological and Cultural Resources

Project Activities and Physical Works	Potential Environmental Effects
	Loss or Alteration to Archaeological and Cultural Resources
Construction	
Site Preparation (including clearing, excavation, material haulage, grading, removal of overburden, and stockpiling)	2

Project Activities and Physical Works	Potential Environmental Effects Loss or Alteration to Archaeological and Cultural Resources
Construction of Roads	2
Construction of Site Buildings and Associated Infrastructure (maintenance facilities, offices, plant, crushers, concentrator, conveyors, gatehouse, pumphouses, substation, security fencing, sanitation system)	2
Construction of Mine Tailings Management Facility (TMF)	2
Construction of Railway and Load-out Facilities (silos)	2
Construction of Power Line	2
Construction of Stream Crossings	2
Installation of Water Supply Infrastructure (wells, pumps, pipes)	2
Onsite Vehicle / Equipment Operation	0
Waste Management	0
Transportation of Personnel and Goods to Site	0
Expenditures	0
Employment	0
Operation and Maintenance	
Open Pit Mining (including drilling, blasting, ore and waste haulage, stockpiling, and dewatering)	2
Ore Processing (including crushing, conveying, storage, grinding, screening)	0
Concentrator Operations (gravity and magnetic separation, tailings dewatering, tailings thickener, concentrate conveyance to load-out)	0
Tailings Disposal in TMF	0
Waste Rock Disposal on Surface	2
Water Treatment (including mine water and surface runoff) and Discharge	0
Rail Load-Out by Silo Discharge	0
Rail Transport	0
Onsite Vehicle / Equipment Operation and Maintenance	0
Waste Management	0
Transportation of Personnel and Goods to Site	0
Fuel Storage and Dispensing	0
Progressive Rehabilitation	0
Expenditures	0
Employment	0

Project Activities and Physical Works	Potential Environmental Effects
	Loss or Alteration to Archaeological and Cultural Resources
Decommissioning and Reclamation	
Site Decommissioning	0
Site Rehabilitation (building demolition, grading, scarifying, hydroseeding)	0
Accidents and Malfunctions	
Forest Fire	2
Polishing Pond Breach	2
Train Derailment	2

KEY
0 No interaction.
1 Interaction occurs; however, based on past experience, the resulting environmental effect can be managed to acceptable levels through standard operating practices or through the application of best management or codified practices. No further environmental assessment is warranted.
2 Interaction occurs, and resulting environmental effect may exceed acceptable levels without implementation of specified mitigation. Further environmental assessment is warranted.

Archaeological and Cultural Resources are located on, or immediately beneath, the ground surface. Based on their nature, in that new archaeological sites are not being created, they are defined as non-renewable resources. Because Archaeological and Cultural Resources are static and finite, any Project interactions will be restricted to physical works that are associated with first-time forest clearing and ground disturbance. Project activities in already-disturbed forest and ground surfaces are unlikely to interact further with any Archaeological and Cultural Resources, including archaeological sites and/or sites of cultural / spiritual importance.

Interactions ranked as 2 in Table 21.2 are those associated with Project activities that involve first-time ground disturbance and are primarily associated with the construction phase.

Project activities with interactions ranked as 0 are those associated with operation and maintenance, or decommissioning and reclamation, which either involve no physical disturbance on the ground surface, or which occur on already-disturbed ground. In consideration of the nature of the interactions, the potential environmental effects of all Project activities and physical works ranked as 0 in Table 21.2 are rated as not significant and are not considered further in the assessment.

21.4.1 Selection of Environmental Effects and Measurable Parameters

The environmental assessment of Archaeological and Cultural Resources is focused on the loss or disturbance of archaeological and other types of cultural / spiritual l sites. The measurable parameter used for the assessment of this environmental effect, and the rationale for its selection, are indicated in Table 21.3.

Table 21.3 Measurable Parameters for Archaeological and Cultural Resources

Environmental Effect	Measurable Parameter	Rationale for Selection of the Measurable Parameter
Loss or disturbance of archaeological and cultural resources sites	• Number of known archaeological and cultural resources sites that will be lost or disturbed	• Loss of known sites would be an adverse effect on Archaeological and Cultural Resources. The number of archaeological and cultural / spiritual sites provides a measurable parameter that allows this environmental effect to be quantified.

21.5 Existing Environment

21.5.1 Methodology for Characterization of Baseline Conditions

Background Research

Historic and Cultural Resources include three distinct categories of resource: archaeological and cultural resources; palaeontological resources; and architectural resources.

Archaeological and Cultural Resources

Background research for Archaeological and Cultural Resources began with a search of the Archaeological Site Record Inventory at the PAO, to determine whether any archaeological or contemporary sites or other cultural resources of significance were registered for the area. In addition to providing site-specific information, such as site locations, time-period, and cultural group(s) represented (if known), the PAO data helped establish a general picture of the archaeological resources potential of the region and, more specifically, the Project Development Area (PDA). To obtain an overview of the cultural / historical sequence of the region, background research also involved a review of reports and published literature regarding previous archaeological and cultural resources assessments and research projects undertaken in western Labrador and adjacent areas of Québec (e.g., Thomson 1983, 1984, 1985; Penney 1986, 1988, 2010; Denton and McCaffrey 1988; Denton 1989; McCaffrey 1989, 2004, 2006a, 2006b; Niellon 1992; JWEL 1997; Loring et al. 2003; Neilsen 2005, 2009a, 2009b; McCaffrey et al. 2006; Minaskuat 2006, 2008; Brake 2007a, 2007b; Pintal 2007; Labrador Iron Mines (LIM) 2009). Background research for archaeological resources also included a review of relevant historic, ethnohistoric, and ethnographic sources (e.g., Delanglez 1948; Mailhot 1997). A detailed review of Project mapping, Landsat imagery and environmental sources helped further refine the archaeological resources potential for the Project area. The mapping reviewed during background research was used to select (for subsequent field investigation) any landforms and/or topographic features within the PDA potentially predictive of past human use / settlement.

Sites of Aboriginal and non-Aboriginal cultural, historic, and religious importance occur in western Labrador. In order to determine whether any cultural / spiritual sites are known for the PDA, a literature search of relevant historic, ethnohistoric and ethnographic sources was completed (e.g., Delanglez 1948; Tremblay 1977; Tanner and Armitage 1986; Armitage 1990, 1992, 2010; Niellon 1992; Mailhot 1997; Weiler 1999; LIM 2009). As well, a review of existing studies on Aboriginal culture, spirituality (Armitage 1992; Weiler 1999) and land-use in western Labrador (Tanner and Armitage 1986; LIM 2009; Armitage 2010; Nalcor Energy 2010) was conducted. No specific information on cultural / spiritual resources in western Labrador was identified through research of PAO data sources.

Because archaeological materials and sites of cultural / spiritual significance are important to contemporary Aboriginal and non-Aboriginal societies, and there is potential that such resources may occur within the PDA, Archaeological and Cultural Resources are assessed fully in this EIS.

Field Survey

In September, 2011, following completion of background research and the selection and rating of areas with varying degrees of archaeological potential, the field survey component of the Stage 1 HROA was undertaken within the PDA, as defined at that time. In accordance with provincial regulations (government of Newfoundland and Labrador 1992), the primary objectives of the Stage 1 HROA were to identify and assess any Archaeological and Cultural resources within the proposed development area.

During the field survey, the PDA and adjacent area was first inspected by means of a detailed helicopter over-flight. The primary purpose of this aspect of the work was to visually inspect from the air the locations of archaeological potential identified during background research and to search for others not selected for a walk-over and sampling at that time. It also served to more accurately rate the potential of terrain intersected by Project infrastructure (notably river and lake shorelines), which in a number of cases resulted in areas of anticipated ‘Higher’ potential being downgraded to Moderate or even Low. The helicopter over-flight was followed by a ground inspection and sub-surface shovel testing of select locations within the PDA that appeared to hold some degree of potential for archaeological remains.

The focus of the ground survey was to test areas of anticipated potential identified during background research and helicopter over-flight, and to locate, during a walk-over and close inspection, any deflated cultural material in exposures, as well as any other surface-visible remains. Sub-surface testing was employed when background research and/or close visual reconnaissance confirmed a testing location had potential for buried pre-contact cultural remains, or when specific historic or contemporary sites might be anticipated, but no surface-visible remains were evident. In locations of particular significance, such the shorelines of rivers and lakes intersected by or close to Project infrastructure, testpits were dug at either 5 m intervals or randomly along cut-lines or paths, focusing on well-drained and level ground suitable for human habitation. The objective of sub-surface sampling was to test areas lacking surface exposures by sampling sub-surface deposits at close and regular intervals, to a depth of several cm below the ‘A’ horizon, below which no cultural remains would be anticipated.

Testpits were an average of 30 cm^2 and excavations were rarely deeper than 40 cm below the surface. Testpits were excavated by shovel and, where necessary, trowel. At several locations, ground disturbance from woods-road construction was extensive. As well, along shorelines, where the majority of recreational cabins are located, the forest and surface vegetation has been removed, leaving the underlying soils exposed. While removal of the vegetation would have likely dispersed or destroyed any *in situ* cultural material, because surface soils are shallow throughout the region, this did allow for comprehensive assessment of large parcels of terrain without excavation of many testpits. Similar conditions of exposed soils and extensive erosion were noted along the majority of an esker that parallels Waldorf River at the southern margins of the PDA adjacent to the locations identified at that time for the impoundment of the mine tailings.

During the field survey, a total of 10 locations were subject to ground investigation and/or sub-surface testing with excavation of 20 testpits. All investigation areas were situated on the shoreline of waterbodies, including: three locations within the Jean Lake Rapids Management Unit (Locations 1 to 3), three locations on a well-defined esker that parallels Waldorf River (Locations 3 to 6), one location near the mouth of Waldorf River at the southern end of Long Lake (Location 7), one location on Long Lake at the proposed access road crossing (Location 8), one location at the northwest end of Mills Lake, covering the area of the proposed access road corridor (Location 9), and one on a point of land that projects out from the east side of Long Lake. A description of the ground investigation / testing locations and the information compiled from each is provided in Section 21.5.3 below.

Archaeological Potential Mapping

Subsequent to completion of the field survey, the archaeological potential of the Kami mineral licenses was mapped, including the proposed pit area and associated infrastructure, the rail line and conveyor system and the transmission line. The purpose of this component of the Stage 1 HROA was to analyze and rate areas as having either Low, Moderate or Higher potential so that a 'planning / precautionary tool' (showing the relative potential of areas) was available for review by the proponent and the PAO if the Project footprint was to be expanded or adjusted, or if pre-construction works (i.e., geo-technical drilling) were scheduled. With such mapping available, it could be determined with a relative degree of certainty if field assessment for specific locations within the Kami mineral licenses was warranted prior to adjustments of the Project footprint and related ground disturbances. The methodology for the archaeological potential mapping was initially developed for assessment of the Lower Churchill Project in 2000 (JWEL/IELP 2001), which was subsequently refined in 2008 and again in 2010 (Stantec Consulting Limited 2010a). The same methodology was applied to map the relative archaeological potential of the Project license area in western Labrador, with some minor modifications.

The approach involved three stages:

- mapping of topographically- and hydrographically-defined Zone Types;
- incorporation into GIS and data analysis; and
- assessing and mapping archaeological potential for each defined Zone Type.

<u>Stage 1: Zone Mapping</u>

Zone mapping followed the approach used previously for other development projects, with some modifications, where 12 archaeological potential Zone Types were defined (JWEL/IELP 2001; Stantec Consulting Ltd. 2010b). The Zone Types represent landforms with distinctive vegetation and topographic features that are readily identifiable in aerial photography and, in some cases, on topographic mapping. Most zones are distinguished by topographic features, principally their slope and edge characteristics, and their relation to waterways. The use of simple presence / absence attributes, recognizable in aerial photography and delineated on topographic mapping, is intended to reduce ambiguity and enhance consistency throughout the mapping process. The zone mapping methodology was modified for the Project in that only 5 of the 12 Zone Types are present and distinguishable. The definitions of these Zone Types follow:

- **Zone Type 01 (Contemporary Strategic Shoreline)** comprises all shorelines along major waterways that display strategic attributes identified as being attractive for human habitation. Major waterways are defined to include the coast, inland lakes greater than approximately 2 km^2 in area, and inland rivers wide enough for both banks to be distinguished on 1:50,000 topographic mapping. Strategic attributes are defined to include points of land, confluences, constrictions in waterways and locations above or below falls and rapids. The strategic significance of these attributes has been tested and verified during previous potential mapping studies (JWEL/IELP 2001; Stantec Consulting Limited 2010b);
- **Zone Type 02 (Contemporary Generic Shoreline)** comprises shorelines along major inland waterways that lack strategic attributes;
- **Zone Type 09 (Upland)** consists of areas of moderate or steep slope. It effectively represents interfluvial upland, encompassing large areas of steep or moderate slope, hilltops and minor stream-courses lying between the major waterways;
- **Zone Type 10 (Wetland)** consists of permanently poorly-drained organic deposits large enough to be mapped at this scale; and,
- **Zone Type 12 (Esker)** consists of eskers discernible on aerial imagery. This Zone Type has potential archaeological significance (see for instance McCaffrey *et al.* 2006), but its archaeological potential has not been fully verified in Newfoundland and Labrador.

In most cases, review of aerial imagery for archaeological potential mapping does not identify specific locations of dry, level terrain that may have been suitable for human habitation. It merely identifies zones within which such terrain, if present, has greater or lesser potential, relative to the area under study, to contain archaeological sites. That is to say that an area rated as having 'Higher' potential, does not necessarily indicate that its potential is 'High'. It indicates only that its rating relative to other mapped zones in the study area is elevated.

Stage 2: Incorporation into GIS and Data Analysis

The maps and associated zone attributes were digitized and incorporated into GIS files. Final output for potential mapping was in the form of polygons. Zone mapping was then correlated with geo-referenced data on ground investigation / testing locations and any known archaeological sites. Analysis of these correlations allowed sampling quality and the relative probability of recovering archaeological sites to be determined for each Zone Type.

Stage 3: Mapping Archaeological Potential

A further stage of the archaeological potential mapping consisted of the reduction of the zone mapping to a relative archaeological potential rating. Each Zone Type was assigned a rating of Low, Moderate or Higher archaeological potential, which are relative to each other within the Kami license area, which was based on the potential mapping criteria as well as being informed by field observation.

Archaeological potential ratings are summarized in Table 21.4.

Table 21.4 Zone Types, Descriptions and Relative Archaeological Potential Ratings

Zone Type	Description	Archaeological Potential Rating
01	Contemporary Strategic Shoreline	Higher
02	Contemporary Generic Shoreline	Moderate
09	Upland	Low
10	Wetland	Low
12	Esker	Moderate

Informant Interviews

Land and resource use interviews were conducted with 15 residents of Labrador City / Wabush and five from Fermont, Québec, who use the area for recreational, subsistence and, to a lesser extent, commercial purposes. The results of the interviews were used to inform the assessment of Historic and Cultural Resources.

Informants were identified through discussions with local government officials and local land user groups (e.g., the snowmobile association). Additional informants were identified during interviews with the first group of informants identified who were asked to identify other potential informants in the region. This approach allowed for the ongoing identification of key land and resource users.

The interviewing process involved the use of a questionnaire and two maps. The interviews in Fermont were conducted in either English or French, depending on the preference of the informant. Prior to the trip, all interview tools (maps, questionnaire, recording sheets) were translated into French. Upon completion of the interviews, all data were compiled in both French and English. Interview questions were tailored to gather detailed information on a broad range of current subsistence, recreational, and commercial land and resource use activities including hunting, fishing, trapping, boating, snowmobile and all-terrain vehicle (ATV) use, wood harvesting (for firewood and saw-logs), berry picking, cabin use, outfitting, and birding and geo-caching. In addition, informants were asked if they knew of any sites or structures of historical, archaeological, paleontological, or cultural / spiritual significance within the PDA or region.

None of the informants who contributed to the study self-identified as Aboriginal. However, in accordance with the EIS Guidelines, Alderon is currently engaging with five Aboriginal groups (Innu Nation, NunatuKavut Community Council, Uashat mak Mani-Utenam, Matimekush-Lac John and Naskapi Nation of Kawawachikamach) to collect land and resource use information and traditional knowledge. Land and resource use collected to date is included in Chapter 22: Current Use of Lands and Resources by Aboriginal Persons for Traditional Purposes, and traditional knowledge is incorporated in relevant sections of the EIS.

21.5.2 Traditional and Local Knowledge

Local knowledge pertaining to Historic and Cultural Resources is presented in Table 21.5.

Table 21.5 Local Knowledge – Historic and Cultural Resources

Date	Stakeholder	Community	Comment
March 14, 2012	Individual	Labrador City	There is a cemetery on the route.

Aboriginal traditional knowledge has been collected through engagement activities. Currently, there is no known published source of Aboriginal traditional knowledge collected at or near the Project area. In the absence of this, Aboriginal traditional knowledge was also collected through published sources from other areas. This information is presented in Table 21.6.

Table 21.6 Aboriginal Traditional Knowledge – Historic and Cultural Resources

Group	Source	Page or Date Reference	Comment or Excerpt
Naskapi	Consultation Assessment Report CEAR Doc#501	P.13-10	From a review of source documentation, the Naskapi Nation of Kawawachikamach maintains a number of sacred areas within their traditional territory (Harper 1964), one of which is Deer Mountain near Indian House Lake (Tanner 1947).

21.5.3 Archaeological and Cultural Resources

Cultural / Historical Overview: Regional Study Area

Archaeological sites and materials have been identified throughout the majority of Newfoundland and Labrador, including the RSA. Many finds have been made along the coast but they have also been identified in near-coastal and interior portions of the province, including western Labrador.

The Maritime Archaic Indian Tradition is the name given to the people who arrived in southern Labrador via the Maritimes and North Shore of the St. Lawrence approximately 7,500 to 8,000 years ago in the wake of retreating glaciers (McGhee and Tuck 1975; Pintal 1998; McCaffrey et al. 2006; Schwarz 2010). The descendants of these first inhabitants gradually moved north along the coast and eventually reached northern Labrador approximately

6,500 years ago (Fitzhugh 1978a). In western Labrador, evidence of an Archaic Indian occupation is limited to a number of stone artifacts found on the Lake Plateau (in an area now encompassed by the Smallwood Reservoir) and near Wabush (MacLeod 1967, 1968; Thomson 1984).

After the Archaic, the next period is referred to as the Intermediate Period (in Labrador prehistory) or the Early Woodland Period (on the North Shore of the St. Lawrence; McCaffrey et al. 2006), dating between 3,800 and 2,000 years ago in Labrador (Fitzhugh 1972; Nagle 1978). Typically, Intermediate-period sites are small and contain few diagnostic artifacts. While sites attributable to this culture have been found on the coast of Labrador, along with those of the contemporary Arctic-adapted, Palaeo-Eskimos (4,000 to 600 years ago) (Cox 1978), it is of note that the majority of finds in the interior appear to belong to this group (Schwarz 2007). The Intermediate Period of occupation appears to have been focused on an interior-oriented lifestyle of hunting caribou and small game and fishing, similar to that recorded for the Innu during the Historic Period. In northern Québec, this period of occupation is not clearly understood (McCaffrey 2006a), but appears to have been less intensive than the occupation of central Labrador. One archaeological site related to the Intermediate Period was found close to a chert outcrop near Schefferville, Québec, which is to the north of the PDA (Denton and McCaffrey 1988).

The Intermediate Period in Labrador is followed by the Late Pre-contact Period (2,000 years ago to the time of Aboriginal contact with Europeans *circa* 1500 to 1700 AD). This is represented in coastal Labrador by the Daniel's Rattle and Point Revenge complexes, and on the North Shore of the St. Lawrence River by sites of the Middle and Late Woodland periods (McCaffrey et al. 2006). In Labrador and the interior of Québec, sites dating to this period frequently contain structures interpreted as the remains of communal dwellings analogous to the *shaputuan* of the historic Innu (Loring 1985). Research has revealed a pattern of marine and terrestrial resource exploitation (Fitzhugh 1978b; Loring 1992), with a much larger emphasis on maritime resources than during the preceding period. In the central Labrador interior, sites dating to the Late Pre-contact Period are far less common than those of the Intermediate Period. This differs from northern Québec, where there are many Late Pre-contact Period sites dating to shortly after 2,000 years ago, which contain evidence of far-ranging exchange or trade, pottery use, and large, *shaputuan*-type dwellings containing a number of hearths (McCaffrey 2006b). It has been demonstrated that people associated with late Pre-contact Period sites in the region are ancestral to the historic and contemporary Québec-Labrador Innu and Naskapi.

After approximately 1500 AD, Labrador and the North Shore of the St. Lawrence River became a focus of European activities. In the sixteenth century, Basque whaling efforts along the coast intensified (Tuck and Grenier 1989), and from the seventeenth century, fur trading posts were established, initially by French merchants along the Québec North Shore (McCaffrey et al. 2006), and eventually in Labrador (McAleese 1991; Kennedy 1995). European activity in the Labrador- Québec interior was more limited. However, trader and explorer Louis Jolliet visited the Ashuanipi Lake area around 1695, providing the earliest written reference to the importance of Ashuanipi Lake as a major Innu gathering place (Delanglez 1948). Aboriginal archaeological sites dating from the mid-seventeenth to the mid-nineteenth century have rarely been identified in interior Labrador and northern Québec, which may be a result of the limited amount of field studies completed there. As a result, the understanding of Aboriginal settlement patterns dating to this time is based largely on ethnohistoric and fur trade accounts, including the records of the Hudson Bay Company (HBC) from interior trading posts in the region (McCaffrey 1989). In the latter half of the nineteenth century, when the fur trade in Labrador was at its peak, Innu mobility was gradually reduced. However, even at that time, long-distance travel by Innu across the Labrador Peninsula and as far south as the Québec North Shore did continue. The Moisie, Ashuanipi, Naskaupi, and Churchill rivers all historically served as means of travel along important travel routes between Uashat (Sept-Îles) on the Québec North Shore, and Sheshatshiu on upper Lake Melville in Labrador (Tremblay 1977; Mailhot 1997).

The second half of the twentieth century saw many changes for the Innu and non-Innu inhabitants of western and central Labrador. Among the more notable were the emergence of the Euro-Canadian communities such as Happy Valley-Goose Bay, Labrador City, Wabush, and Churchill Falls, and the development of road, air travel, and communication networks. The 1960s also saw the implementation of government policies that encouraged the Innu to become increasingly sedentary (Armitage 1990). Further policy shift included the development of the Churchill River for hydroelectric purposes, which resulted in the flooding of vast tracts of land and creation of the Smallwood Reservoir in 1971. Prior to that hydroelectric development, the region had been a major hunting and gathering area for the Innu of Labrador-Ungava and the North Shore of Québec (Loring et al. 2003). While the Sheshatshiu Innu continue to occupy most of the pre-settlement area, inter-band mobility is much diminished and it is now Innu from the North Shore of Québec and Schefferville who are primary users of the region (Tanner and Armitage 1986; Armitage 1990). Data on contemporary land-use in western Labrador in the vicinity of the PDA by Innu from Uashat (Sept-Îles) suggest that travel and harvesting activities are strongly focused on the Ashuanipi River and Menihek Lake (Nalcor Energy 2010). While use of these areas may reflect historic and traditional land-use patterns (as attested to by Louis Jolliet in the 1690s), it may also speak to the scope of ancient Innu land-use throughout western Labrador and parts of adjacent Québec.

Previous Archaeological Research: Regional Study Area

Previous archaeological research in Labrador-Ungava has focused primarily on the Labrador coast to the east of the LSA, the Québec interior to the west, and the North Shore of the St. Lawrence River to the south. The results of work along the coast of Labrador and the North Shore of the St. Lawrence are extensively documented elsewhere and will not be discussed further here (for a review see McCaffrey et al. 2006). In contrast, relatively little work has been conducted in western Labrador near the PDA.

The archaeological research that has been done in the interior of western Labrador and adjacent interior Québec has focused primarily on six areas. Four of these are relatively distant from the LSA: the Smallwood Reservoir of the Lake Plateau Region; the Caniapiscau and Laforge regions to the northwest in interior Québec; the Schefferville area to the north in Québec and Labrador; and along the Ashuanipi River and Menihek Lake. Closer to the LSA, limited archaeological research has been conducted in the Labrador City / Wabush area and along the Highway 500 corridor between Wabush and Churchill Falls.

Lake Plateau Region

The Lake Plateau Region to the northeast of the LSA received little archaeological attention prior to the creation of Smallwood Reservoir in 1971 (Figure 21.4). However, the territory around the former Michikamau Lake (now part of Smallwood Reservoir) was surveyed for archaeological materials in the 1960s prior to flooding (MacLeod 1967, 1968). A total of eight sites were identified during that research project, five of which contained Pre-contact Period components. MacLeod (1967) also noted a number of relatively large historic Innu campsites in his study area, including one he described as "…one of the last preserved major meeting places for the Naskapi from the north and Montagnais from farther south…" The sites recorded by MacLeod in the 1960s were subsequently submerged as a result of flooding for Smallwood Reservoir. In 1995, an archaeological survey undertaken along portions of the Smallwood Reservoir during a period of unusually low water levels indicated that despite erosion from fluctuating water levels and ice scouring, deflated archaeological deposits could still be identified (Loring et al. 2003).

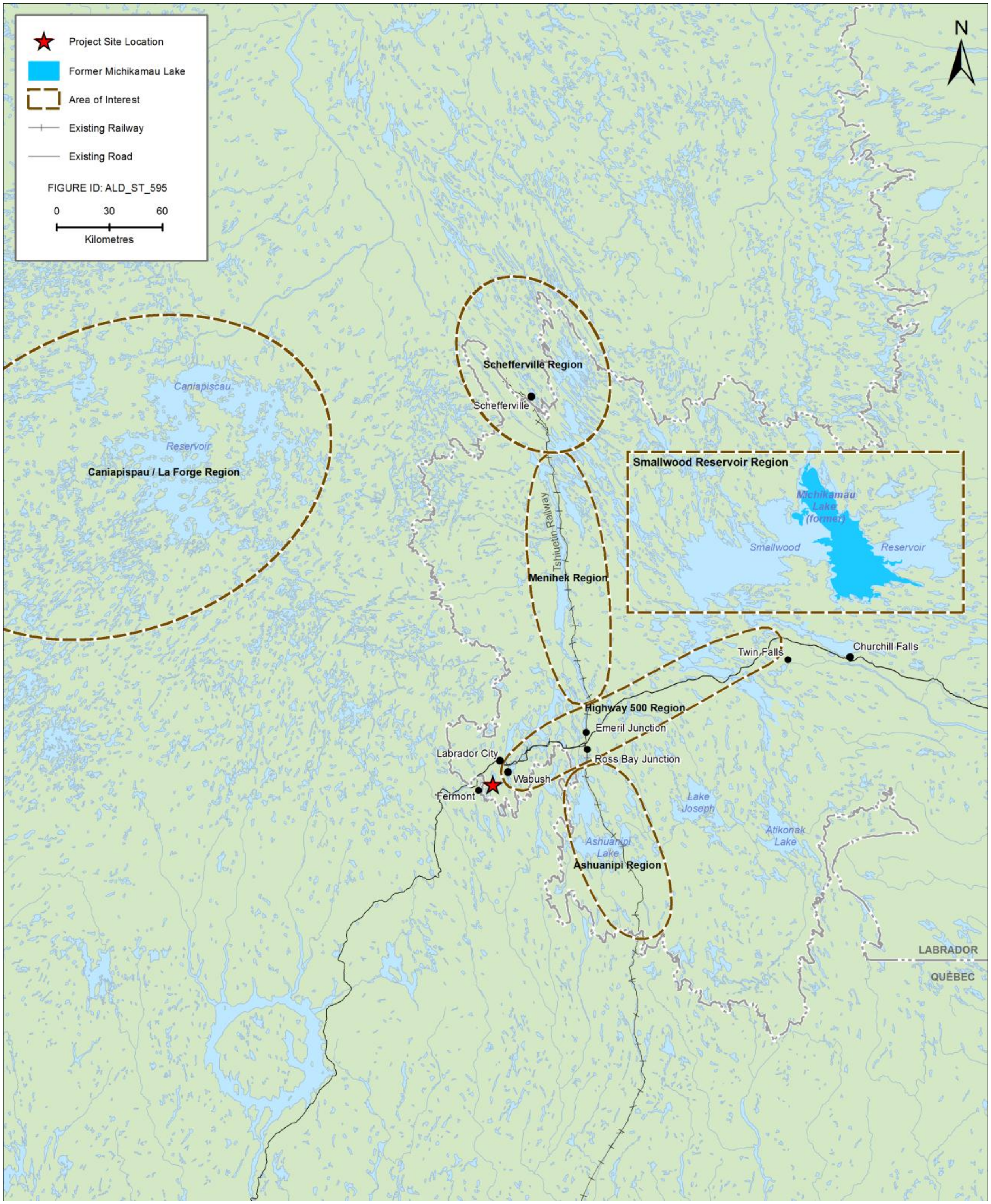
Caniapiscau and Laforge Region

The Caniapiscau and Laforge region (Figure 21.4) received considerable archaeological attention in the 1970s and 1980s in the context of hydroelectric development of Rivière La Grande. Archaeological work in this vast region began with a series of canoe-based surveys during the summers of 1972 and 1976 and grew in scale and duration over the following two decades. Hundreds of Pre-contact, Contact, and Historic Period sites were identified, and a number of these were fully excavated. Reports and publications based on this research provide evidence documenting pre-contact occupation in the far interior of the eastern Subarctic and indicate that this history dates back at least 4,000 years. A number of regional syntheses have been produced (Denton 1989; McCaffrey 2006a, 2006b) and over 100 sites have been radiocarbon dated.

Schefferville Region

In 1984, archaeological surveys in the Schefferville region to the north of the LSA (Figure 21.4) located evidence of pre-contact use of local chert outcrops (Denton and McCaffrey 1988). Other surveys and excavations were also conducted in the area north of Schefferville and in western Labrador, and a number of potential habitation locations were investigated, along with Fort Nascopie, a nineteenth century HBC post on Petitsikapau Lake (McCaffrey 1989). More recently, in 2003 and 2006, sections of a proposed mine site at Howells River to the north of the LSA were inventoried as part of a pre-feasibility historic resources study. The surveys did not yield any evidence of pre-contact or early historic period occupation, but ample evidence of recent Innu land-use dating to the last 50 years was recorded, as were high-quality chert outcrops in the area (McCaffrey 2004; Minaskuat 2006).

Figure 21.4 Archaeological Research Areas



Ashuanipi and Menihek Regions

The Ashuanipi and Menihek regions are shown on Figure 21.4. An archaeological survey in the 1980s identified a number of pre-contact archaeological sites on the west side of Menihek Lake, particularly near the mouth of McPhayden River (McCaffrey 1989). More recently, surveys in the Ashuanipi drainage have led to the discovery of numerous pre-contact and contemporary sites on Ashuanipi Lake (Niellon 1992; Neilsen 2005, 2009a), one of which, the Ferguson Bay 1 site, has been excavated (Brake 2007a; 2007b). In 2006, Minaskuat was retained by LabMag GP Inc. to undertake a Stage 1 HROA of a mining property proposed for development in western Labrador near Schefferville. In addition to evidence of contemporary land-use, the assessment of the slurry pipeline corridor led to the discovery of 13 Pre-contact Period archaeological sites along the Ashuanipi drainage, from Wightman Lake north to the eastern shore of Menihek Lake (Minaskuat 2008). The relative abundance of archaeological sites suggests that the importance of the Ashuanipi as an axis of travel for historic Innu was true as well in the Pre-contact Period.

Closer to the LSA (Figure 21.4), sections of the proposed Highway 500 extension between Labrador City, Wabush, and Churchill Falls were assessed for historic resources in the 1980s (Thomson 1983, 1984, 1985; Penney 1986). As a result of this work, a number of Aboriginal camps dating to the recent past (possibly to within the last 25 years) were located. Findings during the study do not include any pre-contact remains or sites, but a Maritime Archaic Indian ground and polished stone adze from a private collection in Wabush was recorded (Thomson 1984). This artifact was discovered by William Guy in the vicinity of what was referred to as Heath Lake, possibly situated to the west of Wabush Lake, in an area later affected by open pit mining. The single artifact collected by Guy (a section of a Maritime Archaic Indian ground slate celt) was viewed by archaeologist James Wright during a survey carried out in the region in the 1960s. Currently, the whereabouts of the artifact is unknown and it is thought that any site it may have been associated with has been totally destroyed (S. Hull, PAO: pers. comm. 2011). In addition, a number of archaeological assessments have been undertaken in the Labrador City / Wabush area (e.g., JWEL 1997). In recent years, a number of such assessments have been associated with increased mining development in the area (e.g. (Penney 1988; 2010; Pintal 2007; Neilsen 2009b). To date, no archaeological sites have been recorded as a result of this work.

Regionally, the principal axis of travel during the Historic Period appears to have followed the Ashuanipi drainage, and archaeological evidence from the Ashuanipi suggests that this was the case in the Pre-contact Period as well. Moreover, the results of informant interviews suggest that the LSA is generally regarded as a poor harvesting area, particularly for caribou. There is also some potential that secondary historic travel routes leading from the Ashuanipi to the west and southwest toward Rivière aux Pékans and beyond to the Saint-Marguerite or Manicouagan, may have led through the Project LSA, possibly by way of the Shabogamo and Wabush lakes. However, to date no evidence to confirm this has been identified.

Cultural / Spiritual Sites: Regional Study Area

The literature review of existing sources dealing with Aboriginal culture and spirituality (Armitage 1992; Weiler 1999) and land-use in the western Labrador (Armitage 2010; Tanner and Armitage 1986; LIM 2009; Nalcor Energy 2010) identified no sites within the LSA. However, two sites of cultural / spiritual importance to the Innu are known for the RSA along the Ashuanipi drainage system (Figure 21.5). These include:

- A traditional Innu gathering site on Menihek Lake, approximately 110 km northeast of the LSA, marked by a statue of St. Anthony erected in 1970 (Minaskuat 2008); and
- A large Innu burial site on Ashuanipi Lake, approximately 70 km south of the LSA, visited by Père Babel in 1868 (Tremblay 1977; Tanner and Armitage 1986).

No additional specific information on cultural / spiritual resources in western Labrador was identified through research of PAO data sources.

Stage 1 Historic Resources Overview Assessment: Local Study Area

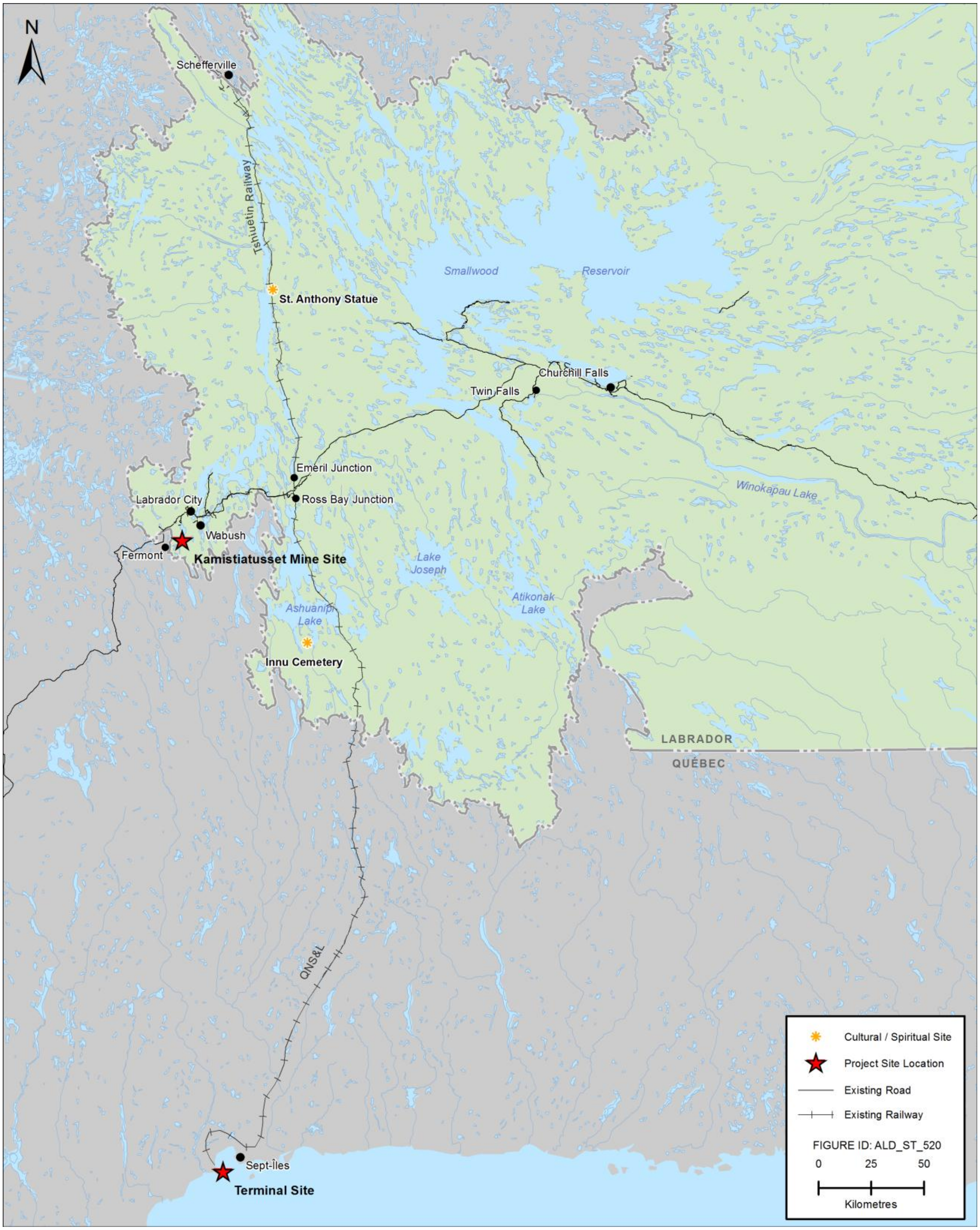
Background Research

A review of the Newfoundland and Labrador Archaeological Site Record Inventory at the PAO completed during background research for the Stage 1 HROA indicated that no archaeological or contemporary sites are registered for the LSA. However, the review of the site record data at the PAO did provide a general view of the nature and extent of archaeological materials and sites that have been identified throughout the Labrador portion of the PDA. Additional information in this regard was gathered through the review of reports and published literature regarding previous archaeological and cultural resources assessments and research projects undertaken in western Labrador and adjacent areas of Québec (e.g., Thomson 1983, 1984, 1985; Penney 1986, 1988, 2010; Denton and McCaffrey 1988; Denton 1989; McCaffrey 1989, 2004, 2006a, 2006b; Niellon 1992; JWEL 1997; Loring et al. 2003; Neilsen 2005, 2009a, 2009b; McCaffrey et al. 2006; Minaskuat 2006, 2008; Brake 2007a, 2007b; Pintal 2007; Labrador Iron Mines (LIM) 2009).

The review of 1:50,000-scale topographic mapping, Landsat imagery and Project mapping of the PDA (as defined at that time) suggested the LSA in general was of relatively Low potential for archaeological sites. The review suggested that the terrain within the PDA was uneven and, in many locations, comprised of wetland and bogs or had seen considerable ground and shoreline disturbance through past industrial development and cabin and wood-road construction. Moreover, a large majority of the terrain where Project infrastructure was proposed to be established avoided most shorelines of the area's larger rivers and lakes and only at six locations did it intersect with or come close to relatively large waterbodies that could have been used for past human settlement. These include:

- The western shoreline of Flora Lake proposed for the railway line;
- The shoreline at Jean Lake Rapids proposed for a railway crossing;

Figure 21.5 Cultural / Spiritual Sites: Regional Study Area



- The southern end of Long Lake proposed for an access road and conveyor crossing;
- The north end of Pike Lake proposed for an access road and conveyor;
- The southern end of Mills Lake, adjacent to the proposed North Rose and Rose pits; and
- The west shoreline of Molar Lake proposed for a waste rock disposal area. It is of note that at the time of the field survey, this Project element was under consideration for reconfiguration and relocation away from this waterbody.

All six locations were noted on Project mapping as having some degree of potential for archaeological remains, although the potential was not considered High, particularly at Flora Lake, where there had been considerable shoreline and terrestrial disturbance from past mining activities, and at the southern end of Pike Lake and western end of Molar Lake, where the shorelines were poorly defined and appeared generally unsuited to human habitation. All other Projects elements were situated in areas of generally Low archaeological potential, as the footprints of these structures, including the rail line and tailings impoundment areas, were inland on hilly terrain away from waterbodies (i.e., locations typically considered Low potential).

Field Study: Project Development Area

The field survey undertaken in 2011 as part of a Stage 1 HROA was focused on assessment of the PDA as configured at that time, with particular emphasis directed toward the six areas selected for ground assessment during background research, but keeping open the option of including additional areas as a result of the helicopter over-flight, or downgrading the potential rating of those pre-selected.

As a result of the helicopter over-flight, it became apparent that, due to previous and extensive ground disturbance and/or unsuitable topographic and hydrographic conditions, that three of the six pre-selected areas were of relatively Low or Moderate potential and did not warrant detailed ground investigation. This included the western shoreline of Flora Lake, the north end of Mills Lake and the west shoreline of Molar Lake. As well, five additional locations, even though outside the PDA, were selected for ground investigation, involving close surface inspection and/or test pitting. Included were four locations along a prominent and eroded esker just to the west of the proposed tailings impoundment areas, and one location on a prominent point of land on the west shoreline of Long Lake. The esker situated to the west of the proposed tailings impoundment areas was walked and examined in its entirety, and tested at the four locations, as these features are considered to have had potential for use in the past as pedestrian corridors between waterbodies. As well it proximity to Project infrastructure warranted investigation as a precautionary measure. The prominent point of land on Long Lake was investigated on the ground for similar rationale, but also to sample a seemingly Higher potential location on a major waterbody to gauge the general, predicted potential of the area.

During the field survey, a total of 10 locations were subject to ground investigation and/or sub-surface testing with excavation of 20 testpits. All investigation areas were situated on the shoreline of waterbodies, including: three locations within the Jean Lake Rapids Management Unit (Locations 1 to 3), three locations on a well-defined esker that parallels Waldorf River (Locations 3 to 6), one location near the mouth of Waldorf River at the southern end of Long

Lake (Location 7), one location on Long Lake at the proposed access road crossing (Location 8), one location at the northwest end of Mills Lake, covering the area of the proposed access road corridor (Location 9), and one on a point of land that projects out from the east side of Long Lake. It is important to note that the points shown on Figure 21.6 indicate the area where GPS readings were taken, however, in all cases the terrain extending out from the points was also investigated to include locations where Project infrastructure intersects with areas selected for ground survey. Regarding Locations 1 to 3, this entire was walked and testpits excavated, as was the area between Locations 4 and 7. A description of the ground investigation / testing locations and the information compiled from each is provided below.

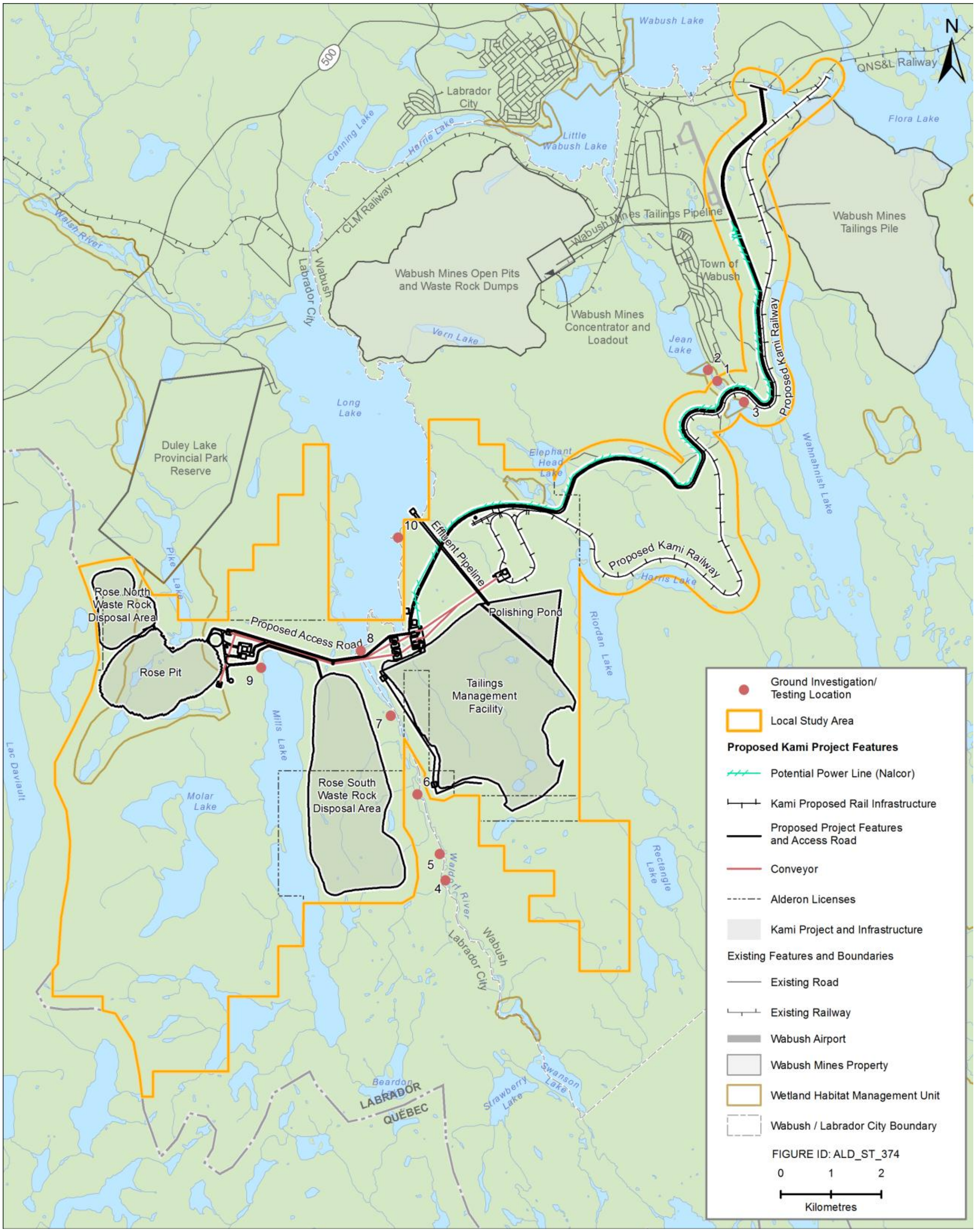
<u>Locations 1 to 3</u>

Locations 1 to 3 are situated on the shoreline of the river that forms part of the Jean Lake Rapids Management Unit (Figure 21.6). Assessment of these locations covered the proposed railway crossing of the waterbody. The shoreline is accessible by road and a partially-developed walking trail, that in places is boggy and, at the time of the field survey in September 2011, wet under-foot. The shoreline of the river is wooded, with a thick growth of alder, spruce, fir and birch, with little or no clearings along the riverbank or at locations where points of land project out into the lakes. On the southern end of the Jean Lake Rapids Management Unit in the vicinity of the proposed railway crossing, the terrain back from shoreline is wet and not suited to human settlement. In other sections comprising Locations 1 to 3, some degree of ground disturbance has occurred from construction of a walking trail and pedestrian bridge. Several locations where soils had been exposed were investigated and 10 testpits were dug (four at Location 1, three at Location 2, and three at Location 3), focusing mainly on the west side of the river and at the north end of the management unit. No archaeological resources were recorded.

<u>Locations 4 to 7</u>

Locations 4 to 7 are situated along a well-defined but somewhat narrow esker that parallels the west shoreline of Waldorf River (Figure 21.6). The terrain on either side of the esker had been burnt-over in relatively recent times, and the top and sides of the feature are free of vegetation and eroded in many locations. Thus, large sections of exposed soils were observed and investigated, as there was potential that it had been used in the past as a pedestrian corridor (possibly even during the Pre-contact and Historic Periods) between waterbodies. The entire section of esker from Location 4 to Location 7 was walked and visually examined, and tested with four testpits at each location. Because many areas of the esker are unvegetated, a comprehensive investigation was achieved. No archaeological materials were recorded.

Figure 21.6 Archaeological Investigations Locations



Location 8

Location 8 is situated at the south end of Long Lake at the proposed access road and conveyor crossing of that waterbody (Figure 21.6). The terrain on both sides of the crossing is heavily forested and sloped, making a helicopter landing on the east side difficult. However, on the west side of the constriction in the lake, a short distance to the north of the proposed crossing, a landing site had recently been prepared. Assessment of Location 8 to the south of the landing site at the proposed crossing verified that there is little or no natural shoreline where campsites might have been situated in the past. Additionally, a cabin has been constructed slightly south of the proposed crossing, which has resulted in tree clearing and removal of the vast majority of surface vegetation. In places it had been replaced with top-soil. A thorough visual inspection of the area's exposed spoil revealed no archaeological materials. On the east shore of the lake, opposite the cabin, the terrain is forested to the shoreline and, in places, is boggy. Thus, the potential was considered Low.

Location 9

Location 9 is situated in the northwest corner of Mills Lake (Figure 21.6). Ground investigation of this location included the location of the proposed access road where it approached the water. The area has recently been burned over and has extensively disturbed through woods-road and cabin construction. These activities have resulted in removal burnt sections of forest and large tracts of surface vegetation. Exposed soils along the narrow woods-road and throughout the area surrounding the water-side property were investigated and tested with six testpits. No archaeological materials were identified.

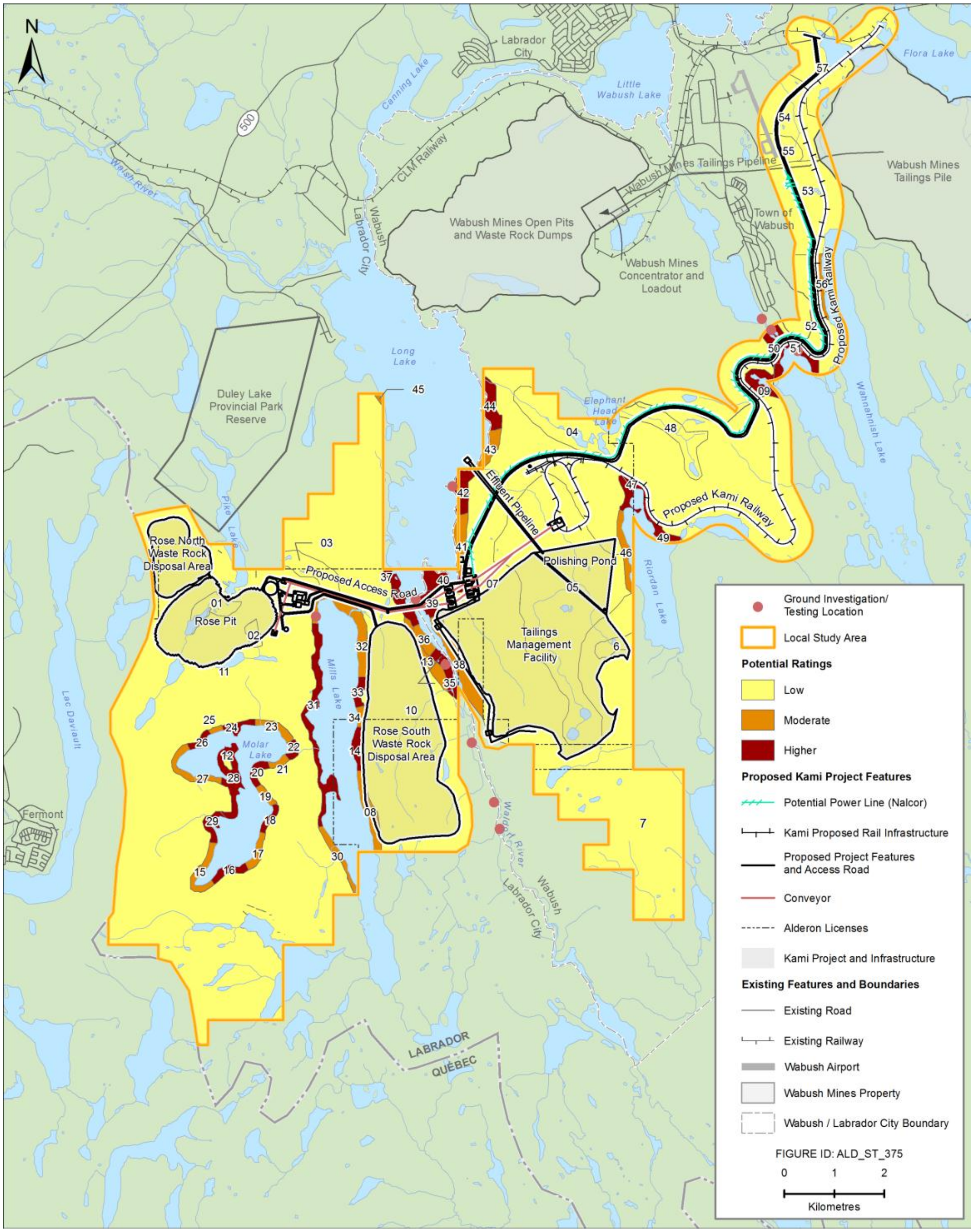
Location 10

Location 10 is situated on a point of land on the east side of Long Lake, approximately 500 m to the west of the proposed rail line (Figure 21.6). Despite the anticipated archaeological potential of the area based on background research and an initial helicopter flight, once on the ground it was determined that the topographic setting is heavily wooded and boggy, to the point that it was difficult to locate a suitable landing site. This location was not suited to human settlement. No archaeological materials were identified.

Archaeological Potential Mapping: Local Study Area

The archaeological potential of the LSA has been mapped in its entirety (Figure 21.7). Overall, the LSA is comprised largely of interfluvial upland terrain of generally Low archaeological potential. Along some of the area's larger waterways, which include most notably the Waldorf River / Long Lake area, in addition to other lakes which drain into Long Lake, such as Riordan Lake and Mills Lake, the potential is relatively Higher. Within the LSA, lakeshores in general are indistinct and poorly drained; thus within the zones of relatively Higher and Moderate archaeological potential, locations suitable for pre-contact or historic habitation are quite limited. Nevertheless, using a precautionary approach, the archaeological ratings shown on the mapping do not assume that undisturbed habitable terrain is absent. Moreover, as discussed (Section 21.5.1), the mapping was developed primarily as a 'planning / precautionary tool' to reduce the likelihood of Project interactions with archaeological materials outside the PDA as defined at the time of the survey (i.e., in the event that the Project footprint is expanded or adjusted). In total, 57 distinct zones of relative archaeological potential were mapped for the LSA, with 22 (generally small in area) zones deemed to have relatively Higher potential, 19 with Moderate potential, and 16 with Low potential. However, in area, the vast majority of the LSA is of Low potential.

Figure 21.7 Archaeological Potential Mapping of the Local Study Area



21.6 Assessment of Project-related Environmental Effects

Any activities that disturb the existing ground cover may adversely affect Archaeological and Cultural Resources. Alterations to the landscape and increased human activity resulting from improved access to the area also increase the likelihood that environmental effects will occur. The Project activities listed in Table 21.2 with interactions ranked as 2 have a potential environmental effect on Archaeological and Cultural Resources because of the possibility of loss or disturbance of sites.

Construction

The following activities and physical works during the construction phase of the Project will involve clearing and/or ground disturbance, with the potential to result in the loss or disturbance of Archaeological and Cultural Resources (Table 21.2):

- Site preparation (including clearing, excavation, material haulage, grading, removal of overburden, and stockpiling);
- Construction of roads;
- Construction of site buildings and associated infrastructure;
- Construction of mine tailings management facility (TMF);
- Construction of railway and load-out facilities;
- Construction of power line;
- Construction of stream crossings, and
- Installation of water supply infrastructure (wells, pumps, pipes).

Within the LSA, there are no Archaeological and Cultural Resources registered with the PAO and none were identified during the field survey conducted in September 2011. Available information and the results of consultation to date with other Aboriginal groups in Labrador and Québec have not identified any such sites in or near the LSA. Any additional and relevant information that is obtained through such consultation activities will be considered in ongoing Project planning, as it becomes available.

Therefore, considering the above information, the construction of the Project will not have an effect on or physically disturb any known Archaeological and Cultural Resources.

Operation and Maintenance

The majority of ground disturbance effects with potential to affect Archaeological and Cultural Resources will occur during the construction phase. During the Project operation and maintenance phase, the only additional ground disturbance beyond those areas affected during Project construction will result from the development of the open pit mine and disposal of waste rock. As noted above, no Archaeological and Cultural Resources have been identified within the PDA or LSA. Therefore, considering the above information, the operation and maintenance of the Project will not have an effect on, or physically disturb, any known sites. The archaeological potential of the mine site and waste rock disposal areas is assessed as relatively Low except in limited areas that approach larger waterbodies (Figure 21.7).

21.6.1 Mitigation of Project Environmental Effects

Although no Archaeological and Cultural Resources have been identified within the LSA, measures will be taken to mitigate adverse environmental effects in the event of an unexpected discovery. A Project-specific Environmental Protection Plan (EPP) will include the procedures to follow in the event of accidental discovery of Archaeological and Cultural Resources. The orientation and training programs provided to construction personnel will include briefings related to Archaeological and Cultural Resources. In the event that undiscovered Archaeological and Cultural Resources are identified as a result of Project activities, Alderon will implement a Stage 1 HROA in accordance with provincial guidelines. No further activity would proceed until an appropriate approach is approved by the PAO.

In addition, the archaeological potential mapping of the LSA will be used to plan further field investigations and mitigation as Project planning progresses, consistent with provincial guidelines (Government of Newfoundland and Labrador 1992). In the event any archaeological materials are identified during any phase of the Project, mitigation of sites or materials could include site avoidance and protection or Systematic Data Recovery (SDR) (i.e. excavation). SDR involves the scientific and systematic investigation of unavoidable archaeological sites losses using accepted data recovery techniques.

For any cultural / spiritual sites identified during any phase of the Project, site avoidance would be initiated until appropriate means and measures of documentation, interpretation and long-term conservation and stabilization are established in consultation with Aboriginal and/or non-Aboriginal groups and persons, and the PAO.

21.6.2 Characterization of Residual Environmental Effects

Residual environmental effects resulting from the Project construction, and operation and maintenance phases on Archaeological and Cultural Resources are not likely to occur because there are no known sites within the PDA. The geographic extent of potential interactions is limited to the PDA where first-time ground disturbance occurs. Mitigation measures will be implemented in the event of an unexpected discovery.

There is a high degree of confidence in the environmental effects prediction because of the low archaeological potential for the area, and based on the results of the field survey, where no Archaeological and Cultural Resources were identified within the PDA or LSA. Therefore, there is low potential for interaction with Archaeological and Cultural Resources.

21.6.3 Summary of Residual Environmental Effects

The residual environmental effects of the Project on Archaeological and Cultural Resources are summarized in Table 21.7.

Table 21.7 Summary of Residual Environmental Effects: Archaeological and Cultural Resources

Project Phase	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics								
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility,	Environmental or Socio-Economic Context	Significance	Prediction Confidence
Construction	• Develop and Implement EPP in the event of an unexpected discovery	A	N/L	S	P	S	I	U	N	H
Operation and Maintenance		A	N/L	S	P	S	I	U	N	H
Decommissioning and Reclamation		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

KEY

Direction:
N Neutral – no effect on Archaeological and Cultural Resources.
A Adverse – loss or disturbance of Archaeological and Cultural Resources.

Magnitude:
N Negligible – no likely effect on Archaeological and Cultural Resources.
L Low – disturbance of Archaeological and Cultural Resources but with prior retrieval of the resource and associated information, and with all necessary regulatory approvals.
M Moderate – disturbance or loss of a portion of an Archaeological and Cultural Resource, with retrieval of a portion of the resource and its associated information, or a direct effect on a known Archaeological and Cultural Resource that is of interest and concern to the associated community, but that does not reduce the overall integrity and cultural value of the site.
H High – disturbance or loss of an Archaeological and Cultural Resources, with no retrieval of the resource and its associated information, or a direct effect on Archaeological and Cultural Resources, which reduces the overall integrity and cultural value of the site.

Geographic Extent:
S Site – effect confined to the PDA.
L Local – any effect will be limited to the LSA.
R Regional – effects may extend beyond the LSA.

Duration:
T Temporary – effect will occur but measures are taken to salvage and retrieve information from the resources, and/or move / rehabilitate the site.
P Permanent – effect will be permanent and irreversible.

Frequency:
O Once - effect occurs once.
S Sporadically – effect occurs occasionally but not consistently throughout the life of the Project.
R Regularly – effect occurs at regular intervals throughout the life of the Project.
C Continuous – effect will occur continuously.

Reversibility:
R Reversible – will likely recover to baseline conditions after the end of Project decommissioning.
I Irreversible – Unlikely to recover to baseline conditions after the end of Project decommissioning.

Environmental or Socio-economic Context:
U Undisturbed – area has been relatively or not adversely affected by recent human activity.
D Disturbed – Area has been substantially previously disturbed by recent human development or human development is still present.
N/A Not Applicable.

Significance:
S Significant.
N Not Significant.

Prediction Confidence:
Based on scientific information and statistical analysis, and effectiveness of mitigation or effects management measure
L Low level of confidence.
M Moderate level of confidence.
H High level of confidence.

21.7 Assessment of Cumulative Effects

In association with the Project-related environmental effects discussed in Section 21.6, an assessment was conducted of the potential cumulative effects of the Project in combination with those of other projects and activities within the RSA.

The potential adverse residual environmental effects of the Project on Historic and Cultural Resources are presented in Table 21.7. The potential adverse residual environmental effects to Historic and Cultural Resources as a result of the Project would occur as a result of construction activities that result in ground disturbance within the PDA. There are currently no known Historic and Cultural Resources within the PDA. Standard precautionary procedures such as halting construction activities in the event of the discovery of a potential archaeological/cultural resource as described above will be included in the Project EPP and applied throughout each phase of the Project to protect such resources if they are accidentally discovered. In the unlikely event that the Project does affect an archaeological or cultural resource, it is anticipated that the affected resource would be small in magnitude because none were observed during the field surveys; appropriate measures would be undertaken to salvage and retrieve the material culture and the information it contains such that a significant adverse residual environmental effect does not occur. Therefore, residual environmental effects of the Project on Historic and Cultural Resources are not likely to occur.

Any potential adverse residual environmental effects of other projects on Historic and Cultural Resources would be similarly limited to instances where construction activities result in ground disturbance that could affect Historic and Cultural Resources. All development activities in the province are subject to the Newfoundland and Labrador *Historic Resources Act* (1985) and in this way, new projects and activities will be governed by application of the legislation and guidelines, which would serve to minimize any potential adverse residual environmental effects on Historic and Cultural Resources.

As noted in Table 21.8, several existing mining projects and towns are located within the RSA for Historic and Cultural Resources; the effects of which are reflected in baseline conditions. There is insufficient information available regarding the existence of the noted Historic and Cultural Resources in the locations of the existing projects prior to their development; however, it is known that the current area of disturbance of these projects totals approximately 130 km^2. Development of older projects (e.g., IOC Labrador operations, Wabush Mines) would not have fallen under regulatory protection for Historic and Cultural Resources and may have resulted in the loss of the material culture and the information it contains.

The potential cumulative effects of the Project acting in combination with other projects and activities are summarized in Table 21.8. There are no residual environmental effects of the Project on Historic and Cultural Resources and thus no anticipated cumulative effects.

Table 21.8 Summary of Potential Cumulative Effects to Historic and Cultural Resources

<table>
<tr><th>VEC Existing Condition (Past & On-Going Activities)</th><td colspan="8">• No known Historic and Cultural Resources occur within the LSA.
• Historic and Cultural Resources are known to occur near: the Smallwood Reservoir; the Caniapiscau and Laforge regions to the northwest in interior Québec; the Schefferville area to the north in Québec and Labrador; and along the Ashuanipi River and Menihek Lake.</td></tr>
<tr><th>Project Residual Environmental Effects</th><td colspan="8">• Loss or disturbance to Historic and Cultural Resources is not likely to occur as a result of the Project.
• An EPP will be prepared and will include procedures to follow in the event of an accidental discovery of Historic and Cultural Resources.</td></tr>
<tr><th>Other Projects / Activities</th><th colspan="2">Likely Effect Interaction (Y/N)</th><th colspan="3">Rationale</th><th colspan="3">Cumulative Effects</th></tr>
<tr><td>IOC Labrador Operations</td><td colspan="2" rowspan="8">N</td><td colspan="3" rowspan="8">• The Project and other activities and projects are subject to the Newfoundland and Labrador Historic Resources Act (1985) and in this way, new projects and activities will be governed by application of the legislation and guidelines, which would serve to avoid or minimize any potential adverse residual environmental effects on Historic and Cultural Resources. Residual environmental effects are not anticipated from the Project and therefore, cumulative effects are not anticipated.</td><td colspan="3" rowspan="8">• There are no likely cumulative effects because the Project will not likely result in residual environmental effects to Historic and Cultural Resources. It is possible that isolated and small Historic and Cultural Resources - the presence and location of which are currently not known - could be disturbed by the Project or other activities or projects. In the unlikely event that this occurs, measures will be implemented to salvage and retrieve material culture and information such that significant cumulative effects do not occur.</td></tr>
<tr><td>Wabush Mines (Cliffs Resources)</td></tr>
<tr><td>Mont Wright Mine (ArcelorMital)</td></tr>
<tr><td>Bloom Lake Mine and Rail Spur (Cliffs Resources)</td></tr>
<tr><td>Schefferville Iron Ore Mine (Labrador Iron Mines)</td></tr>
<tr><td>DSO Iron Ore Project (Tata Steel Minerals Canada)</td></tr>
<tr><td>Lower Churchill Generation Project (Nalcor Energy)</td></tr>
<tr><td>Infrastructure or other projects at Port of Sept-Îles</td></tr>
<tr><th rowspan="2">Cumulative Effects Summary (Project + All Relevant Activities / Projects / Effects)</th><th>Direction</th><th>Magnitude</th><th>Geographic Extent</th><th>Duration</th><th>Frequency</th><th>Reversibility</th><th>Significance</th><th>Confidence</th></tr>
<tr><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>NS</td><td>N/A</td></tr>
<tr><td colspan="9">There are no likely significant cumulative effects because the Project will not likely result in residual environmental effects to Archaeological and Cultural Resources.
Note: Environmental effects descriptors and their definitions are as used in the assessment of Project-related environmental effects</td></tr>
</table>

21.8 Assessment of Accidents and Malfunctions

Three potential accident or malfunction scenarios could interact with Archaeological and Cultural Resources. These are:

- Forest fire caused by the Project;
- Breach of the polishing pond; and
- Train derailment and consequent spill of materials or contaminants.

In the unlikely event of any of these scenarios, loss or disturbance of Archaeological and Cultural Resources could result. The potential interaction of these events is summarized in Table 21.2. The interactions are ranked as 2 and, therefore, are assessed in more detail.

A forest fire caused by the Project could disturb Archaeological and Cultural Resources by altering or destroying the cultural object and landscape of which is a part, or contaminating the forest floor and underlying soils in which archaeological are situated. Forest fires caused by the Project could potentially expand beyond the LSA to affect the broader RSA. Fire can destroy organic materials associated with an archaeological site or cultural object, such as the wooden elements of an historic tilt or structure or grave markings not yet identified. They can also contaminate potentially-datable archaeological samples with modern charred organic matter. However, the LSA has almost certainly been subjected to many naturally occurring forest fires and therefore, forest fires caused by the Project on Archaeological and Cultural Resources are classified as disturbance rather than total loss, in that no sites or objects of cultural / spiritual are known.

A breach or failure of the polishing pond dyke could lead to discharge of effluent into and along the shorelines of Long Lake and Waldorf River, which have relatively Higher potential for archaeological resources. Therefore, this event could result in disturbance and loss of previously unidentified Archaeological and Cultural Resources due to flooding or shoreline erosion. Artifacts, cultural objects or structural remains, and the associated soils and context in which they were situated, could be displaced or lost.

A train derailment may lead to the sudden deposition of materials (e.g., ore concentrate) or contaminants (such as fuel) onto adjacent terrain. Deposition of contaminants may compromise the scientific and cultural value of archaeological deposits and other types of cultural features. Deposition of materials will likely only affect surface-visible Archaeological and Cultural Resources. However, unidentified archaeological and cultural sites may be discovered and adversely affected during subsequent clean-up operations involving earth-moving equipment and consequent ground disturbances.

Effects of Accidents and Malfunctions

These three accident / malfunction scenarios have potential to cause environmental effects, which may lead to the loss or disturbance of Archaeological and Cultural Resources. The residual environmental effects of Project-related accidents and malfunctions are summarized in Table 21.9.

Any of these scenarios that lead to environmental effects on Archaeological and Cultural Resources would likely be rare but would be expected to be adverse, permanent, and irreversible if they occurred.

The environmental effects of a forest fire caused by the Project could be low to high in magnitude and could range from local to regional in geographic extent. The magnitude of the environmental effects on Archaeological and Cultural Resources would be higher if the geographic extent were regional. A forest fire could potentially be caused during any of the three phases of the Project. However, with implementation of a forest fire prevention and response plan, forest fires are unlikely to occur and are likely to be contained before they reach a regional geographic extent.

The environmental effects of a polishing pond dyke breach on Archaeological and Cultural Resources would be low in magnitude and local in geographic extent. The dykes located at the TMF will be designed to standards of the Canadian Dam Association Dam Safety Guidelines. The outlet structures and TMF are being designed to accommodate a 100-year storm. Therefore, the risk of a dyke breach is low. Were a breach to occur, then the site will be assessed to determine the extent of erosional effects and to determine whether any previously unknown Archaeological and Cultural Resources have been exposed / identified. If this is the case, further assessment will be undertaken in accordance with the EPP (Section 21.6.1).

The environmental effects of a train derailment, associated materials or fluids spill, and subsequent cleanup on Archaeological and Cultural Resources would be low in magnitude and in geographic extent and restricted to the site itself. Preventive measures, including an inspection regime, will be taken to reduce the likelihood of a derailment. Were a derailment to occur, then areas of Higher potential at the site will be assessed for Archaeological and Cultural Resources in accordance with the EPP (Section 21.6.1).

Table 21.9 Summary of Residual Environmental Effects for Archaeological and Cultural Resources – Accidents and Malfunctions

Accident / Malfunction	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	
Forest Fire	• EPP. • Emergency Response Plan.	A	H	S-R	P	U	I	U/D	S	H	Implement measures in EPP.
Polishing Pond Breach	• TMF and Polishing Pond are being designed to 1:100 year storm event. • EPP. • ERP.	A	L	L	P	U	I	U/D	N	H	Implement measures in EPP.
Train Derailment	• Railway design will follow the prescribed standards as set out by the American Railway Engineering and Maintenance-of-Way Association. • EPP. • ERP.	A	L	S	P	U	I	U/D	N	H	Implement measures in EPP.

Accident / Malfunction	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	

KEY

Direction:
N Neutral – no effect on Archaeological and Cultural Resources.
A Adverse – loss or disturbance of Archaeological and Cultural Resources.

Magnitude:
N Negligible – no likely effect on Archaeological and Cultural Resources.
L Low – disturbance of Archaeological and Cultural Resources but with prior retrieval of the resource and associated information, and with all necessary regulatory approvals.
M Moderate – disturbance or loss of a portion of an Archaeological and Cultural Resource, with retrieval of a portion of the resource and its associated information, or a direct effect on a known Archaeological and Cultural Resource that is of interest and concern to the associated community, but that does not reduce the overall integrity and cultural value of the site.
H High – disturbance or loss of an Archaeological and Cultural Resources, with no retrieval of the resource and its associated information, or a direct effect on Archaeological and Cultural Resources, which reduces the overall integrity and cultural value of the site.

Geographic Extent:
S Site – effect confined to the PDA.
L Local – any effect will be limited to the LSA.
R Regional – effects may extend beyond the LSA.

Duration:
T Temporary – effect will occur but measures are taken to salvage and retrieve information from the resources, and/or move / rehabilitate the site.
P Permanent – effect will be permanent and irreversible.

Frequency:
U Unlikely.
O Once - effect occurs once.
S Sporadically – effect occurs occasionally but not consistently throughout the life of the Project.
R Regularly – effect occurs at regular intervals throughout the life of the Project.
C Continuous – effect will occur continuously.

Reversibility:
R Reversible – will likely recover to baseline conditions after the end of Project decommissioning.
I Irreversible – Unlikely to recover to baseline conditions after the end of Project decommissioning.

Environmental or Socio-economic Context:
U Undisturbed – area has been relatively or not adversely affected by recent human activity.
D Disturbed – Area has been substantially previously disturbed by recent human development or human development is still present.
N/A Not Applicable.

Significance:
S Significant.
N Not Significant.

Prediction Confidence:
Based on scientific information and statistical analysis, and effectiveness of mitigation or effects management measure.
L Low level of confidence.
M Moderate level of confidence.
H High level of confidence.

21.9 Determination of Significance

21.9.1 Project-Related Residual Project Environmental Effects

As described in Section 21.6, any potential adverse residual environmental effects of the Project on Archaeological and Cultural Resources would occur primarily, if not exclusively, as a result of first-time clearing and/or ground disturbance during Project construction and any additional ground disturbance during operations and maintenance. Any such effects, if they did occur, would therefore be restricted to the PDA.

With the proposed mitigation and environmental protection measures in the event of an unexpected discovery, the environmental effect of loss or disturbance of Archaeological and Cultural Resources is predicted to be adverse but not significant during the construction and operations and maintenance phases. This determination is made with a high level of confidence based on the results of the field survey, literature review and informant interview data.

During decommissioning, there will be no additional ground disturbance and no interaction between the Project and Archaeological and Cultural Resources. Therefore, there are no significant adverse residual environmental effects.

21.9.2 Cumulative Effects

The characterization of the potential cumulative effects and associated mechanisms, combined with the proposed mitigation / effects management measures proposed in Section 21.7, demonstrate that there are no cumulative effects of loss or disturbance of Historic and Cultural Resources as a result of the Project in combination with the environmental effects of past, present, and reasonably foreseeable projects and activities that have been or will be carried out. This determination is made with a high level of confidence because there is no likely adverse residual environmental effect resulting from the Project.

21.9.3 Accidents and Malfunctions

The adverse residual environmental effects of a forest fire caused by the Project on Archaeological and Cultural Resources during construction, operation and maintenance, or decommissioning and reclamation could be significant, particularly due to the potential high magnitude and potential regional geographic extent of the environmental effects. However, with implementation of a forest fire prevention and response plan, forest fires are unlikely to occur and are likely to be contained to the PDA.

The adverse residual environmental effects of a polishing pond dyke breach on Archaeological and Cultural Resources during operation and maintenance are predicted to be not significant because environmental effects would be of low magnitude and geographically restricted to the PDA. The geographic extent of the environmental effects will be local.

The adverse residual environmental effects of a train derailment and subsequent clean-up on Archaeological and Cultural Resources in the PDA are predicted to be not significant because environmental effects would be of low magnitude and geographically restricted to the PDA. The terrain which could potentially be affected is generally rated as having relatively Low potential for Archaeological and Cultural Resources. In the event of a materials spill, the principal environmental effect would consist of ground disturbance during clean-up operations, which would be managed by routine implementation of the EPP.

21.9.4 Overall Residual Effects Conclusion

The Project is not likely to result in significant adverse residual environmental effects on Archaeological and Cultural Resources.

21.10 Follow-up and Monitoring

As outlined in the EIS Guidelines, monitoring and follow-up is a process designed to verify environmental effects predictions, to assess the effectiveness of strategies implemented to optimize Project outcomes and implement adaptive management measure where necessary. Monitoring also helps ensure compliance with any commitments made and for any unforeseen effects to be identified and addressed. Provisions of the EPP will be implemented.

As a result of the findings of the survey and the mitigation measures identified in Section 21.6, follow-up activities are not recommended for Archaeological and Cultural Resources.

21.11 Next Steps

Prior to construction, an EPP will be developed. Mitigation measures for Archaeological and Cultural Resources will be incorporated.

21.12 Summary

Historic and Cultural Resources include sites of archaeological, cultural / spiritual, paleontological, and architectural importance. Despite extensive background, field research and informant interviews, no Archaeological and Cultural Resources have been identified within the LSA. Archaeological potential mapping indicates that the LSA is largely comprised of interfluvial upland terrain of generally Low archaeological potential, though zones of relatively Higher archaeological potential are found along some waterways. There are no known cultural / spiritual sites within the LSA. Background research determined that there was little or no potential for palaeontological or architectural resources within the LSA.

Based on the results of the background research field survey and informant interviews, and the application of standard mitigation measures, significant adverse residual environmental effects on Historic and Cultural Resources are not likely to result from the Project.

22.0 CURRENT USE OF LAND AND RESOURCES FOR TRADITIONAL PURPOSES BY ABORIGINAL PERSONS

22.1 Valued Ecosystem Component Definition and Rationale for Selection

This VEC chapter focuses on the Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons, and assesses and evaluates the potential effects of the Project on such activities.

Aboriginal traditional uses are often considered to refer to the practices, traditions and customs that distinguish the distinctive culture of an Aboriginal group and which were practiced prior to European contact. These can include, for example, hunting and fishing for food and for ceremonial purposes. Section 35 of the Canadian *Constitution Act* (1982) recognizes and affirms the existing Aboriginal and treaty rights of the Indian, Inuit, and Métis peoples of Canada, the nature, scope and existence of which have been further defined through various legal decisions as well as through Land Claims Agreements (treaties) between governments and particular Aboriginal groups in specific areas.

A number of Labrador and Québec Aboriginal communities and organizations claim Aboriginal rights and/or title to areas of Labrador and Québec (Figure 22.1), including lands where proposed Project components and activities will take place. The land claims of these groups are at varying stages of progress, negotiation, and settlement, including the Labrador Innu (Land Claims Agreement-in-Principle concluded, with associated land selection completed) and other Labrador and Québec Aboriginal groups whose land claim applications are at various stages of recognition by the federal and provincial governments.

The Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons, and the potential effects of the Project on these activities, are a key aspect of and consideration in the EA, given the overall importance of these elements of the socioeconomic environment. This is further reflected in the *Canadian Environmental Assessment Act* definition of "environmental effect", which specifically includes: *"(a) any change that the project may cause in the environment, ….[and] (b) any effect of any change referred to in paragraph (a) on … (iii) the current use of lands and resources for traditional purposes by aboriginal persons...*".

As reflected in the title of this VEC, the associated environmental effects assessment focuses upon the *current* (existing) use of land and resources by Aboriginal persons for traditional purposes, and the potential changes to these activities that may occur (either directly or indirectly) as a result of the Project. This analysis has focused on, and provides relevant information related to, each of the Aboriginal communities and organizations that have identified that they have an interest in the Project and/or surrounding area through Alderon's Aboriginal engagement activities.

Figure 22.1 Aboriginal Communities in Labrador and Québec

Alderon has carried out this assessment with a view to addressing the requirements of the EA process and as part of its on-going engagement processes with relevant Aboriginal groups, in keeping with its desire to identify, assess and to attempt to address potential effects on Aboriginal communities and their traditional activities.

This VEC also overlaps with other components of the natural and socioeconomic environments, including several of the VECs considered elsewhere in this assessment. Potential effects to these activities may result from, for example, changes in air quality and noise levels in an area (Chapter 14), in the availability and quality of vegetation, wildlife, water, fish resources, and/or other components of the biophysical environment (Chapters 15 to 20), cultural areas and resources (Chapter 21), effects on viewscapes and the remoteness and wilderness character of an area (Chapter 23), and others. These potential relationships and interactions are considered integrally within the environmental effects assessment for this VEC.

22.1.1 Issues

Alderon is committed to ensuring that relevant Aboriginal communities and organizations are engaged in relation to the Project. As described in Chapter 10, the proponent has proposed - and where possible and agreed, implemented - consultation mechanisms and forums with each of the Aboriginal groups that have identified that they have an interest in the Project (including the assertion of Aboriginal rights in the area). These processes have been designed to share information and views on the Project, in an attempt to better understand and seek to address any questions, issues, or concerns on the part of these communities with regard to the Project and its potential effects.

These engagement activities have included a key focus on any questions or issues related to the potential implications of the Project for current Aboriginal traditional land and resource use activities and potential measures to avoid or reduce any such effects. These processes are on-going, and have been an important and integral input to Project planning and design, as well as having contributed greatly to the nature, focus and findings of this EA.

Potential issues and interactions related to this VEC that are identified in the EIS Guidelines include the possibility for Project construction or operations activities to:

- Alter or destroy wildlife and fish habitat;
- Contaminate country food or drinking water supplies;
- Result in restricted access to the site; or
- Modify any existing use of the Project area as a result of diminished air quality, noise and other disturbances.

An inventory of the various issues and questions that have been raised by Aboriginal communities and organizations in relation to this VEC through Alderon's consultation initiatives to date is provided in Table 22.1.

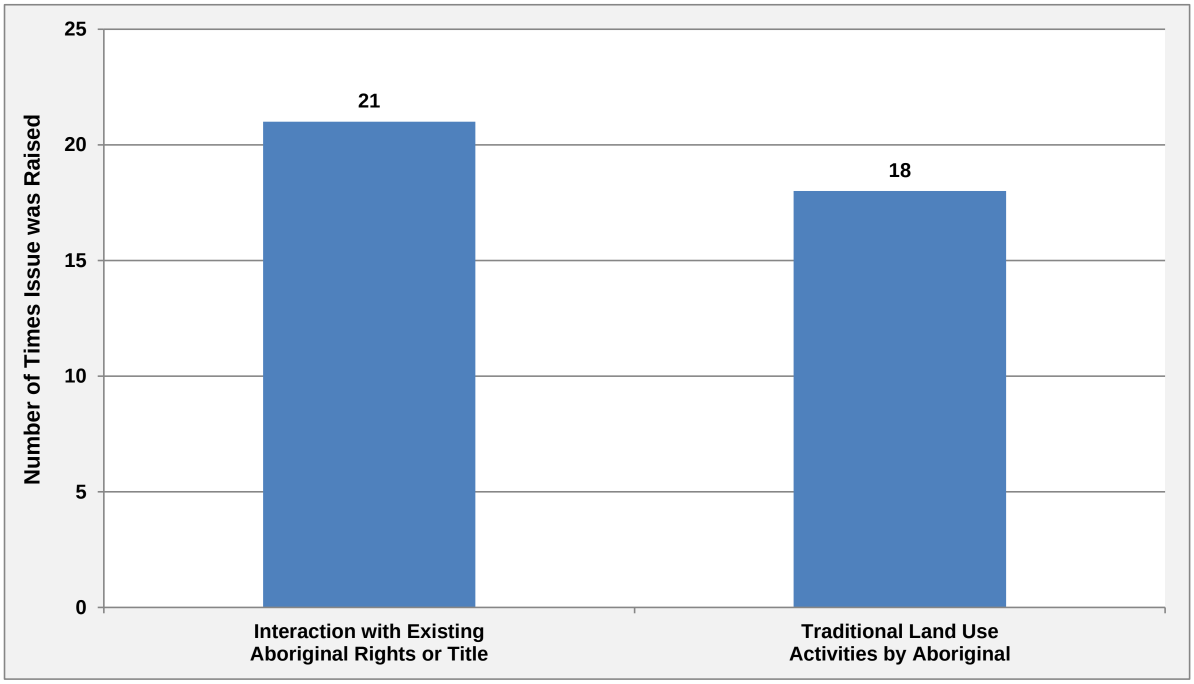
Table 22.1 Issues Raised by Aboriginal Groups and Stakeholder

Issue	Community / Organization	Summary of Comments Raised During Consultation and Engagement Activities	Response / Location in the EIS
Cumulative Effects on Use of Lands and Resources for Traditional Purposes by Aboriginal Persons	Innu of Uashat mak Mani-Utenam	Expressed concerns about other mining companies in area and cumulative effects on traditional territory. Cumulative effects are particularly important to address. Community members feel more and more dispossessed of their land. Comments included: • We thought development on our territory was over. Is still room for other companies in that area? Alderon said they would take care of the environment, but we cannot use the land in that area anymore. Everything has been destroyed, water and animals. Some people go on land just for wellbeing and this cannot be done any more in this area.	The purpose of the EA process is to identify mitigation measures to avoid or reduce environmental issues and effects. Cumulative effects on Current Use of Lands and Resources for Traditional Purposes by Aboriginal Persons are assessed and evaluated in Section 22.8.
Potential Effects on Traditional Land Use Activities	Innu Nation	Alderon could contribute in the Innu Nation community by providing funding for an outpost program for Innu who want to participate in harvesting activities.	Alderon's current Aboriginal engagement processes are described in Chapter 10, and its Aboriginal Relations Policy is outlined in Section 1.1.1. Alderon is currently negotiating a benefits agreement with Innu Nation.
	Naskapi Nation of Kawawachikamach	Alderon should set aside money for community members to hunt in areas far from their community (i.e., for skidoos). The caribou once came through the community but no longer. At one point there were 900,000 caribou; now there are around 80,000.	Alderon's current Aboriginal engagement processes are described in Chapter 10, and its Aboriginal Relations Policy is outlined in Section 1.1.1.
	Innu Nation	In the spring, summer and fall, community members hunt in the area. They are concerned with what partridges, beavers and other animals eat there. They are also concerned with contamination of fish.	A human health risk assessment was completed for the Project reviewing potential pathways for contamination. This assessment determined that there is a low risk of effect to country foods. These issues and analyses are provided in Chapter 25. An assessment of current land and resource use by Aboriginal persons in the Project area is presented in Chapter 22.

Issue	Community / Organization	Summary of Comments Raised During Consultation and Engagement Activities	Response / Location in the EIS
	Innu of Matimekush - Lac John	The Project overlaps with their traditional territory. There are potential effects of the Project on land use in the area.	An assessment of current land and resource use by Aboriginal persons in the Project area is presented in Chapter 22.
	Naskapi Nation of Kawawachikamach	Do not currently practice land use activities in the Project area but still have land claims in Labrador. Currently, the Naskapi do not go into Lab West. Will share maps of their traditional hunting routes and historic sites with Alderon.	Information on current land and resource use that has been made available to Alderon is presented in Chapter 22. Existing land and resource use and the status of land claims are described in Sections 22.2.3 and 22.5.
	Innu Nation	Alderon could contribute in the Innu Nation community by providing funding to build cabins on the territory.	Alderon's current Aboriginal engagement processes are described in Chapter 10, and its Aboriginal Relations Policy is outlined in Section 1.1.1. Alderon is currently negotiating a benefits agreement with Innu Nation.
Potential Interaction with Existing Aboriginal Rights / Title	Innu Nation	Consider all of Labrador as their traditional territory and will not surrender their rights.	An assessment of current land and resource use by Aboriginal persons in the Project area is presented in Chapter 22. Existing land and resource use and the status of land claims are described in Sections 22.2.3 and 22.5.
	Innu of Matimekush - Lac John	Project overlaps with their traditional territory.	
	Naskapi Nation of Kawawachikamach	They have an unresolved land claim deep in Labrador territory. They have followed the caribou into Labrador in the past and may again in the future.	
	Innu of Uashat mak Mani-Utenam	Confirm that the Project area is claimed territory as it is located within their ancestral territory. Their traditional families own the land covered by the Project.	
	Innu of Matimekush - Lac John	Wish to be engaged separately from the Innu of Uashat mak Mani-Utenam, even though they share the same territory. Any benefit agreement must be negotiated with both groups independently.	Alderon is committed to building mutually beneficial and respectful relationships with all Aboriginal groups. Alderon's current Aboriginal engagement processes are described in Chapter 10, and its Aboriginal Relations Policy is outlined in Section 1.1.1.
	Innu of Uashat mak Mani-Utenam	Are there other Aboriginal groups involved on the Kami Project?	

The frequency of these issues by type is summarized in Figure 22.2.

Figure 22.2 Frequency of Issues Raised Related to the Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons



22.1.2 Approach to Assessment of Effects

The assessment of potential Project effects on this VEC included a general approach of "overlaying" the proposed Project components and activities (Chapter 2) with what is known about the nature and distribution of current Aboriginal land and resource use activities (Section 22.5), in order to identify potential interactions and resulting effects on this VEC. In doing so, potential interactions between the Project and the VEC were identified and analysed, the need for mitigation considered, and the significance of any residual effects determined and evaluated.

Methodology for Assessment of Baseline Conditions

As reflected in the title of this VEC, the assessment has focused upon the current (existing) use of land and resources by Aboriginal persons for traditional purposes. For the purposes of this assessment, "current" is generally defined as those which have been occurring over the past several decades (generally between about 1990 and the present), although as illustrated in the following sections the focus and content of the description of current uses has been influenced strongly by the availability (and age) of the existing information.

A variety of information sources were used to understand and describe current land and resource use activities by the various Aboriginal groups under consideration. As described in Chapter 10, Alderon has been making significant efforts to consult with each of the relevant Aboriginal communities and organizations in Labrador and Québec. This has included the ongoing provision of Project information, as well as offers of consultation agreements and associated funding to gather and provide information on current land and resource use, Aboriginal knowledge, and community issues and concerns regarding the Project and its potential environmental effects, for consideration and incorporation into the EIS. Where Aboriginal organizations have chosen to participate in such initiatives, the information and insights obtained through these processes has been extremely valuable and were considered and incorporated throughout the EA.

Other Aboriginal groups have declined to provide information on their activities or facilitate the collection of additional land and resource use information from their membership. In these cases, the EA was conducted on the basis of existing and publicly available information including various existing and publicly available sources of information and mapping such as, where available, previous land use and harvesting studies completed by the groups and/or others. Alderon respects the views and wishes of the communities in this regard, and has continued to be open to discussion and cooperation with these groups. The proponent also encourages these Aboriginal groups to provide any relevant input and information that they may have directly as part of the EA review process.

22.2 Environmental Assessment Boundaries

22.2.1 Spatial Boundaries

The following geographic areas were used to understand and describe the local and regional nature of current Aboriginal Land and Resource Use activities and the potential effects of the Project on this VEC: the Project Development Area (PDA), a Local Study Area (LSA); and Regional Study Area (RSA), each of which is further described and defined below.

Project Development Area

The PDA is the area represented by the physical Project footprint as defined in the Project Description. The PDA includes the area of physical disturbance for the Project and includes and fully encompasses the following components: the open pit mine (Rose Pit); mineral processing infrastructure and site buildings; waste rock disposal areas (Rose North and Rose South waste rock disposal areas); Tailings Management Facility (TMF); access roads; power / transmission lines; rail infrastructure ; and other ancillary infrastructure and equipment.

Local Study Area

The LSA is defined as a larger area, centered on the PDA, that encompasses all Project planned Project components and activities and the potential "zones of influence" of any Project-related disturbances.(Figure 22.3). Again, the LSA has been conservatively defined so as to encompass the PDA and any adjacent areas where Project-related environmental effects may reasonably be expected to occur, through both the direct "footprint" of the Project itself as well as the likely geographic extent of the various other Project-related disturbances that may occur during construction and/or operations and eventual closure (such as noise, dust, visibility and others).

Regional Study Area

The RSA for this VEC is generally defined as the overall geographic extent of traditional land and resource use activities by the various Labrador and Québec Aboriginal groups that are being considered in this assessment (Figure 22.3). The RSA is therefore somewhat "group-specific", although for general analytical purposes it has been defined to fully encompass the overall known distribution of these activities by all of the groups under consideration.

This larger area is intended to provide an appropriate, regional context to the assessment, thereby illustrating the overall relationship of the Project and its possible effects / zone of influence to each group's overall current land and resource use activities throughout Labrador and/or Québec (including any preferred or alternative land and resource use areas). In doing so, this larger focus helps to evaluate whether, how and to what degree the Project is likely to have an effect on the overall nature, intensity or value of these traditional activities by each group.

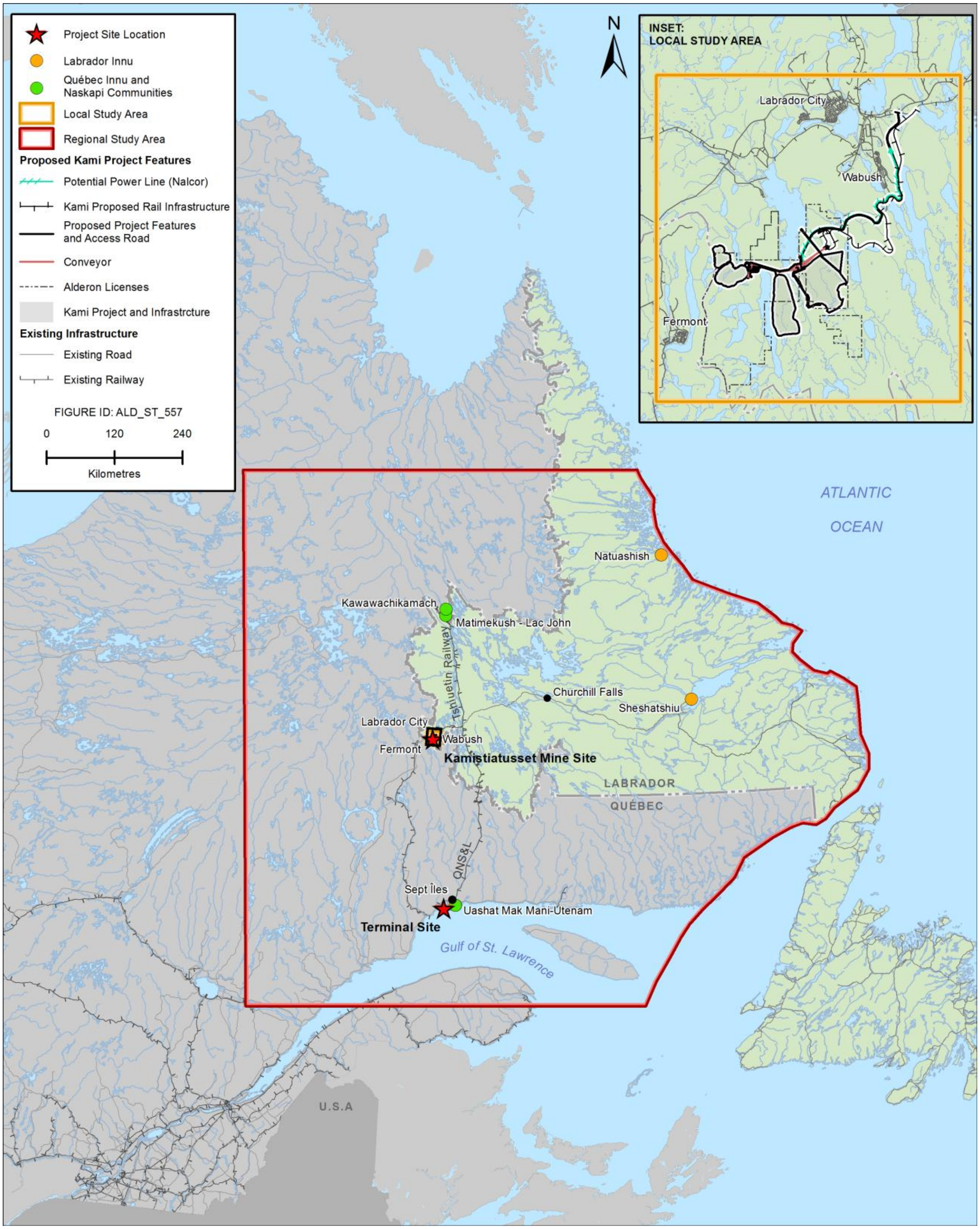
22.2.2 Temporal Boundaries

The temporal boundaries for the assessment of potential environmental effects of the Project on this VEC include the Project phases of construction (approximately two years), operation and maintenance (approximately 17 years), and eventual decommissioning and reclamation (approximately two years).

22.2.3 Administrative Boundaries

As indicated previously, a number of Labrador and Québec Aboriginal groups undertake traditional land and resource use activities in Western Labrador and in areas of the Québec North Shore. The land claims of these groups are at varying stages of progress, negotiation and settlement.

Figure 22.3 Local and Regional Study Areas: Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons



Labrador Innu

The Innu of Labrador currently number about 2,500 and reside primarily in two communities - Sheshatshiu in central Labrador and Natuashish on the North Coast, with small numbers of Innu also residing in Happy-Valley-Goose Bay and elsewhere. The Sheshatshiu Innu and the Mushuau Innu of Natuashish comprise separate Bands, with each community currently a Reserve with an elected Chief and Council. Both communities are represented by Innu Nation in land claims negotiations and on other matters of common interest.

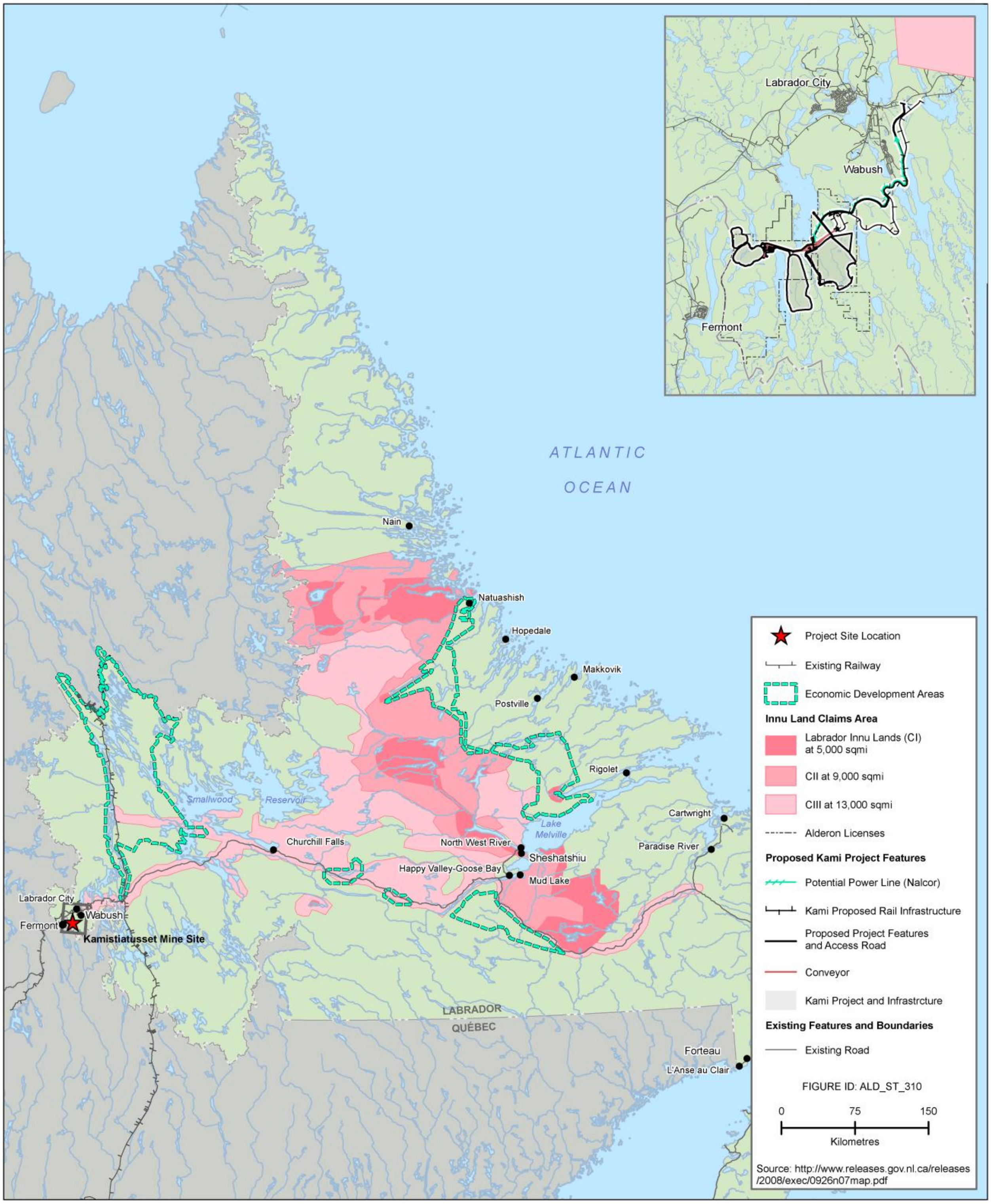
The Labrador Innu claim Aboriginal rights and title to much of Labrador (and portions of Québec). In September 2008, the Government of Newfoundland and Labrador and Innu Nation announced the signing of the *Tshash Petapen* (which translates as "*New Dawn*") *Agreement*, which resolved key issues relating to matters between the Province and Innu Nation surrounding the Innu land claim, as well as impacts and benefits related to past and proposed hydroelectric developments in Western and Central Labrador. Since that time, the provincial and federal governments and Innu Nation have completed detailed agreements on these matters, including a tripartite Labrador Innu Land Rights Agreement-in-Principle (AIP), which were ratified by the Innu on June 30, 2011, and signed by the three parties on November 18, 2011.

The AIP sets out jurisdictions, rights, benefits and limitations for the Labrador Innu in a variety of subject areas, which are tied directly to specific geographic areas. There are various types of lands referenced in the AIP, including (Figure 22.4):

- **Labrador Innu Lands (or LIL, Category 1)** are lands comprising an area of 12,950 km^2 which would be held by the Labrador Innu and under the administration and control of the Labrador Innu government as of the effective date of a Final Land Claims Agreement.
- **Labrador Innu Settlement Area (or LISA, Category 2)** comprises 36,260 km^2 of lands and waters that include LIL, and within which the Labrador Innu will be entitled to a variety of rights and benefits, including resource harvesting and management.
- **Permit-Free Hunting Area (Category 3)** comprises 33,670 km^2 of lands and waters where the Innu would have the right to harvest wildlife without obtaining a licence or permit.
- **Economic and Hydroelectric Major Development Impacts and Benefits Areas** would give the Innu the right to Impact and Benefits Agreements (IBAs) for "Major Developments" as defined in the AIP.

The proposed Project does not overlap with land areas that have been designated under the current Labrador Innu Land Claims AIP. The AIP is not legally binding, and will form the basis for on-going treaty negotiations.

Figure 22.4 Labrador Innu Land Claims AIP Areas



NunatuKavut

The NunatuKavut Community Council (NCC, formerly the Labrador Métis Nation) reports a membership of over 6,000 members who reside primarily in southern and central Labrador. Originally established as the Labrador Métis Association in 1985, the NCC has asserted a land claim that covers much of central and southeastern Labrador – including the area of western Labrador in which the proposed Project will occur (Figure 22.5) - but this has not been accepted for negotiation by the federal or provincial governments. Again, however, the NCC may be consulted as part of project EAs and other processes by governments and/or project proponents.

Québec Innu and Naskapi Groups

In addition to Aboriginal organizations residing in Labrador, Innu and Naskapi communities that reside in the Schefferville area and along the Québec North Shore, claim Aboriginal rights and/or title to parts of Labrador, including areas of western Labrador. These include the following (Figure 22.1):

- **Uashat mak Mani-Utenam:** Two Innu Reserves in the Sept-Îsles, Québec area, with a total population of approximately 3,200 persons, whose traditional territory occupies a large area of western Labrador and eastern Quebec (Figure 22.6);
- **Matimekush - Lac John First Nation:** Two Innu Reserves in the Schefferville, Québec area, with a total population of approximately 800 persons, whose traditional territory occupies a large area of western Labrador and eastern Quebec (Figure 22.6); and
- **Naskapi Nation of Kawawachikamach:** A Naskapi community of approximately 700 residents, located 15 km northeast of Schefferville, Québec, whose land claims in Québec have been resolved but who also claim large areas of Labrador (Figure 22.7).

The land claims asserted by Québec First Nations for territory in Labrador have not been accepted for negotiation by the Government of Newfoundland and Labrador. The assertion of Aboriginal rights by these or other Aboriginal communities can trigger requirements for such groups to be consulted regarding proposed development activities in Labrador.

Figure 22.5 NunatuKavut Community Council Asserted Land Claim Area

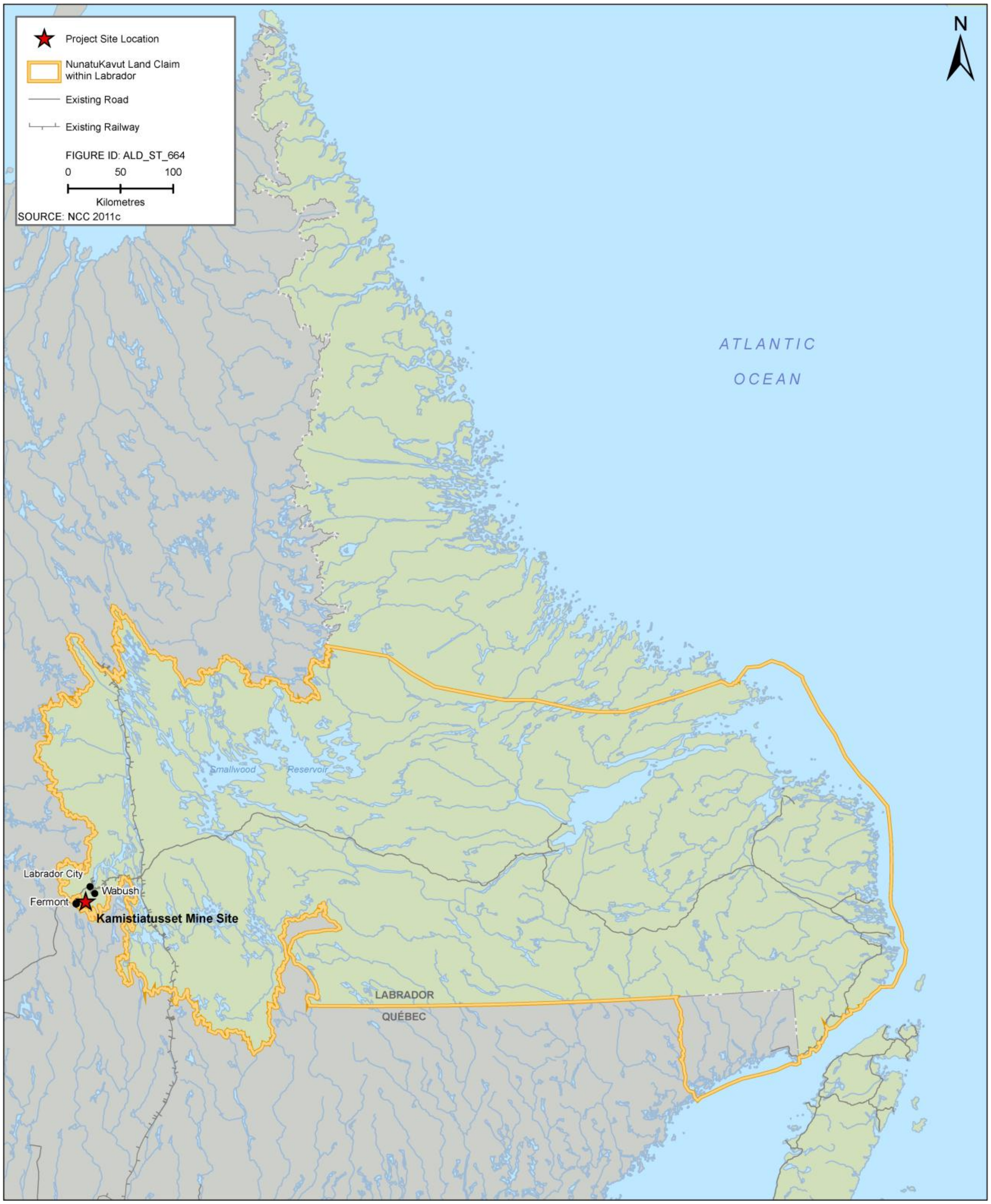


Figure 22.6 Traditional Territory of the Innu of Uashat mak Mani-Utenam and Matimekush - Lac John

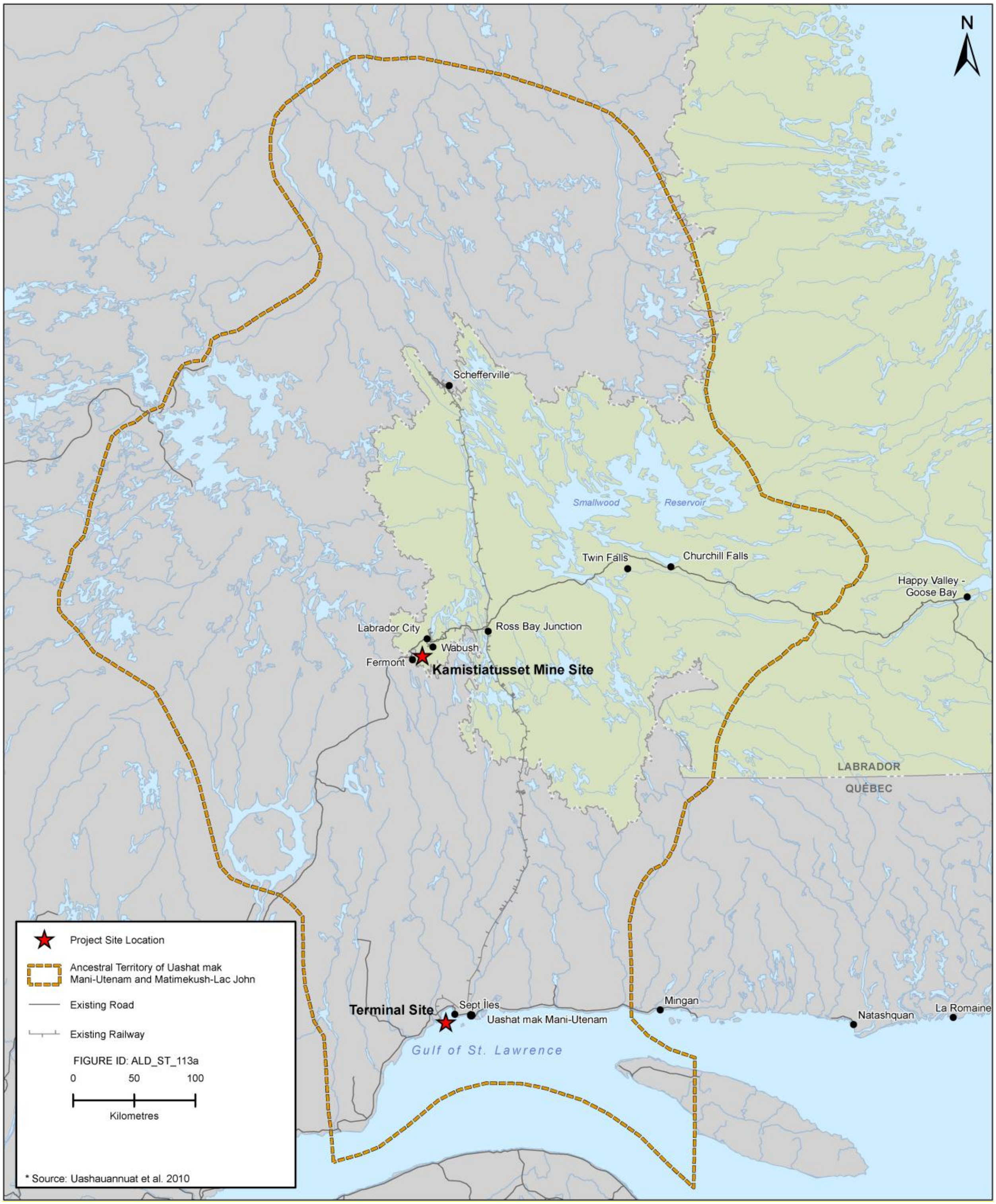
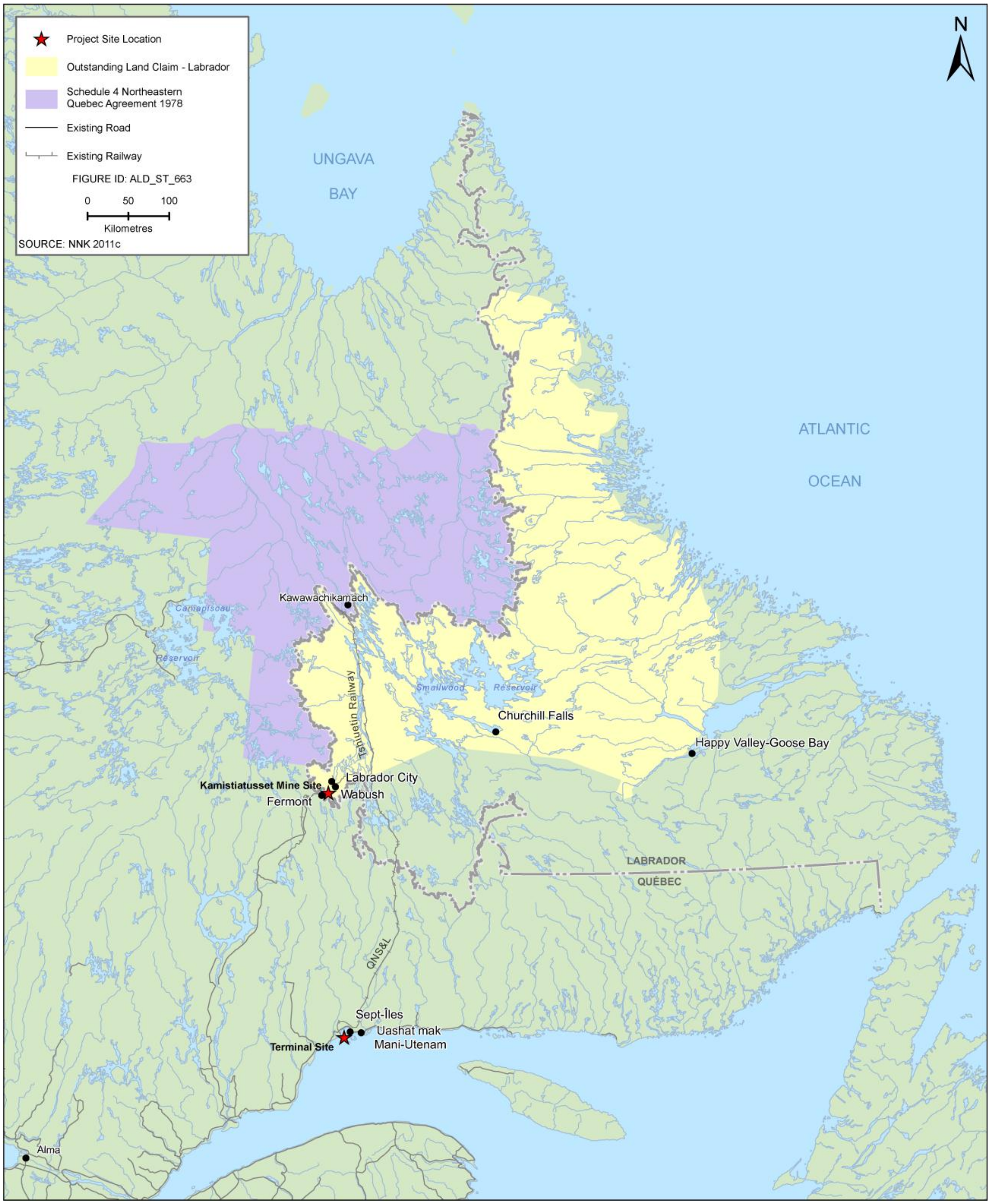


Figure 22.7 Naskapi Nation of Kawawachikamach Land Claim Areas



22.3 Establishing Standards or Thresholds for Determining the Significance of Environmental Effects

22.3.1 Environmental Effects Descriptors

The likely effects of the Project on the Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons are described using the following descriptors, which are based on recent environmental assessment practice and the EIS Guidelines:

- **Direction:**
  - Neutral (or possibly, No Effect);
  - Adverse; or
  - Positive.
- **Magnitude:**
  - Low (affects a small number of Aboriginal land and resource users);
  - Moderate (affects less than the majority of Aboriginal land and resource users for one or more activities); or
  - High (affects the majority of Aboriginal land and resource users across multiple activities).
- **Geographic Extent:**
  - Site (within the PDA);
  - Within the LSA; or
  - Within the RSA.
- **Frequency:**
  - Not likely to occur;
  - Occurs once;
  - Occurs sporadically at irregular intervals;
  - Occurs on a regular basis and at regular intervals; or
  - Occurs continuously.
- **Duration:**
  - Short Term (restricted to the construction phase(s));
  - Medium Term (continues into the operations and maintenance phase);
  - Long Term (16 to 50 years); or
  - Permanent.

- **Reversibility:**
  - Reversible: the VEC can be returned to existing conditions; or
  - Irreversible: the effect cannot be reversed.
- **Environmental or Socio-economic Context:**
  - Undisturbed: Area relatively or not adversely affected by human activity; or
  - Disturbed: Area has been substantially previously disturbed by human development and/or human development is still present.

Threshold for Determining the Significance of Residual Environmental Effects

A significant adverse effect on the Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons is defined as one which will result in a change in the current spatial and temporal distribution and/or an overall decrease in activity levels by those Aboriginal communities who currently undertake such activities within the RSA, resulting in a reduction in the overall cultural value of such activities for the community over the long-term.

22.4 Potential Project-VEC Interactions

Each of the Project's main planned activities during its construction, operation and maintenance, and decommissioning and reclamation phases as well as possible accidental events and malfunctions, are listed in Table 22.2. The Table also indicates whether, and at what level, each will likely interact with the VEC (based on a ranking of 0, 1, or 2, which are defined at the bottom of the table). This approach has been taken in order to frame and focus the environmental effects assessment early and on the key potential issues and interactions of concern, including those for which standard mitigations and guidelines are not necessarily defined and applicable.

Table 22.2 Potential Project Environmental Effects to Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons

Project Activities and Physical Works	Potential Environmental Effects (should any Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons occur within the LSA)		
	Change in Activity Distribution (location and/or timing)	Change in Overall Activity Levels	Resulting Change in Overall Quality and Cultural Value of the Activity
Construction			
Site Preparation (incl. clearing, excavation, material haulage, grading, removal of overburden and stockpiling)	2	2	2
Construction of Roads	2	2	2

Project Activities and Physical Works	Potential Environmental Effects (should any Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons occur within the LSA)		
	Change in Activity Distribution (location and/or timing)	Change in Overall Activity Levels	Resulting Change in Overall Quality and Cultural Value of the Activity
Construction of Site Buildings and Associated Infrastructure (maintenance facilities, offices, plant, crushers, concentrator, conveyors, gatehouse, pumphouses, substation, security fencing, sanitation system)	2	2	2
Construction of Mine Tailings Management Facility (TMF)	2	2	2
Construction of Railway and Load-out Facilities (silos)	2	2	2
Construction of Power Line	2	2	2
Construction of Stream Crossings	2	2	2
Installation of Water Supply Infrastructure (wells, pumps, pipes)	2	2	2
Onsite Vehicle / Equipment Operation	2	2	2
Waste Management	0	0	0
Transportation of Personnel and Goods to Site	2	2	2
Expenditures	0	0	0
Employment	2	2	2
Operation and Maintenance			
Open Pit Mining (incl. drilling, blasting, ore and waste haulage, stockpiling, and dewatering)	2	2	2
Ore Processing (incl. crushing, conveying, storage, grinding, screening)	2	2	2
Concentrator Operations (gravity and magnetic separation, tailings dewatering, tailings thickener, concentrate conveyance to load-out)	2	2	2
Tailings Disposal in TMF	2	2	2
Waste Rock Disposal on Surface	2	2	2
Water Treatment (incl. mine water and surface runoff) and Discharge	2	2	2
Rail Load-Out by Silo Discharge	2	2	2
Rail Transport	2	2	2
Onsite Vehicle / Equipment Operation and Maintenance	2	2	2
Waste Management	0	0	0
Transportation of Personnel and Goods to Site	2	2	2
Fuel Storage and Dispensing	0	0	0

Project Activities and Physical Works	**Potential Environmental Effects (should any Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons occur within the LSA)**		
	Change in Activity Distribution (location and/or timing)	**Change in Overall Activity Levels**	**Resulting Change in Overall Quality and Cultural Value of the Activity**
Progressive Rehabilitation	0	0	0
Expenditures	0	0	0
Employment	2	2	2
Decommissioning and Reclamation			
Site Decommissioning	2	2	2
Site Rehabilitation (building demolition, grading, scarifying, hydro-seeding)	2	2	2
Accidents and Malfunctions			
Fire	2	2	2
Spill / Release of Hazardous Materials	2	2	2
KEY 0 No interaction. 1 Interaction occurs; however, based on past experience, the resulting effect can be managed to acceptable levels through standard operating practices and/or through the application of best management or codified practices. No further assessment is warranted. 2 Interaction occurs, and resulting effect may exceed acceptable levels without implementation of specified mitigation. Further assessment is warranted.			

In general, any Project components or activities that result in possible restricted access to the Project area, ground disturbance, interactions with waterbodies, possible emissions to the atmospheric, aquatic or terrestrial environments, or other disturbances (presence of workers and equipment; associated noise, dust or visual intrusions) have the potential to (directly or indirectly) affect local land and resource use activities, where these occur within or near the Project area.

As indicated, in many cases there are no general or generic regulatory standards that are designed to avoid or reduce the possible effects of these Project components or activities on land and resource use, and therefore, the assessment is based (rather conservatively) on an initial assumption that most elements of the Project may interact with these activities, should they currently occur in the Project area. These possible interactions and effects have therefore brought forward into the VEC chapter for further analysis and assessment, including, initially, an evaluation of whether each identified group is (based on existing and available information) known to undertake such activities in the PDA and/or LSA, and if so, the nature and degree of any Project-related effects to these current activities and the relationship of this to their overall land and resource use activities and patterns.

22.4.1 Selection of Environmental Effects and Measurable Parameters

The environmental effects assessment for the Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons VEC is focused on the following environmental effects:

- Change in Activity Distribution (Location and/or Timing);
- Change in Overall Activity Levels; and
- Resulting Change in Overall Quality and Cultural Value of the Activity.

These potential effects are considered to be the primary potential outcomes which may result from the possible interaction of Project components and activities with any Aboriginal land and resource use activities that currently occur within the PDA and/or LSA.

Required restrictions on access to the Project area during construction and operations may, for example, have a direct effect on the use of certain lands and resources for such activities. The presence of Project-related structures and disturbances may also result in Aboriginal persons choosing not to use a larger area surrounding the Project site, which may further contribute to a change in the spatial and/or temporal distribution of land and resource use activities, especially if alternate areas are not available for such uses. An associated decrease in the use of particular land areas and lack of suitable alternative locations, and/or other possible issues and restrictions on the sites or times available for such activities (such as due to increased involvement in the wage economy) may also affect the overall levels of traditional land and resource use by individuals or communities. Finally, any Project-related changes in the overall level, distribution (geographic or timing) and/or quality of current Aboriginal land and resource for traditional purposes may adversely affect the cultural value of these activities for the Aboriginal community or organization in question.

The analysis and assessment of Project effects on this VEC was based on an extensive review of existing and publically available information, any additional information made available by relevant Aboriginal communities and organizations, and any applicable questions and issues raised during Alderon's Aboriginal engagement initiatives. The environmental effects assessment for this VEC focuses primarily upon the key potential effects identified above, with a series of Measureable Parameters then being defined which represent associated aspects of the VECs to which changes could possibly be detected / measured. Although some potential Project effects may be indeed be "measured", for many potential social and cultural issues quantitative predictions are frequently neither possible nor particularly meaningful. In these cases, the identified Measureable Parameters are primarily used as key concepts upon which to focus the effects assessment, rather than to generate quantitative effects predictions.

The measurable parameters used for the assessment of the various potential environmental effects, and the rationale for their selection, are indicated in Table 22.3.

Table 22.3 Measurable Parameters for Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons

Environmental Effect	Measurable Parameter	Rationale for Selection of the Measurable Parameter
Change in Activity Distribution (location and/or timing)	• Area available and used for traditional land and resource use activities by each group. • Timing, frequency and duration of traditional land and resource use activities by each group.	• Any changes to the areas and/or times used for such activities can be assessed and evaluated.
Change in Overall Activity Levels	• Community participation rates in traditional land and resource activities.	• Any changes to overall activity levels / participation rates can be assessed and evaluated.
Resulting Change in Overall Quality and Cultural Value of the Activity	• Degree of cultural value / fulfillment associated with traditional land and resource activities by a community.	• Any changes in the nature, distribution and/or quality of traditional land and resource use may diminish the overall value of a cultural activity.

22.5 Existing Environment

The following sections provide a description of the existing environment for the Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons VEC. This description focuses on, and provides relevant information related to, each of the Aboriginal communities and organizations that have identified that they have an interest in the Project and/or surrounding area through Alderon's Aboriginal engagement activities, namely the (see Figure 22.1):

- Labrador Innu (Innu Nation);
- NunatuKavut Community Council (Labrador);
- Innu of Uashat mak Mani-Utenam (Québec);
- Innu of Matimekush-Lac John (Québec); and,
- Naskapi Nation of Kawawachikamach (Québec).

Each of these Aboriginal communities and organizations is addressed in a separate subsection below.

The descriptions focus upon the current (existing) use of land and resources by Aboriginal persons for traditional persons, which is generally defined as those which have been occurring over the past several decades (generally between about 1990 and the present). As illustrated in the following sections, however, the focus and content of the description has been influenced by the availability (and age) of the existing information. The subsections which follow also provide a very brief overview of the cultural / historical sequence of the Labrador region, as overall background and context to the Aboriginal groups and their traditional activities. The subsequent assessment of potential Project effects on this VEC, however, focuses exclusively upon whether, how and to what degree the Project may affect current activities.

A variety of information sources were identified, compiled, reviewed and summarized to understand and describe current land and resource use activities by the various Aboriginal groups under consideration. This has included publicly available land claims documentation, other land use studies completed by Aboriginal groups, archaeological reports and other literature, government documents and studies completed for other resource development projects and their EAs in Labrador and Eastern Québec. As described in Chapter 10, Alderon has been making significant efforts to consult with each of the relevant Aboriginal communities and organizations in Labrador and Québec. This has included the ongoing provision of Project information, as well as offers of consultation agreements and associated funding to gather and provide information on current land and resource use and harvesting, Aboriginal knowledge, and community issues and concerns regarding the Project and its potential environmental effects, for consideration and incorporation into the EIS. Where Aboriginal organizations have chosen to participate in such initiatives, the information and insights obtained through these processes has been extremely valuable and were considered and incorporated throughout the EA. Other Aboriginal groups have declined to provide information on their activities or facilitate the collection of additional land and resource use information from their membership. In these cases, the EA was conducted on the basis of existing and publicly available information.

Further information on the historic and current land and resource use of these Aboriginal communities (where available) is provided in Appendix Z.

Table 22.4 provides an overview of Aboriginal Traditional Knowledge that is relevant to this VEC, and which has been considered integrally throughout the environmental effects assessment.

Table 22.4 Aboriginal Traditional Knowledge - Current Use of Lands and Resources for Traditional Purposes by Aboriginal Persons

Group	Source	Page or Date Reference	Comment or Excerpt
Innu Nation of Labrador	Consultation Meeting with Innu Nation of Labrador	November 24, 2011	In the spring, summer and fall, Innu go hunt in the Wabush area.
Innu Nation of Labrador	Consultation Meeting with Innu Nation of Labrador	September 27, 2011	Alderon is negotiating with others on a territory where Innu Nation has traditional rights. Innu Nation considers all of Labrador as their traditional territory and will not surrender their rights.
Naskapi Nation of Kawawachikamach	Consultation Meeting with Naskapi Nation of Kawawachikamach	January 23, 2012	One elder: There is a historical basis for the Naskapi hunting routes. Maps with traditional hunting routes and historical places are located at the Naskapi Development Corporation offices.

Group	Source	Page or Date Reference	Comment or Excerpt
Innu Nation of Matimekush-Lac John	Consultation Meeting with Innu Nation of Matimekush-Lac John	January 26, 2011	Presently, there are six mining companies interested in this part of the peninsula. The Project is located on the trapping lot number 244. A few families from Schefferville and from Sept-Îles (including the Pinett family) have used this trapping lot. Naskapi people use this area. Land use activities include fishing and trapping. They presently hunt caribou near Smallwood reservoir.
Innu Nation of Matimekush-Lac John	Consultation Meeting with Innu Nation of Matimekush-Lac John	December 6, 2011	The Project overlaps with their traditional territory. Other claims overlap with their ancestral territory
NunatuKavut Community Council	Consultation Meeting with NunatuKavut Community Council	November 4, 2011	The NunatuKavut Community Council asserts Aboriginal traditional land use in Labrador West. There are approximately 250 NunatuKavut Community Council members residing in the Labrador West area
NunatuKavut Community Council	Consultation Meeting with NunatuKavut Community Council	November 25, 2011	There are houses and cabins close to the Project, particularly in the Duley Lake area.
Innu Nation of Uashat mak Mani-Utenam	Consultation Meeting with Innu Nation of Uashat mak Mani-Utenam	January 21, 2011	Project area is claimed territory
Innu Nation of Uashat mak Mani-Utenam	Consultation Meeting with Innu Nation of Uashat mak Mani-Utenam	September 29, 2011	Claim that they own the land where the Project is, and that some families are on it. Have agreements with Cliffs for Bloom Lake, ArcelorMittal, LIP, Cap-Ex, Champion, Tata Steal for projects in the area.
Innu Nation of Uashat mak Mani-Utenam	Consultation Meeting with Innu Nation of Uashat mak Mani-Utenam	January 26, 2011	A trapping lot located on the Project area, lot number 244, belongs to families in Sept-îles (Pinette, Volant et Grégoire).
Innu Nation of Uashat mak Mani-Utenam	Consultation Meeting with Innu Nation of Uashat mak Mani-Utenam	January 26, 2011	Influx of workers in Labrador City marginalized Aboriginal communities and created land use conflicts and social pressure. It would be interesting to document the story of this area. There is presently a study running by Sylvie Vincent on the land use. Furthermore, even if no CAM (Conseil des Atikamekws et des Montagnais) study exists for Uashat mak Mani-Utenam, the community has data that should be given to Alderon. These data are in the study center of Uashat mak Mani-Utenam.

Group	Source	Page or Date Reference	Comment or Excerpt
Innu Nation of Uashat mak Mani-Utenam	Consultation Meeting with Innu Nation of Uashat mak Mani-Utenam	January 26, 2011	This is my land, the place where my family uses to go. So it would be necessary to determinate the use of the area.
Innu Nation of Uashat mak Mani-Utenam	Consultation Meeting with Innu Nation of Uashat mak Mani-Utenam	September 29, 2011	Participant identified that his mother was born in the Project area and that this is where his grandfather lived. He stated that his family has used this area since the 18th century. Some Labrador Innu are from Uashat, so may have some rights in the Uashaunnuat territory. However, not all Innu from elsewhere can claim rights here.
Innu Nation of Uashat mak Mani-Utenam	Consultation Meeting with Innu Nation of Uashat mak Mani-Utenam	December 1, 2011	They stayed on the territory for a few years after the mines opened. His dad did not want to work on mines, he had always lived from the land and wanted to continue doing so. The city grew and his family had to leave as they were not comfortable. They left everything, including their trapping camps. They moved to Maliotenam and could not go back because there were too many companies in the area. However, he stated that he still goes on the land every year, except in a different territory, located north of the Smallwood Reservoir.
Innu Nation of Uashat mak Mani-Utenam	Consultation Meeting with Innu Nation of Uashat mak Mani-Utenam	December 1, 2011	The Chief identified that it is very important for the Innu to understand how much it hurts to have their territory taken away by companies. He tried to hunt in that area one day, and the next day there were no hunting signs all over the place. Companies are disturbed when Innu go on their land, but the mines disturbed Innu when they came on Innu lands.
Innu Nation of Uashat mak Mani-Utenam	Consultation Meeting with Innu Nation of Uashat mak Mani-Utenam	May 16, 2012	Uashat requires Alderon to address the interests of the traditional families in Beaver Lots 244 and 245.
Naskapi	Lower Churchill Project - Consultation Assessment Report	p.13-7	Naskapi Nation of Kawawachikamach has established travel routes across Labrador (Weiler 1992). Currently, the primary travelways are the TLH and the Québec – Labrador Railway. In addition, charter flights which move families to outpost camps are commonly used (Weiler 1992). From a review of sources (CAM 1982; Weiler 1992), trails / roads were identified

Group	Source	Page or Date Reference	Comment or Excerpt
Naskapi	Lower Churchill Project - Consultation Assessment Report	p.13-9	The Naskapi moved with the herd, ranging through its annual range, travelling north to Ungava Bay, east to the coast and south to the Churchill River (Henriksen 1978). They hunted caribou during the migration past Indian House Lake.
Naskapi	Lower Churchill Project - Consultation Assessment Report	p.13-9	The Naskapi Nation of Kawawachikamach harvest plants for food and medicinal purposes (Weiler 1992). Labrador tea and berries are commonly harvested near Kawawachikamach (Weiler 1992). A reference was made to using spruce buds and rock tripe in a broth during times of starvation (Henriksen 1978). The Naskapi use medicinal plants. Of deep significance for Naskapi is the tight link between their health and wellness and the medicinal properties of plants and animals, including caribou, moose, bear and beaver.
Naskapi	Lower Churchill Project - Consultation Assessment Report	p.13-10	The Naskapi Nation of Kawawachikamach maintains a number of sacred areas within their traditional territory (Harper 1964),
Innu of Matimekush-Lac John	Lower Churchill Project - Consultation Assessment Report	p.12-9	CAM data indicate that contemporary territory use is far less extensive than historical land use. The study lacks information on certain areas but considers the activities on the Matimekush-Lac John hunting grounds within the Saguenay reserve to be representative of the community's general territory use. Originally members of the Uashat mak Mani-Utenam band, the Innu of Matimekush-Lac John share their individual hunting grounds with the Sept-Îles community. These territories are chiefly located north of Lake Ashuanipi. However, there are no data to confirm the actual use of the trapping lots attributed to the Innu of Matimekush-Lac John. The CAM study includes a map of the contemporary camp sites and itineraries used by the Innu of Matimekush- Lac John., which shows a high concentration of locations and itineraries around the reserve.

22.5.1 A Brief Historical Overview of Aboriginal Use and Occupancy

Labrador has a rich history and cultural heritage which extends over a period of more than 8,000 years. Previous archaeological research has revealed a cultural-historical sequence that is long and complex.

The Labrador region was initially colonized by Maritime Archaic groups from the south shortly after deglaciation. These groups arrived in the southeast part of Labrador by 8,000 years before present (BP), expanding northward along the coast to central and then northern Labrador by 7,500 years BP (Fitzhugh 1972; McGhee and Tuck 1975). After 4,000 BP, coastal Labrador was also colonized by Arctic-adapted peoples from the north (Cox 1978), and thereafter, Labrador pre-contact history is characterized by a sequence of Intermediate Indian (Nagle 1978), Recent Indian and Historic Innu (Fitzhugh 1978a; Loring 1992; Mailhot 1997) occupations, overlapping with Palaeo Eskimo occupations (Pre-Dorset, Groswater, Dorset), and culminating with the arrival of the Thule, ancestors of the modern Inuit, approximately 700 BP (Kaplan 1983; Fitzhugh 1994). Archaeological and historical records also confirm a lengthy European presence throughout the Labrador region.

To provide an appropriate background and context for the assessment, the following sections very briefly summarize information regarding the Aboriginal use and occupancy of Labrador and parts of adjacent Québec during the Pre-contact Period (ca. 8,000 to 500 years BP), the Historic Period (ca. 500 BP to 1950 AD) and the Contemporary Period (1950 AD to 1990).

Overview of Pre-contact Cultural Traditions in Labrador (8,000 to 500 BP)

The Maritime Archaic Indian Tradition is the name given to the people who arrived in southern Labrador via the Maritimes and Lower North Shore of Québec approximately 7,500 to 8,000 years ago in the wake of retreating glaciers (McGhee and Tuck 1975; Pintal 1998; Schwarz 2010). The descendants of these first inhabitants gradually moved north along the coast and eventually reached northern Labrador by approximately 6,500 years ago (Fitzhugh 1978a). There is little evidence of a Maritime Archaic Indian occupation in south-central Labrador; however, several archaeological sites attributable to this group have been identified to the north and in the near-coastal interior (Loring 2001). In Western Labrador, evidence of a Maritime Archaic Indian occupation is limited to a number of stone artifacts found on the Lake Plateau (in an area now encompassed by the Smallwood Reservoir) and near Wabush (MacLeod 1967, 1968; Thomson 1984). These are dated to at least 3,500 to 4,000 years ago.

The next period in Labrador prehistory is referred to as the Intermediate Period, dating between 3,800 and 2,000 years ago (Fitzhugh 1972; Nagle 1978). Typically, Intermediate-period sites are small and contain few diagnostic artifacts. Although sites attributable to this culture have been found on the coast of Labrador along with those of the contemporary Arctic-adapted, Palaeo-Eskimos (4,000 to 600 years ago) (Cox 1978), it is noteworthy that the majority of finds in the interior (in places such as the Churchill River valley), appear to belong to this group (Schwarz 2007). The Intermediate Period of occupation appears to have been focused on an interior-oriented lifestyle of caribou and small game hunting and fishing, similar to that recorded for the Innu during the Historic Period (see below). In Northern Québec, this period of occupation is not clearly understood (McCaffrey 2006a), but appears to have been less intensive than the occupation of Central Labrador. One archaeological site related to the Intermediate Period was found close to a chert outcrop near Schefferville, Québec located north of the Project area (Denton and McCaffrey 1988).

The Intermediate Period in Labrador was followed by the Late Pre-contact Period (2,000 years ago to the time of European contact with Aboriginal people ca. 1500 to 1700 AD), which is represented in coastal Labrador by the Daniel's Rattle and Point Revenge complexes. Sites dating to this period frequently contain structures interpreted as the remains of communal dwellings analogous to the shaputuan of the historic Innu (Loring 1985). Research has revealed a pattern of marine and terrestrial resource exploitation (Fitzhugh 1978b; Loring 1992), with a much larger emphasis on maritime resources than that during the preceding period. In the Central Labrador interior, sites dating to the Late Pre-contact Period are far less common than those of the Intermediate Period. This differs from Northern Québec, where there are many Late Pre contact Period sites dating to shortly after 2,000 years ago, that contain evidence of far-ranging exchange / trade, pottery production and large, shaputuan-type dwellings containing several hearths (McCaffrey 2006b). It has been demonstrated that people associated with late Pre-contact Period sites in the region are ancestral to the historic and contemporary Innu and Naskapi of Labrador and Québec.

The Historic Period (Circa 500 BP to 1950 AD)

After approximately 1500 AD, Labrador and the Lower North Shore of Québec increasingly became a focus of European activities. Basque whaling efforts in the sixteenth century intensified (Tuck and Grenier 1989), as did fishing, sealing and fur trading by people from other European countries (McAleese 1991; Kennedy 1995). European activity in the interior was relatively more limited, although trader and explorer Louis Jolliet did visit the Ashuanipi area around 1695, providing the earliest written reference of its importance as a major Innu gathering place (Delanglez 1948).

Aboriginal archaeological sites dating from the mid-seventeenth to the mid-nineteenth centuries have rarely been identified in interior Labrador and northern Québec, which may be at least partially the result of the relatively limited amount of field studies completed there to date. As a result, the understanding of settlement patterns dating to this time is based largely on ethno-historic and fur trade accounts, including the records of the Hudson's Bay Company (HBC), from interior trading posts in the region (McCaffrey 1989). In the latter half of the nineteenth century, when the fur trade in Labrador was at its peak, Innu mobility was gradually reduced. However, even at that time long-distance travel by Innu across the Labrador Peninsula and as far south as the Lower North Shore of Québec did continue to take place (Tremblay 1977; Mailhot 1997).

The Contemporary Period (1950 AD to 1990 AD)

The second half of the twentieth century saw significant changes for the Aboriginal inhabitants of Western and Central Labrador. Among the more notable was the emergence of the Euro-Canadian communities such as Labrador City, Wabush, Churchill Falls and Happy Valley-Goose Bay, as well as the development of road, air travel and communication networks.

The 1960s also saw the development and implementation of government policies that encouraged the Innu to become increasingly more sedentary through settlement in established communities (Armitage 1990). Further changes came with the development of the Churchill

River for hydroelectric purposes, which resulted in the flooding of vast tracts of land through the creation of the Smallwood Reservoir in the early 1970s. Prior to the hydroelectric development, the region had been a major hunting and gathering area for the Innu of Labrador-Ungava and the Lower North Shore of Québec (Loring et al. 2003). While the Sheshatshiu Innu continue to use parts of the pre-settlement area such mobility is much diminished, and the area is also used by Innu from the Lower North Shore of Québec and Schefferville (Tanner and Armitage 1986; Armitage 1990).

22.5.2 Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons

The following sections provide a description of the Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons, based on existing and available information. The known current activities of each relevant Aboriginal community or organization are described in a separate sub-section, including a general overview of the group's overall activities (within the RSA) as well as, where applicable and possible, a particular focus on any known current land and resource use activities that take place within the PDA and/or LSA.

Labrador Innu

The Innu (previously known as Montagnais and Naskapi Indians) are indigenous inhabitants of an area they refer to as Nitassinan, which comprises much of the Québec-Labrador peninsula. They were traditionally a nomadic people, whose movements responded to the seasons and to the migrations of the animals they relied upon.

The names Montagnais and Naskapi were historically used by European settlers to refer to the southern and northern Innu of Labrador, respectively. Currently, the Labrador descendants of the people previously referred to as Montagnais live mainly in Sheshatshiu in Central Labrador, while Natuashish on the Labrador North Coast is the Labrador home of those descended from those referred to as Naskapi. As noted by Armitage (1989), however, the historic distinction between Montagnais and Naskapi in Labrador is misleading, because both Labrador groups are descendants of one culture and speak dialects of the same language – *Innu-aimun*. The ancestors of the modern day Labrador Innu were nomadic caribou hunters who traveled in relatively small groups throughout portions of the interior of the Labrador-Québec Peninsula, in pursuit of caribou.

Beginning in the early nineteenth century, Innu gathered seasonally at various HBC trading posts and at favoured hunting locations, such as Indian House Lake on the George River. North West River (near the current community of Sheshatshiu) originated as a trading post in 1743 and became an important service centre for the region. The Innu used North West River only as a campsite in summer until the late 1950s, after which they began to settle there more permanently. Sheshatshiu, located on the south bank of North West River, formed part of the community of North West River until 1979, at which time the Innu formed a separate community which is currently a Reserve with an elected Chief and Band Council. This section focuses on the current land and resource use activities of the Sheshatshiu Innu First Nation, including hunting, fishing and gathering.

Armitage (1989) depicts the approximate boundaries of the Sheshatshiu Innu territory between 1900 and 1965. The approximate limit of this territory extended west from Sheshatshiu along the Churchill River to Churchill Falls, although a number of places within the general Western Labrador / Eastern Québec region were reportedly used by Labrador Innu while part of, or when hunting with, members of other bands (e.g., Innu from Sept-Îles). These sites include the Ashuanipi River, Ashuanipi Lake and Lac Joseph, east of Wabush. This area corresponds to one of six sub-regions occupied by the Innu of Labrador and northeastern Québec (Tanner 1944; Tanner 1977; Mailhot 1986; Armitage 1989). Armitage (1989) identifies the Lac Joseph sub-region as the area surrounding Atikonak Lake and Lac Joseph, extending from Winokapau Lake and Ashuanipi Lake. The area was used in pre-settlement times by Innu who traded at Sheshatshiu, and Sept-Îles and Natashquan, Québec. As noted by Armitage (1989), for the period 1900-1965, this sub-region was primarily used by the adjacent Sept-Îles Innu with some associated use by Sheshatshiu Innu.

Existing and available information indicates that there are presently three core areas for traditional land and resource use by Sheshatshiu Innu (Mailhot 1997; Armitage and Stopp 2003):

- The hub of activity remains the group of lakes at the headwaters of Eagle River in southeastern Labrador and its tributaries, which had been an important area since pre-settlement times;
- An area of Central Labrador bounded by Uinnukapau (Winnokapau Lake) in the south, Smallwood Reservoir (formerly Mishikamau) in the west, Atshuku-nipi (Seal Lake) in the north, and Nipishish (Nipishish Lake) in the east; and
- An area centered on three lakes – Ashuapamatikuan (Shipiskan Lake), Ashtunekamuku (Snegamook Lake), and Shapeiau (Shapio Lake).

Each of the identified core areas for current Labrador Innu land and resource use is located well outside of the PDA and LSA. Land use in these main areas is now also supplemented by Innu harvesting along the TLH and various secondary roads between Happy Valley-Goose Bay and Western Labrador (Armitage and Stopp 2003).

22.5.3 Travel Routes and Camp Sites

It is clear that the Sheshatshiu Innu travelled across and used large areas of Labrador in pre-settlement times (Armitage and Stopp 2003). As the Innu adapted to a more sedentary settlement in the twentieth century, however, their travels and associated harvesting were located more and more in close proximity to the communities and in areas made accessible by road, trails and transmission corridors. This has had notable effects on the nature and distribution of traditional activities, including how people travel to and from seasonal hunting, trapping and fishing areas. While in the past hunters and their families would have walked and travelled by canoe, vehicles, snowmobiles and motorized boats eventually became the preferred modes of transportation. As a consequence of these changes, traditional Innu travel corridors and temporary camp locations are now used considerably less frequently (Stopp 2002; Armitage and Stopp 2003). These overall changes in Innu land use patterns are reflected generally in the data presented by Armitage (2010), which show an increase in the prevalence and use of camps along the TLH and other roads within the 1990 to 2009 period.

The Sheshatshiu Innu Band Council began administering an Outpost Program in the 1970s to help finance travel by Innu families to and from camps in the interior of Labrador. The purpose of this program has been to enable Innu to travel into the country as an educational community activity and to live in their traditional ways, allowing for the inter-generational transmission of cultural knowledge, traditional practices, spiritual and cultural values and traditional language. The program has financed a country-based harvest referred to as *Kakushpinanut*, whereby Innu families travel to and from camps in the interior of Labrador to spend time hunting caribou and engaging in other traditional activities (Armitage and Stopp 2003).

As discussed above, the use of roads such as the TLH between Happy Valley-Goose Bay and Churchill Falls for community based harvesting has grown considerably in recent times, while the use of remote camps by Sheshatshiu Innu has declined (Armitage and Stopp 2003). In the most recent available Labrador Innu land and resource use study, Armitage (2010) recorded Innu travel routes, including road, snowmobile, walking, canoe and motorboat routes and associated activities within a large regional study area that covered the overall southern portion of Labrador (including western, central and eastern areas). This study indicates a relatively high concentration of Innu travel routes near the TLH between Churchill Falls and Happy Valley-Goose Bay, and near Lake Melville. No snowmobile, motor-boat, canoe or walking routes were recorded west of Churchill Falls. Vehicle routes were recorded on the TLH between Churchill Falls and Wabush, as well as the road to Twin Falls and the roads branching towards the Smallwood Reservoir from the TLH (Armitage 2010).

Armitage (2010) also compiled data from the Innu Nation on the location of Innu cabins, tents and Outpost Program camps. Identified Innu cabins were clustered near the Sheshatshiu / Lake Melville region and along the TLH west of Happy Valley-Goose Bay. Outpost camp locations aligned approximately with the three core land use areas described above (Armitage and Stopp 2003), with a relatively high density of cabins near the Eagle River headwaters. There were six Innu cabins recorded in the area west of Churchill Falls, including near the TLH and the roads to Twin Falls and the Smallwood Reservoir. There were also two Outpost Program camp locations documented west of Churchill Falls in an area bounded by Smallwood Reservoir to the north and by the TLH to the south. The map biography data reported by Armitage (2010) shows Innu cabins near Churchill Falls on the TLH, on the road to Smallwood Reservoir, on the TLH between Churchill Falls and Labrador City-Wabush, and possibly south of the TLH east of Churchill Falls.

22.5.4 Hunting, Trapping, and Gathering

Several sources have documented Sheshatshiu Innu harvesting locations, with notable concentrations being located in the eastern parts of the RSA. Important areas for Innu harvesting appear to be located near the TLH between Churchill Falls and Happy Valley-Goose Bay, north and west of the Churchill River, in the Mealy Mountains, and on the Eagle River Plateau where waterfowl and other species are harvested (Armitage 1989, 2010; Armitage and Stopp 2003). Harvesting areas west of Churchill Falls include the Menihek Lakes and Ashuanipi

River south of Schefferville, as well as in the vicinity of Lobstick Lake (Armitage 1989). Armitage (1989) also described Sheshatshiu Innu harvesting in the vicinity of roads to Churchill Falls and Esker, on the QNS&L railway.

Armitage (2010) recorded Sheshatshiu Innu kill sites for large and small mammals, furbearers, waterfowl, and fish throughout western, central and eastern Labrador. Large mammals hunted by the Labrador Innu include caribou, moose and black bear (although harvesting of the latter two species is reportedly uncommon). This study did not report individual caribou kill sites. Armitage and Stopp (2003) refer to itinerant harvesting activities along roads or at remote locations in Innu territory, such as the trips to the Orma Dyke road or Esker to hunt caribou. However, these locations are not documented and are identified by the researchers as an Innu land use data gap. Map biography data recorded by Armitage (2010) does not show any large mammal kill sites in or near the LSA.

Small game was hunted at a number of locations along the TLH between Churchill Falls and Labrador City-Wabush. Map biographies completed with Sheshatshiu residents by Armitage (2010) recorded kill sites for porcupine, partridge, and beaver in this general area. Sheshatshiu Innu also hunted goose and duck near the TLH west of Churchill Falls, although none were reported within the PDA or in the immediate vicinity of it.

Two other key areas used by Labrador Innu for land use and harvesting were identified by Armitage and Stopp (2003). One area is bounded by Winokapau Lake in the south, Smallwood Reservoir (formerly Mishikamau Lake) in the west, Seal Lake in the north and Nipishish Lake in the east. The second area is centered on three large lakes known as Shipiskan Lake (Ashuapamatikuan), Snegamook Lake (Ashtunekamuku) and Shapio Lake (Shapeiau) (Armitage and Stopp 2003). Other important areas for Sheshatshiu Innu include Dominion Lake (Nipissu) and Lake Minipi (Minai-nipi).

Other key hunting areas were found to include a large tract of land south of Lake Melville on the Eagle River Plateau and an area to the south of Muskrat Falls along the Churchill River. Between 1979 and 1987, small game was hunted from areas along the south shore of Lake Melville and in the Mealy Mountains, at Disappointment and Hope Lakes, and in the Metchin River system. Small game and furbearers were hunted at the Naskaupi River (including, the watersheds of the Wachusk, Seal, Pocket Knife, Salmon, Portage, Namaycush and North Pole lakes), and along the north shore of Lake Melville to Mulligan Bay and Grand Lake. Furbearer trapping areas roughly correspond to those described above for small game, with the concentration in the area along the TLH and north to just above the Red Wine River (MacLaren Plansearch 1994). Along the Churchill River and the TLH, the following animals were recorded to have been harvested: partridge, porcupine, rabbit, beaver, muskrat, otter, duck and goose. Near Dominion (Nipissu) Lake and at an unnamed lake about 10 km northeast of it, harvesting was found to include partridge, porcupine, rabbit, beaver, marten, duck and goose. Harvesting at Lake Minipi (Minai-nipi) was found to include beaver, otter and, muskrat.

Migratory waterfowl were hunted around Crooks Lake and Parke Lake in southeastern Labrador, at various locations on the shoreline of Lake Melville, along several roads between Happy Valley-Goose Bay and Sheshatshiu and on the south side of Churchill River at Gull

Island (MacLaren Plansearch 1994). Two key hunting areas were situated on the Eagle River plateau in southeastern Labrador as well. Waterfowl were also harvested in the Mud Lake / Upper Lake Melville area and near Sheshatshiu and North West River (Armitage and Stopp 2003; Armitage 2010). Detailed information collected for the year 1987 shows that while the country-based harvest still provided considerable food resources for the community and possibly cash through the sale of furs, the majority was being acquired through community-based harvesting activities of various wildlife and fish resources.

Berry picking is common throughout Labrador along access routes and in river valleys. Commonly gathered berries include blueberries, partridgeberries and bakeapples. Mid- to late-summer is the primary gathering time, although some berries are left to freeze under the snow for a second harvest in spring (Armitage 1989). The harvesting of blueberries occurs in dry open areas, with other berries harvested in marshy areas (Tanner 1978). Wild fruits were gathered at a number of locations, including the area around Sheshatshiu, at the north end of Grand Lake and near the Red Wine River (MacLaren Plansearch 1994). Burnovers and open terrain are also popular harvesting locations. Goudie (1991) identified a large berry picking area in a former burn area adjacent to Muskrat Falls, indicating raspberries, blueberries, squashberries, bakeapples, and partridgeberries as being abundant in the area.

Medicinal plants are also harvested in certain areas, including the inner and outer bark of some trees, roots, herbs, flowers, berries, mosses and lichens. According to Armitage (2008), medicinal plant species used by Labrador Innu include: balsam fir, bay bush, birch, black spruce, Canada yew, ground juniper, Labrador tea, mushrooms, northern mountain ash, poplar, tamarack, white spruce and willow.

22.5.5 Fishing

Available information on Sheshatshiu Innu land and resource activities indicates concentrations of fishing sites considerably east of the LSA.

Between 1979 and 1987, for example, fish were harvested from areas along the south shore of Lake Melville and in the Mealy Mountains, at Disappointment and Hope Lakes, in the Metchin River system, and at the Naskaupi River including, the watersheds of the Wachusk, Seal, Pocket Knife, Salmon, Portage, Namaycush and North Pole lakes (MacLaren Plansearch 1994). Fishing was also recorded in the area around Grand Lake and Red Wine River, as well as at a number of locations along and north of the TLH between Happy Valley-Goose Bay and Churchill Falls. Other fishing areas were identified south of Lake Melville on the Eagle River plateau, south of Muskrat Falls along the Churchill River, on the south side of the Churchill River at Gull Island, and on the north side of the river between Gull Island and Happy Valley-Goose Bay. Between 1979 and 1987, it was also indicated that the Labrador Innu harvested trout and smelt from North West Point (Uhuniau), on Rabbit Island, near the mouth of Kenamu River, on Carter Basin, in Mulligan Bay and at the west end of Double Mer (MacLaren Plansearch 1994). Most recently, Armitage (2010) identified the location of fishing sites utilized by the Labrador Innu, one of which was recorded west of Churchill Falls on the road branching towards the Smallwood Reservoir from the TLH.

22.5.6 Cultural / Spiritual Sites

Based on interviews and information included in existing Innu Nation databases, Armitage (2010) identified and described cultural / spiritual sites, including birth, burial, death and gathering places, places of religious and historical significance, shaking tent ceremony locations and the location of the Land-based Family Treatment Program Camp. Neither of these is located within the PDA or LSA.

Along the Churchill River, birth and gathering places, shaking tent locations and one place of religious significance were recorded. In the Happy Valley-Goose Bay and Mud Lake areas, burial and death places as well as one place of religious significance and one shaking tent location were noted. Armitage (2010) recorded birth, burial and death places, places of religious significance and a shaking tent location near Carter Basin and Gibeon Point in Happy Valley-Goose Bay. East and south of this area many birth and burial places were recorded, as well as one location marking a death, one shaking tent location and three places of religious significance.

Between Happy Valley-Goose Bay and Sheshatshiu (about 25 km from Sheshatshiu), a place of religious significance and one each of a birth, gathering, and shaking tent location were recorded. Toward Churchill Falls along the TLH, a gathering place and a place of religious significance were identified (Armitage 2010).

Armitage (2008) identified two shaking tent places located at Ushkan-shipiss and Manitu-utshu. Both places involved gatherings of Innu families to participate in shaking tent (kushapatshikan) ceremonies. Historically, Innu families would travel to meet for the shaking tent ceremony, with its time and location predetermined. The shaking tent at Ushkan-shipiss was last performed in November 1969 by Uatshitshish (Shinipesht Pokue). The shaking tent at Muskrat Falls was last performed on the portage trail by Manitu-utshu (Muskrat Falls Hill), sometime before 1969 (Armitage 2008, 2010).

The naming of places is an important aspect of the use, occupation, history and meaning of a landscape, as they act as links between physical landforms and cultural events passed down in oral traditions including myths, cultural histories and personal biographies (Armitage 2010). The Labrador Innu have many place names for topographic features situated throughout their traditional territory (INSIFN 2008). Armitage (2010) reports one known place of religious significance in Western Labrador, west of the town of Churchill Falls: *Patshishetshuanau*. This is the Innu place name for the physical landform of Churchill Falls on the Churchill River, which means “Where the Current Makes Clouds of Vapour”.

Other available information on Innu place names in Labrador does not contain any reference to other named sites in or near the LSA (Innu Nation and Sheshatshiu Innu First Nation 2008; Armitage 2010).

22.6 Summary

A review of existing and available information indicates that the Labrador Innu partake in many land and resource use activities for traditional purposes, including hunting, fishing and gathering. While some of these activities occur within Western Labrador generally (primarily along the TLH and other access roads), the review of available information did not identify any evidence of current land and resource use activities in or near the Project area. Alderon is likewise not aware of any future, planned land and resource uses that may occur within or near the Project area and which may therefore be affected.

Innu Nation databases and other available information describe cultural / spiritual sites and places, including birth, burial, death and gathering places, sites of religious and historical significance, and shaking tent ceremony locations. Again, the available information does not contain reference to any such sites or places within the LSA.

Finally, the proposed Project does not overlap with land areas that have been designated under the current Labrador Innu Land Claims AIP. Although it is recognized that the AIP is not legally binding and will form the basis for on-going treaty negotiations between Innu Nation and the provincial and federal governments, it does reflect the most recent information available regarding Labrador Innu land selection and the various land areas, types and associated rights which would be associated with an eventual Final Land Claims Agreement.

NunatuKavut Community Council

The NunatuKavut Community Council (NCC, formerly the Labrador Métis Nation) reports a membership of over 6,000 persons who reside primarily in southeastern and central Labrador and who are descendants of Inuit and Europeans who traveled to Labrador in the 1700-1800s (NCC 2012).

The NCC's membership live throughout Labrador and elsewhere, particularly in the communities along the southeast coast from Hamilton Inlet south to the Labrador Straits, including the towns of Cartwright, Charlottetown, Port Hope Simpson, St. Lewis and Mary's Harbour and the communities of Paradise River, Black Tickle-Domino, Norman Bay, Pinsent's Arm, Williams Harbour and Lodge Bay, as well as in Central and Western Labrador and elsewhere.

The NCC has asserted a land claim that covers much of Central and Southeastern Labrador – including the area of Western Labrador in which the proposed Project will occur - but this has not been accepted for negotiation by the federal or provincial governments. The NCC membership continue to rely upon the resources of the land, the water and the sea (NCC 2012), and are known to undertake land and resource use activities throughout Labrador.

Travel Routes and Camp Sites

Members of NCC travel on the land and sea by truck, snowmobile, boat, foot, dog-team, and snowshoes (LMN 2009; NCC 2010b). Travel along the TLH by automobile is currently the main mode of travel and for accessing land use areas. In addition, there is a network of snowmobile trails connecting North West River, Happy Valley-Goose Bay, Mud Lake and Churchill Falls with other communities in Labrador, including Labrador City-Wabush and Cartwright. The above mentioned trails / travel arteries are not used exclusively by NCC members, but rather by most Labrador residents.

Hunting and Trapping

In 1979, researchers produced a series of over 200 map overlays during fieldwork in Southeastern Labrador, showing harvesting activities extending from the Sandwich Bay region, south to Port Hope Simpson and Williams Harbour, and west to the area of the Paradise and Eagle rivers (Jackson 1983). The available information indicates that the traditional trapping territory of this group included the Churchill River Valley from the Kenamu River to Churchill Falls. Harvesting activities also extended from the Sandwich Bay region, south to Port Hope Simpson and Williams Harbour, and west to the area of the Paradise and Eagle rivers (LMN 2009). During research conducted in North West River in the early 1980s, respondents described trap lines expanding onto the "Height of Land", into what had been considered exclusive hunting grounds of the Innu during the period around the 1930s.

Currently, members of the NCC continue to hunt both large (e.g., caribou, moose and bear) and small (e.g., hare and porcupine) game in central and southeastern Labrador (NCC 2010a). Members of NCC rely on caribou, described as culturally significant to their people, as an important food source and have done so for generations. NCC members also hunt a variety of birds, including, grouse, ptarmigan, geese and migratory birds such as black ducks, in addition to trapping marten and other species. They also harvest marine mammals (NCC 2010b), such as seals, which provide income and meat (Martin 2009). One seal harvesting area was identified at a polynya near North West River (NCC 2010b).

NCC members harvest plants for traditional medicines, food, firewood and other purposes (Martin 2009; CCC 2010b). NCC members have identified the Canada yew as an important source of traditional medicine (LMN 2009), but have not identified specific locations where this plant or other medicinal plants are harvested in the available documentation.

Fishing

Atlantic salmon fisheries are an integral part of the NCC members' way of life. The current Atlantic salmon fishery has changed from the past, as the netting of salmon has become regulated (Martin 2009). The federal government has established a Communal Fishing License for NCC members under the *Fisheries Act* (Martin 2009). Data presented by the NCC (2010b) indicate that its membership fish throughout central and southeastern Labrador. Members of the NCC fish in a number of areas, including Happy Valley-Goose Bay, Grand Lake and its tributaries, Sebaskachu Bay and Sebaskachu River, Mud Lake, Traverspine River, the mouths of Caroline Brook, McKenzie River, lakes south of the Churchill River, including Annie Marie Lake, Minipi Lake and Dominion Lake. Fishing also occurs along the Goose River and in a number of lakes along the road to the head of Grand Lake. Members of NCC also fish in streams and lakes along the TLH, although the data reviewed did not specify specific streams or lakes.

Cultural / Spiritual Sites

No cultural or spiritual sites related to the NCC in the PDA or LSA are identified in the existing and available information.

NunatuKavut 2012 Land Use Study

In February 2012, Alderon and the NCC entered into an Agreement to gather and provide information from NCC members in Labrador West regarding their current land and resource use activities, as well as any questions or concerns regarding the Project and its potential effects for use in the EIS. This included surveys and mapping regarding the general nature and location of land and resource use activities within a regional area that included the Kami Project area in Labrador. The Final Report from this study is presented in Appendix L of this EIS, some of the key results of which are briefly summarized below.

The information collected through this 2012 study indicates that NCC members residing in Labrador City and Wabush currently undertake a variety of land and resource use activities throughout Western Labrador, including hunting, fishing, berry picking, camping and associated travel across the land. These activities occur throughout the Western Labrador region, including in areas adjacent to the communities themselves as well as at other locations along the TLH, railway and other existing roadways, near the Smallwood Reservoir and elsewhere (Figure 22.8).

In terms of current land and resource use activities and locations identified specifically by NCC members within or near the Project area (PDA) itself, survey participants indicated that fishing activity did take place in a number of local waterbodies including Long Lake, Mills Lake, Riordan Lake, Rectangle Lake and others, with some associated place names, camping locations and travel / trapping routes in the area as well (Figure 22.9).

The study report also concluded that “the total area for many of the species harvested was often wide ranging and the Kami Mine footprint area…made up a small portion of the total harvested land base”. No NCC cultural or spiritual sites were identified within the proposed Project area.

Summary

NCC members live and work in the Labrador West area, and currently undertake a number of recreational land and resource use activities throughout the region, including hunting, trapping, camping and general travel. As “traditional use” is, however, generally understood to mean activities that have been exercised (and are being exercised) by an identifiable Aboriginal community since before European contact or control of a specific area, these land and resource use activities may not be considered traditional in that they are not necessarily a continuation of ancestral activities that took place historically within this area of Western Labrador (although they do reflect local knowledge and use of the area). These current activities are, however, considered integrally within the overall assessment of current land and resource use in and near the Project area (Chapter 23).

Figure 22.8 NunatuKavut Land Use Study: Regional Land Uses

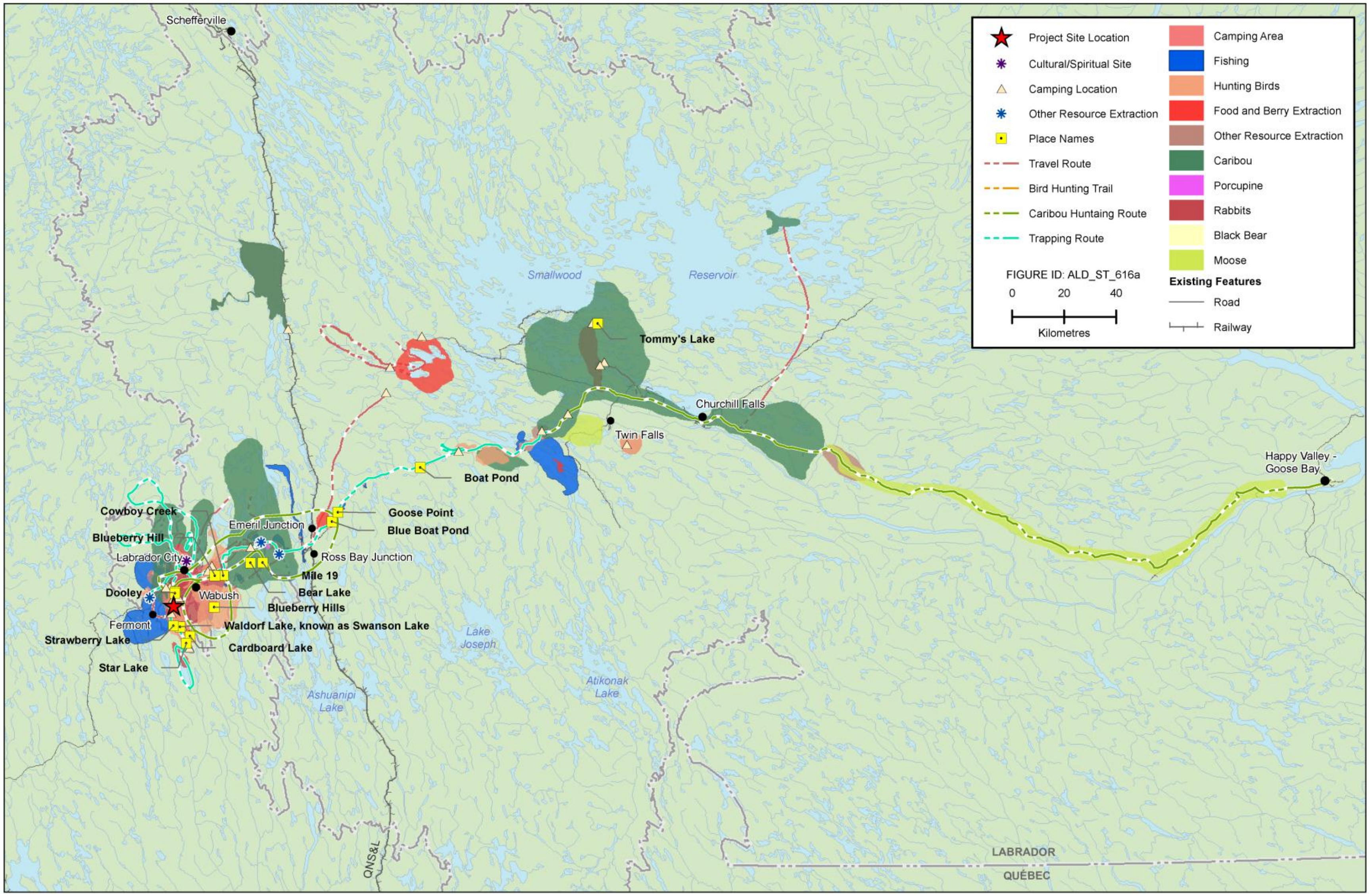
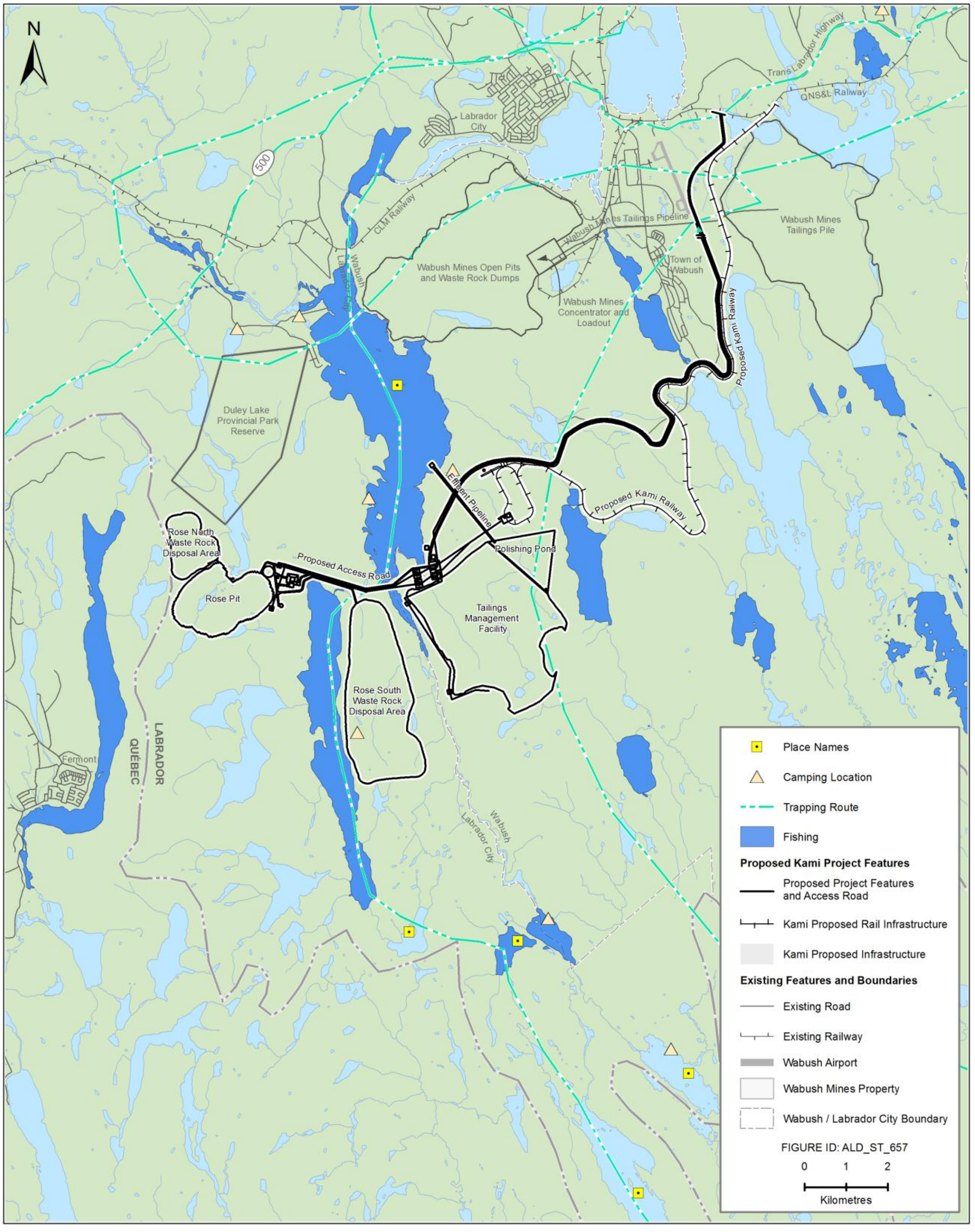


Figure 22.9 NunatuKavut Land Use Study: Land Uses in and Near the Project Area



Innu of Uashat mak Mani-Utenam (Québec)

The Innu of Uashat mak Mani-Utenam are the descendants of an Aboriginal population that has occupied parts of the Québec-Labrador peninsula for centuries. The traditional territory of this First Nation extended along the rivers from the coast of Québec's Lower North Shore into the Québec-Labrador interior as far as lakes Petitsikapau, Caniapiscau and Michikamau (Hydro-Québec 2007).

Traditionally, this group was involved in nomadic hunting, fishing and gathering. After spending the winter in their hunting grounds in the interior, families would return to the coast in spring, notably via the Sainte-Marguerite and Moisie rivers. Spring also signaled the beginning of waterfowl hunting and was followed by salmon fishing in June and July. During certain times in summer large gatherings were held, consisting of festivities, religious practices and, during the Historic Period, fur-trading. In fall, the Innu prepared to return to interior hunting grounds.

By the mid-1830s, the Innu became increasingly involved in commercial salmon fishing activities in a number of rivers along the Québec Lower North Shore, although over time they became progressively excluded from such activities by colonists who also placed increasing pressure on the various resources of the land and water upon which the Innu depended for subsistence and trade. By the late nineteenth century, this pushed many Innu families to begin to reside permanently on the coast (Castonguay, Dandenault et Associés 1999).

In 1906, the Uashat Reserve was founded at the mouth of the Sainte-Marguerite and in 1949 the federal government created a second reserve, the Maliotenam Reserve, at the mouth of the Moisie River (Hydro-Québec 2007). Although some individuals moved to the new reserve, approximately 50 Innu families refused to abandon their traditional gathering just outside Sept-Îles. In 1952, families living in Moisie West were forced to move to make way for construction of a radar station. Some families relocated to the newly established Maliotenam Reserve, while others relocated to Schefferville (CERANE 1990 in Castonguay et al. 1999). In 1966, the Uashat Reserve was integrated into the Sept-Îles development plan (Corporation Ashuanipi 2010).

The two First Nations reserves of the Uashat mak Mani-Utenam First Nation are located in the Sept-Îles area. Uashat is a 177 hectare reserve, located on the western outskirts of Sept-Îles, whereas the Mani-Utenam Reserve is located 16 km east of Sept-Îles and comprises an area of 527 hectares. The Uashat and Mani-Utenam Reserves constitute a single Band governed by a Band Council, Innu Takuaikan Uashat mak Mani-Utenam (ITUM) (Castonguay, Dandenault et Associés 1996; Corporation Ashuanipi 2010). In 2006, the *Corporation Ashuanipi* was created to represent Uashat mak Mani-Utenam and Matimekush-Lac John in their land claims negotiations.

The Innu of Uashat mak Mani-Utenam share their ancestral territory with the Innu of Matimekush-Lac John (see later sections), which stretches from the Québec Lower North Shore to north of Matimekush-Lac John, encompassing much of Western Labrador and Eastern Québec (see Figure 22.6) (Uashaunnuat et al. 2010). Traditionally, the Innu of Uashat mak Mani-Utenam used the Ste-Marguerite and Moisie rivers in their annual movements between coastal camps and inland hunting and trapping areas. Starting in mid or late summer, families would follow the Moisie River to the Nipissis River and then on to Lake Nipissis. They would then continue on to Lake Matinipi and west to Lakes Caophacho, Ashuanipi and Menihek, and disperse into smaller groups for hunting and trapping throughout the fall and winter (Castonguay et al. 1999). Following the goose hunt in spring, families would reunite at fixed locations and travel by canoe back to the coast.

Although the Innu of Uashat mak Mani-Utenam have indicated that they still engage in traditional activities such as hunting, trapping, and fishing within this large traditional territory, activities are mainly practiced along the coast of the St. Lawrence River, at the mouth of rivers and along the existing highway (Route 138) (Uashaunnuat et al. 2010). Data on current land use in Western Labrador by Innu from Uashat (Sept-Îles) suggests that travel and harvesting activities are strongly focused on the Ashuanipi River and Menihek Lake (Nalcor Energy 2010).

Hunting and Trapping

The Innu of Uashat mak Mani-Utenam hunt caribou and small game for subsistence and recreational purposes. Trapping - mainly for beaver and marten - is also practiced, although to a lesser degree in comparison to past times and other activities (Castonguay et al. 1996; Castonguay et al. 2006). Armitage and Stopp (2003) found that Innu from Uashat mak Mani-Utenam used the TLH to hunt caribou, porcupine, beaver, ptarmigan and other species found near the highway in Labrador.

Although the Innu have identified that the areas along the coast are currently used more frequently (Uashaunnuat et al. 2010), regular use of the QNS&L Railway by Sept-Îles Innu was noted during the 1980s (Tanner and Armitage 1986). Land and resource use during this time extended along the railway into Labrador and included the establishment of temporary tent camps and cabins. Armitage and Stopp (2003) indicate that Innu from Uashat mak Mani-Utenam and other groups on Québec's Lower North Shore use the TLH for hunting. Logging roads and access to the Sainte-Marguerite-3 Complex are also used to access the northern portion of the Sainte-Marguerite River basin by Innu hunters and trappers (Castonguay, Dandenault et Associés 1996).

The Saguenay Beaver Reserve (Sept-Îles Division) is part of a larger statutory beaver conservation regime which has been implemented in Quebec, beginning in the 1930s. The Saguenay Beaver Reserve was created unofficially in 1950 and then officially in 1954, through collaboration between the Governments of Canada and Québec, in order to protect beaver populations in the area by repopulating the territories of Côte-Nord and its hinterland and to control harvesting of this animal so as to maintain trapping as a key economic activity in the region.

The contemporary Quebec legislation which regulates trapping activities (including the licensing of trappers) in the various beaver reserves in the province does not confer title or other form of proprietary right to the lands within the administrative boundaries of the reserve (see Regulation respecting beaver reserves, C-61.1, r.28). Nor does this legislation, as it applies to the Saguenay Beaver Reserve, confer any exclusive trapping rights upon Aboriginal persons. While trapping privileges are enjoyed only by Aboriginal persons in many of the other beaver reserves in Quebec, both Aboriginal and non-Aboriginal persons may harvest furbearers in the various divisions of the Saguenay Beaver Reserve.

The Saguenay Beaver Reserve was established by the Government of Quebec without regard to the provincial border between that province and Newfoundland and Labrador and according to available information, approximately 40 trapping areas of the Saguenay Beaver Reserve (Sept-Îles Division) lie within Labrador (Figure 22.10). Specifically, the Project will be carried out in whole or in part in Lots 244 and 245 of the Saguenay Beaver Reserve, which are the subject of claimed interests by certain traditional families of Uashat mak Mani-Utenam. These two Lots are physically located entirely within Labrador and do not extend across the provincial border into Quebec. As a result, the Quebec legislation purporting to create reserves and to regulate trapping in those portions of the Saguenay Beaver Reserve located in western Labrador, including Lots 244 and 245, has no extra-territorial application or legal effect on activities carried out in Labrador. Up until the late 1960s, the Government of Newfoundland and Labrador issued permits to Québec residents allowing them to carry on their trapping activities in this area, although when the federal government subsequently recognized the Montagnais Band of Matimekush-Lake John this practice was discontinued.

A 1983 report produced by Québec's Ministère du Loisir, de la Chasse et de la Pêche (Department of Recreation, Hunting and Fishing) (MLCP 1983) concerning "hunting, fishing and trapping activities pursued by the Attikameks and the Montagnais" showed that only between 5 and 10 percent of the territory reserved for the Sept-Îles – Schefferville beaver reserve was frequented by the Montagnais. Beyond that date, there is no documented evidence of the use of the trapping area of this reserve.

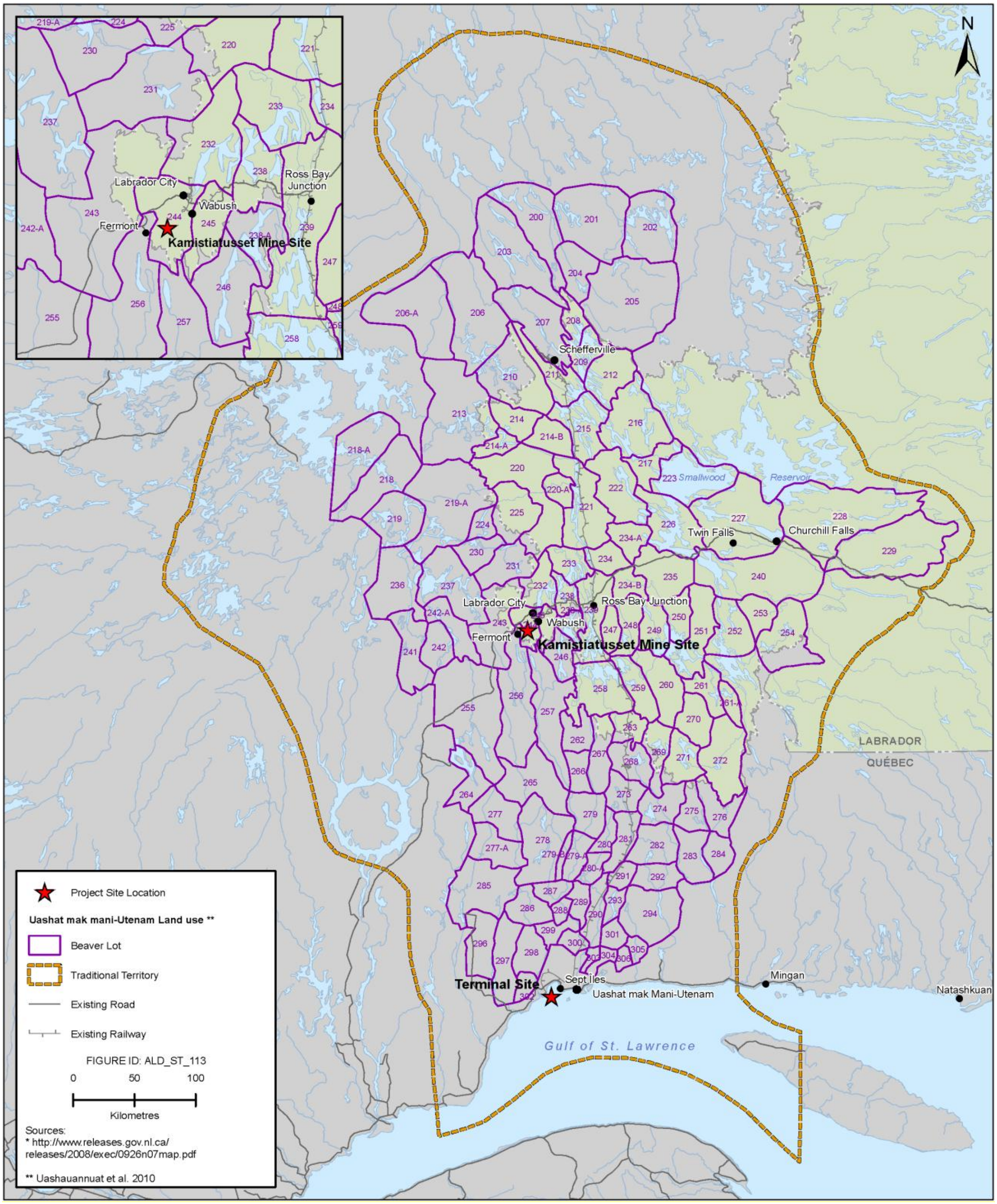
In particular, there is no existing and available information which indicates that there is any current use of land and resources for traditional purposes by Aboriginal persons in Lots # 244 and 245.

Camp Sites

The fund created as part of the 1994 agreement between Uashat mak Mani Utenam and Hydro- Québec as compensation for the construction of the Sainte- Marguerite- 3 station led to the establishment of new camps and snowmobile trails across the territory, which has somewhat increased land use. Castonguay, Dandenault and Associates (1996) identified several permanent and temporary campsites and chalets within the Sainte-Marguerite river basin distributed as follows: four permanent sites on Cousin Lake in beaver lots 302; one temporary site and one chalet on Brulé Lake on lot 298; one temporary site at Grad Portage on lot 286; and 14 chalets near the SM-2 dam.

Some 200 camps have been established over the territory since that time, with many of these sites located along a logging road running the length of the Sainte-Marguerite River, while others are located along the Tshiuetin Railway and snowmobile trailhead (Castonguay et al. 2006). The exact location of these camps was not indicated in the study, and thus it cannot be said where these occur within the RSA. The new camps have had the effect of increasing the frequency of trips into the interior for subsistence, social and recreational purposes. The permanent camps have also made it more common for entire families to go into the country for short periods (Castonguay et al. 2006).

Figure 22.10 Traditional Territory of the Innu of Uashat mak Mani-Utenam and Matimekush - Lac John and Beaver Lots



In addition to the family camps, four community camps have been established west of the Sainte-Marguerite River and one along the Moisie, and several new camps are planned, (Castonguay et al. 2006) the location of which was not indicated.

Fishing

The Innu of Uashat mak Mani-Utenam continue to fish along the coast and in the rivers within their traditional territory. Salmon fishing plays a significant role in Uashaunnuat culture (Castonguay et al. 1999), and the Moisie River is a prime fishing location for salmon and brook trout (Uashaunnuat et al. 2010).

In 1979, the Ministry of Hunting and Fisheries granted exclusive fishing rights for the purposes of subsistence to Innu at the mouth of the Moisie River (Castonguay et al. 1999). In 1980, the Québec Government created a zone d'exploitation controlée along a productive section of the lower Moisie River. The fishing rights granted to the Innu extend to three types of activities: salmon fishing with nets, trout fishing with nets, and salmon fishing with lines (Castonguay et al. 1999). Salmon fishing is subject to community quotas. Consultations held with local fishermen in 1998 reveal reductions in the salmon catch (Castonguay et al. 1999). Fish species harvested by the Innu of Uashat mak Mani- Utenam between 2000 and 2005 included pike, burbot, brook trout, sea-run brook trout, Atlantic salmon and lake trout (Castonguay et al. 2006).

Cultural / Spiritual Sites

Cultural and spiritual activities occur across the territory and are based on the traditions of hunting, fishing, trapping and gathering, as these practices are integral to the culture (Uashaunnuat et al. 2010). Cultural visits and stays are also sometimes organized for the purpose of transmitting traditional knowledge to young people (Castonguay et al. 2006).

Cousin Lake in the lower Sainte-Marguerite River basin reportedly represents an important spiritual site, as it is the location of a pilgrimage site built to honour Saint Anne. An altar holding a sculpted figure of the Saint was erected in the mid-1980s and is visited by some 100 to 150 community members per year (Castonguay et al. 1996). Each year, a special mass and community dinner is held at the site. Access to the site is through the Sainte-Marguerite-3 (SM-3) road.

Summary

The Innu of Uashat mak Mani-Utenam were involved in a tradition of seasonal migration, moving from their summer gathering sites at the mouths of the Sainte-Marguerite and Moisie rivers on Québec's Lower North Shore to the interior of the Québec-Labrador Peninsula to hunt caribou, geese and other game. Fishing, especially for salmon, continues to hold an important place in the culture. Although they have become more sedentary in recent times, the Innu continue to utilize of their traditional territories, especially in the southern region which is accessible from the Uashat and Maliotenam reserves. The creation and up-grading of the QNS&L Railway and SM-3 road have increased access to traditional hunting and trapping areas, while the establishment of snowmobile trails and new campsites has also encouraged more frequent visits.

Existing and available information indicates that there is no evidence of current land or resource use by the Innu of Uashat mak Mani-Utenam within the PDA or LSA. Alderon is likewise not aware of any future, planned land and resource uses that may occur within or near the Project area and which may therefore be affected. The available information also does not indicate that spiritual or other culturally significant sites or places are situated within the PDA or LSA.

Innu of Matimekush-Lac John (Québec)

The Québec Innu First Nation of Matimekush-Lac John reside on two reserves near Schefferville, Québec, approximately 200 km north of the Project area (Figure 22.1). The Matimekush Reserve is located on the shore of Lac Pearce and has an area of approximately 0.68 km^2, whereas the Lac John Reserve covers an area of about 0.23 km^2 and is located approximately 3.5 km from Matimekush and from the center of Schefferville. Currently, the Matimekush Reserve and Lac John Reserve are jointly administered by Conseil de la Première Nation des Innus de Matimekush-Lac John (CPNIMLJ). In 2005, the Corporation Ashuanipi was created to represent Uashat mak Mani-Utenam and Matimekush-Lac John in their land claims negotiations with the Governments of Canada and Québec. Negotiations were suspended in 2008 and the Corporation Ashuanipi has been dissolved.

The Innu of Matimekush–Lac John are likewise descendants of an Aboriginal population that has traditionally occupied much of the Québec-Labrador peninsula. The group shares strong cultural and familial ties to the Innu of Uashat mak Mani-Utenam, and followed a similar pattern of land use and harvesting. Traditionally, these Innu traveled to summer camps at the mouth of the Sainte-Marguerite and Moisie rivers to fish, trade and gather. With the establishment of fur-trading posts, they would also travel to the coast to trade with Europeans and visit mission stations (Charron 1994).

Because of the rarity of caribou in the interior and the closing of key trading posts in the interior in the late nineteenth century, many Innu moved seasonally to the coast and to the north. The late nineteenth century also signaled the expansion of mineral exploration activities in the Québec-Labrador interior, and eventually, the exploitation of vast iron reserves found in the area around Schefferville. In 1954, a railway connecting Schefferville and Sept-Îles was completed to transport ore to the coastal ports and in 1955 the town of Schefferville was incorporated (Charron 1994).

Due to the difficulty of sustaining a livelihood through trapping and hunting at that time, many Innu from Maliotenam moved to Matimekush in the Schefferville area to work on the railway or in the mines (Charron 1994). In 1956, concerns about water pollution caused by the Innu settlement prompted the Minister of Indian Affairs to try to persuade the group at Matimekush to relocate to Lac John. Some families agreed to move to the new site and were joined by Naskapi. Those who stayed in Matimekush were pressured to return to Maliotenam, but only a few did, despite threats of cutting off aid and health services to the community (Charron 1994).

In 1960, the Lac John Reserve was created by the Ministry of Indian Affairs and a reserve was established in Matimekush in 1968, albeit at a slightly different site. Houses were built on the new reserve in 1972 (Charron 1994). In 1973, the Minister of Indian Affairs recognized the Innu of Matimekush-Lac John as an autonomous band (Hydro-Québec 2010) whereas, prior to this, they had been considered part of the Innu of Uashat mak Mani-Utenam. The closing of the Schefferville mines in 1982 signaled the departure of most of the non-Aboriginal residents. In May 1998, land from the largely-abandoned town of Schefferville was reallocated to expand the size of the Matimekush Reserve.

The Innu of Matimekush-Lac John maintain many aspects of their traditional way of life and culture. Like many Aboriginal and other northern communities, hunting, fishing, trapping and other land and resource use activities form a key part of their food supply and overall culture. The ensemble of forest activities and traditions are called Innu Aitun (Hydro-Québec 2010). Along with the Innu of Uashat mak Mani-Utenam, the Matimekush-Lac John Innu claim ancestral use of the land indicated by Figure 22.6.

Travel Routes and Camp Sites

The traditional territory used for hunting, fishing and trapping is quite large, reaching from the Mistashipi River and Moisie River to the Bouleau, Sheldrake and Magpie rivers in the North (Charron 1994). The community also reportedly uses parts of the Churchill River (Charron 1994).

The CAM (1983) study indicated that travel routes were not documented and that the key routes were determined based on interviews. The railway and roads were the most popular departure points for travel, with the remainder of journeys being made by canoe, snowmobile, on foot and snowshoes. Most travel routes and campsites were located near the reserves, and none were shown as overlapping with the PDA or LSA (CAM 1983). Tanner and Armitage (1986) described land use by Innu from Schefferville in the area north of Menihek and Marble Lakes, and south along the railway line into Labrador. Clément (2009) recorded travel routes near Matimekush-Lac John. Gravel and dirt roads near Schefferville were also important routes, which were accessed by snowmobile, ATV or automobile depending on the season.

Clément (2009) also documented approximately 35 Innu place names for geographical features near Matimekush-Lac John. Approximately 15 Innu place names were recorded in Labrador near the Québec border, indicating traditional use of that area. Innu cabins were documented near Stakit Lake, and Wishart Lake in Labrador. In Québec, cabins were documented north-west of Schefferville, at Deanult, Ridge, Star, La Cosa and Vacher Lakes (Clément 2009).

Hunting, Trapping and Gathering

Travel routes and campsites are typically carried out in association with, and are therefore often indicative of, other land and resource use activities such as hunting and trapping. CAM (1983) identified hunting and trapping as important activities for sustaining the economy of the Innu of Matimekush-Lac John. The hunting and trapping activities of the Innu of Matimekush-Lac John up to 1982 were mainly located near the Reserves and in areas north and south of Schefferville (CAM 1983).

The CAM (1983) study confirmed that the caribou hunt began in early fall. This hunt preceded the winter caribou hunt, which happened more intensively during the months of February and March. Interviewees who participated in the CAM (1983) study identified sites located both north and south of Schefferville. George River caribou are present in the area north of Schefferville, and this area was therefore identified as a preferred region for hunting. At the time of the CAM (1983) study, the fall hunt was practiced by groups of hunters who usually travelled in the Schefferville area, along roads and their extensions. The regions around the Iron Arm, Petitsikapau and Attikamegen lakes are also areas that the hunters accessed by road and then by canoe to reach their hunting sites (CAM 1983). Clément (2009) indicated that big game hunting near Matimekush-Lac John was limited to caribou, as the Innu do not typically hunt black bear or moose.

Trapping also began in the early fall, when small animals such as hare, porcupine, partridge and beaver were harvested, and continued throughout the fall until January or February depending on the temperature. Harvesting sites were most often accessed by plane in the fall and snowmobile in the winter. Areas along the railway were the main locations where the Innu of Matimekush-Lac John trapped (CAM 1983). The leadership of Matimekush-Lac John have stated that more than 12 families have used trapping lots in Labrador (CPNIMLJ 2011), which are located around and to the south of the Reserve, and west of Churchill Falls. In 2008, the Innu trapped furbearers included beaver, mink, red fox, otter, marten, hare and muskrat. Porcupine was also taken, as well as geese and a number of species of duck (Clément 2009). Trapping is reportedly not as widespread among the Innu as it once was, but it is reportedly still carried out near Matimekush-Lac John. While beaver and muskrat were trapped for subsistence purposes, many furbearers are not eaten. Clément (2009) also discusses the use of these and other species for medicinal purposes.

The Innu of Matimekush-Lac John also harvest edible berries, plants used for medicinal purposes and firewood (Clément 2009). Berries are usually gathered from July to September, including cloudberries, blueberries, and cranberries. Berry and firewood gathering sites were also recorded in Labrador, near Stakit Lake and Ruth Lake. In Québec, plants were harvested near Lac John and Knob Lake, as well as near the lakes north-west of Schefferville.

Fishing

Fishing was found to occur mainly near the communities throughout summer, when many seasonal employees returned to work (CAM 1983). Net fishing was practiced by the Innu of Matimekush-Lac John during the fall, continuing throughout the winter and peaking in the spring. Current fishing locations are not detailed in the CAM study as fishing was not found to be a main activity for the group. One study participant mentioned that fish were plentiful, but fishing only took place when there was no other food available (CAM 1983). Clément (2009) found that fishing was practiced throughout the year, using a variety of gear. Increased fishing was noted as a recent change in land and resource use activities, along with decreased trapping and an increase in very short hunting trips near Matimekush-Lac John. Fish species harvested included pike, Atlantic salmon and brook trout, with Star Lake being identified as a popular trout fishing site.

Cultural / Spiritual Sites

There are few specific cultural and spiritual sites identified in the available literature. Clément (2009) identifies the Matimekush Reserve and the small lake (Matamekush-shipiss) nearby as an area of historical importance for the Innu. The lake is named for its abundance of brook trout, which saved several families from starvation (Clément 2009).

Clément (2009) also identified two religious sites near Schefferville. The Innu place name Shetan-shakaikaniss ("le Petit lac Saint-Anne") refers to Hope Lake, in Labrador, where a statue of Sainte-Anne was erected circa 1980. This area is a pilgrimage site on Saint Anne's Day for the Innu who cannot go to Sainte-Anne de Beaupré to celebrate the assembly of Aboriginal peoples in July of each year. The second place name is Tshitua-Mani-katshimisht meshkanau ("the road of the Holy Virgin"), which refers to the dirt road from Schefferville to Annabel Lake and Leroy Lake. The road is used extensively for hunting by the Innu. There is a statue of the Virgin Mary erected along this road, at Hameau Lake (Clément 2009). There are no known cultural or spiritual sites located within or near the PDA.

Summary

The Innu of Matimekush-Lac John share close ties with the Innu of Uashat mak Mani-Utenam. As with the Uashaunnuat, they have traditionally used and occupied a vast territory ranging over much of the Québec-Labrador Peninsula and down to the coast of the Lower North Shore. Evidence suggests that during the Historic Period, travel corridors used by these Innu overlapped with parts of the general region surrounding the PDA and overall LSA. By the 1980s, however, it appears that travel in the interior was greatly reduced, focusing on the area to the north of the communities of Labrador City and Wabush.

Although the Innu have adopted a more sedentary lifestyle during the twentieth century, traditional activities, including hunting, trapping and fishing continue to play a central role in the lives and culture of the Innu of Matimekush- Lac John, including the hunting of caribou and other wildlife, fishing, and other types of harvesting. No information was identified, however, to suggest current use of the PDA or LSA by the Innu of Matimekush-Lac John. Alderon is likewise not aware of any future, planned land and resource uses that may occur within or near the Project area and which may therefore be affected.

Naskapi Nation of Kawawachikamach (NKK, Québec)

The Naskapi reside on the Kawawachikamach Reserve, which is located approximately 15 km northeast Schefferville, Québec and approximately 240 km north of the Project area (see Figure 22.1). Information from the latest Indian Registry places the registered NKK membership at 703 as of March 2012, with 624 people living on the Kawawachikamach Reserve (AANDC 2012).

Archaeological evidence indicates that the Naskapi and their ancestors have utilized the northern part of the interior of the Québec-Labrador Peninsula for the past several thousand years (McCaffrey 1983). The wildlife resources of this area have historically been the cultural and economic basis for the Naskapi, with the George River caribou herd playing a particularly important role (Weiler 1992).

The name “Naskapi” was used by missionaries to refer to Aboriginal people in Québec and Labrador who were not integrated into the fur trade and “were not subject to [the government’s] jurisdiction, who could not be enumerated, or had not yet begun to settle down” (Cooke 1981; Armitage 1989). Traditionally, the Naskapi were a nomadic people who followed the migrations of the George River caribou herd across what is now northeastern Québec and northwestern Labrador (Weiler 1992). The Naskapi settled near Schefferville, Québec after several key factors altered their traditional land and resource use activities, including their increased participation in the fur trade (beginning in the 1800s) as well as twentieth century mining developments near the Québec-Labrador border (Weiler 1992). Currently, the Québec Naskapi reside in Kawawachikamach, established in 1984 under the provisions of the *Northeastern Québec Agreement* (NEQA) (NNK 2011b).

The *NEQA* outlines the NKK’s traditional territory within Québec, which encompasses much of northern Québec (NNK 2011b) (see Figure 22.7). Land and resource use occurs throughout the lands set out in the NEQA, although some travel routes and campsites have also been identified within Labrador, including in the Smallwood Reservoir area (Henriksen 1978). The Naskapi continue to practice many aspects of their traditional way of life and culture throughout portions of this overall region.

Travel Routes and Camp Sites

NNK members have established travel routes across northeastern Québec and in parts of Labrador. Weiler (1992) discusses two types of Naskapi resource harvesting: 1) individual and family activities, and 2) hunting and fishing trips arranged under a Hunter Support Program. Individual and family activities comprise the majority of NNK wildlife, plant and berry harvest, with the primary travel routes used by the NNK for such activities being along the TLH and the QNS&L Railway (Weiler 1992). Charter flights are also used for access to outpost camps (CAM 1982).

Weiler (2009) also describes two main Naskapi travel routes, which have remained relatively stable over multiple generations. These areas cover the whole of the traditional territory of the Naskapi from its northernmost limit at Ungava Bay to the central lake plateau around Attikamagen, Petitsikapau and Michikamau lakes in the south. The first route runs along the Howells River connecting Ungava Bay with the Ashuanipi region via the lower Koksoak, Caniapiscau, Goodwood rivers in the north and Menihek and Ashuanipi lakes in the south. The second route follows the Swampy Bay River and links the Ungava region via the lower Koksoak and lower Caniapiscau rivers with the Attikamagen-Petitsikapau lake plateau and ultimately Michikamau Lake.

Previous studies have indicated numerous smaller Naskapi camps near Schefferville (Weiler 1992). Weiler (1992) also illustrates that the most concentrated land and resource use by NNK members occurs within an approximately 30 km radius around Kawawachikamach during the summer, when roads are used, and within a 50 km radius during the winter when snowmobile trails are accessible. In a 2006 survey, Weiler (2009) documented several Naskapi camp sites which were located within the Howells River valley, situated near Kivivivic, Elross, Fleming and Stakit lakes. In Québec, a campsite was identified on the western shore of Lake Hameau.

Hunting and Trapping

Caribou were traditionally the primary resource harvested by the Naskapi (Harper 1964; NNK 2011b), who moved with the herd through its annual range extending across the Québec-Labrador Peninsula north to Ungava Bay and south to the Churchill River (Henriksen 1978). In the past, some of the best caribou harvesting areas were located between Border Beacon and Lake Mistastin, east and northeast of Indian House Lake, and just north of Border Beacon, and in the early 1960s the Naskapi hunted north of Churchill Falls (Henriksen 1978). One of the most important cultural activities was *mushan*: a feast of caribou focused on communal food sharing (Speck 1977).

Weiler (2009) recorded three key areas for caribou hunting during the period of IOC operations at Schefferville between 1954 and 1982. These include the area between Schefferville and Howells River in Labrador, the area west of Howells River, and in the area of Attikamegen Lake in Labrador, and the series of lakes to the northwest of there. Occasional harvesting of black bears and moose by members of the NNK has also been documented. Weiler (1992) also found that the main small game species harvested by the Naskapi were ptarmigan and snowshoe hare, while the main animals harvested for fur by NNK members were marten, arctic fox, red fox, mink, lynx, otter, muskrat and weasel. Beaver are only present (and harvested) in the southern portion of NNK territory. Henriksen (1978) described how NNK members also harvested ptarmigan in winter, while spruce grouse were harvested year-round. Weiler (1992) indicated that waterfowl, including geese, black duck, oldsquaw and others were also harvested. Trapping may be combined with other hunting and fishing activities (Henriksen 1978).

Fishing

Fishing is reportedly an important year-round activity for NNK members (Weiler 1992, 2009), with most fishing conducted at large lakes (Weiler 1992). Weiler (2009) identified the Attikamagen Lake region as a frequently used area for fishing, as well as the Swampy Bay River basin and Howells River, and the lakes along it. According to Weiler (1992), the main species caught are lake trout, two species of whitefish, two species of suckers, brook trout, pike and ouananiche. In addition, speckled trout are harvested from streams (Weiler 1992). Methods used for harvesting fish include: nets, angling and ice-fishing (Speck 1977; Weiler 1992). Historically, winter fishing was uncommon, since the focus during this season was on caribou hunting; however, studies have found that winter fishing has become more common (Henriksen 1978; Weiler 1992).

Cultural / Spiritual Sites

The Naskapi have identified a number of culturally significant areas within their traditional territory (Harper 1964), one of which was at Indian House Lake in Québec where they would meet for the fall migration of the George River Caribou Herd (Henriksen 1978). Another culturally significant area was described by Tanner (1947) as the sacred area of Deer Mountain, which is also near Indian House Lake.

The Naskapi Toponymy Project is designed to assign traditional Naskapi place-names to geographic features and link them to Naskapi history. The NNK has produced a collection of Naskapi legends and stories as told in the 1960s and since the 1990s (NNK, undated). This collection is a product of the Naskapi Traditional Knowledge Project and has been used to educate youth on the Naskapi way of life on the land (NNK, undated). The NNK are compiling a database of Naskapi place names, building on the work of Paré (1990), the results of which are not currently available (NNK 2010).

Summary

The Naskapi traditionally followed the migration patterns of the George River caribou herd across the Québec-Labrador Peninsula. After they began to reside in the Schefferville area more permanently during the twentieth century, Naskapi land and resource use activities focused increasingly upon adjacent areas. Land and resource use activities such as hunting, trapping and fishing remain important for the culture and economy of the NNK, whose members continue to pursue these activities near Kawawachikamach, along the TLH and QNS&L Railway, and occasionally at outpost camps. None of the identified existing and available information indicates any current land or resource use activities or the presence of any sites or places of cultural / spiritual significance within or near the PDA. This was further reinforced in the information and comments received during Alderon engagement activities with the NNK, through which it was confirmed that the Naskapi do not currently use the Project area of other parts of Western Labrador (Section 22.1). Alderon is likewise not aware of any future, planned land and resource uses that may occur within or near the Project area and which may therefore be affected.

22.7 Assessment of Project-Related Environmental Effects

Land and resource use activities may be affected by development projects both directly and indirectly. Direct effects occur where established activities are disturbed or otherwise interfered with by project-related components or activities during their construction or operations phases (e.g., reduced access to harvesting areas; avoidance or reduced use of areas due to project-related disturbances such as increased human presence, noise, dust; increased competition for land and resources with other local residents, etc.). Indirect effects to such activities can also occur when projects adversely affect vegetation, fish or wildlife, where such biophysical effects reduce the availability and/or quality of such resources and thus, their use and enjoyment for traditional purposes. In both cases, these direct and/or indirect effects may translate into a decrease in the overall quality and cultural value of these traditional activities by Aboriginal persons and communities.

Again, therefore, the environmental effects assessment for the Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons VEC is focused on the following potential environmental effects:

- Change in Activity Distribution (location and/or timing);
- Change in Overall Activity Levels; and

- Resulting Change in Overall Quality and Cultural Value of the Activity.

22.7.1 Change in Activity Distribution (Location and/or Timing)

The Project will result in changes in the accessibility of particular sites within the PDA for defined periods within the Project's construction and operations phases, due to required site access restrictions for safety reasons. It will also potentially affect such activities through the alteration of the natural landscape following the development of the various Project components and other associated activities within the Project "footprint" as well as, potentially, within the larger zone of influence of the various Project-related disturbances (noise, dust, visual intrusions), should Aboriginal land and resource users currently utilize these areas and choose to alter their use patterns to avoid them during one or more phases of the Project.

Construction

Construction activities for the Labrador components of the Project will initially occur over an approximately two year period (with further construction in Phase 2 as required), and will include the following:

- Movement of equipment, materials and personnel to, within and from the site;
- Mobilization and installation of required construction infrastructure;
- Site preparation (including vegetation clearing, grubbing and excavation as required);
- Establishing site buildings and other components and facilities such as access roads, the rail infrastructure, transmission lines, associated watercourse crossings, the TMF, etc.);
- Installation of associated systems, equipment and utilities, and
- Project commissioning.

Initial Project site preparation and development activities will include the clearing of vegetation, stripping and grubbing, excavation, filling, infrastructure and equipment installation, and other activities which will have associated "footprints" and which will therefore essentially remove certain land areas from use for other purposes (see Chapter 2 and associated Figures) as well as affecting certain landforms and other topographic features within the PDA.

Access restrictions will also be implemented progressively throughout the PDA as required, including for the eventual footprint of the open pit, TMF, waste rock disposal areas, and buildings and associated infrastructure (including the conveyor). These restricted-access zones are necessary for public safety and operational reasons, and once established, many will remain in place throughout the life of the Project. A gate and guardhouse will be installed on the access road which will restrict access to the Project site. In other areas, such as those associated with the construction of the site access roads, the power line, stream crossings, and much of the rail line, temporary access restrictions will be required during active construction periods. Eventually, overall access to the Project site will be by means of a new access road that will extend south from the TLH to the Project area.

In addition to the direct "footprint" of the Project and associated site access restrictions, the construction phase of the Project will result in other types of disturbances, such as those associated with air emissions (including dust and construction equipment exhausts), noise, light, vibrations, potential sedimentation of watercourses, the visibility of Project equipment and physical works, and other potential emissions and related disturbances. Detailed modeling and analysis of the nature, magnitude and spatial and temporal distribution of the potential air and water emissions, noise, vibration and light that may be associated with the Project has been presented in Chapters 14 and 16, and a viewshed analysis is presented in Chapter 23. These analyses have indicated that these construction-related disturbances will occur intermittently and/or over a relatively short time period (2 years of initial construction, with a possible Phase 2 overlapping with Project operations), and will have a limited geographic zone of influence. The various environmental effects mitigation measures outlined in these other VEC chapters will further serve to avoid or reduce any Project-related disturbances or effects that could potentially have implications for land and resource use in the region.

As indicated in the preceding Section 22.5 (Existing Environment), existing and available information in current land and resource use activities and patterns amongst the various Labrador and Québec Aboriginal communities and groups under consideration does not indicate that current activities occur within the LSA itself (and particularly, with the PDA), or especially that this area comprises an important or core use area within which any group carries out its known land use and harvesting activities. In all cases, other areas of Labrador and/or Québec (within the RSA) have been documented as being considerably more important for the current land and resource use activities of each of the groups under consideration, and in no cases are their known sites of historical, cultural or spiritual importance to either group within the PDA or LSA (Chapter 21).

As noted previously, indirect effects to traditional land and resource use activities can also occur where projects adversely affect vegetation, fish or wildlife, where such biophysical effects reduce the availability and/or quality of such resources and thus, their use and enjoyment for traditional purposes. The potential implications of the Project for vegetation, fish, wildlife and other resources have been assessed in detail in the associated, earlier biophysical VECs, which concluded that the Project will not likely cause significant adverse environmental effects on any aspect of the biophysical environment. This, in combination with the fact that key resources (such as caribou) are not found in the area and/or likely to be affected, as well as the resulting and above described lack of known Aboriginal land and resource use in the PDA and LSA at present, will likely mean that there is little or no potential for consequent effects on the traditional use of these resources.

As a result, and based on the information available to Alderon for use in this EA, the construction phase of the Project is not likely to have any effect upon the distribution (location or timing) of the current use of land and resources for traditional purposes by Aboriginal persons.

Alderon will, however, continue to consult with relevant Aboriginal communities and organizations in Labrador and Québec through established and/or informal engagement processes, which will include the provision of Project information and updates on on-going and planned activities, as well as discussion of any issues and potential means of addressing them.

Operation and Maintenance

Once the construction phase of the Project is completed and its various components have been commissioned, the operations phase of the Project will commence. The current Project schedule indicates that this phase of the Project will commence in late 2015 (pre-production), and extend to approximately 2033.

Although the operations phase of the Project will not result in significant additional ground disturbance and access restrictions from those which were implemented and completed during construction, Project operations and maintenance activities will entail open pit mining (drilling and blasting, mineral loading and transportation, waste rock disposal), mineral processing and associated support activities (tailings management, water management, equipment use, railway operations, fuel handling, inspection and maintenance work). Project areas will continue to have associated public access restrictions for safety and operational purposes, which will remain in place throughout the life of the Project. A portion of the site access road will be available for public use, and the rail line does not cross or otherwise interfere with the access road network in the region. The operations phase of the Project will also result in other types of disturbances, such as those associated with air emissions (dust, engine exhausts) noise, light, vibrations, the visibility of Project infrastructure and activities, other potential emissions and related disturbances, for which detailed modeling and analysis have been presented in other sections of this EIS (Chapters 14, 16, 23). These analyses have also indicated that these emissions and associated disturbances will have a limited geographic zone of influence.

In summary, therefore, many of the sorts of issues and potential implications of Project operations on land and resource use activities essentially represent a continuation of those which occurred during the construction, albeit over a longer time period. Again, the various environmental effects mitigation measures outlined in these other VEC chapters will further serve to avoid or reduce any Project-related disturbances or effects that could potentially have implications for traditional land and resource use in the region.

Given that the PDA and larger LSA are not known to currently be used for traditional land and resource use activities by Aboriginal persons (with other areas of the RSA known to be much more important and extensively used) or to contain known sites of historical, cultural or spiritual importance, as well as the relatively small size of the Project area and its environmental zones of influence, the operations phase of the Project is not likely to have an effect upon the location or timing of the current use of land and resources for traditional purposes by Aboriginal persons. Again, Alderon will continue to consult with relevant Aboriginal communities and organizations in Labrador and Québec throughout the life of the Project (through established and/or informal engagement processes), which will include the provision of Project information and updates on on-going and planned activities, as well as discussion of any issues and potential means of addressing them.

Decommissioning and Reclamation

Once operations activities cease at the end of the mine life, the decommissioning and reclamation phase of the Project will commence, as described in detail in Section 2.6.3. Progressive rehabilitation involves rehabilitation that is completed, where possible or practical, throughout the mine operation stage and prior to closure (as described above). Closure rehabilitation involves measures undertaken after mining operations, in order to restore or reclaim the property as close as reasonably possible to its pre-mining condition. This could include demolition and removal of site infrastructure, revegetation, and any other activities required to achieve the requirements and goals detailed in the required Rehabilitation and Closure Plan. Upon completion of the closure rehabilitation activities, a period of "post-closure monitoring" is then required to ensure that the rehabilitation activities have been successful in achieving the prescribed goals.

Site decommissioning will include removal of all site buildings, roads, and rail, contouring of waste rock disposal areas, and re-vegetation of these areas and the TMF. Although there will be access restrictions while decommissioning and rehabilitation are on-going, these activities will ultimately lead to restoration of public access across most of the PDA. One feature of the mine site that will not be fully rehabilitated is the open pit. During decommissioning a barrier will be erected around the pit and safety signs will be installed. Decisions on whether and how to deactivate and reclaim site access roads, or to potentially keep these or a portion of them in place for future public access, will be made by Alderon as part of the development of its eventual rehabilitation and closure plan, in consultation with applicable regulatory authorities and relevant Aboriginal groups.

For the most part, however (and pending the eventual development and approval of the required Rehabilitation and Closure Plan for the Project), the Project area will become progressively available to land and resource users, including any Aboriginal persons who may choose to do so. Again, it is likely that Project related permitting will require a program of environmental monitoring at the site to monitor compliance with regulatory guidelines and standards, and which will therefore help to evaluate the future suitability of local lands and resources for such activities over time.

Effects Management / Mitigation Measures

The consideration of environmental issues from the earliest stages of Project planning and design has been an integral part of Alderon's approach to its proposed Project. This approach allows potential environmental issues and interactions to be identified early, so that they can be considered and addressed in a proactive manner through appropriate Project planning and design. The objective is to attempt to avoid adverse environmental effects where possible and practical, or at least, to put in place mitigation measures to ensure that they are maintained at acceptable levels.

The following activities and considerations have been integrated into Project planning and design to attempt to avoid or reduce the effects of the Project on land and resource use (by Aboriginal and non-Aboriginal persons):

- Meetings, discussions and correspondence with Aboriginal communities and organizations (See Chapter 10), to provide Project information and to seek to better understand each group's use of and interest in the Project area;
- The offering (and implementation where accepted and agreed) of Aboriginal engagement processes with relevant groups in Labrador and Québec, including processes for the collection of information on current land and resource use, traditional knowledge and issues scoping (with associated funding and resources);
- The identification, review and analysis of existing and available information on Aboriginal land and resource use activities, in order to consider this early in and throughout Project planning and design; and
- Progressive rehabilitation during operation and maintenance to ensure that access will be available upon closure of the mine.

In addition to Project design mitigation, the following effects management measures will be implemented:

- Alderon and its contractors will establish and enforce a no hunting and fishing policy for all on-site Project personnel, to avoid any associated effects of fish and wildlife resources and reduce any associated competition for lands and resource with non-residents;
- Alderon and its contractors will comply with any relevant benefits agreements provisions; and
- Alderon will continue to consult with relevant Aboriginal communities and organizations in Labrador and Québec throughout the life of the Project (through established and/or informal engagement processes), which will include the provision of Project information and updates on on-going and planned activities, as well as discussion of any issues and potential means of addressing them (See Alderon's Aboriginal Relations Policy, Section 1.1.1).

In addition, the various environmental effects mitigation measures outlined in these other VEC chapters will further serve to avoid or reduce any Project-related disturbances or effects that could potentially have implications for land and resource use in the region.

Characterization of Residual Effects

In general, any Project components or activities that result in possible restricted access to an area, ground disturbance, interactions with waterbodies, possible emissions to the atmospheric, aquatic or terrestrial environments, or other disturbances (presence of workers and equipment; associated noise, dust or visual intrusions) have the potential to (directly or indirectly) affect the location and/or timing of local land and resource use activities.

The Project will result in changes in access to particular sites within the PDA for defined periods within the Project's construction and operations phases, due to required site access restrictions for safety reasons. It will also potentially affect such activities through the alteration of the natural landscape following the development of the various Project components and other associated activities within the Project "footprint" as well as, potentially, within the larger zone of influence of the various Project-related disturbances (noise, dust, visual intrusions).

Although these types of footprints and localized disturbances will certainly occur as a result of Project construction and operations, existing and available information on current land and resource use activities and patterns amongst the various Labrador and Québec Aboriginal communities and groups under consideration does not indicate that traditional activities occur within the PDA or LSA,. In all cases, other areas of Labrador and/or Québec have been documented as currently being much more important for the traditional land and resource use activities of each of the groups under consideration, and in no cases are their known sites of historical, cultural or spiritual importance to either group which may be adversely affected by the Project. Moreover, the Project is not likely to result in significant adverse effects to vegetation, fish or wildlife resource themselves.

As a result, and based on the information available to Alderon for use in this EA, the Project is not likely to adversely affect the location or timing of the current use of land and resources for traditional purposes by Aboriginal persons.

Any residual environmental effects resulting from decommissioning and reclamation will be both positive and adverse. Although there will be continued restrictions in access during decommissioning and reclamation activities, the goal of this phase is to prepare the environment to return to a pre-Project state, including providing access to the site for land and resource use purposes. The open pit will remain however, and restrictions on access to this site will remain in place for safety reasons.

Again, Alderon will continue to consult with relevant Aboriginal communities and organizations in Labrador and Québec through established and/or informal engagement processes, which will include the provision of Project information and updates on on-going and planned activities, as well as discussion of any issues and potential means of addressing them.

22.7.2 Change in Overall Activity Levels

In addition to possible changes in the distribution of land and resource use activities, Project components and activities may also have the potential to affect overall levels of participation in such activities by Aboriginal persons and groups. This may result from a real or perceived decrease in the availability or quality of land and resource use opportunities, such as through changes in the land and resource base available for such activities (due to restricted access to preferred harvesting locations; reduced resource availability due to biophysical effects; increased competition for resources), or an associated increase in the cost, time or effort required to access alternative areas. It may also occur as a result of a decrease in the time available to partake in such traditional activities.

This section examines the potential effects of the Project on overall levels of land and resource use by Aboriginal communities and organizations. Each of the Project's phases are discussed here in a common section, given that relevant Project elements and potential issues and interactions are quite similar between these. Any important differences are also highlighted as relevant.

The potential for direct interaction between the Project (construction, operations, decommissioning and closure phases) and Aboriginal land and resource use activities were assessed in some detail in the preceding section. As indicated, the Project will result in changes in access to particular sites within the PDA for defined periods within the Project's construction and operations phases, as well as alter aspects of the natural landscape and create various Project-related disturbances (noise, dust, visual intrusions) within and surrounding the Project area itself. However, existing and available information does not indicate that Labrador and Québec Aboriginal communities and groups currently undertake traditional land and resource use activities within the LSA itself, or especially, that this area comprises a particularly important or core use area for any group. The total area which will be affected by the Project will represent a relatively small portion of the land area available for such activities in the RSA. Also, there are no known sites of historical, cultural or spiritual importance to either group (Chapter 21), and the Project is not likely to result in significant adverse effects to vegetation, fish or wildlife resources themselves.

As a result, and based on the information available to Alderon for use in this EA, the Project is not likely to adversely affect the location or timing of the current use of land and resources for traditional purposes by Aboriginal persons, and is therefore also not expected to have any associated effect on the overall type and level of such activities by Aboriginal persons and groups.

In addition to these "spatial" considerations regarding the location and availability of land and resources for such activities and the geographic extent of Project-related disturbances, traditional activity levels may also be affected by any overall decrease in the amount of time available for undertaking these by Aboriginal persons and communities.

Traditional land and resource use activities continue to comprise an important and integral part of the lives and cultures of Labrador and Québec Aboriginal persons and communities (Section 22.5). Notwithstanding changes in the nature, location and timing of traditional land and resource use activities over recent decades, harvesting and other cultural activities continue to be undertaken during specific time periods of the year, such as the seasonal caribou hunts, in-country retreats, and others. The increasing participation of Aboriginal peoples in development projects and other aspects of the wage economy can, however, also at times present challenges for their ability and availability to participate in certain traditional activities.

On the one hand, the work locations and times (schedules and rotations) that are often associated with the construction and operations phases of large scale resource development projects often result in extended periods away from the community, during which work commitments may interfere with traditional activities and other cultural pursuits. On the other, the typical work rotations (comprised of several weeks on and then several weeks off) that are often associated with such projects (see Chapter 2) may also be somewhat more conducive to participating in such activities. This may be even further facilitated by the employment income that is associated with project-related work, which can aid in the purchase of required equipment and supplies (Hobart 1984; Myers and Forrest 2000; BHP 2012).

In its on-going and planned discussions with Aboriginal groups related to the Project, Alderon will continue to assess potential time-related issues which may affect the ability of Aboriginal employees to participate in traditional activities, as well as exploring possible measures to address this. This may include, for example, possible alternative work rotations and/or cultural leave provisions for Aboriginal workers during particular times of the year to allow for their participation in such activities. Alderon will also plan and implement cultural activities in the workplace, which will be further defined and implemented in consultation with Aboriginal groups. No changes in overall activity levels are therefore anticipated.

22.7.3 Resulting Change in Overall Quality and Cultural Value of the Activity

As noted above, participation in traditional land and resource use activities is an important and integral aspect of the lives and socio-cultural fabric of Aboriginal people and communities. Of particular interest and relevance, therefore, is whether and how any Project-related disruption of these traditional activities may in turn affect their overall quality and cultural value to the Aboriginal groups under consideration.

As indicated in the preceding analyses, although the Project will (during its various phases) affect the nature and use of specific land areas and resources, through both its direct 'footprint" and associated disturbances, the existing and available information does not indicate that Labrador and Québec Aboriginal communities and groups currently undertake traditional land and resource use activities within the PDA or LSA itself, or especially, that this area comprises a particularly important or core use area for any group. Again, the total area which will be affected by the Project will represent a relatively small portion of the available land area available for such activities in the overall RSA, and there are no known sites of historical, cultural or spiritual importance to either group within the LSA. As a result, the Project is not likely to adversely affect the location or timing of the current use of land and resources for traditional purposes by Aboriginal persons, nor the overall level of participation in such activities by Aboriginal persons and groups. The various mitigation measures outlined above and throughout this EIS, in combination with Alderon's on-going engagement with Aboriginal groups throughout the life of the Project, will serve to even further avoid or reduce the potential for any such adverse effects.

No associated and consequent decrease in the overall quality or underlying cultural value of the current use of land and resources for traditional purposes by Aboriginal persons is therefore anticipated during either phase of the Project.

22.7.4 Summary of Project Residual Environmental Effects

The anticipated residual environmental effects of the Project on the Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons are summarized in Table 22.5.

Again, given that the proposed project area (PDA) and LSA are not known to currently be used for such traditional land and resource use activities by either of the Labrador and Québec Aboriginal groups under consideration, the Project is not expected to adversely affect this VEC, including each of the main potential issues that were identified and upon which the associated effects assessment has focused, namely:

- Change in Activity Distribution (Location and/or Timing);
- Change in Overall Activity Levels; or
- Resulting Change in Overall Quality and Cultural Value of the Activity.

The results of this assessment therefore indicate that there will not likely be a residual adverse effect upon this VEC as a result of the Project.

The mitigation and consultation measures outlined in this VEC and elsewhere in the EIS have been put forward in order to further avoid or reduce any such adverse effects.

22.8 Assessment of Cumulative Effects

Traditional land and resource use activities have and continue to comprise an important and integral part in the lives and cultures of Labrador and Québec Aboriginal persons and communities (Section 22.5). Although the traditional way of life of some groups that reside in and use the region continued until approximately the mid-20th century, the settlement of Aboriginal peoples into communities and the beginning of a more sedentary lifestyle, along with past development activities within their traditional territories and increased road and railway access (and the resulting concentration of much land and resource use along these right of ways), has considerably influenced the nature, intensity and distribution of traditional land and resource use activities by Aboriginal groups in Labrador and Québec in recent decades. That being said, however, these Aboriginal people have continued to carry out such activities and to maintain and preserve these traditional pursuits as a vital aspect of their current societies and cultures.

Table 22.5 Summary of Project Residual Environmental Effects

Project Phase	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Frequency	Duration	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	
Change in Activity Distribution (Location and/or Timing)											
Construction	• On-going engagement with Aboriginal communities and organizations. • No hunting and fishing policy for on-site Project workers. • Progressive rehabilitation.	N	-	-	N	-	-	D	N	H	On-going engagement with Aboriginal communities and organizations.
Operation and Maintenance		N	-	-	N	-	-	D	N	H	
Decommissioning and Reclamation		N	-	-	N	-	-	D	N	H	
Change in Overall Activity Levels											
Construction	• On-going engagement with Aboriginal communities and organizations. • Possible work rotations / cultural leave provisions and cultural activities in the workplace.	N	-	-	N	-	-	D	N	H	On-going engagement with Aboriginal communities and organizations.
Operation and Maintenance		N		-	N	-	-	D	N	H	
Decommissioning and Reclamation		N		-	N	-	-	D	N	H	
Resulting Change in Overall Quality and Cultural Value of the Activity											
Construction	• On-going engagement with Aboriginal communities and organizations.	N	-	-	N	-	-	D	N	H	On-going engagement with Aboriginal communities and organizations.
Operation and Maintenance		N	-	-	N	-	-	D	N	H	
Decommissioning and Reclamation		N	-	-	N	-	-	D	N	H	

Project Phase	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Frequency	Duration	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	

KEY

Direction:
P Positive.
A Adverse.
N Neutral (or No Effect).

Magnitude:
L Low: affects a small group of users.
M Moderate: affects less than the majority of users across multiple activities.
H High: affects the majority of land and resource users across multiple activities.

Geographic Extent:
S Site: includes PDA and 200 m beyond.
L Local: LSA.
R Regional: RSA.

Frequency:
N Not likely to occur.
O Once: Occurs once.
S Sporadic: occurs sporadically.
R Regular: occurs on a regular basis.
C Continuous.

Duration:
S Short-term: construction phase only.
M Medium-term: continues through operation and maintenance phase.
L Long-term: continues beyond operation and maintenance.
P Permanent.

Reversibility:
R Reversible.
I Irreversible.

Environmental or Socio-economic Context:
U Undisturbed: Area relatively or not adversely affected by human activity.
D Developed: Area has been substantially previously disturbed by human development or human development is still present.

Significance:
S Significant.
N Not Significant.

Prediction Confidence:
Based on scientific information and statistical analysis, and effectiveness of mitigation or effects management measure
L Low level of confidence.
M Moderate level of confidence.
H High level of confidence.

N/A Not Applicable.

As indicated in the preceding analyses, although the Project will, during its various phases affect the possible characteristics and use of specific land areas and resources, through both its direct 'footprint" and associated construction and operational disturbances, existing and available information does not indicate that Labrador and Québec Aboriginal communities and groups currently undertake traditional land and resource use activities within the PDA or the LSA itself, or especially, that this area comprises a particularly important or core use area for any group. Again, the total area which will be affected by the Project will represent a relatively small portion of the land area available for such activities in the overall RSA, and there are no known sites of historical, cultural or spiritual importance to either group that may be affected. As a result, the Project is not likely to adversely affect the location or timing of the current use of land and resources for traditional purposes by Aboriginal persons, nor the overall type and level of such activities by Aboriginal persons and groups. No associated and consequent decrease in the overall quality or underlying cultural value of the current use of land and resources for traditional purposes by Aboriginal persons is therefore anticipated during either phase of the Project. The various mitigation measures outlined above and throughout this EIS, in combination with Alderon's on-going engagement with Aboriginal groups throughout the life of the Project, will serve to even further avoid or reduce the potential for any such adverse effects. The proposed Project will therefore contribute very little – and likely, not at all – to any cumulative effects to this VEC within the RSA.

Other on-going and proposed projects and activities within the LSA may, to varying degrees, interact with and affect the Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons within this overall region. The existing and long-standing mining operations at IOC and Wabush Mines in Western Labrador and associated infrastructure and activities at the Port of Sept-Îsles Québec have been on-going for decades, and these areas therefore likely see little if any current use by Aboriginal people. Any future proposed expansions to these facilities and operations may interact with Aboriginal communities and their activities, depending on their location, nature and scale. Recent and proposed mining developments in the Schefferville area will occur in relatively close proximity to, and within and adjacent to the areas used by, the Matimekush - Lac John First Nation and the Naskapi Nation of Kawawachikamach. It is understood that the proponents of these projects have on-going consultation initiatives and Benefits Agreements in place with these and other groups, to address potential issues and provide associated benefits. Similarly, the Labrador Innu are involved, through their associated Benefits Agreement with Nalcor Energy, in the proposed Lower Churchill Project.

Again, the proposed Project is not likely to interact with or affect (and especially, to have significant adverse effects on) the Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons. Although each of the other projects and activities referenced above and listed in Table 22.6 will take place within the RSA, and to varying degrees, have implications for such activities by Aboriginal people, the total area covered and affected by these projects is still relatively small given the overall size of the RSA and the overall and core areas used by each group. This in combination with the mitigation measures being proposed by Alderon and those being implemented by other proponents (including consultation initiatives and in some cases, benefits agreements) will therefore mean that the Project will not likely result in significant adverse cumulative environmental effects in combination with other projects and activities that have been or will be carried out.

Table 22.6 Summary of Potential Cumulative Effects to Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons

VEC Existing Condition (Past & On-Going Activities)	• The use of land and resources for traditional purposes by Aboriginal persons has been affected and influenced by various issues and factors in previous years (including settlement into permanent communities, past development projects, increased road access), but overall it remains a very important and integral aspect of the cultures of these Labrador and Québec Aboriginal groups.		
Project Residual Environmental Effects	• The proposed Project is not likely to interact with or affect (and especially, to have significant adverse effects on) the Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons, given the nature, location and scale of the Project and area affected, and because existing and available information does not indicate that such activities currently occur within the PDA or LSA.		
Other Projects / Activities	**Likely Effect Interaction (Y/N)**	**Rationale**	**Cumulative Effects**
IOC Labrador Operations	Y	• Interaction possible in that each project occurs within the overall RSA. Located approximately 20 km northeast of the Project area. Little potential for interaction with existing operations, which have been on-going for decades and likely see little if any use. Possible interaction with any future expansion (depending upon specific characteristics and location).	• The Project is unlikely to interact with or affect this VEC. Mitigations in place by Alderon as well as other proponents (consultation, benefits agreements etc.).
Wabush Mines (Cliffs Resources)	Y	• Located approximately 10 km north of the Project area. Little potential for interaction with existing operations, which have been on-going for decades and likely see little if any use. Possible interaction with any future expansion (depending upon specific characteristics and location).	• The Project is unlikely to interact with or affect this VEC. Mitigations in place by Alderon as well as other proponents (consultation, benefits agreements etc.).
Mont Wright Mine (Arcelor Mital)	Y	• Located approximately 25 km west of the Project area. Given overall size of RSA, possible interaction if Aboriginal land and resource use occurred in both areas (but this is not known to be the case).	• The Project is unlikely to interact with or affect this VEC. Mitigations in place by Alderon as well as other proponents (consultation, benefits agreements etc.).
Bloom Lake Mine and Rail Spur (Cliffs Resources)	Y	• Located approximately 20 km west of the Project area. Given overall size of RSA, possible interaction if Aboriginal land and resource use occurred in both areas (but this is not known to be	• The Project is unlikely to interact with or affect this VEC. Mitigations in place by Alderon as well as other proponents (consultation, benefits agreements etc.).

		the case).	
Schefferville Iron Ore Mine (Labrador Iron Mines)	Y	• Located approximately 200 km away from the Project area, but in relatively close proximity to several Aboriginal communities. Given overall size of RSA, possible interaction if Aboriginal land and resource use occurred in both areas (but this is not known to be the case).	• The Project is unlikely to interact with or affect this VEC.. Mitigations in place by Alderon as well as other proponents (consultation, benefits agreements etc.).
DSO Iron Ore Project (Tata Steel Minerals Canada)	Y	• Located approximately 200 km away from the Project area, but in relatively close proximity to several Aboriginal communities. Given overall size of RSA, possible interaction if Aboriginal land and resource use occurred in both areas (but this is not known to be the case).	• The Project is unlikely to interact with or affect this VEC. Mitigations in place by Alderon as well as other proponents (consultation, benefits agreements etc.).
Lower Churchill Generation Project (Nalcor Energy)	Y	• Located approximately 375 km away from the Project area. Given overall size of RSA, possible interaction if Aboriginal land and resource use occurred in both areas (but this is not known to be the case).	• The Project is unlikely to interact with or affect this VEC. Mitigations in place by Alderon as well as other proponents (consultation, benefits agreements etc.).
Infrastructure or other projects at Port of Sept-Îles	Y	• Located approximately 815 km away from the Project area, but in relatively close proximity to several Aboriginal communities. Given overall size of RSA, possible interaction if Aboriginal land and resource use occurred in both areas (but this is not known to be the case).	• The Project is unlikely to interact with or affect this VEC. Mitigations in place by Alderon as well as other proponents (consultation, benefits agreements etc.).

Cumulative Effects Summary (the Project + All Relevant Projects / Effects)	**Direction**	**Magnitude**	**Geographic Extent**	**Duration**	**Frequency**	**Reversibility**	**Significance**	**Confidence**
	N (A)	L	R	L	N	R	N	H

Summary: The proposed Project is not likely to interact with or affect (and especially, to have significant adverse effects on) the Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons. Although each of the other projects and activities referenced above will take place within the RSA, and to varying degrees, have implications for such activities by Aboriginal people, the total area covered and affected by these projects is still relatively small given the overall size of the RSA and the overall areas used by each group. This in combination with the mitigation measures being proposed by Alderon and those being implemented by other proponents (including consultation initiatives and in some cases benefits agreements) will therefore mean that the Project will not likely result in significant adverse cumulative effects in combination with other projects and activities that have been or will be carried out.

Note: Environmental effects descriptors and their definitions are as used in the assessment of Project-related environmental effects (See previous Table).

22.9 Assessment of Accidents and Malfunctions

In the construction, operation and maintenance, and decommissioning and closure of a large scale development project, an accidental or other unplanned event is an unlikely, but unfortunately possible, outcome.

Some of the potential accidental events or malfunctions that may be associated with the Project and which are particularly relevant for EA purposes and specifically this VEC include:

- A fire at the Project site, potentially extending into adjacent areas and communities; and
- An accidental release of fuels, chemicals or other substances into the terrestrial and/or aquatic environments (such as through an accidental spill, breach of the tailings management facility, train derailment, etc.).

A fire at the Project site spreading into adjacent areas could adversely affect land areas and/or resources, rendering then unavailable or unsuitable for traditional land and resource use activities. Similarly, an accidental spill of deleterious substances or other materials into adjacent waterbodies, land areas or otherwise may prevent the use of these for certain (particularly consumptive) activities for particular periods of time. Either of these events could potentially occur during the Project's construction, operations and/or decommissioning and closure phases, the potential environmental effects of which would clearly depend upon the nature, magnitude, location and duration of the event.

The proposed project area and adjacent area (PDA and LSA) are not known to currently be used for such traditional land and resource use activities by either of the Labrador and Québec Aboriginal groups under consideration, and the Project is therefore not expected to adversely affect this VEC. Moreover, given the typically "mobile" nature of many of the land and resource use activities involved (e.g., hunting, fishing etc), any users may choose to use other areas during any temporary periods of disturbance, which will certainly be possible given the overall land area available for such pursuits in the RSA. Therefore, no overall decreases in the overall levels of such pursuits or their value is anticipated.

Human health and safety and environmental protection have been paramount considerations by Alderon in the planning and design of the Project, and these will continue to be key priorities during the construction, operation and eventual closure of the Project. As referenced previously and described in some detail elsewhere in this EIS, Alderon has and will develop and implement comprehensive Environmental Protection and Emergency Response Plans for the various phases of the Project. These are being designed to avoid such events and their associated environmental outcomes, or as required, to effectively and efficiently respond to such an accidental event or malfunction should one occur.

The potential residual environmental effects of Project-related accidents and malfunctions on Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons are summarized in Table 22.7.

Table 22.7 Summary of Residual Environmental Effects for Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons – Accidents and Malfunctions

Accidental Event / Malfunction Scenario	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	
Change in Activity Distribution (Location and/or Timing)											
Fire	• Development and implementation of the Project EPP(s) and Emergency Response Plan.	N	-	-	-	N	-	D	N	M	On-going engagement with Aboriginal communities and organizations.
Spill / Release of Hazardous Materials		N	-	-	-	N	-	D	N	M	
Change in Overall Activity Levels											
Fire	• Development and implementation of the Project EPP(s) and Emergency Response Plan.	N	-	-	-	N	-	D	N	M	On-going engagement with Aboriginal communities and organizations.
Spill / Release of Hazardous Materials		N	-	-	-	N	-	D	N	M	
Resulting Change in Overall Quality and Cultural Value of the Activity											
Fire	• Development and implementation of the Project EPP(s) and Emergency Response Plan.	N	-	-	-	N	-	D	N	M	On-going engagement with Aboriginal communities and organizations.
Spill / Release of Hazardous Materials		N	-	-	-	N	-	D	N	M	

Accidental Event / Malfunction Scenario	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	

KEY

Direction:
P Positive
A Adverse
N Neutral (or No Effect)

Magnitude:
L Low: affects a small group of users
M Moderate: affects less than the majority of users across multiple activities
H High: affects the majority of land and resource users across multiple activities

Geographic Extent:
S Site: includes PDA and 200 m beyond
L Local: LSA
R Regional: RSA

Frequency:
N Not likely to occur
O Once: Occurs once
S Sporadic: occurs sporadically
R Regular: occurs on a regular basis
C Continuous

Duration:
S Short term: construction phase only
M Medium term: continues through operation and maintenance phase
L Long term: continues beyond operation and maintenance
P Permanent

Reversibility:
R Reversible
I Irreversible

Environmental or Socio-economic Context:
U Undisturbed: Area relatively or not adversely affected by human activity
D Developed: Area has been substantially previously disturbed by human development or human development is still present

Significance:
S Significant
N Not Significant

Prediction Confidence:
Based on scientific information and statistical analysis, and effectiveness of mitigation or effects management measure
L Low level of confidence
M Moderate level of confidence
H High level of confidence

N/A Not Applicable

22.10 Determination of Significance of Residual Adverse Environmental Effects

22.10.1 Project-related Residual Environmental Effects

Although the Project will (during its various phases) affect the nature and use of specific land areas and resources, through both its direct 'footprint" and associated disturbances, the existing and available information does not indicate that Labrador and Québec Aboriginal communities and groups currently undertake traditional land and resource use activities within the PDA or LSA, or especially, that these comprise a particularly important or core use area for any group. Again, the total area which will be affected by the Project will represent a relatively small portion of the land area available for such activities in the overall RSA, and there are no known sites of historical, cultural or spiritual importance to either group which may be affected.

As a result, the Project is not likely to adversely affect the location or timing of the current use of land and resources for traditional purposes by Aboriginal persons, nor the overall type and level of such activities by Aboriginal persons and groups. The various mitigation measures outlined above and throughout this EIS, in combination with Alderon's on-going engagement with Aboriginal groups throughout the life of the Project, will serve to even further avoid or reduce the potential for any such adverse effects. No associated and consequent decrease in the overall quality or underlying cultural value of the current use of land and resources for traditional purposes by Aboriginal persons is therefore anticipated during either phase of the Project.

22.10.2 Cumulative Effects

The proposed Project is not likely to interact with or affect (and especially, to have significant adverse effects on) the Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons, and will therefore contribute little (if at all) to any cumulative effects on this VEC within the RSA. Although various other existing and proposed projects and activities in the region may to varying degrees, have implications for such activities by Aboriginal people, the total area covered and affected by these projects is still relatively small given the overall size of the RSA and the overall (and core) areas used by each group. This in combination with the mitigation measures being proposed by Alderon and those being implemented by other proponents (including consultation initiatives and in some cases benefits agreements) will therefore mean that the Project will not likely result in significant adverse cumulative effects in combination with other projects and activities that have been or will be carried out.

22.10.3 Accidents and Malfunctions

Possible accidental events or malfunctions that may result in effects on this VEC include a fire or the accidental release of fuels, chemicals or other substances into the environment (such as through an accidental spill, breach of the tailings management facility, train derailment, etc.). Either of these events could potentially occur during the Project's construction, operations and/or decommissioning and closure phases, the potential environmental effects of which would clearly depend upon the nature, magnitude, location and duration of the event. Alderon has and will develop and implement comprehensive Environmental Protection and Emergency Response Plans for the various phases of the Project.

22.10.4 Overall Residual Effects Conclusion

The Project is not likely to result in adverse effects on the Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons.

22.11 Follow-up and Monitoring

Any follow-up and monitoring programs that have been identified and proposed for other VECs (particularly for the biophysical environment) will be indirectly applicable to land and resource use. No specific follow-up and monitoring programs are proposed in relation to this VEC.

22.12 Next Steps

Alderon will continue to consult relevant Aboriginal communities and organizations to provide Project information and updates on on-going and planned activities, as well as to facilitate discussion of any issues and potential means of addressing them during design, construction, operations and/or closure. Summary

22.13 Summary

The Project is not likely to result in adverse effects on the Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons, either in and of itself or in combination with other projects and activities.

23.0 OTHER CURRENT USE OF LANDS AND RESOURCES

23.1 Valued Ecosystem Component Definition and Rationale for Selection

Other Current Use of Lands and Resources is defined as any land use or harvesting, including industrial uses, undertaken by non-Aboriginal persons or communities in western Labrador and Fermont, Québec. For the purposes of this VEC, ‘current’ refers to the period from 1990 to present. The purpose of this VEC is to identify and describe other current use of lands and resources in western Labrador generally and, more specifically, for areas where Project infrastructure will be situated and where physical disturbance resulting from the Project will occur.

Other Current Use of Lands and Resource is included as a VEC in this EIS due to its socio-economic importance and because of the degree and diversity of land and resource use activities being conducted western Labrador.

There are linkages between this VEC and Chapter 22: Current Use of Lands and Resources for Traditional Purposes by Aboriginal Persons, and Chapter 21: Historic and Cultural Resources.

The fisheries of western Labrador are undertaken exclusively for recreational purposes. No commercial operations were identified through research completed for this VEC.

23.1.1 Issues

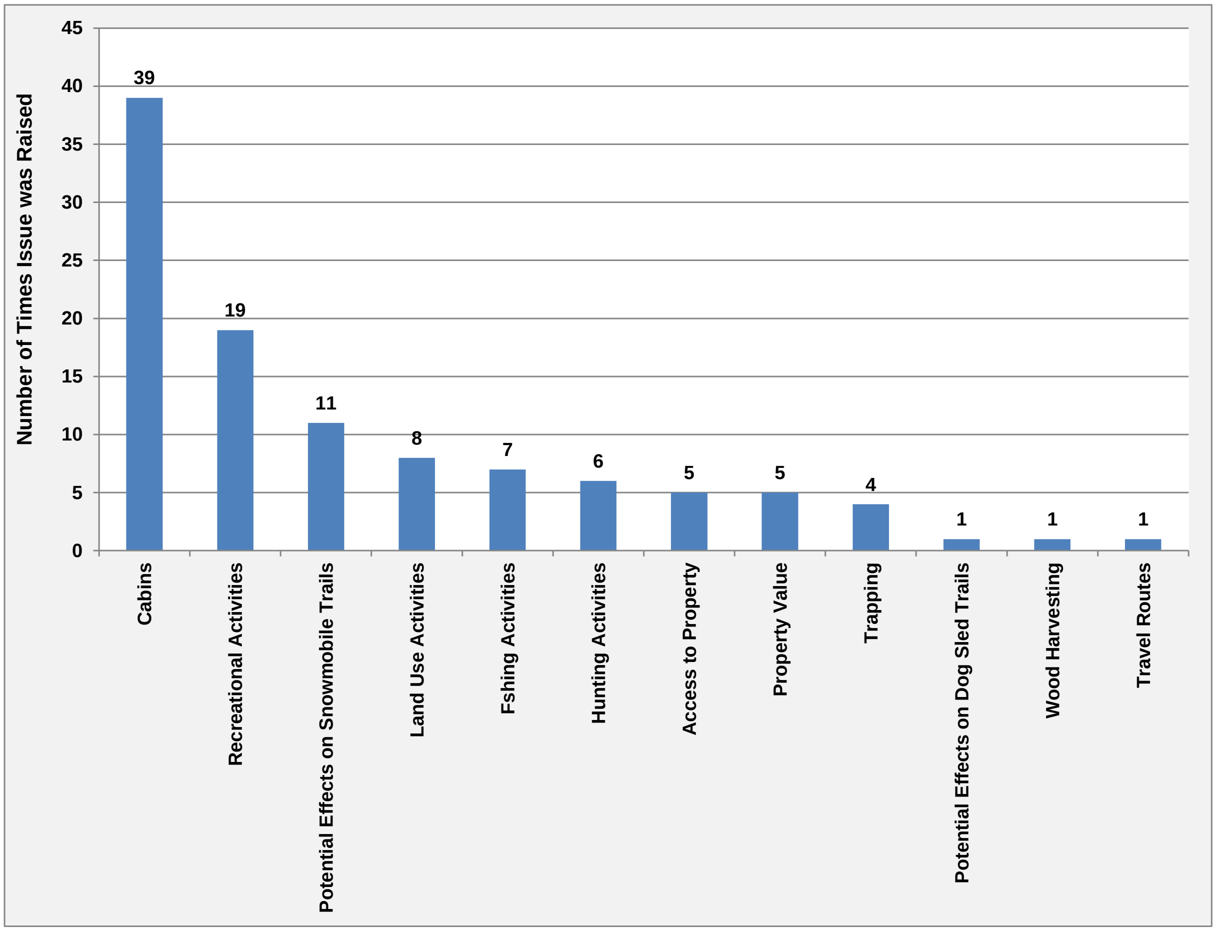
Alderon has consulted, and engaged with, a variety of stakeholders, Aboriginal groups, and members of the public prior to and throughout the EA process, and is committed to being responsive to questions and concerns that arise. Potential issues of concern related to Other Current Use of Lands and Resources include:

- Potential effects on cabins;
- Potential effects on dog sled trails;
- Potential effects on fishing activities;
- Potential effects on hunting activities;
- Potential effects on land use activities;
- Potential effects on recreational activities;
- Potential effects on snowmobile trails;
- Potential effects on trapping; and
- Potential effects on wood harvesting.

Accordingly, these issues are included in the assessment of the VEC. Details on the issues raised by stakeholders are provided in Table 23.1.

The frequency of issue type is summarized in Figure 23.1.

Figure 23.1 Frequency of Issues Raised Related to Other Current Use of Lands and Resources



On Tuesday March 20th 2012, preliminary results and approach for the Other Current Use of Lands and Resources was discussed with officials representing the Department of Tourism, Culture and Recreation and the Environmental Assessment Division of the Department of Environment and Conservation (DOEC). Topics discussed included the preliminary results of informant interviews, study methodology, and timeline for study completion.

23.1.2 Approach to Assessment of Effects

The assessment of Project environmental effects on this VEC included an extensive review of publically available secondary source material and detailed informant interviews with local land and resource users to characterize local and regional baseline conditions. The interactions between the Project and Other Current Use of Lands and Resources were assessed, the need for mitigation considered, and the significance of residual effects determined. The effects assessment focuses on issues raised by the public.

Table 23.1 Issues Raised by Aboriginal Groups and Stakeholders

Issue	Community / Organization	Summary of Comments Raised During Consultation and Engagement Activities	Response / Location in the EIS
Visual Aesthetics	Cabin Owners	Participants concerned they will be able to see mine from their properties.	Viewshed analyses and before and after photosimulations of the Project from select vantage points have been included in the EIS. These show that the Project will be minimally visible from the three municipalities. The Project will be visible from some cabin locations. See Section 23.6.4 for the viewshed analysis and photosimulations.
	CIM Conference / Fermont / Le mouvement citoyen de Fermont	Mining in Labrador, but most of the negative impacts are going to be on the Fermont side. Concern that the Project will create visual pollution, particularly waste rock pile. Desire to preserve untouched visual aesthetic in Fermont. Questions include: • Will the mine manage the site in a manner that makes it not visible from Fermont? • What will I see from my home?	To minimize effects on the citizens of Fermont, the Rose South Waste Rock Disposal has been relocated approximately 5 km to the east. Due to the relocation of the Rose South Waste Rock Disposal Area, the Project will be minimally visible from Fermont. A before and after photosimulation was completed for Fermont, from the western shore of Lac Daviault and from the peak of Mont Daviault. This simulation showed that the Project is minimally visible. See Section 23.6.4 for the viewshed analysis and photosimulations. Section 2.5.3 includes a description of the waste rock disposal area.
	Fermont	For the visual aesthetics study, two points of view should be assessed: • From Fermont. • From top of hill by Lac d'Aviault. A lot of people hike there and there is a beautiful viewpoint we would not want compromised by the waste rock pile.	
	Labrador City	Concern that other lakes will have the same visual impact issue as Wabush Lake.	Alderon will treat all effluent to meet regulatory standards prior to release into the environment. In addition, the treatment is designed to minimize red water. The key characteristics of the TMF and effluent treatment infrastructure are described in Section 2.5.4 and 2.6.2. The issue of red water and measures to mitigate any potential effects are assessed in detail in Chapter 16.

Issue	Community / Organization	Summary of Comments Raised During Consultation and Engagement Activities	Response / Location in the EIS
	Labrador City / Wabush	Will there be any visible impacts to the Duley Lake Park area (e.g., such as trucks driving around or waste rock piles)?	Viewshed analyses and before and after photosimulations of the Project from select vantage points have been included in the EIS. Based on the viewshed analysis, it is not likely that the Project will affect the view from the camp grounds near the Duley Lake Provincial Park Reserve at the northwestern end of Long Lake. The Rose South Waste Rock Disposal Area will be minimally visible from the dock at the Duley Lake Provincial Park Reserve. See Section 23.6.4 for the viewshed analysis and photosimulations.
	Wabush	Power lines are a visual issue.	Viewshed analyses and before and after photosimulations of the Project from select vantage points have been included in the EIS. Based on the viewshed analysis, the power line will likely be visible from adjacent areas. However, the power line was relocated along the road/rail right-of-way to limit visual effects from the Jean Lake hiking trail. See Section 23.6.4 for the viewshed analysis and photosimulations.
Access to Property	Wabush / Cabin Owners	Proposed rail line follows current access used by cabin owners. Many cabin and camp owners, particularly those at Mills Lake are concerned with how their access will be affected by the railway, conveyor, crusher, and pit. Questions include: • Will the proposed road along the rail line be a public roadway? • Will access be provided to cabin properties that are presently only accessed by ski-doo or ATV? • What steps will be undertaken to ensure their access? • How soon before cabin owners are evicted? • Will Mills Lake Road be plowed for access this	The potential Project effects on access, including snowmobile trails, are included in the assessment of the Project on Other Use of Lands and Resources. Alderon will work with local user groups to address Project effects. The rail line will not cross any paved roads. Alderon has been engaging with cabin owners in the Project area and has developed a strategy to mitigate adverse effects on cabin owners. Alderon will continue its engagement with cabin owners to determine appropriate mitigation measures for individual cabin owners, as applicable. See Section 23.5, and 23.6 for more information.

Issue	Community / Organization	Summary of Comments Raised During Consultation and Engagement Activities	Response / Location in the EIS
		winter? In the past, a loader clearing snow roughed up the road.	
Potential Effects on Cabins	Cabin Owners / Labrador West Status for Women / Le mouvement citoyen de Fermont / NNK / NCC	Effect of the Project on cabins in an important issue. There are houses and cabins close to the Project, particularly in the Duley Lake area, that could be affected by the Project. What will Alderon do with the cabins that will be impacted by mines? What measures will be in place to protect cottages and cabins in the area?	The potential Project effects on cabin use are included in the assessment of the Project on Other Use of Lands and Resources. Alderon has been engaging with cabin owners in the Project area and has developed a strategy to mitigate adverse effects on cabin owners. Alderon will continue its engagement with cabin owners to determine appropriate mitigation measures for individual cabin owners, as applicable. See Section 23.5.2.1, 23.6.3

	Cabin Owners / Labrador City / Fermont / Wabush	Participants want to know if they will lose their cabins, especially those that are planning renovations or upgrades to their properties. Questions asked:
		• When / where / how will each cabin owner / cabin be affected?
		• What will happen to cabins and cabin owners in the area?
		• How would Alderon compensate cabin owners?
		• How is the value of the cabins determined?
		• Will Alderon meet again with cabin owners?
		• Some people believe that Alderon will compensate for discomfort, even if owners have access and get to keep their cabins.
		• Suggested mitigation:
		    ○ Relocate owners to private accessible land.
		    ○ Rebuild cabins in another area accessible by road with electricity.	

Issue	Community / Organization	Summary of Comments Raised During Consultation and Engagement Activities	Response / Location in the EIS
	Labrador City / Fermont / Wabush	Concern that the Project will affect the quality of cabin life due to pollution, noise, vibrations, dust and other effects.	The potential Project effects on cabin use are included in the assessment of the Project on Other Use of Lands and Resources. Alderon has been engaging with cabin owners in the Project area and has developed a strategy to mitigate adverse effects on cabin owners. Alderon will continue its engagement with cabin owners to determine appropriate mitigation measures for individual cabin owners, as applicable. To address concerns about blasting, Alderon has committed to developing a Project-specific Blasting Plan. Effects of the Project on the atmospheric environment, including air quality, noise, vibration and dust have been assessed and mitigation measures identified. During Project activities, blast noise and vibration will be monitored and will comply with regulatory standards. See Section 23.5.2.1, 23.6.3 and Chapter 14 (Atmospheric Environment) for more information.
	Labrador City / Wabush	Corrections to cabin map and ownership.	Alderon is conducting an inventory of existing cabins and owners to ensure that the most accurate and up-to-date information is in-hand. See Section 23.6.3 for more information.
	Cabin Owners	Concern about how tailings will affect cabin located on Loon Lake.	Potential effects to water resources from Project activities are assessed in Chapter 16. There are no effects anticipated on Loon Lake as a result of the Project. The key characteristics and features of the TMFare described in Section 2.5.4 and 2.6.2. See Section 2.4 for Project location.
	Cabin Owners	Although Mills is not part of the start up operations, when will cabins there be affected? How will they be compensated? Do these cabin owners proceed with renovations on their cabins now?	The Project does not include any activity at Mills Lake. See Section 2.4 for Project location. Section 23.5.2.1 and 23.6.3 include an assessment of potential effects on cabins and proposed mitigation measures.

Issue	Community / Organization	Summary of Comments Raised During Consultation and Engagement Activities	Response / Location in the EIS
	Cabin Owners	Cabin owner at Duley wants to get electricity as a result of the Project.	Alderon has been engaging with cabin owners in the Project area and has developed a strategy to mitigate adverse effects on cabin owners. Alderon will continue its engagement with cabin owners to determine appropriate mitigation measures for individual cabin owners, as applicable. See Section 23.5.2.1, 23.6.3
Potential Effects on Property Value	Cabin Owners	An important issue for me is the depletion of property values.	Given the anticipated population growth in western Labrador and existing demand for housing, property values in the municipalities are not likely to decrease as a result of the Project. Alderon has been engaging with cabin owners in the Project area and has developed a strategy to mitigate adverse effects on cabin owners. Alderon will continue its engagement with cabin owners to determine appropriate mitigation measures for individual cabin owners, as applicable. See Section 23.5.2. and 23.6.3
	Wabush	What will effect be on property values by rail, increased traffic and heavy equipment traffic?	
Potential Effects on Fishing	Wabush	Concerns identified about Project effects on fishing. E.g. cabin owner utilizes a fishing area near Rose South Waste Rock disposal area. Is he permitted access to that location this summer?	Project-related disruptions will be minimal during Summer-2012 as construction is not scheduled to commence until late 2013, provided EA approval is received. See Section 2.6 for more information about the Project Schedule. More information about potential effects to fishing activities in the Project area is included in Section 23.6.
Potential Effects on Hunting	Cabin Owners	Will cabin owners in the Mills Lake & Rose areas still be able to hunt and harvest wood? A participant advised that drillers asked hunters to put their shotguns away, even though hunting has been taking place there for approximately 30 years. Will there be restrictions on hunters that presently access the area?	Cabin owners will still be able to continue to practice their land and resource use activities, however there will be access restrictions at the Project site for the safety of both workers and the public. See Sections 23.5.5, 23.6.2 and 23.6.3.

Issue	Community / Organization	Summary of Comments Raised During Consultation and Engagement Activities	Response / Location in the EIS
Potential Effects on Land Use Activities	Labrador City	Are there issues around Duley Lake? Will there be a road access going through Duley Park? There are a lot of activities in that area and we are concerned that the Project will affect this.	There will be no Project roads in Duley Lake Provincial Park Reserve. Access to the Project site will be made through the access road located east of Wabush. In the EIS, potential effects on land-use activities at Duley Lake Provincial Park Reserve are assessed and mitigation measures are identified. See Section 23.6.1 for information about this assessment and Section 2.4 for information about the Project location.
	Cabin Owners	Participant expressed concern with a proposed high voltage power line running behind houses in Wabush.	The location of the proposed power line was re-routed in response to community concerns. See Section 23.6.4 for viewshed analyses and before and after photosimulations of the Project, including the power line, from select vantage points.
	Labrador City	How can loss of habitat be avoided in the conservation area? Or how will habitats within the conservation area be replaced?	Alderon is in the process of pursuing a Corporate Stewardship Agreement with the municipalities and the Eastern Habitat Joint Venture to mitigate loss of alternate Management Units. See Section 19.6.5 for more information about the assessment of potential effects and proposed mitigation for change in protected areas.
	Le mouvement citoyen de Fermont	Will water planes still be able to fly and land with no restrictions?	Water planes will still be able to use the existing marinas in western Labrador and Fermont. See Section 23.5 for more information.
	Wabush	There is a high population growth in Wabush. Concerned that with the railway will limit the Town expansion. Alderon should assess the potential impacts of the railway on future town planning.	To address this issue, Alderon moved the rail line further away from the Town of Wabush to minimize interaction with future town development planned in the southeast area. See Section 2.5.7 and 2.6.2

Issue	Community / Organization	Summary of Comments Raised During Consultation and Engagement Activities	Response / Location in the EIS
Potential Effects From Blasting Operations	Cabin Owners	Will there be blasting operations on weekends?	Following the EA approval, a Blasting Plan will be developed and implemented in compliance with all applicable laws, regulations and industry best practices, and with consideration of safety, environmental and social issues as identified throughout the EIS. There may be blasting on weekends. See Section 2.6.2 for more information.
	Le mouvement citoyen de Fermont	Will the time of blasting be coordinated with other mines in the region to avoid blasting all at once?	Following the EA approval, a Blasting Plan will be developed and implemented in compliance with all applicable laws, regulations and industry best practices, and with consideration of safety, environmental and social issues as identified throughout the EIS. See Section 2.6.2 for more information.
	Fermont / Lab City / Wabush / Cabin Owners	Concern about noise pollution from, blasting by cabin owners (Round Rail, Riordan Lake), residents, and recreation users at Duley Park. Residents can hear operations located further away than the Project so they are concerned about noise impacts from operations that are very close. Will the noise break windows or dishes?	Following the EA approval, a Blasting Plan will be developed and implemented in compliance with all applicable laws, regulations and industry best practices, and with consideration of safety, environmental and social issues as identified throughout the EIS. See Section 2.6.2 for more information. Effects of the Project on the atmospheric environment, including air quality, noise, vibration and dust have been assessed and mitigation measures identified. During Project activities, blast noise and vibration will be monitored and will comply with regulatory standards. See Section 23.5.2.1, 23.6.3 and Chapter 14 (Atmospheric Environment) for more information.

Issue	Community / Organization	Summary of Comments Raised During Consultation and Engagement Activities	Response / Location in the EIS
Potential Effects on Recreational Activities	Cabin Owners	An important issue is community impact from the movement of heavy equipment in a recreational area. Exploration activities have disrupted recreational activities.	Use of heavy equipment will be restricted to the Project site and will not travel through designated recreational areas such as campgrounds or parks. See Section 23.6.2 for a description of potential effects and mitigation measures for recreational activities and land use. The effects on noise, including noise from equipment has also been assessed in the EIS (see Chapter 14, Atmospheric Environment, for this assessment)
	Cabin Owners / Fermont / Le mouvement citoyen de Fermont	Potential effects on Lac Daviault, recreational activities, boating, planned camp ground are important for community members. Recreational activities occur in proximity to the Project and they are concerned that it will affect activities.	The Project will not overlap with Lac Daviault and will therefore not affect current use of the lake for boating or camping. Based on viewshed analysis only some waste rock areas will be visible from the western shores of Lac Daviault. Although blasting may be audible, vibrations will not be felt on the western shore of Lac Daviault. Modeling of noise levels resulting from the Project will not exceed Health Canada guidelines at Lac Daviault. Modeling of dust dispersion indicates that dust levels at Lac Daviault will not be elevated as a result of the Project. See Section 23.6.2, 23.6.4 and Chapter 14 (Atmospheric Environment)
	Le mouvement citoyen de Fermont	How can you assure that the Fermont marina and swimming activities will not be polluted by mining operations?	The Project will not overlap with waterbodies in Québec. Modeling also indicates that there will not be elevated levels of either dust or noise in Québec as a result of the Project. See Section 2.4 for information about the Project location, Section 23.6.2 for the assessment of activities/use that may be affected by the Project, and Chapter 14 for details about the assessment of effects on the Atmospheric Environment.
	Fermont	There is a trail that goes approximately 2km from pit, will it be affected?	The Project will not overlap with the trail. See Section 23.5.4 for a description of outdoor recreation activities that may be affected by the Project, change in access is assessed in Section 23.6.1.

Issue	Community / Organization	Summary of Comments Raised During Consultation and Engagement Activities	Response / Location in the EIS
	Le mouvement citoyen de Fermont	What will be the security perimeter to avoid the risks from flying rocks and particles on recreational areas in the town of Fermont?	A security perimeter will be developed and implemented as part of the Blasting Plan. Rocks and particles resulting from blasting in the open pit are not anticipated to affect the Town of Fermont. Section 23.6.2 for the assessment of activities/use that may be affected by the Project, and Chapter 14 (Atmospheric Environment) for more information.
		Request study on the impacts on tourism and recreational activities during the duration of the Project.	An assessment of effects on recreational use of lands and resources is included in Section 23.6.2. An assessment of effects on recreational infrastructure within Labrador City, Wabush and Fermont is included in Section 24.6.1 (Community Services and Infrastructure). An assessment of effects on tourism businesses is included in Section 26.6 (Economy, Employment, and Business).
	Innu Nation	Alderon could contribute in the Innu Nation community by providing funding for hockey tournament.	Alderon is committed to engaging Aboriginal groups throughout the EA process and the life of the Project. Alderon's current Aboriginal engagement processes are described in Chapter 10, and its Aboriginal Relations Policy is outlined in Section 1.1.1.
	Wabush	An upset or spill from trains may affect recreational use of area.	Although a train derailment is unlikely and has not been experienced in western Labrador to date, assessment of the potential effects and identification of mitigation measures for such a derailment on land and resource use is included in the EIS as part of the assessment of Accidents and Malfunctions. See Section 23.8 and 23.9.3 for more information about this assessment.
Potential Effects on Snowmobile Trails	Wabush	Concerns about proposed changes and accessibility to snowmobile trails. Proposed railway will intersect the current snowmobile trails. Snowmobilers do not like dead-end trails, they prefer loops.	Alderon will work with local snowmobile groups to address Project concerns. See Section 23.5.4 and 23.6.1.

Issue	Community / Organization	Summary of Comments Raised During Consultation and Engagement Activities	Response / Location in the EIS
	Wabush	Are there any plans for crossing areas, installation of culverts, stop lights or signs? Need to implement proper safety precautions for travel back and forth from the mill, as it may interact with snowmobile trails.	

Following the characterization of baseline conditions for Other Current Use of Land and Resources, the assessment of potential Project effects proceeded through a series of steps:

- Description of potential Project environmental effects;
- Determination of the nature and extent of potential interactions between the Project and Other Current Use of Land and Resources;
- Description of standard feasible and effective measures which may be taken to mitigate potential adverse environmental effects;
- Identification of any residual Project environmental effects which may remain following the application of mitigation measures;
- Identification of any cumulative effects which may occur if environmental effects of other projects and activities in the region overlap with this Project;
- Identification of environmental effects which may occur as a result of accidents or malfunctions;
- Determination of the significance of environmental effects; and
- Proposal of monitoring and follow-up measures.

23.1.2.1 Methodology for Assessment of Baseline Conditions

Review of Publically Available Sources

Information was gathered through a detailed review of data related to a broad range of subsistence, recreational and commercial land and resource use activities currently undertaken in western Labrador. It was collected through analysis of government data, publicly available secondary sources and key informant interviews.

Secondary information sources reviewed included those related to:

- Legislation, regulations, policies and guidelines governing land and resource use activities in the region;
- Land and resource user-groups and individual users;

- Use of western Labrador's waterbodies for navigation, commercial and recreational fishing and other recreation;
- Hunting, fishing and trapping guidelines and practices, including licensing and permitting records;
- Cabins, trails and recreational areas;
- Mining and mineral exploration and quarrying activities; and
- Agriculture and forestry operations (as applicable).

Information was also obtained from archaeological reports and other literature, and databases held by government departments and agencies, including:

- Department of Natural Resources;
- Department of Municipal Affairs;
- Water Resources Management Division, (DOEC);
- Wildlife Division, DOEC;
- Parks and Natural Areas, DOEC;
- Lands Branch (Crown Lands), DOEC;
- Department of Tourism, Culture and Recreation;
- Department of Fisheries and Aquaculture;
- Department of Fisheries and Oceans;
- Transport Canada; and
- Industry Canada.

Informant Interviews

A key component of the Other Current Use of Lands and Resources Baseline Study was interviews with 15 residents of Labrador City-Wabush and five residents of Fermont, Québec, who use the region for recreational, subsistence and, to a lesser extent, commercial purposes. A questionnaire was designed by Alderon and the study team prior to the interviews. The responses of interviewees to questions were recorded in detail on the questionnaire and with a numbering and coloured code to indicate various land use activities and locations on two differently-scaled maps. Informants were identified through discussions with local government officials (e.g., wildlife officers, municipal employees) and local land user groups (e.g., snowmobile association). Additional informants were identified using a "snowball" approach, whereby key users were asked to identify other individuals from the region known to use the land and its resources. This approach allowed for the ongoing identification of key users.

The interviews in Fermont were conducted in either English or French, depending on the preference of the informant. Prior to the trip, all interview tools (maps, questionnaire, recording sheets) were translated into French. Upon completion of the interviews, all data was provided to the reporting and GIS teams in both French and English.

Interview questions were tailored to gather detailed information on a broad range of subsistence, recreational and commercial land and resource use activities currently being carried out in the region. Information related to hunting, fishing, trapping, boating / water navigation, snowmobile and all-terrain vehicle (ATV) use, wood harvesting (for firewood and saw-logs), berry picking, cabin use, outfitting, and birding and geo-caching was collected.

Information was recorded on the questionnaire and as coded or coloured lines, points, and polygons on area mapping. Where appropriate, activities were recorded on two separate maps of different scale (e.g., trapping areas: RSA and trapping areas: LSA). The maps were used to record in a consistent manner the specific data. A standard legend and recording sheet was developed for the mapping portion of the interviews. The locations of any sites or structures of historical, archaeological, paleontological or cultural / spiritual significance were also recorded. Subsequent to fieldwork, the maps were scanned and digitized for incorporation into a GIS database for analysis.

The 20 informant interviews were supplemented through discussions with government personnel, including fisheries and wildlife conservation officers familiar with western Labrador. Where appropriate, these discussions were conducted using the questionnaire and maps developed for the key informant interviews.

23.2 Environmental Assessment Boundaries

23.2.1 Spatial Boundaries

To capture the regional and local nature of current use of lands and resources in western Labrador generally, and within and adjacent to the Project location specifically, three distinct areas were used for the collection and characterization of baseline conditions. They include: the Project Development Area (PDA), a Local Study Area (LSA); and Regional Study Area (RSA). Each is described below.

23.2.1.1 Project Development Area

The PDA is the area represented by the physical Project footprint as defined in the Project Description. The PDA includes the area of physical disturbance for the Project and includes the open pit, waste rock disposal areas, concentrator / processing area, conveyor, Tailings Management Facility (TMF), on-site roads, rail line, and on-site transmission line.

23.2.1.2 Local Study Area

The LSA is approximately 515 km^2 centred on the PDA. The LSA encompasses all Project features as well as several waterbodies and terrestrial landscape features that are currently used by local residents for recreational, subsistence and, in some cases, commercial land use and harvesting activities (Figure 23.2).

The LSA is the maximum area within which Project-related environmental effects can be predicted or measured with a reasonable degree of accuracy and confidence. The LSA includes the PDA and any adjacent areas where Project-related environmental effects may reasonably be expected to occur.

23.2.1.3 Regional Study Area

The RSA for Other Current Use of Lands and Resources covers an area of approximately 46,000 km^2. This area is used to provide a regional context for land use patterns across western Labrador and in adjacent areas of eastern Québec.

The RSA was delineated to include the multiple travel routes used in western Labrador, including both roads and other cleared corridors which provide access to the country via snowmobile or ATV. Within the boundaries of the RSA are a number of roads and byways that provide access throughout the region, including the Trans Labrador Highway Phase I (TLH) and two well-travelled smaller roads between the TLH near Twin Falls to locations on Smallwood and Ossokmanuan reservoirs. There are also two major hydroelectric transmission corridors that are used for travel into the region from west and southwest of Churchill Falls, and south of the TLH. Other potential travel arteries within the RSA include the Québec North Shore and Labrador Railway (QNS&L) and its corridor, the extensive network of groomed snowmobile trails, and the many off-road trails and paths connecting with remote waterbodies and privately-owned cabins. It is along these and other arteries that people from Labrador and, to a lesser extent, Québec can access hunting, fishing, trapping and other harvesting and land use locations throughout the region (Figure 23.2).

23.2.2 Temporal Boundaries

The temporal boundaries for the assessment of potential environmental effects of the Project on Other Use of Lands and Resources include the Project phases of construction (approximately two years), operation and maintenance (approximately 17 years), and decommissioning and reclamation (approximately two years).

23.2.3 Administrative Boundaries

Administrative boundaries for Other Current Use of Lands and Resources include the jurisdictional and government planning regimes and legislative requirements that apply to the management of various species and resources in western Labrador. The majority of Other Current Uses of Lands and Resources, including hunting, fishing, trapping, boating / water navigation and local water supply, are managed by the Government of Newfoundland and Labrador, the Government of Canada, or through municipal legislation.

23.2.3.1 Municipal Land Use and Communities

Municipal land use in Newfoundland and Labrador is governed by the *Urban and Rural Planning Act, 2000*, administered by the Department of Municipal Affairs, specifically the Land Use Planning Section of the Division of Engineering and Land Use Planning. The Act establishes the Province's land use planning system and outlines the requirements for preparing, approving and implementing planning documents, including municipal, regional, local and protected area plans.

Development is controlled by a municipal plan, which divides the planning areas into land use zones and classifies types of land use as permitted, prohibited, or discretionary for each zone. Development along roadways is also controlled by Section 32 of the *Urban and Rural Planning Act, 2000*, which enables existing or proposed highways to be declared a protected road. Unless development is within a municipality or a planning area, building control lines are established as 400 m from the centre-line of a protected road and development within these lines requires a permit. Most of the length of the TLH is zoned as a protected road.

Both Labrador City and Wabush have municipal plans in place. There are currently no regional or local area plans in Labrador. The current Labrador City Municipal Plan came into effect in 2007 and sets out a ten-year land use strategy for development with the Town's MPA (Town of Labrador City 2007). The current Wabush Municipal Plan came into effect in 2004 and is also a ten-year planning document. It is due for review in 2012 (Town of Wabush 2004).

Figure 23.2 Local and Regional Study Areas: Other Current Use of Lands and Resources

23.2.3.2 Municipal Water Supplies

In Newfoundland and Labrador, municipal water supplies are protected under the provincial *Water Resources Act*. The municipal water supplies for Labrador City and Wabush are Beverly Lake and Wahnahnish Lake, respectively (Town of Wabush 2004; Town of Labrador City 2007). Both towns follow the Standards for Bacteriological Quality of Drinking Water as provided by DOEC and the Guidelines for Canadian Drinking Water Quality prepared by Health Canada in the management of municipal water supplies.

Under the Policy for Land and Water Related Developments in Protected Public Water Supply Areas administered by the Water Resources Division of DOEC, a minimum buffer of 150 m must be maintained around a water supply intake pond or lake (DOEC 1999).

23.2.3.3 Hunting, Trapping, Guiding and Outfitting

Hunting and trapping are regulated by the Wildlife Division of DOEC in accordance with the *Wildlife Act* and *Wildlife Act Regulations*. The Wildlife Division of the DOEC is responsible for wildlife regulation and management in Newfoundland and Labrador, including issuing hunting and trapping licenses. The hunting of migratory birds is managed by the Government of Canada by the Canadian Wildlife Service, which administers the *Migratory Birds Convention Act* (DOEC 2011a).

Caribou

Caribou management decisions for the 2012 – 2013 season are to be announced by the DOEC when sufficient information on the population of the George River Caribou herd is available (DOEC 2012a). Labrador is populated by four distinct caribou herds: the George River herd, which is migratory, and the Lac Joseph, Red Wine and Mealy Mountain herds, which are sedentary herds referred to as woodland caribou. Caribou hunting in Labrador has been permitted only for the migratory George River herd, as woodland caribou are threatened. However, the George River herd is also in decline; in 2010 the population was estimated to be 74,000, down 81 percent from the 2001 census estimate of 385,000 animals. Population projections indicate that, as of 2012, the George River caribou herd may be less than 50,000 animals (DOEC 2012a).

In response to this decline, the DOEC implemented new rules for caribou hunting in Labrador for the 2011 – 2012 season (DOEC 2011a). Such measures include reducing the hunting season from eight to three months, closing commercial hunting, and reducing the bag limit per hunter from two caribou to one. DOEC has considered a total allowable catch approach for the 2012-13 season. Management decisions are to be made in consultation with Aboriginal organizations, the Government of Québec and other stakeholders (DOEC 2012a).

According to the management decisions for the 2011– 2012 season, the RSA encompasses or intersects a total of ten Caribou Management Zones (DOEC 2011a) (Figure 23.3). Lac Virot (Zone 19) is the only Caribou Management Zone in the LSA. Hunting in these areas has been permitted as the George River caribou migrated, conditional upon Departmental confirmation of sufficient numbers of caribou. A Resident Labrador Caribou License is required. There were approximately 11,000 of licenses issued in Labrador for the 2011-2012 season, including 1,000 special licenses available free of charge to the residents of the Torngat Mountains Electoral District (DEOC 2012a). Management areas for the 2012 – 2013 season have not been released, pending decisions to be made by DOEC.

Moose

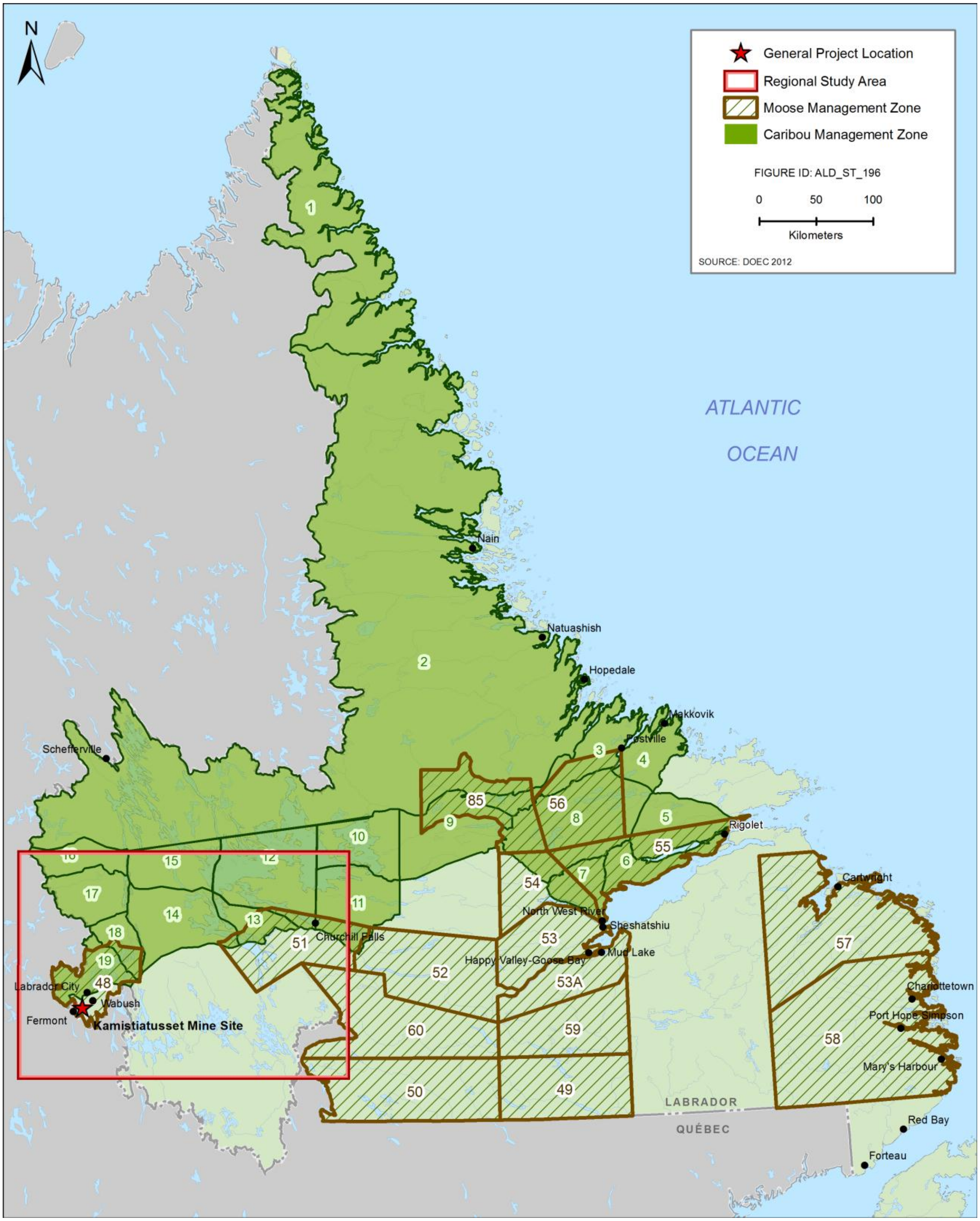
There is one Moose Management Areas (MMAs) encompassed by the RSA (Figure 23.3). Three other MMAs are intersected by the eastern portion of the RSA. MMA 48, located in the Labrador West area, is the only MMA in the LSA. MMAs 51, 60 and 50 are south of Churchill Falls. Moose licenses are distributed through an annual draw held by DOEC. The numbers of licenses issued are dependent on the moose population. Therefore, despite relatively high demand for licenses near Labrador City and Wabush, the number of licenses available is low (Table 23.2). In 2011 there were 135 applications in MMA 48 and 150 applications in MMA 51. There were seven applications for licenses in MMA 50 and five applications for MMA 60 (DOEC 2012). Each license permits harvest of one animal.

Table 23.2 License Applications and Quotas for Moose Management Areas in the Regional Study Area

Moose Management Area	Applications for License	Licenses Issued (Quota of Moose per MMA)
48	135	5
50	7	5
51	150	10
60	5	10

For 2012-2013, hunting season in all Labrador MMAs was scheduled for September 8 to March 10. The total number of licenses to hunt either sex was five in MMA 48, five in MMA 50, ten in MMA 51, and ten in MMA 60. There were no quota changes from the 2010-2011 season (DOEC 2012).

Figure 23.3 Caribou and Moose Management Areas, Labrador



Black Bear

There are two Black Bear Management Zones in Labrador: the George River Zone and the Labrador South Zone (Figure 23.4). The RSA and the LSA are contained within the Labrador South Black Bear Management Zone. There are 1,500 licenses available per season throughout Labrador.

There are two separate black bear hunting seasons in Labrador, which vary from year to year. The 2012 spring season extends from April 1 to July 13 in both zones. The 2012 fall season extends from August 10 to November 30 in the George River Zone and from September 1 to November 30 in the Labrador South Zone (DOEC 2012c). The bag limit for both residents and non-residents is two animals (either sex). Female bears with cubs may not be harvested. Non-resident licenses are only available through one of the Province's licensed outfitters (DOEC 2012c).

Small Game

There are two zones for hunting small game in Labrador: the Northern Zone and the Southern Zone (Figure 23.5). The RSA and the LSA are situated entirely within the Southern Zone. Within the two zones, there are Species Management Areas (SMAs), with established shooting and snaring seasons for each species (DOEC 2012c):

- The Ptarmigan SMA, which includes hunting of both Willow and Rock Ptarmigan, encompasses all of Labrador.
- The Grouse SMA, which includes hunting of both Spruce and Dark Grouse, is divided into the Northern and Southern Zone. The LSA is within the Southern Zone of the Grouse SMA.
- SMAs for both the Arctic and snowshoe hare encompass all of Labrador.

The Porcupine SMA encompasses all of Labrador.

For all species except porcupine, the 2012-2013 shooting season extends from October 1 to April 20. Shooting season for porcupine is open from October 1 to March 31. Snaring season for all species except porcupine extends from October 1 to March 31. Unlike large game, non-resident hunters do not require a guide to hunt small game (DOEC 2012c). Season dates, bag limits, and possession limits for various small game species are provided in Table 23.3.

Table 23.3 Small Game Season and Bag / Possession Limits

Species	Area	2012-2013 Season (Shooting)	2012-2013 Season (Snaring)	Bag / Possession Limit
Ptarmigan	All Labrador	Oct. 1 – April 20	Oct. 1 – Mar. 31	25/50
Grouse	Southern Zone	Oct. 1 – April 20	Oct. 1 – Mar. 31	25/50
	Northern Zone	Oct. 1 – April 20	Oct. 1 – Mar. 31	No limit
Arctic and Snowshoe Hare	All Labrador	Oct. 1 – April 20	Oct. 1 – Mar. 31	No limit
Porcupine	All Labrador	Oct. 1 – Mar. 31	-	1/1
Source: DOEC 2012c				

Figure 23.4 Black Bear Management Zones, Labrador

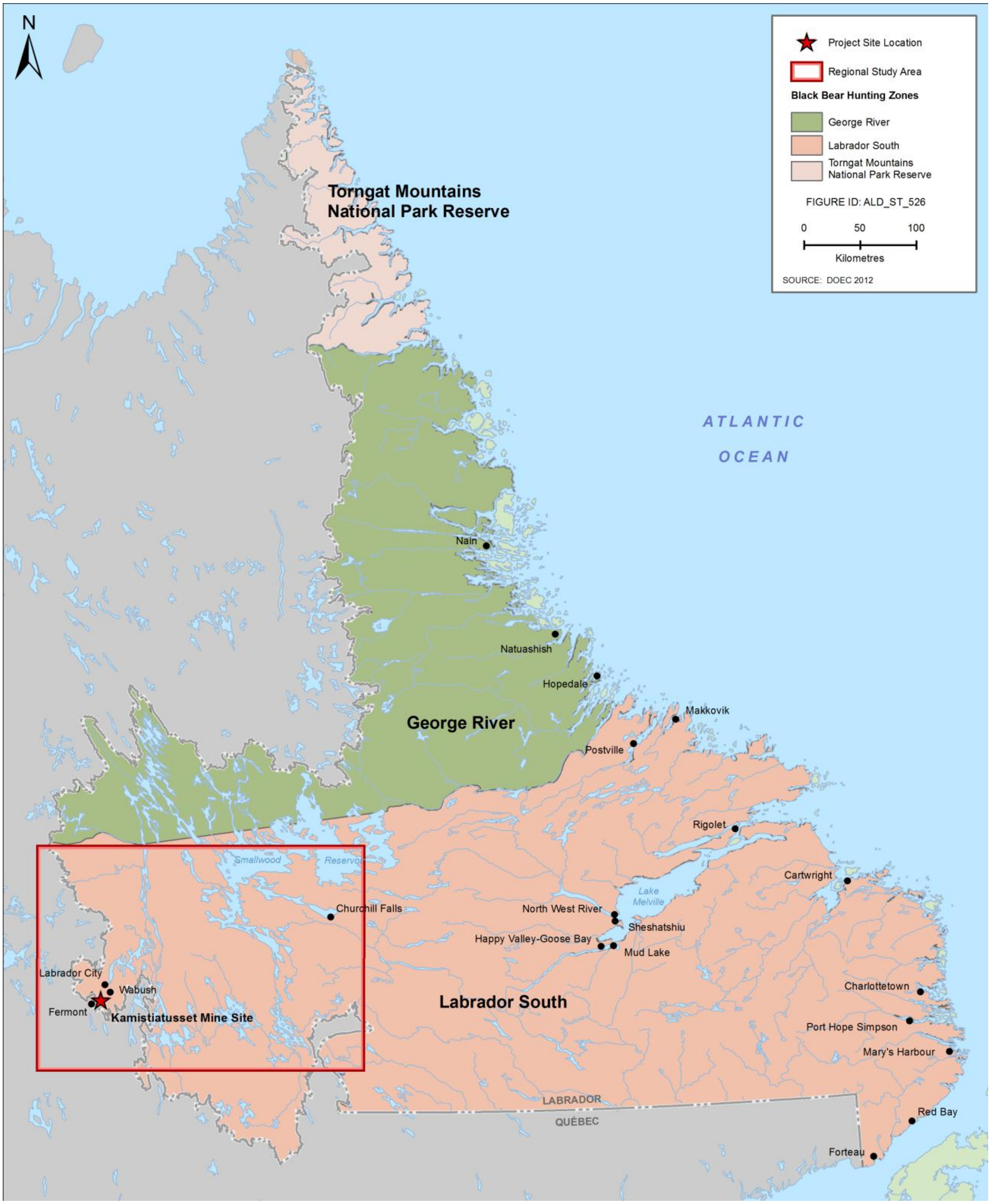
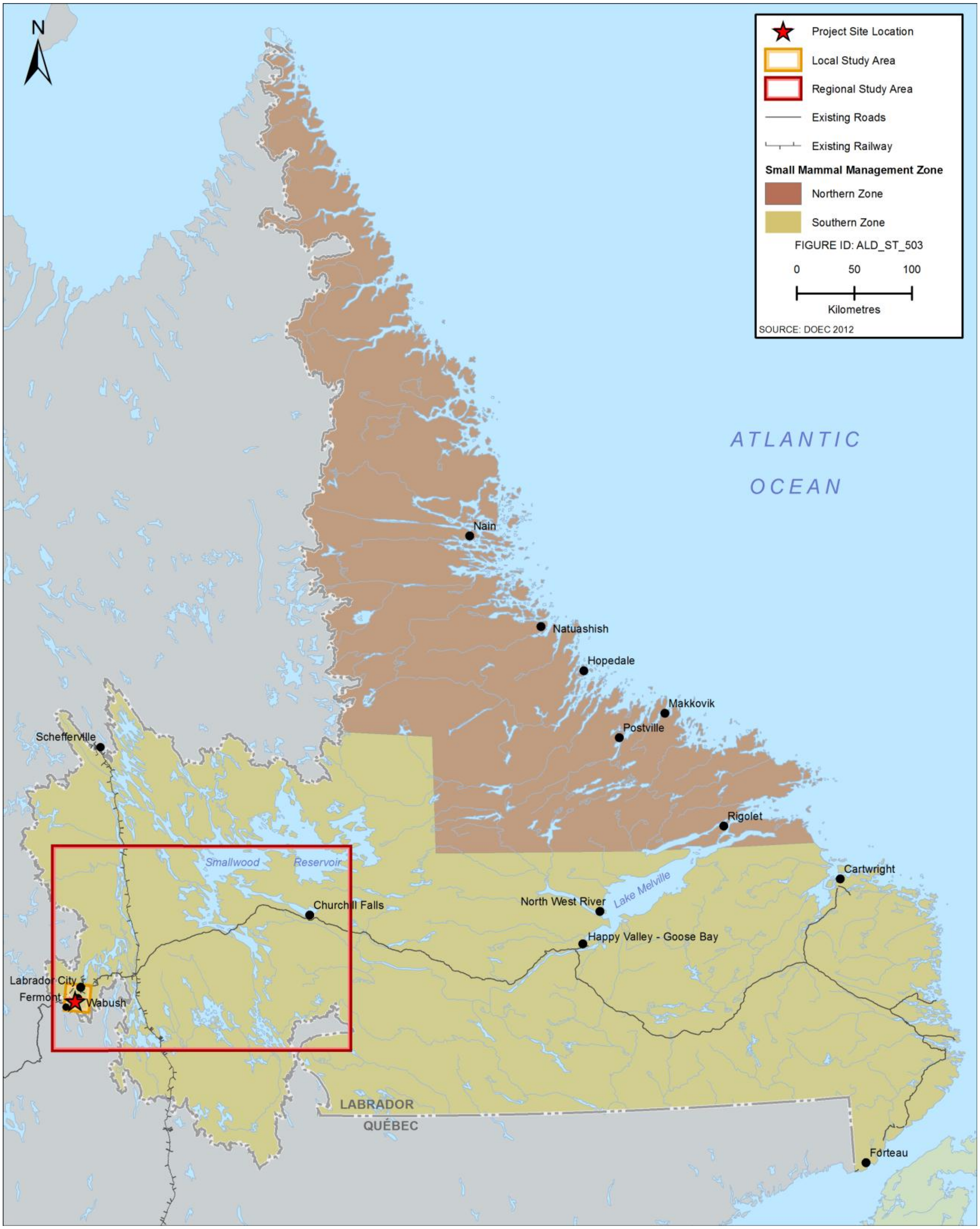


Figure 23.5 Small Game Hunting Zones, Labrador



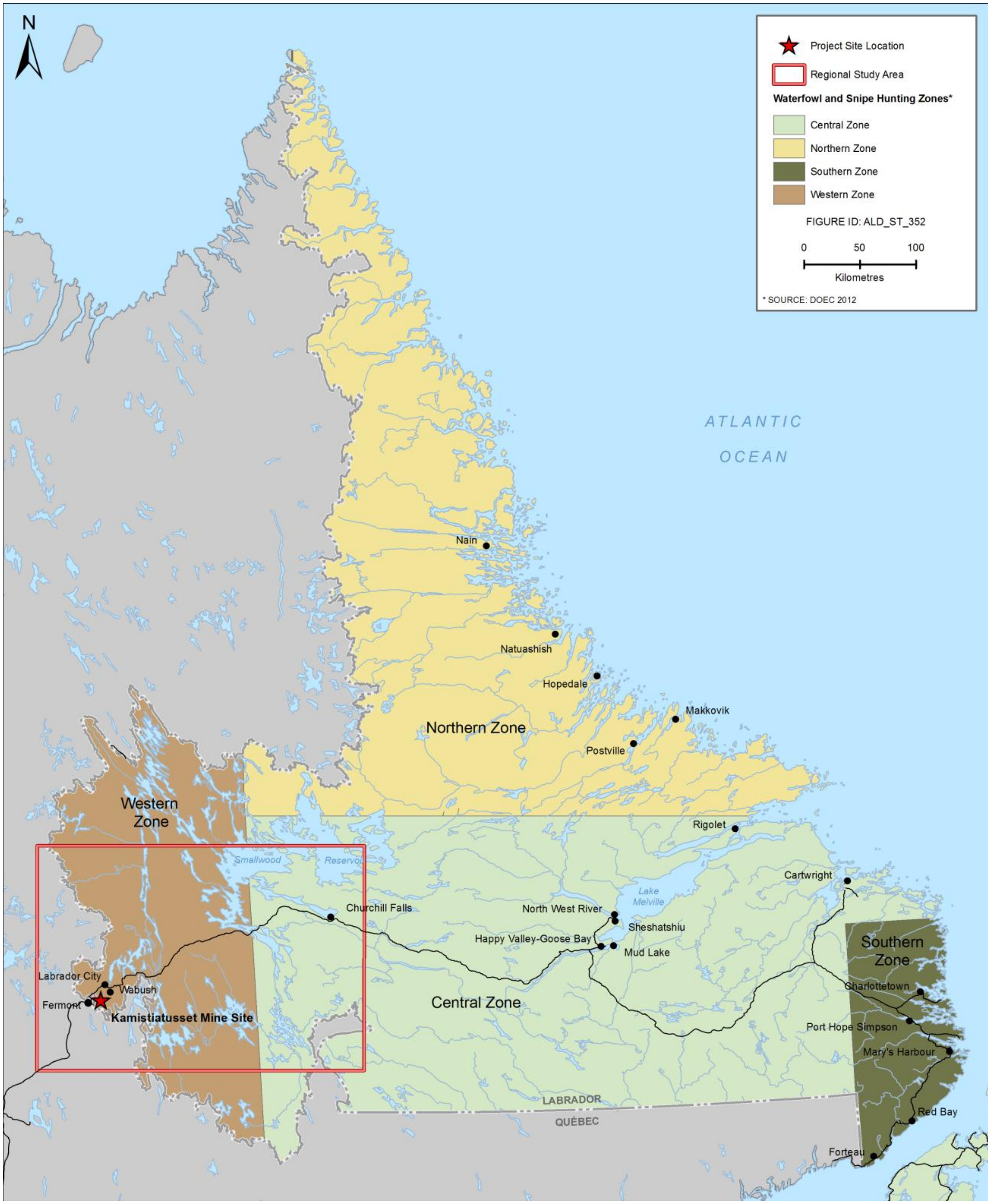
Migratory Birds and Waterfowl

Hunting of migratory birds is managed for the Government of Canada by the Canadian Wildlife Service (CWS), which is a division of Environment Canada. It administers the Migratory Birds Convention Act, including the management of bag limits and licenses. There are four waterfowl and snipe hunting zones in Labrador: Western, Central, Northern and Southern (Table 23.4 and Figure 23.6). The Project is located within the Western Zone, which has a season for ducks, geese and snipe (extending from the first Saturday in September to the second Saturday in December) and no open season for eider ducks. The daily bag limit, excluding the special status harlequin duck, which cannot be hunted, is six and the possession limit is 12. The daily bag limit for geese is five while the possession limit is 10. The daily bag limit for Snipe is 10 and the possession limit is 20 (DOEC 2012c).

Table 23.4 Migratory Birds Seasons and Bag / Possession Limits

<table>
<tr><th>Species</th><th>Hunting Zone</th><th>Season</th><th>Bag / Possession Limit</th></tr>
<tr><td rowspan="4">Ducks</td><td>Western Labrador</td><td rowspan="3">First Saturday in September - second Saturday in December</td><td rowspan="4">6/12</td></tr>
<tr><td>Central Labrador</td></tr>
<tr><td>Northern Labrador</td></tr>
<tr><td>Southern Labrador</td><td>Second Saturday in September - third Saturday in December</td></tr>
<tr><td rowspan="4">Eider</td><td>Western Labrador</td><td>No open season</td><td rowspan="4">6/12</td></tr>
<tr><td>Central Labrador</td><td>Last Saturday in October to last Saturday in November and first Saturday in January to last day of February</td></tr>
<tr><td>Northern Labrador</td><td>Last Saturday in September to second Saturday in January</td></tr>
<tr><td>Southern Labrador</td><td>Fourth Saturday in November to last day in February</td></tr>
<tr><td rowspan="4">Geese</td><td>Western Labrador</td><td rowspan="3">First Saturday in September – second Saturday in December</td><td rowspan="4">5/10</td></tr>
<tr><td>Central Labrador</td></tr>
<tr><td>Northern Labrador</td></tr>
<tr><td>Southern Labrador</td><td>Second Saturday in September – second Saturday in December</td></tr>
<tr><td rowspan="4">Snipe</td><td>Western Labrador</td><td rowspan="3">First Saturday in September – second Saturday in December</td><td rowspan="4">10/20</td></tr>
<tr><td>Central Labrador</td></tr>
<tr><td>Northern Labrador</td></tr>
<tr><td>Southern Labrador</td><td>Second Saturday in September – third Saturday in December</td></tr>
<tr><td colspan="4">Source: DOEC 2012c
Note: No open season for Harlequin Ducks</td></tr>
</table>

Figure 23.6 Waterfowl and Snipe Hunting Areas, Labrador



Trapping

Labrador is divided into two trapping zones; the Labrador North Fur Zone and the Labrador South Fur Zone (DOEC 2012c) (Figure 23.7). The PDA is contained in the southern zone. Furbearers may be taken only by licensed trappers. Trapping licenses are issued by the DOEC. Applicants must complete a Trapper Education Course. In Labrador, a General Trapping Licence authorizes trappers to trap for all species during the open seasons (Table 23.5) prescribed and in accordance with trapping regulations (DOEC 2012c).

Table 23.5 Labrador Trapping Seasons and Zones

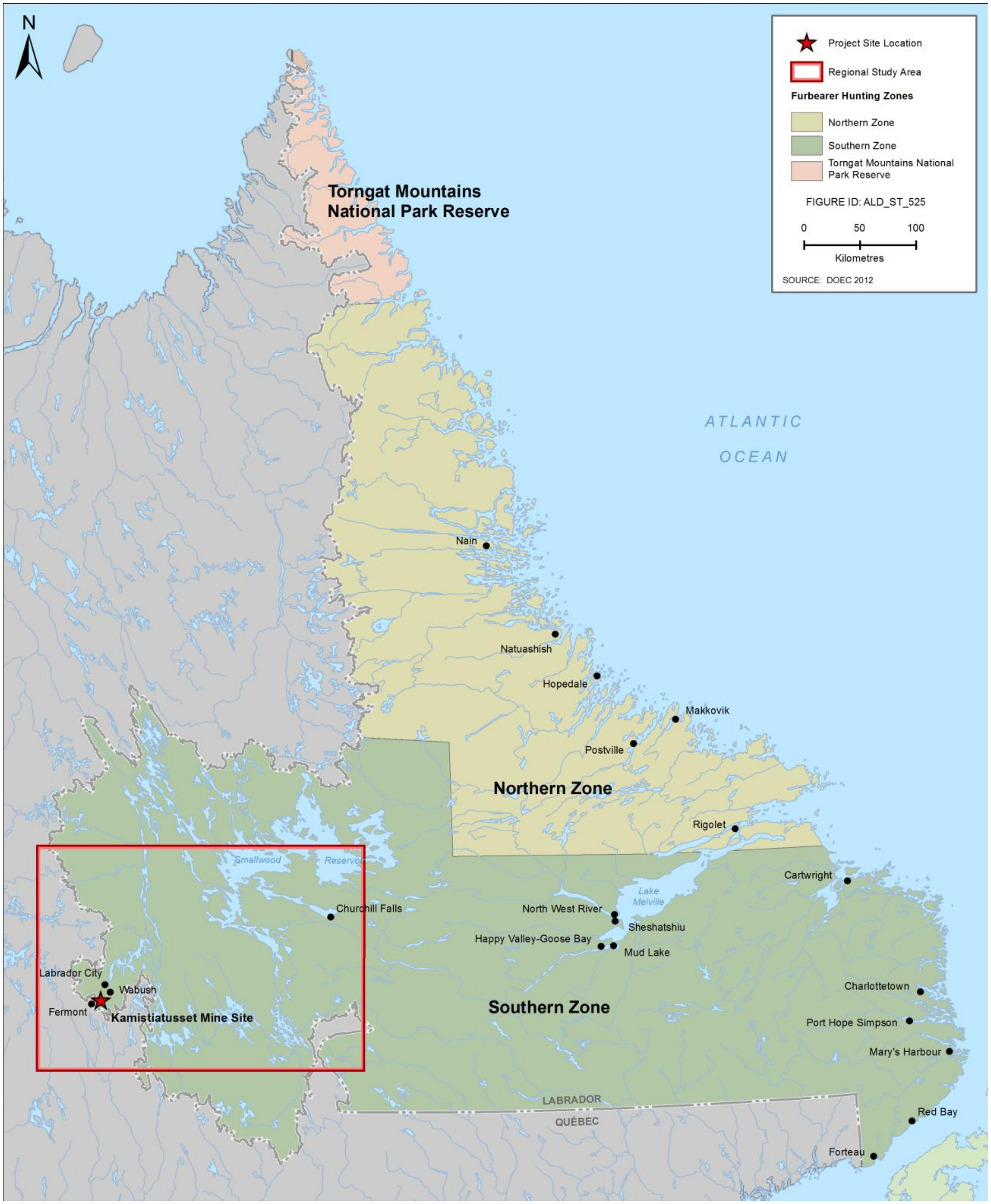
Species	Labrador North	Labrador South
Beaver	October 15, 2012 - May 31, 2013	October 15, 2012 - May 31, 2013
Muskrat	October 5, 2012 - May 31, 2013	October 15, 2012 - May 31, 2013
Otter	October 15, 2012 - March 31, 2013	October 15, 2012 - March 20, 2013
Mink	November 1, 2012 - March 1, 2013	November 1, 2012 - March 20, 2013
Coyote	October 15, 2012 - March 31, 2013	November 1, 2012 - March 20, 2013
Fox, Coloured	October 15, 2012 - March 31, 2013	November 1, 2012 - March 20, 2013
Fox, White	October 15, 2012 - May 31, 2013	November 1, 2012 - March 20, 2013
Lynx	October 15, 2012 - March 31, 2013	November 1, 2012 - March 20, 2013
Wolf	October 15, 2012 - April 30, 2013	November 1, 2012 - April 30, 2013
Ermine (Weasel)	October 15, 2012 - March 31, 2013	November 1, 2012 - March 20, 2013
Squirrel	October 15, 2012 – March 1, 2013	November 1, 2012 - March 20, 2013
Marten	October 15, 2012 - March 31, 2013	November 1, 2012 - March 20, 2013
Fisher	Closed	Closed
Wolverine	Closed	Closed
Source: DOEC 2012c		

Guiding and Outfitting

Outfitters and Guides in Newfoundland and Labrador are regulated by the *Guides Regulations* under the *Wildlife Act* (1985).

Licensed guides are registered by the Government of Newfoundland and Labrador following successful completion of a Firearm Safety / Hunter Education course, a boating safety course, and a valid first aid course; or, successful completion of a guide training program. The annual fee for a guide license is $10.00 plus HST following approval of the application (DOEC 2011a). Guiding without a license or acting as a guide to any un-licensed hunter or angler is an offence under both the *Wildlife Act* and Newfoundland and Labrador *Fishery Regulations.*

Figure 23.7 Furbearer Hunting Zones, Labrador



Non-residents must be accompanied by a licensed guide to participate in big game hunting activities in the Province. Non-residents must obtain a permit from an outfitting company and be accompanied by a licensed guide, hired by the outfitting company. For angling in scheduled waters, non-residents must be accompanied by a licensed guide or a direct relative who is a resident of Newfoundland and Labrador (DOEC 2011a).

23.2.3.4 Fishing

Fishing in Newfoundland and Labrador is regulated and monitored by DFO through the *Newfoundland and Labrador Fisheries Regulations* under the *Fisheries Act* (1985). There are strict measures in place as a result of this Act to ensure harvesting of marine and aquatic species is done in a sustainable manner.

These regulations state that non-residents of Newfoundland and Labrador are required to hire an outfitting company if they wish to fish inland waters of the province. There are two sets of exceptions to this rule that apply, depending on location within the province. In Newfoundland, and Labrador south of 52°N, satisfying one of the following criteria would nullify the legal requirement for a guide (DFO 2012):

- The angler is accompanied by a direct relative who is a resident; or
- The angler in on non-scheduled waters within 800 m of a provincial highway.

In Labrador north of 52°N, hiring an outfitting company / guide is not required if one or more of the follow criteria are met (DFO 2012):

- The angler is accompanied by a direct relative who is a resident;
- The angler is angling at a cooperative camp, anywhere in the lake or pond on which the camp is located or 800 m above or below the camp, but must be accompanied by a licensed guide or direct relative;
- Non-scheduled waters within 800 m of a provincial highway; or
- Within 800 m above or below a bridge on a provincial highway, but must be accompanied by a licensed guide or a direct relative.

Commercial fishing is not prevalent in western Labrador. As of 2006, there were no workers in Economic Zone 2 (the Economic Zone in which the LSA is located) employed as fishers or fish processing workers (Community Accounts 2012).

Trout

Recreational trout fishing is regulated via seasonal and spatial restrictions. Labrador is divided into five Angling Zones (Figure 23.8). The LSA and the majority of the RSA lie within Angling Zone 48. The eastern extent of the RSA intersects the southern portion of Angling Zone 5. Angling Zones differ on daily bag limits, size restrictions, and possession limits for different species of trout. Restrictions and limits for Angling Zones 4 and 5 are shown in Table 23.6.

Table 23.6 Angling Restrictions and Limits by Species, Angling Zones 4 and 5

Species	Daily Bag Limit / Size Restrictions	Possession Limit
Trout – Includes speckled trout and ouananiche	12 fish which can be a combination of any of the species (speckled or ouananiche) or 5 lbs (2.27 kg) round weight + 1 fish of any of those species, whichever is reached first. No ouananiche less than 20 centimeters (8 inches) can be retained.	Twice the daily bag limit
Lake trout	Three fish	Three fish
Northern pike	Two fish	Twice the daily bag limit
Arctic char	Two fish	Twice the daily bag limit
Whitefish	No limit	No limit
Smelt	No limit	No limit
Source: DFO 2012		

Atlantic Salmon

The range of Atlantic salmon throughout the province is divided into 15 Salmon Fishing Zones (SFZs) with rivers connecting to the ocean being classified as scheduled rivers. Fishing on any scheduled river within the Province requires a salmon license, regardless of the fish species pursued or caught. Although there are two SFZs within the RSA, there are no scheduled rivers within the RSA due to its inland location (Figure 23.8). Therefore, sea-run Atlantic salmon are not discussed further in this chapter. A license is not required to angle for ouananiche (land locked Atlantic salmon) within the LSA or RSA.

23.2.3.5 Outdoor Recreation and Tourism

Outdoor recreation and tourism activities with legislative or administrative frameworks in western Labrador include snowmobiling and cabin development.

The Government of Newfoundland and Labrador has legislated mandatory trail passes for snowmobile riders in Labrador. White Wolf Snowmobile Club in western Labrador maintains the White Wolf Trail (Figure 23.9), a network with approximately 500 km of trails (White Wolf Snowmobile Club, 2012). The trail network in western Labrador connects with 300 km of trails in Québec, which are maintained by The Lagoped Snowmobile Club, based in Fermont. Trails in western Labrador are also connected to the Electric Link Trail, which is 200 km in length and runs from western Labrador to Churchill Falls (Destination Labrador 2012a). Trail passes are required for access to these trails.

Figure 23.8 Angling and Salmon Fishing Zones, Labrador

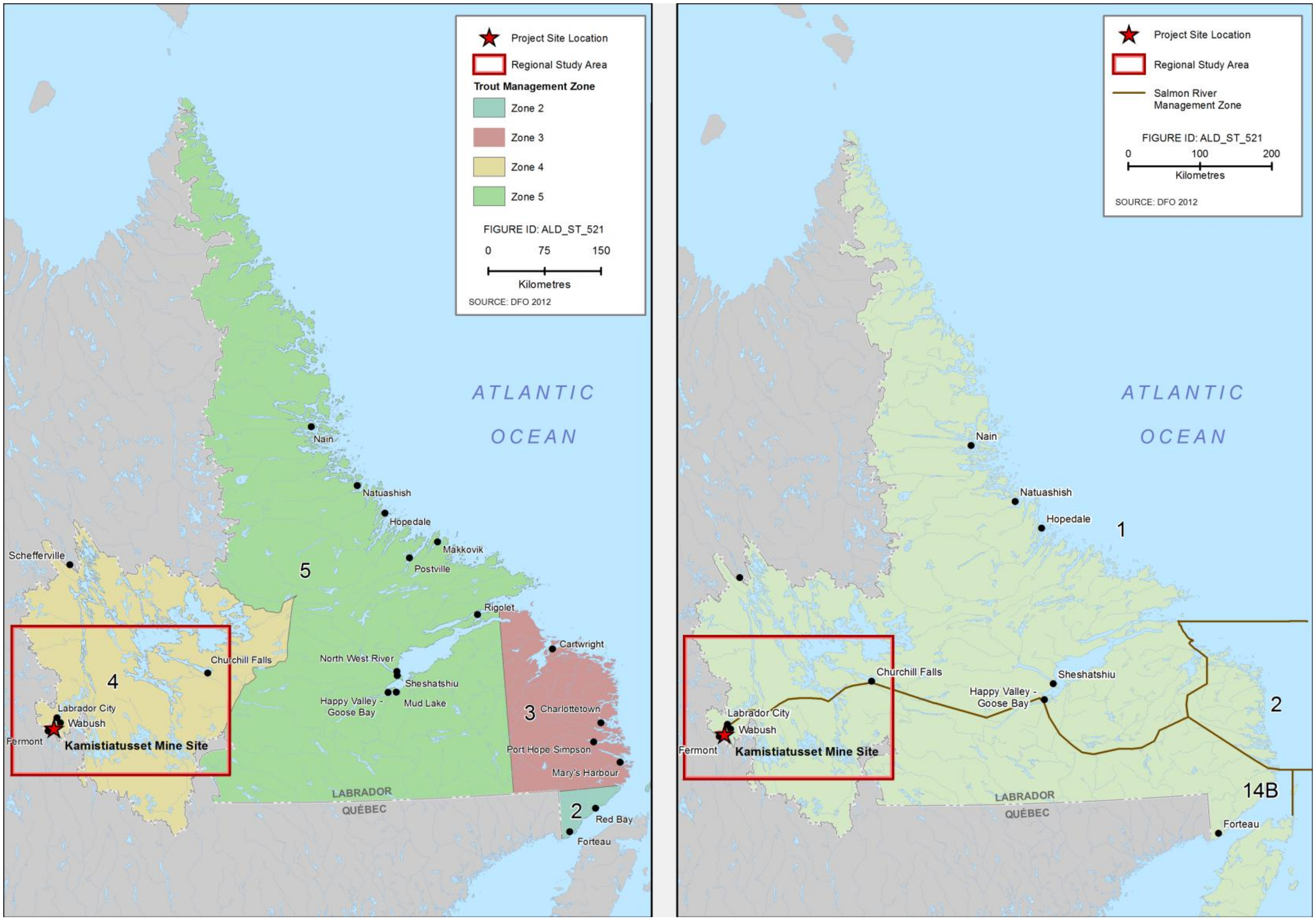
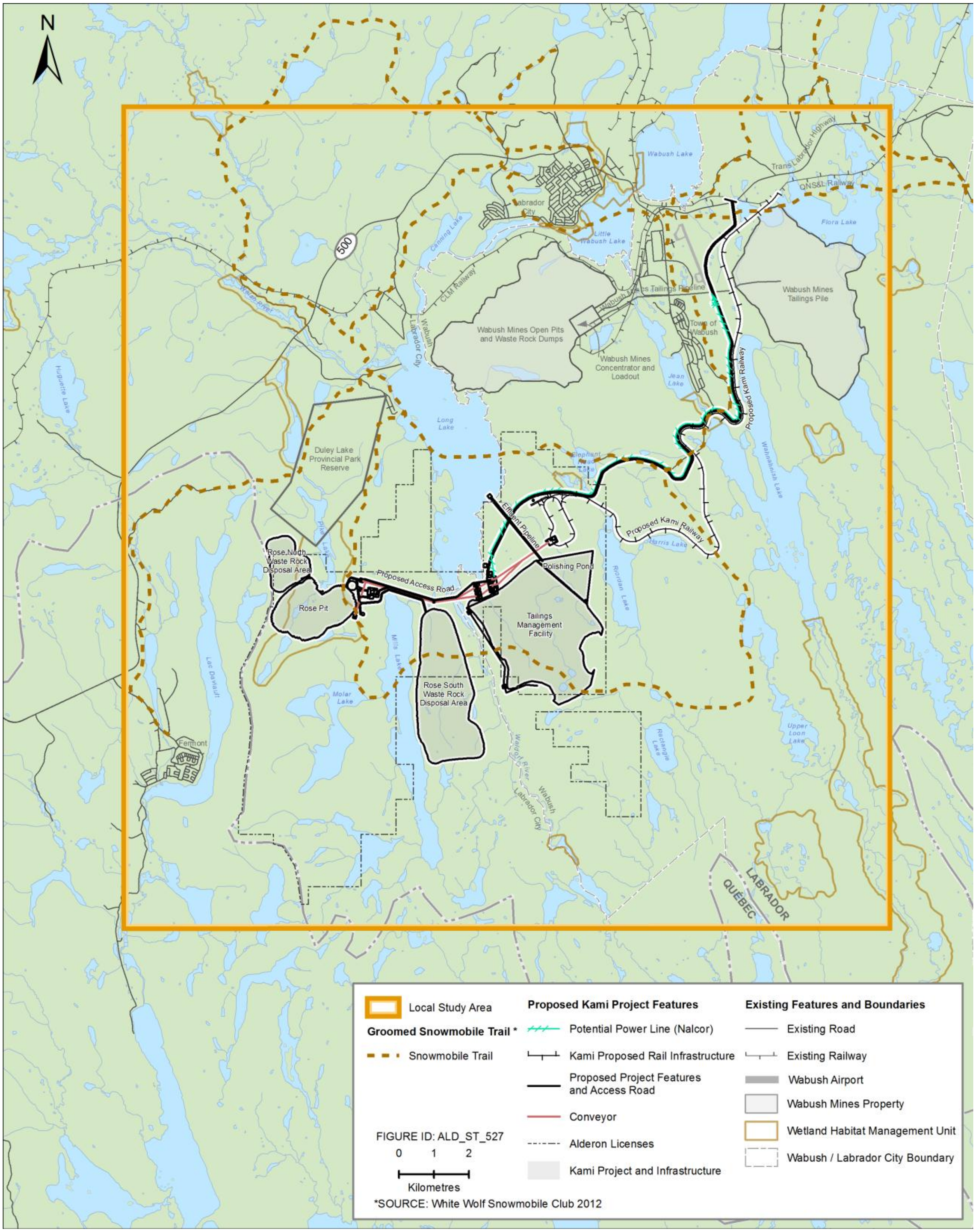


Figure 23.9 Groomed Snowmobile Trails, Western Labrador



Lands available for cabins and cottages in Newfoundland and Labrador are managed by the DOEC, Lands Division. The types of licenses and grants issued by the department include Remote Recreational Cottage Licenses and Recreational Cottage Grants. The former are available where no land-use conflict exists and where no Crown Timber License is in place. Recreational Cottage Grants are available where no land use conflict exists or in areas that have been designated by the Lands Branch for recreational cottage development. In both cases, a completed Crown Land Application Form must be filed with the Regional Lands Office nearest to the land applied for and licenses are only available to permanent residents of Newfoundland and Labrador (DOEC 2007).

To build a cabin in Fermont, applicants must complete a request to use public lands, which is evaluated by the MRC de Caniapiscau. Upon their approval, the request is forwarded to the provincial Ministère des Ressources naturelles et de la Faune (MRNF). The MRNF then consults with Aboriginal groups before they will offer a lease for the public lands. Sites for cabin use must be $4000 m^2$ and must be located within 300 m of a lake or 100 km of a river. Many lakes in the area have reached their limit for cabin usage (Belanger, pers. comm.).

23.2.3.6 Parks, Reserves and Special Areas

Provincial parks, reserves, and ecological reserves in Newfoundland and Labrador are administered through the *Wilderness and Ecological Reserves Act*. There is one Provincial Park Reserve and two Wetland Stewardship Zones within the LSA.

Duley Lake Provincial Park Reserve is located 10 km south of Labrador City and has an area of approximately 7 km^2 (DOEC 2011b). The main purpose of the Duley Lake Provincial Park Reserve is to protect open lichen woodlands, which is representative of Ecoregion V (Labrador). Day use is allowed in the Park Reserve, however overnight camping and timber harvesting area not permitted.

The Newfoundland and Labrador Municipal Wetland Stewardship Program began in 1993 to increase awareness of wetlands and waterfowl in the municipal planning process (Sharpe 2010). Stewardship Programs are joint initiatives between the Eastern Habitat Joint Venture (through DOEC) and municipalities. Labrador City and Wabush have each entered into a Stewardship Agreement in 2005. Each Stewardship Program designates Habitat Management Units for waterfowl habitat conservation purposes. The Project overlaps one of Labrador City's Management Units and is in close proximity to two of Wabush's Units (DOEC 2012b). Details pertaining to the Stewardship Agreements and Habitat Management Units are provided in Chapter 19: Birds, Other Wildlife and their Habitats, and Protected Areas.

The *Wilderness and Ecological Reserves Act* also administers ecological reserves within the Province. Although the Redfir Lake-Kapitagas Channel Ecological Reserve is outside the LSA, it overlaps with the RSA. It is located in southwest Labrador, south of Ashuanipi Lake and approximately 160 km southeast of Labrador City and Wabush. The two parcels of the Redfir Lake-Kapitagas Channel Ecological Reserve protect the only known natural stands of jack pine in the province, and the most easterly occurrence of this tree species in North America (DOEC 2011d).

23.2.3.7 Forestry

Forest harvesting in Newfoundland and Labrador is managed by the Department of Natural Resources (NLDNR), with some elements, including promotion and opportunity identification, managed through the Forestry and Agrifoods Agency. Forest harvesting is managed pursuant to the *Forestry Act* and supporting regulations. In Labrador, forestry is managed through a regional office in Happy Valley-Goose Bay, with support from District Offices in North West River, Cartwright, and Wabush. There are also satellite offices throughout the area.

Labrador is divided into eight Forest Management Districts (FMDs). The LSA and RSA is almost entirely within FMD 22, intersecting the western extent of FMD 19B (Figure 23.10). FMDs 19A and 19B are the centre of forestry-related activity in Labrador (Halifax Global Management Consultants 2006). Combined, FMD 19 is 7.1 million hectares in size and FMD 19A, which has the highest concentration of high boreal forest, is 2.3 million hectares in size; it is described as a heavy to moderately-stocked spruce forest.

District 22 covers an area of approximately 8 million hectares, making it the largest FMD in the Province. While this FMD has not been utilized for large scale commercial harvesting, small scale commercial and subsistence harvesting have been carried out in the district (NLDNR 2011a). The 2012 – 2016 Management Plan for FMD 22 included proposed commercial and domestic harvesting activities in the area. Commercial harvesting is permitted to occur in six commercial blocks, which are outside the LSA, but within the RSA (Figure 23.11).

Domestic harvesting in FMD 22 is carried out under a provincial permit for firewood, saw-logs and building materials. A total of 151 domestic permits are issued each year. Each permit allows for a maximum volume of 22 m^3. The management plan for FMD 22 also anticipates small volumes of wood to be harvested by cabin owners outside of the identified domestic harvesting areas (NLDNR 2011a).

The District 22 management plan considers forest management actions in response to potential developments, including mining industry expansion. There are two scheduled actions in the event of such development:

1. Participate in any consultations on potential new developments; and
2. Monitor new developments so that timber is used before additional area is disturbed (NLDNR 2011a).

Domestic harvesting is carried out under a provincial permit for firewood, saw-logs and building materials. A total of 151 domestic permits are issued each year. The management plan for FMD 22 also anticipates small volumes of wood to be harvested by cabin owners outside of the identified domestic harvesting areas (NLDNR 2011a).

Figure 23.10 Forest Management Districts in the Local and Regional Study Areas

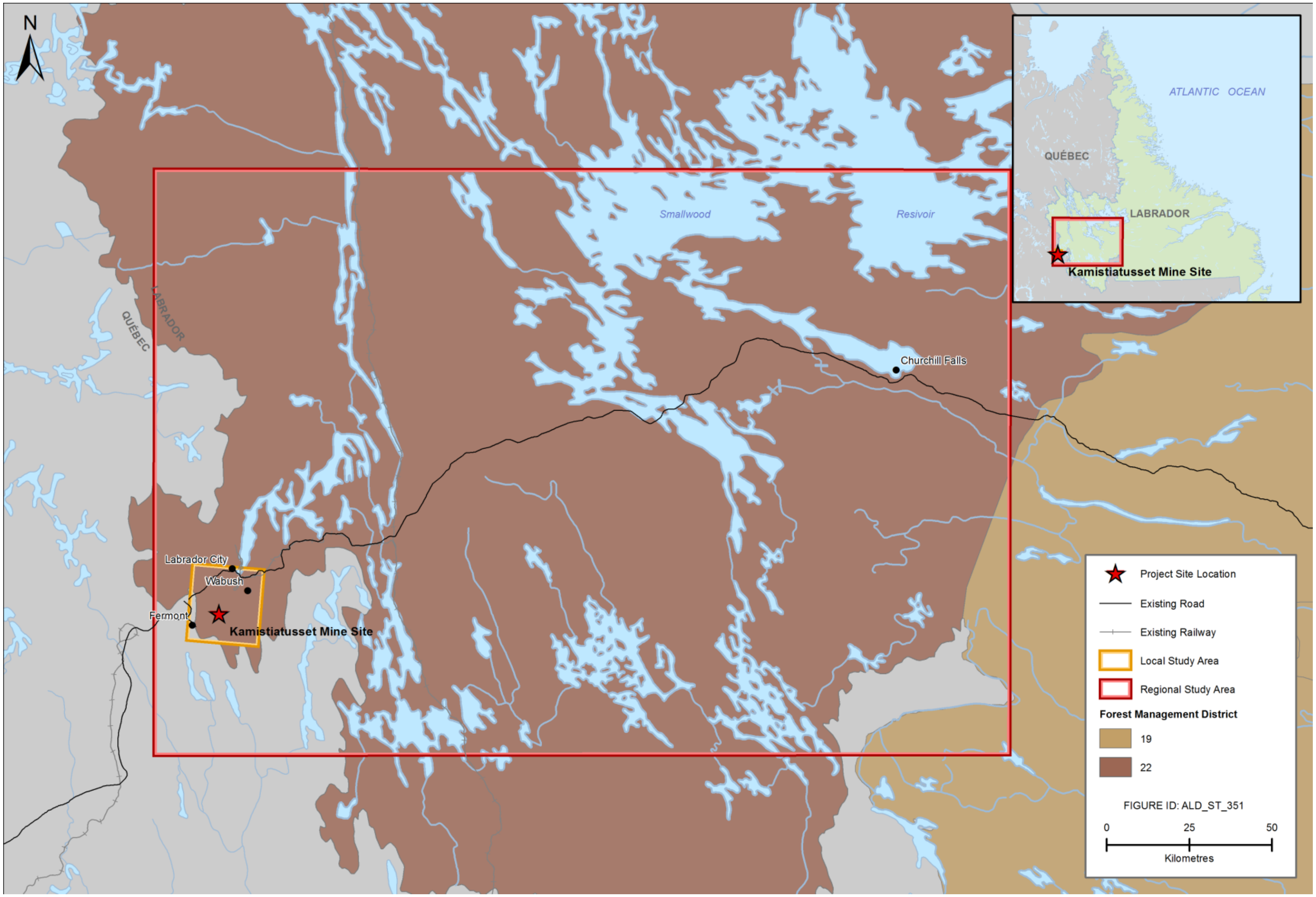
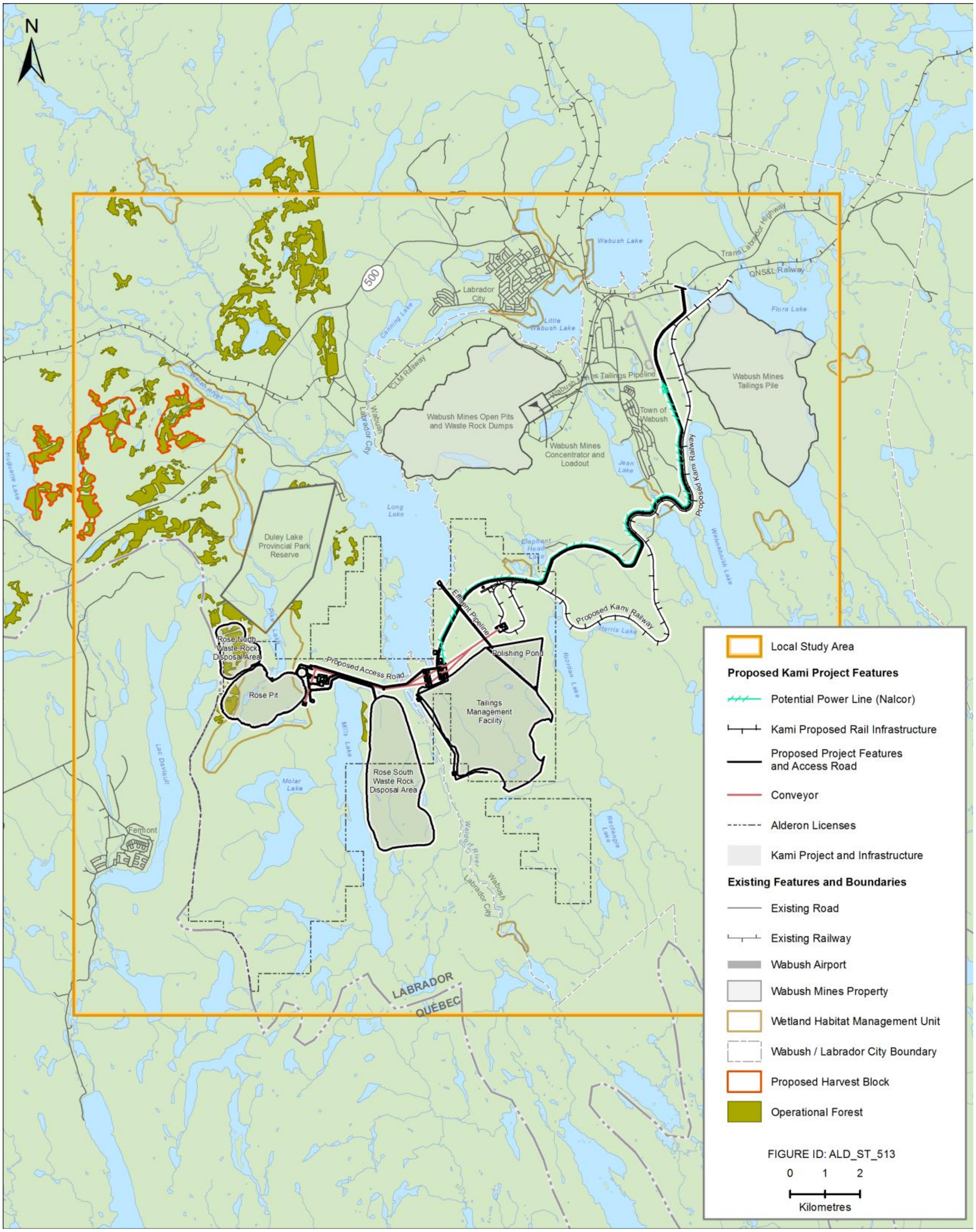


Figure 23.11 Commercial Forestry Harvesting Blocks in Western Labrador



23.2.3.8 Mineral Exploration

Mining and mineral exploration in Newfoundland and Labrador is regulated by the *Mining Act*, *Mining Regulations*, the *Mineral Holdings Impost Act* and *Mineral Holdings Impost Regulations*, the *Quarry Minerals Act*, *Quarry Minerals Regulations*, as well as the *Undeveloped Mineral Areas Act* and Undeveloped Mineral Areas Order. The Mines Branch of the NLDNR is responsible for the supervision, control and direction of all matters relating to mines, minerals, quarries and quarry materials (NLDNR 2012d).

23.2.3.9 Agriculture

Agriculture in Newfoundland and Labrador is administered through the Agrifoods Development Branch of NLDNR. The provincial government entered into a new agriculture cost–shared agreement with the federal government in March 2009. The Growing Forward Framework Agreement will provide funding for land development, food safety, environmental stewardship, innovation and human resource development. Labrador farmers can apply for funding through six programs: Agriculture Innovation Program, Agriculture Land Development Program, Agriculture Opportunities Program, Agriculture Sustainability Program, Mitigating Agriculture Risks Program, and the New Farm Investment Program (NLDLAA 2010). There is no designated agricultural land use in the LSA or the RSA. Labrador Rail Transportation

Rail transportation in Newfoundland and Labrador is regulated by the *Rail Service Act, 2009* under the authority of the provincial department of Transportation and Works (NLDTW 2011). The Act prohibits the purchase, operation or construction on a rail service without government approval and a permit. Under the Act, the minister has authority to issue regulations respecting the operation of a rail service, the interconnection of rail service lines, and rail inspection, as well as administrative regulations regarding permits and fees.

23.2.3.10 Seaplane Usage

Seaplane (commonly referred to as floatplanes) use is regulated by Transport Canada under the *Canadian Aviation Regulations.* Transport Canada also encourages all commercial and private seaplane operators to adopt the safety best industry practices detailed in the Civil Aviation Safety Alert (CASA) No. 2011-03.

23.2.3.11 Communications Towers

The regulation of communications towers is the responsibility of the Radiocommunications and Broadcasting Regulatory Branch of Industry Canada under the federal *Radiocommunications Act*. Industry Canada is the federal authority responsible for regulating radiocommunication, including TV and radio broadcasting, cable TV, cellphone networks, two-way radios and other radiocommunication services. Such services are covered by the federal *Radiocommunications Act*. Industry Canada requires proponents who are planning to install an antenna tower to cooperate with local land use authorities to accommodate reasonable local requirements. The required procedures for installing or modifying an antenna system are detailed in the Industry Canada publication *Radiocommunication and Broadcasting Antenna Systems* (Industry Canada 2007).

23.3 Establishing Standards or Thresholds for Determining the Significance of Environmental Effects

The likely effects of the Project on Other Current Use of Lands and Resources are described using the following attributes, which are based on standard environmental assessment practice and the EIS Guidelines.

The criteria for establishing significance are as follows:

- **Direction:**
  - Neutral;
  - Adverse; or
  - Positive.
- **Magnitude:**
  - Low (affects a small group of land and resource users);
  - Moderate (affects less than the majority of land and resource users across multiple activities); or
  - High (affects the majority of land and resource users across multiple activities).
- **Geographic Extent:**
  - Within the PDA;
  - Within the LSA; or
  - Within the RSA.
- **Frequency:**
  - Not likely to occur;
  - Occurs once;
  - Occurs sporadically at irregular intervals;
  - Occurs on a regular basis and at regular intervals; or
  - Occurs continuously.
- **Duration:**
  - Short Term (restricted to construction phase);
  - Medium Term (continues through operations and maintenance phase);
  - Long Term (16 to 50 years); or
  - Permanent.
- **Reversibility:**
  - Reversible: the effect can be reversed to existing conditions; or

  - Irreversible: the effect can not be reversed.
- **Environmental or Socio-economic Context:**
  - Undisturbed: Area relatively or not adversely affected by human activity; or
  - Disturbed: Area has been substantially previously disturbed by human development or human development is still present.

A significant adverse effect on other current land and resource use is defined as one where use of the land by the Project is not compatible with adjacent land use as designated through a regulatory land use process, or the Project results in wide restrictions or degrades land and resource use to a point where activities cannot continue at or near current levels within the RSA over the long-term.

23.4 Potential Project-VEC Interactions

Each Project activity and physical work for the Project, listed in Table 23.7, is ranked as 0, 1, or 2 based on the level of interaction each will have with the VEC. A key to these rankings can be found at the bottom of the table.

Table 23.7 Potential Project Environmental Effects to Other Current Use of Lands and Resources

Project Activities and Physical Works	Potential Environmental Effects				
	Change in Access	Change in Level of Activity / Use	Change in Cabin Use	Change in Viewscape	Change in Designated Land Use
Construction					
Site Preparation (incl. clearing, excavation, material haulage, grading, removal of overburden and stockpiling)	2	2	2	2	2
Construction of Roads	2	2	2	2	2
Construction of Site Buildings and Associated Infrastructure (maintenance facilities, offices, plant, crushers, concentrator, conveyors, gatehouse, pumphouses, substation, security fencing, sanitation system)	2	2	2	2	0
Construction of Mine Tailings Management Facility (TMF)	2	2	2	2	2
Construction of Railway and Load-out Facilities (silos)	2	2	2	2	2
Construction of Power Line	2	2	2	2	2
Construction of Stream Crossings	2	2	2	2	2
Installation of Water Supply Infrastructure (wells, pumps, pipes)	2	2	2	2	0
Onsite Vehicle / Equipment Operation	0	2	2	0	0

Project Activities and Physical Works	Potential Environmental Effects				
	Change in Access	Change in Level of Activity / Use	Change in Cabin Use	Change in Viewscape	Change in Designated Land Use
Waste Management	0	0	0	0	0
Transportation of Personnel and Goods to Site	0	2	2	0	0
Expenditures	0	0	0	0	0
Employment	0	1	0	0	0
Operation and Maintenance					
Open Pit Mining (incl. drilling, blasting, ore and waste haulage, stockpiling, and dewatering)	2	2	2	2	2
Ore Processing (incl. crushing, conveying, storage, grinding, screening)	1	2	2	2	2
Concentrator Operations (gravity and magnetic separation, tailings dewatering, tailings thickener, concentrate conveyance to load-out)	1	2	2	0	0
Tailings Disposal in TMF	1	1	2	2	0
Waste Rock Disposal on Surface	1	1	2	2	2
Water Treatment (incl. mine water and surface runoff) and Discharge	1	2	2	1	0
Rail Load-Out by Silo Discharge	1	2	2	2	2
Rail Transport	2	2	2	2	2
Onsite Vehicle / Equipment Operation and Maintenance	0	2	2	2	0
Waste Management	0	0	0	0	0
Transportation of Personnel and Goods to Site	0	2	1	2	0
Fuel Storage and Dispensing	1	0	1	2	0
Progressive Rehabilitation	2	0	2	2	0
Expenditures	0	0	0	0	0
Employment	0	2	0	0	0
Decommissioning and Reclamation					
Site Decommissioning	2	2	2	2	2
Site Rehabilitation (building demolition, grading, scarifying, hydro-seeding)	2	2	2	2	2

Project Activities and Physical Works	Potential Environmental Effects				
	Change in Access	Change in Level of Activity / Use	Change in Cabin Use	Change in Viewscape	Change in Designated Land Use
Accidents and Malfunctions					
Forest Fire	2	2	2	2	2
Polishing Pond Breach	2	2	2	2	0
Train Derailment	2	2	2	2	2
KEY 0 No interaction. 1 Interaction occurs; however, based on past experience, the resulting effect can be managed to acceptable levels through standard operating practices and/or through the application of best management or codified practices. No further assessment is warranted. 2 Interaction occurs, and resulting effect may exceed acceptable levels without implementation of specified mitigation. Further assessment is warranted.					

Any Project activity resulting in alterations or restrictions to specific terrestrial landscape features and waterbodies, or activities requiring implementation of restricted zones, can result in environmental effects on Other Current Use of Lands and Resources. Each Project activity and physical work is listed in Table 23.7, and each interaction is ranked as 0, 1, or 2 based on the level of interaction each activity or physical work could have on Other Current Use of Lands and Resources.

Interactions ranked as 2 are those associated with Project activities involving alterations of the terrain (and potentially waterways), creation of dust or noise, or implementation of restricted access zones that could result in measureable changes to land and resource use, and are primarily associated with the construction phase.

Interactions ranked as 0 either involve no alteration to the existing landscape and ground surface, generate no dust or noise, or occur on already-disturbed ground. In consideration of the nature of the interactions, the potential environmental effects of all Project activities and physical works ranked as 0 in Table 23.7 are rated as not significant and are not considered further in the assessment.

Interactions ranked as 1 may result in landscape or ground alteration, or generate dust or noise. However, based on past experience, the resulting effect can be managed to acceptable levels through standard operating practices and/or through the application of best management or codified practices. No further assessment is warranted.

Change in Access

Change in access due to the Project could result from alteration of the landscape or waterbodies and implementation of restricted-access zones around Project activities and features, preventing access or altering access routes.

Construction activities that will not result in landscape or waterbody alterations, do not require implementation of a restricted-access zone, and are therefore ranked as 0 (i.e., no effect anticipated) are:

- Onsite vehicle / equipment operation;
- Waste Management;
- Transportation of personnel and goods to site;
- Expenditures; and
- Employment.

Operations and maintenance activities that will not result in landscape or waterbody alterations, do not require implementation of a restricted-access zone, and are therefore ranked as 0 are:

- Onsite vehicle / equipment operation and maintenance;
- Waste management;
- Transportation of personnel and goods to site;
- Expenditures; and
- Employment.

Several areas which were subject to landscape alterations and implementation of restricted-access zones during the construction phase will continue to be used throughout the operation and maintenance phase. As the footprint of various Project features and their associated restricted-access zones will be on-going throughout the operations and maintenance phase, they have been ranked 1. These activities include:

- Ore processing;
- Concentrator operations;
- Tailings disposal in the TMF;
- Waste rock disposal on surface;
- Rail load-out by silo discharge; and
- Fuel storage and dispensing.

Water treatment and discharge has also been ranked as 1 for operation and maintenance. The Project will discharge treated process water into the southeast corner of Long Lake. For public safety, access to this corner of the lake by boat will be limited by fencing and signage. It is anticipated that the restricted area would occupy less than 5 percent of Long Lake and would be designed such that it does not interfere with navigation between the lake and Waldorf River.

Change in Level of Activity / Use

Change in level of activity / use due to the Project could result from alteration of the landscape or waterbodies, implementation of restricted-access zones around Project activities and features, increased levels of dust and/or noise, and increased competition for resources due to changes in the local population.

Expenditures and waste management are the only construction activities that will not result in alteration of the landscape or waterbodies, implementation of a restricted-access zone, increased levels of dust and/or noise, or increased local population, and is therefore ranked 0.

Employment is the only construction activity ranked 1. Alderon will implement a no harvesting and firearms prohibition policy at the Project site, which will help reduce the likelihood of the construction workforce competing with local residents. . Therefore there will not be an increase in activity or competition for resources during construction.

Operations and maintenance activities that will not result in alterations of landforms or waterbodies, implementation of restricted-access zones, or increased levels of dust or noise, and therefore are ranked 0, are waste management, fuel storage and dispensing, progressive rehabilitation, and expenditures.

As tailings disposal in the TMF and waste rock disposal have the potential to result in increased levels of airborne dust, which could discourage land and resource use, these activities are ranked 1. Alderon will employ best practices for dust suppression at the TMF and waste rock disposal areas. In addition the TMF and waste rock disposal areas will be designed to meet industry and regulatory standards. Disposal at these facilities will be completed in accordance with industry best practices, and will be in compliance with the Project EPP.

Change in Cabin Use

Change in cabin use due to the Project could result from cabins overlapping with the PDA, by elevated noise and dust levels, and by changes in access to cabin areas.

Expenditures, employment, and waste management are the only construction and operations and maintenance activities that will not overlap with existing cabins, and will not cause increased noise and dust levels and is therefore ranked 0.

For operation and maintenance, fuel storage and dispensing and progressive rehabilitation are ranked 1. Although these specific activities will not directly interact with adjacent cabin use or cause increased dust and noise, they will result in increased traffic and activity at the Project site.

Change in Viewscape

The viewscape can be altered by physical features or works that are visible from outside the PDA.

Construction activities that will not result in changes to the viewscape and are therefore ranked 0 are:

- Onsite vehicle / equipment operation;
- Waste management;
- Transportation of personnel and goods to site;
- Expenditures; and
- Employment.

During operations and maintenance there will be Project activities that do not result in changes to the viewshed. These are concentrator operations, waste management, expenditures, and employment. These activities are ranked 0. Concentrator operations will occur entirely within structures that were built during the construction phase and will not be visible. Waste management will involve the removal of all domestic waste from the PDA, to be disposed in licensed facilities off-site. Transportation of personnel and goods will involved trucks and busses, and will not result in changes to the landscape or view.

Water treatment and discharge is ranked 1 during operation and maintenance. Discharge water will treated using industry best practices so as to meet regulatory discharge guidelines. In addition, red water will be treated by flocculation so that it does not alter the color of the receiving waterbody (Long Lake).

Change in Designated Land Use

The Project is located in close proximity to, and in some cases, overlaps with designated lands. These include a provincial park reserve, wetland conservation habitat management units, and municipally zoned lands. Project effects to Duley Lake Provincial Park Reserve and Habitat Management Units are assessed in Chapter 19 (Birds, Other Wildlife and Their Habitats, and Protected Areas), and are not assessed further in this chapter. Municipally zoned lands such as the Wabush Protected Water Supply Area are addressed in this chapter.

Construction activities that will not overlap with municipally zoned lands, and that are therefore ranked 0, are:

- Construction of site buildings and associated infrastructure;
- Installation of water supply infrastructure;
- Onsite vehicle / equipment operation;
- Waste management;
- Transportation of personnel and goods to site;
- Expenditures; and
- Employment.

Operation and maintenance activities that will not overlap with municipally zoned lands, and that are therefore ranked 0 are:

- Concentrator operations;
- Tailings disposal in the TMF;
- Waste rock disposal on surface;
- Water treatment and discharge;
- On-site vehicle / equipment operation and maintenance;
- Waste management;
- Transportation of personnel and goods to site;
- Fuel storage and dispensing;
- Progressive rehabilitation;
- Expenditures; and
- Employment.

Selection of Environmental Effects and Measurable Parameters

The environmental assessment of the Other Current Use of Lands and Resources is focused on the following environmental effects:

- Change in access;
- Change in level of activity;
- Change in Cabin use;
- Change in Viewscape; and
- Change in Designated land use areas.

The assessment of Project effects is based on an extensive review of publically available, secondary sources, informant interviews with local land users to characterize baseline conditions, and issues raised during Alderon's public consultations. The Project effects on Other Current Use of Lands and Resources are assessed, the need for mitigation considered and the significance of residual effects are determined. The measurable parameters used for the assessment of the five potential environmental effects, and the rationale for their selection, are indicated in Table 23.8.

Table 23.8 Measurable Parameters for Other Current Use of Lands and Resources

Environmental Effect	Measurable Parameter	Rationale for Selection of the Measurable Parameter
Change in Access	• Measured by changes in access to harvesting areas, waterbodies (including Lac Daviault for sea planes), snowmobile trails, hiking trails, outdoor recreation areas	• The Project may affect access to areas used by local residents
Change in Level of Activity / Use	• Measured by changes in opportunity to conduct hunting / trapping / fishing / navigation / winter travel / outdoor recreation activities; changes in use of the communication tower; and by noise and dust levels. It is also measured by the increase in population	• The Project may affect the way land users and harvesters use the area • There is potential of increased pressure on resources as the local population increase as a result of the Project.
Change in Cabin Use	• Measured by change in number of cabins and access to cabin areas, and by noise and dust levels	• The Project may have an effect on cabins and access to them
Change in Viewscape	• Measured by viewshed analysis and before-and-after photo simulations	• The Project will affect the viewscape
Change in Designated Land Use	• measured by changes in number of designated land use areas	• The Project may affect land uses as designated in provincial and municipal planning documents

23.5 Existing Environment

The existing environment for Other Current Use of Lands and Resources was characterized through an extensive review and analysis of government data, publicly available secondary source material, and informant interviews. Detailed information was gathered on a number of recreational, subsistence and commercial activities that occur in western Labrador including: cabin use, hunting, fishing, boating / water navigation; trapping (for commercial and recreational purposes); snowmobiling and skiing; wood harvesting (for firewood and saw-logs); berry-picking; birding and geo-caching; guiding; forestry; mineral exploration; agriculture, transportation; seaplane usage; communications towers; and municipal water supplies.

A detailed description of the Labrador City and Wabush Wetland Stewardhip Zones is provided in Chapter 19 (Birds, Other Wildlife and their Habitats, and Protected Areas).

Local knowledge pertaining to the Atmospheric Environment is presented in Table 23.9.

Table 23.9 Local Knowledge – Other Land and Resources Use

Date	Stakeholder	Community	Comment
September 7, 2011	Town of Wabush	Wabush	There are more than 500 cabins in the Labrador City area.
September 7, 2011	Town of Wabush	Wabush	It was mentioned that Alderon would need to implement proper safety precautions for travel back and forth from the mill, as it may interact with snowmobile trails.
March 15, 2012	Town of Wabush	Wabush	Wabush and Labrador City do not have capacity to provide firefighting service.
March 15, 2012	Town of Wabush	Wabush	Jean Lake and Elephant Head Road are recreation areas.
March 15, 2012	Town of Wabush	Wabush	No operational sewage plant in industrial area.
March 13, 2012	Individual	Wabush	Snowmobile usage in the Project area.
March 13, 2012	Individual	Wabush	Proposed rail line follows current access used by cabin owners. Rail line will cut off roadway access to cabins if no alternative is provided.
March 13, 2012	Individual	Wabush	Provided information and corrections about the locations and ownership of cabins in the Project area
March 13, 2012	Individual	Wabush	Cabin owner 301 indicated that his cabin is located less than 1km from the rail line.
October 24, 2011	Town of Fermont	Fermont	The Town is developing a protection area in which there will be recreational activities taking place. This area is located in proximity to the Project.
November 15, 2011	Town of Fermont	Fermont	A lot of people hike there [the hill by the Lac d'Aviault] and there is a beautiful viewpoint, we would not want it to be compromised by the waste rock pile.
November 15, 2011	Town of Fermont	Fermont	There are two cabins on the lake by Rose Pit.
Februrary 9, 2012	Town of Fermont	Fermont	There is a snowmobile trail that might be affected by the Project. Fermont is also planning to build a camping site by the Lac d'Aviault, in which they would seed trout in the lake to organize an annual fishing derby.
February 23, 2012	Town of Fermont	Fermont	Cross country ski and snowshoeing trails that may be affected by the Project.
February 23, 2012	Town of Fermont	Fermont	There is a trail that goes approximately 2km from pit
March 15, 2012	Individual	Fermont	There are only two good beaches in the entire area - in Fermont and Duley Lake.
March 15, 2012	Individual	Fermont	There is a campground near Daviault Lake.
October 12, 2011	Labrador City Community Member	Labrador City	Provided information about ownership and location of cabins in the Project area:

Date	Stakeholder	Community	Comment
March 15, 2012	Individual	Labrador City	Provided information about the location and ownership of cabins in the Project area
March 15, 2012	MRC de Caniapiscau		There is a trail that goes approximately 2km from pit

23.5.1 Municipal Land Use

The PDA overlaps the both the Labrador City Municipal Planning Area (MPA) and Wabush MPA.

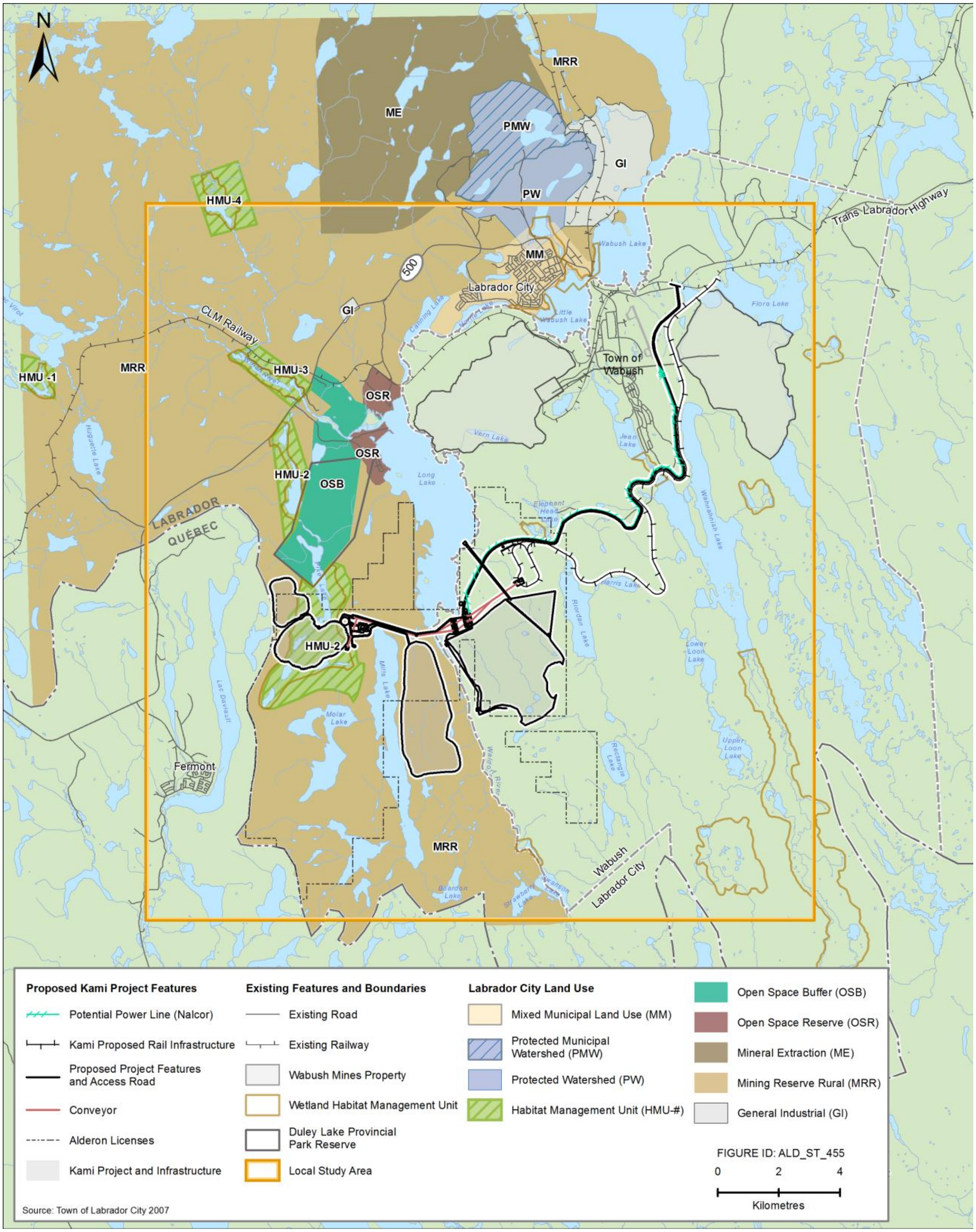
23.5.1.1 Labrador City

The Labrador City MPA includes lands west of Wabush Lake, Little Wabush Lake, Long Lake and the Waldorf River extending toward the Labrador – Québec border (Town of Labrador City 2007). The MPA encompasses proposed Project features, including Rose North Waste Rock Disposal Area, Rose Pit, parts of the site access road and Rose South Waste Rock Disposal Area (Figure 23.12).

The Labrador City Municipal Plan details the following specific land use zones:

- Residential-1;
- Residential-2;
- Mixed Development;
- Commercial General;
- Commercial Highway;
- Central Business District;
- Light Industrial;
- Public Use;
- Open Space Recreation;
- Open Space Buffer;
- Conservation;
- Mineral Extraction;
- Mining Reserve Rural;
- Protected Watershed; and
- Protected Municipal Watershed.

Figure 23.12 Municipal Land Use Designations, Town of Labrador City



Mineral Reserve Rural lands refer to all lands within the Labrador City planning area that do not fall within other land use designations. The Labrador City municipal plan states that almost the entire planning area, approximately 446 km^2, has either commercial mineral reserves or high potential to contain mineral resources. Permitted land use in the Mining Reserve Rural zone includes mineral exploration, agriculture, cemetery, transportation (related to mining operations) and forestry. Other uses may be permitted at the discretion of council. It is the intention of town council to protect Mineral Reserve Rural lands from any type of development that would hinder the future development of mineral reserves (Town of Labrador City 2007).

Open Space Recreation areas are designated for outdoor recreation uses and facilities, public, private and commercial parks, and natural areas, as well as trail corridors. Other uses such as agriculture, mineral exploration and transportation may be permitted if they meet appropriate development criteria (Town of Labrador City 2007). There are two Open Space Recreation zones designating private campgrounds located on the northeast shore of Long Lake.The Open Space Buffer designation is designed to provide separation between conflicting land uses. The open space buffer zone encompassing the Duley Lake Provincial Park Reserve serves as a buffer for the private campgrounds designated as Open Space Recreation (Town of Labrador City 2007).

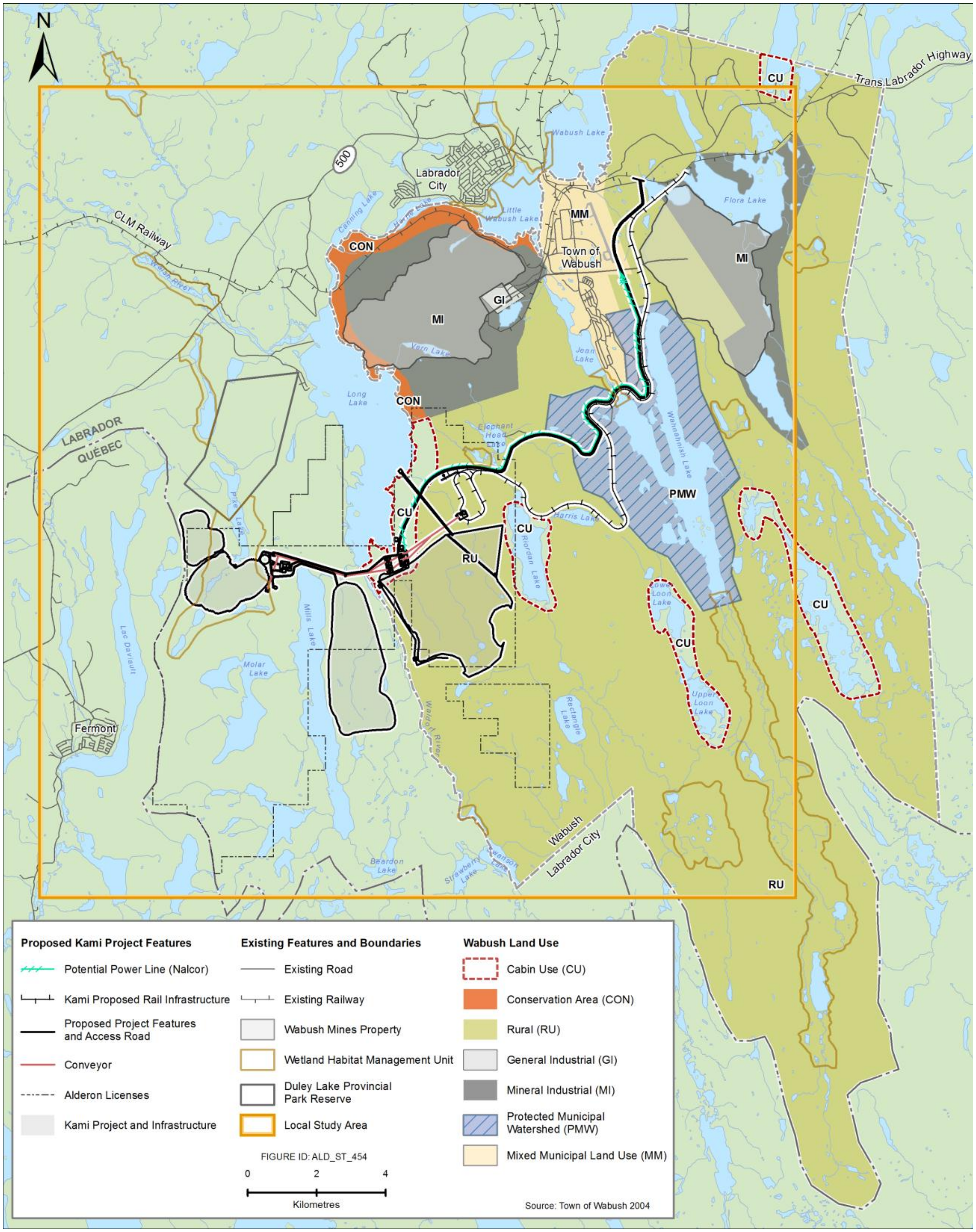
Water supply zones are discussed separately below.

23.5.1.2 Wabush

The Wabush MPA extends to the western shores of Wabush Lake, Long Lake and the Waldorf River. Its eastern extent is approximately 6 km from the Town of Wabush (Figure 23.13). The Wabush MPA is divided into the following designations:

- Residential;
- Mobile Home;
- Commercial;
- General Industrial;
- Airport Industrial;
- Light Industrial;
- Mining Industrial;
- Public;
- Recreation;
- Comprehensive Development Area;
- Conservation;
- Watershed; and
- Rural.

Figure 23.13 Municipal Land Use Designations, Town of Wabush



Rural lands refers to all lands within the Wabush MPA other than those designated for urban and other specific purposes. The Municipal Plan states that no development will be permitted on rural land, except development associated with forestry, municipal water storage, outdoor recreation, resource conservation, and other uses outlined in the plan. Other uses may be permitted at the discretion of Council, including industrial activity such as mineral exploration, aggregate resource extraction, hazardous industry, and general industry. The plan also states that electric power transmission, other public utilities or road construction and maintenance may be permitted, provided that they are consistent with the objective of retaining the qualities of the rural environment (Town of Wabush 2004).

Residential dwellings are not permitted in rural lands. However, there are five areas designated for cabin use within the rural land use zone. Infill development is permitted in these areas, subject to requirements of DOEC, Government Services, and approval by Wabush council (Town of Wabush 2004).

23.5.1.3 Protected Water Supply

Wabush sources its municipal water supply from Wahnahnish Lake, located to the southeast of the town. Under the Town of Wabush Municipal Plan, Wahnahnish Lake and its watershed area are protected from development (Figure 23.14). Development activity in Wahnahnish Lake watershed must be approved by the Wabush Municipal Council and the Water Resources Division of DOEC (Town of Wabush 2004).

Labrador City's municipal water supply is currently sourced from Beverly Lake, located to the northeast of the town (Figure 23.14). In 2007, it was estimated that the Beverly Lake water supply would be sufficient to meet the demand over the next ten-year population forecast. Dumbell Lake, located north of Beverly Lake, has been designated as a future municipal water supply for Labrador City. This lake is reserved to meet future commercial / industrial demands (Town of Labrador City 2007).

23.5.2 Residential and Recreational Property

23.5.2.1 Cabins

Within the Labrador City / Wabush / Fermont area, a total of 276 recreational cabins identified through requests to Newfoundland and Labrador Crown Lands and Québec Ministère des Ressources naturelles et de la Faune, and were supplemented through direct consultation with cabin owners at various public events held by Alderon. Of the 276 cabins recorded, 233 are within the LSA (Figure 23.15). This includes 200 in Labrador, and 76 in Québec. The number and precise locations of cabins will be refined as Alderon continues its on-going consultation with cabin owners.

Access to cabins during the ice-free months is either by boat, road or along trails or wood-roads using ATVs or trucks. Snowmobiles are the principal means of travel to and from cabins in winter, when the majority of cabin usage appears to occur.

It is estimated that three cabins are located within the PDA, overlapping with features of the Project (Figure 23.15).

Figure 23.14 Protected Water Supply Areas of Labrador City and Wabush

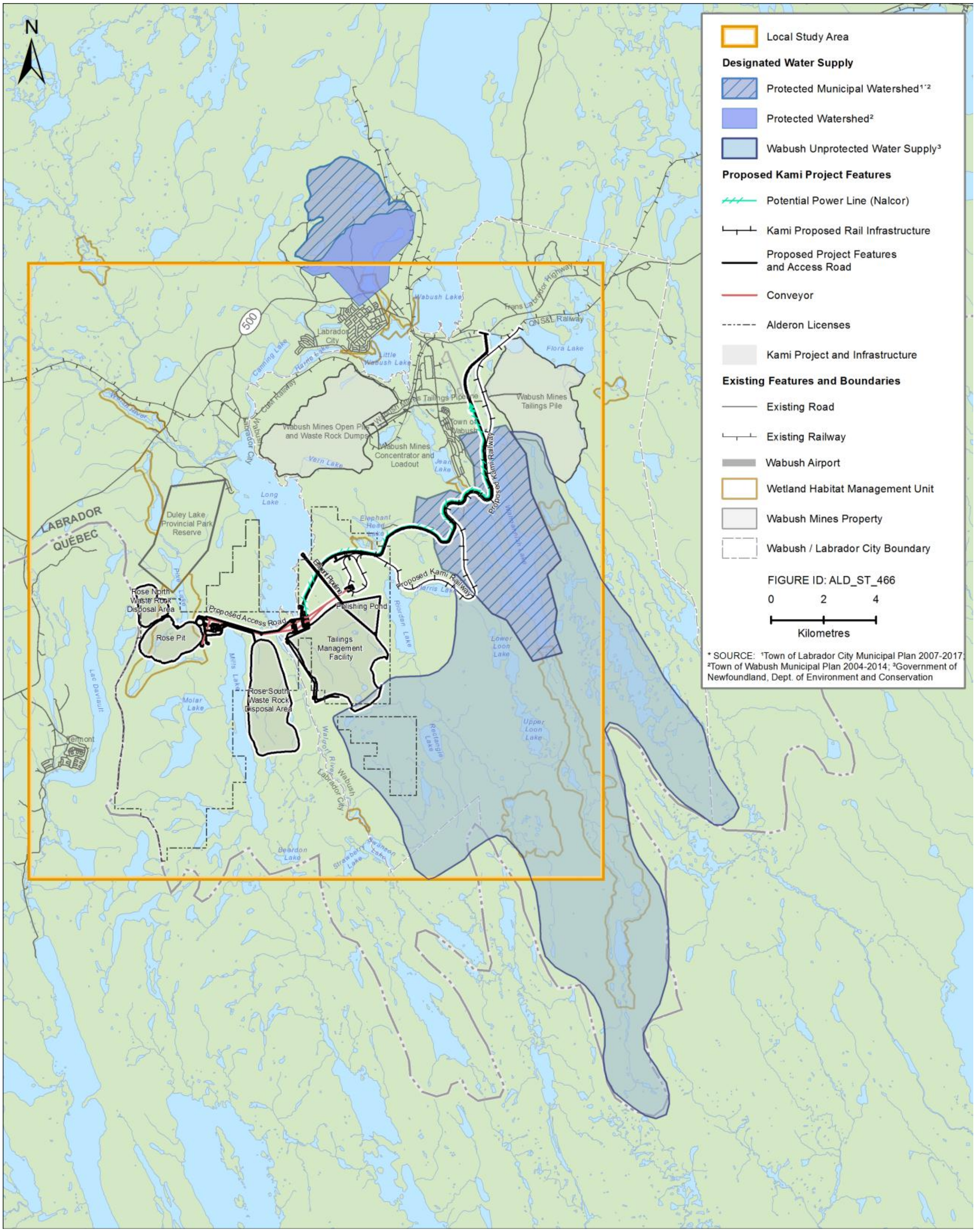
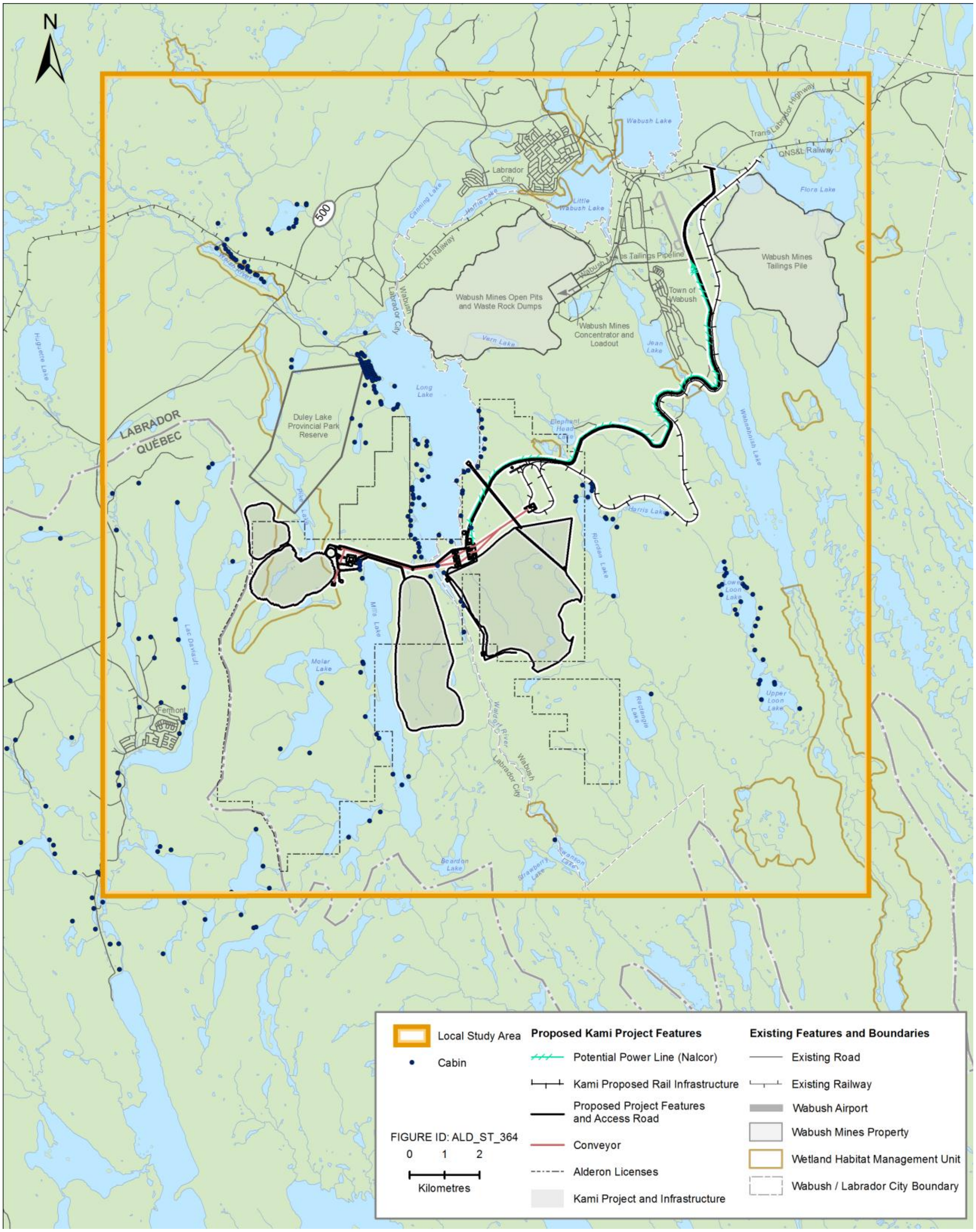


Figure 23.15 Distribution of Recreational Cabins



23.5.2.2 Residential Property

In Labrador City, the number of occupied dwellings increased by 3.2 percent between 1991 and 2006, from 2,695 to 2,780. In 2006, 78.8 percent of these were owned and 21.4 percent were rented. By 2011, the number of occupied private dwellings increased 2.8 percent to 2,859 (Statistics Canada 2007; 2012). Between 1991 and 2006, the number of occupied private dwellings in Wabush increased from 680 to 690 (1.5 percent). The majority (84.1 percent) was owned and 15.2 percent was rented in 2006. By 2011, the number of occupied private dwellings increased by 6.2 percent to 733 (Statistics Canada 2007; 2012).

In recent years, many new people have been drawn to western Labrador due to increased mining activity in the area and IOC's expansion plans. This has led to a shortage of housing and an increase in housing prices. The price of a single family bungalow has increased more than 120 percent in the last couple of years. Canada Housing and Mortgage Corporate statistics indicate that from 2004 to 2008 the average price for a house in western Labrador increased from $73,300 to $181,000 (150 percent). Between 2007 and 2008 alone, the average price of housing increased by 34 percent (RNC, no date). In 2010, the average sale price across all housing types in western Labrador was approximately $250,000, with the breakdown of average costs by housing type as follows:

- New mini-homes = $200,000;
- Bungalows = $220,000 - $320,000;
- Townhomes = $180,000 - $230,000; and
- Duplexes = $175,000 - $270,000 (Cleary 2010).

Rental rates have also increased. In 2010, renters were paying between $900 and $1,200 per month (Labrador West Chamber of Commerce 2010). There are reports that, in the spring of 2011, bungalows were renting for $4,500 per month and homes that sold for $150,000 a few years before were selling for over $300,000 (Cleary 2010).

Adding to the need for housing is the fact that many people are choosing to remain in western Labrador once they retire. Past trends indicate that approximately 65 percent of retirees have chosen to maintain residency in western Labrador (Labrador West, no date).

The Project will not overlap with residential areas. The Project access road / rail / power line corridor is located approximately 700 m away from a residential subdivision in the southern portion of Wabush.

23.5.3 Fishing

The following reviews recreational and subsistence fishing / angling in western Labrador. Aboriginal fisheries are discussed in Chapter 22 (Current Use of Lands and Resources by Aboriginal Persons for Traditional Purposes). There are no commercial fisheries in western Labrador.

23.5.3.1 Recreational Fishing

Based on the informant interviews, recreational fishing occurs at a number of locations in the LSA, however fishing at waterbodies within the Project footprint appears to be limited. Two informants identified the area between Wahnahnish and Jean lakes, where there will be a crossing for the railway and access road. Another informant outlined this area, as well as the area between Elephant Head and Wahnahnish lakes where the access road will be constructed. The informants who identified these areas fished for lake and speckled trout.

Fishing within the LSA is centered on the many of the area's large waterbodies, including the Long Lake and Waldorf River area, south along the Waldorf River to Swanson and Strawberry Lakes, the Riordan and Harris Lakes area, Rectangle Lake and Wahnahnish Lake (Figure 23.16). Some informants who fished in the LSA also pursued fishing and other harvesting activities regionally, travelling to areas outside of the LSA but within the RSA. Such areas included the Ossokmunuan Reservoir and the Atikonak and Joseph Lakes area. Among the informants interviewed, Long Lake and the Waldorf River were the waterbodies most frequently mentioned as fishing locales. Fish species taken by interview informants included speckled and lake trout, whitefish, burbot, northern pike, and ouananiche.

For fishing within the LSA, boat, informants noted that road and trail access to harvesting locations is a major factor. In general, informants who fished close to town (e.g., Long Lake) reported accessibility and proximity to cabins as the reasons for use, while those who fished further away from town reported that these were better areas for fish in terms of both size and numbers.

Many of the preferred fishing locations are situated reasonably close to existing access roads and travel corridors, including the TLH from Labrador City / Wabush to near Churchill Falls and along either side of the railway line extending from Emeril Junction north toward Schefferville, Québec. Other locations include parts of Ossokmanuan Reservoir and the northern portion of Panchia Lake. Fishing in the RSA is undertaken on a many of the large and small waterbodies extending as far north as Lobstick Lake on Smallwood Reservoir, at a number of locations on either side of the TLH, along virtually all the shoreline of Ashuanipi Lake to the south of Ross Bay Junction and on many unnamed lakes, ponds and rivers south of Wabush (Figure 23.17). Many of the places fished in the RSA involve the use of watercraft.

In general, informants indicated that they fished at preferred locations throughout the year, typically fishing by boat or from shorelines during the ice-free seasons and ice fishing in the winter. Areas specifically mentioned as ice fishing locations include Twocum Lake and in the area of Jean Lake and Wahnahnish lakes. Informants went ice fishing for lake and speckled trout, using snowmobiles to access fishing holes.

Figure 23.16 Fishing Activity, Local Study Area

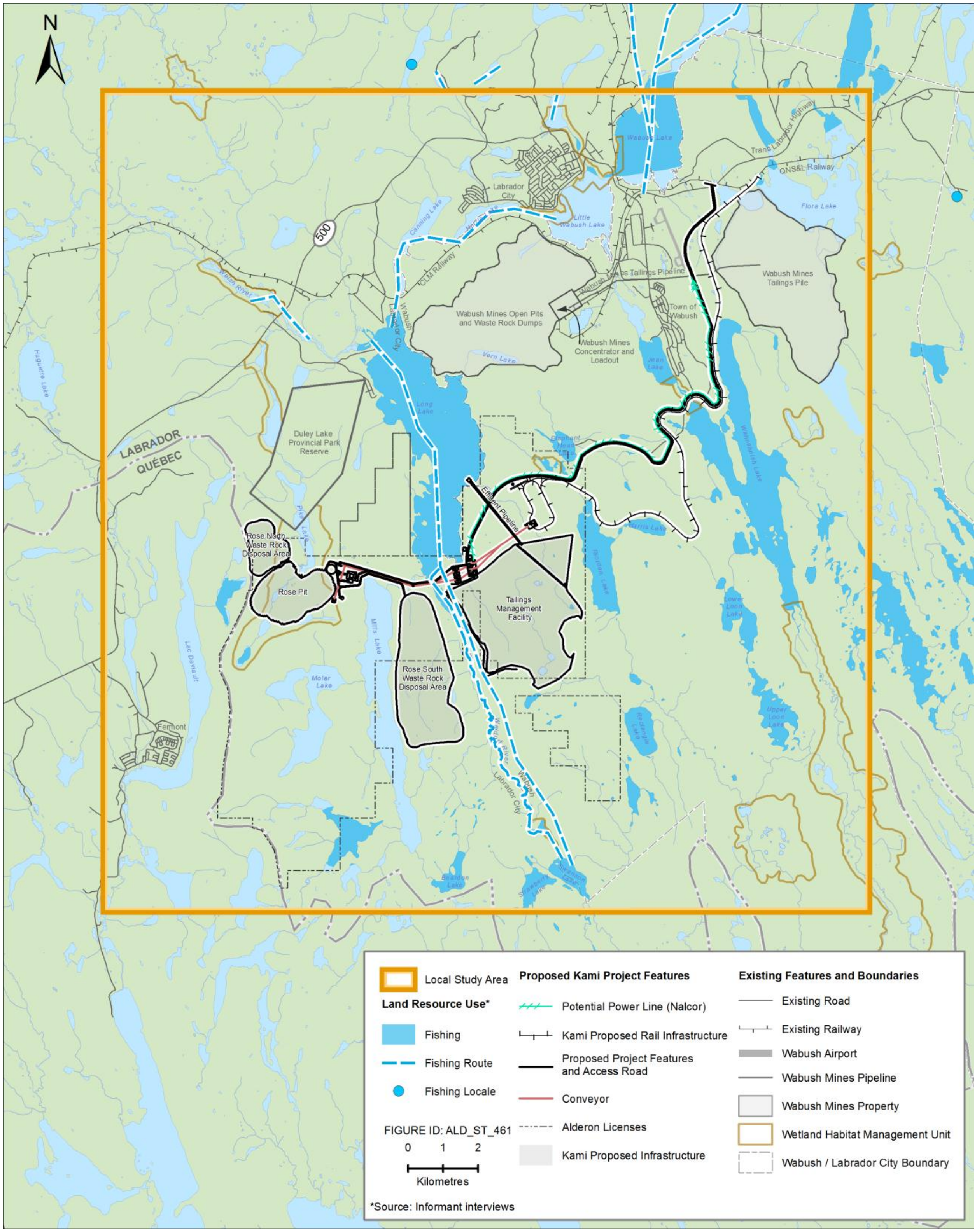
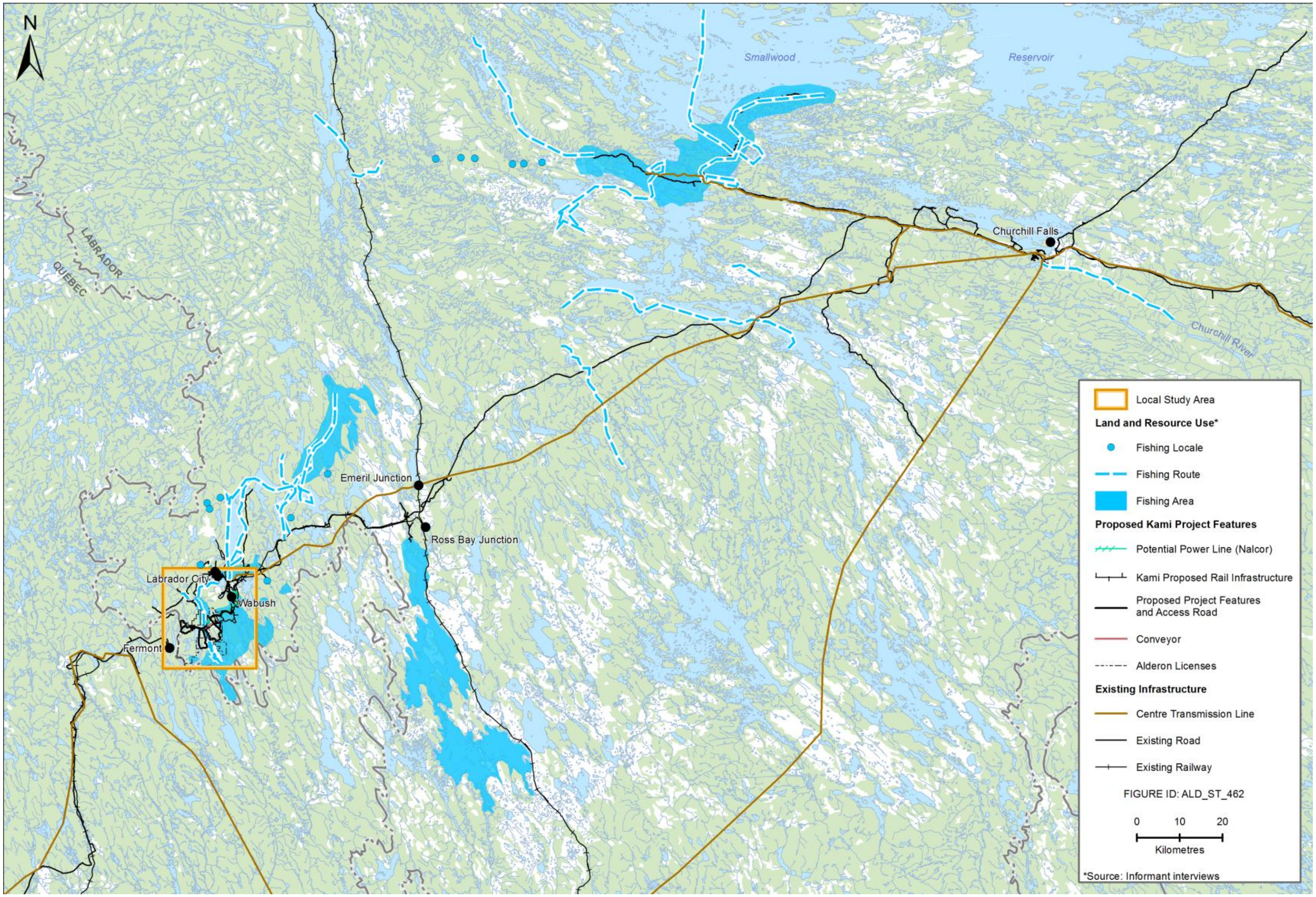


Figure 23.17 Fishing Activity, Regional Study Area



23.5.4 Outdoor Recreation

The following discussion of outdoor recreation activities is largely based on the activities reported by informants during interviews.

23.5.4.1 Berry Picking and Plant Harvesting

Berry picking occurs at a number of locations in the PDA, although it is not possible to quantify the activity based on informant interviews. Typically, berries are harvested in summer and fall from areas of burnover.

Within the LSA, informants noted that berry picking is a common summer and fall activity and takes place adjacent to cabins, in burnovers and in more remote locations. The majority of sites where berry picking takes place are in relatively close proximity to communities and are generally accessible by roads or trails (Figure 23.18). The most common berries picked include blueberries, partridge berries, and bakeapples.

Berry picking in the RSA is practiced in the large burnovers that straddle the TLH. The largest area, based on information provided by a number of informants, is situated along the shoreline of Ossokmanuan Reservoir toward Twin Falls (Figure 23.19).

23.5.4.2 Walking Trails

There are walking trails in both Labrador City and Wabush which are maintained by the municipalities. In Wabush, the Jean Lake walking trail is a 5 km trail, which surrounds Jean Lake. Walking trails in Labrador City include the Menihek Interpretive Trail, the Tanya Lake Walking Trail, and Crystal Falls Trail (Labrador West 2012b).

All of these trails are within the LSA (Figure 23.20). Jean Lake trail is the closest to the Project. At its closest point, it is approximately 600 m from the Project road / power line / rail corridor.

23.5.4.3 Recreation Parks and Beaches

In addition to municipal parks within Labrador City and Wabush, there is one privately operated park in western Labrador. The Duley Lake Family Park is located approximately 10 km west of Labrador City, at the northern end of Long Lake. It offers camping facilities, a sandy beach, swimming, boat rentals, and picnic facilities (Newfoundland and Labrador Tourism 2012).

There are an additional three sandy beaches in western Labrador. Two are within Labrador City, at Quartzite Lake and Tanya Lake. There is one within Wabush, at Jean Lake (Destination Labrador 2012a).

Figure 23.18 Berry Picking Areas, Local Study Area

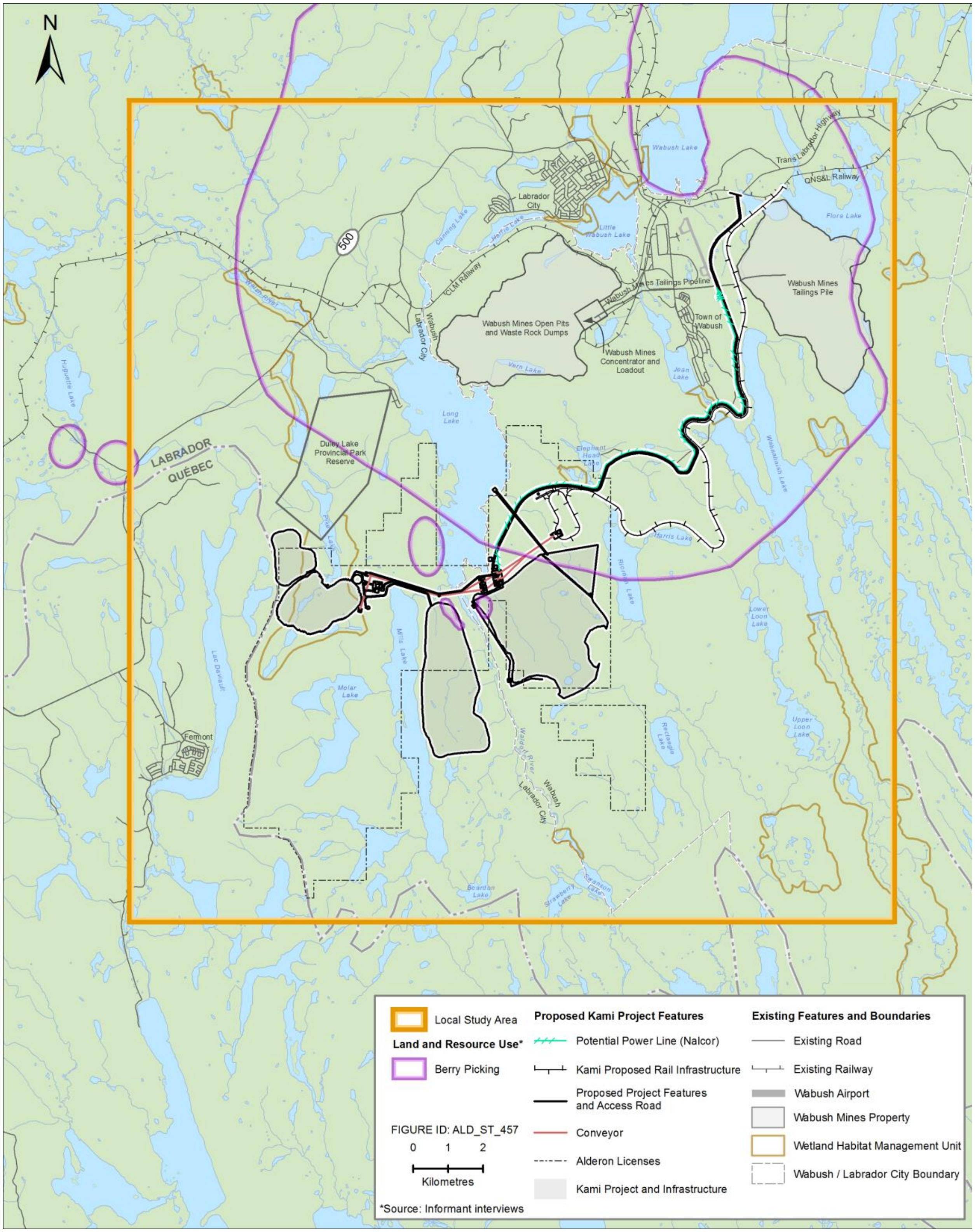
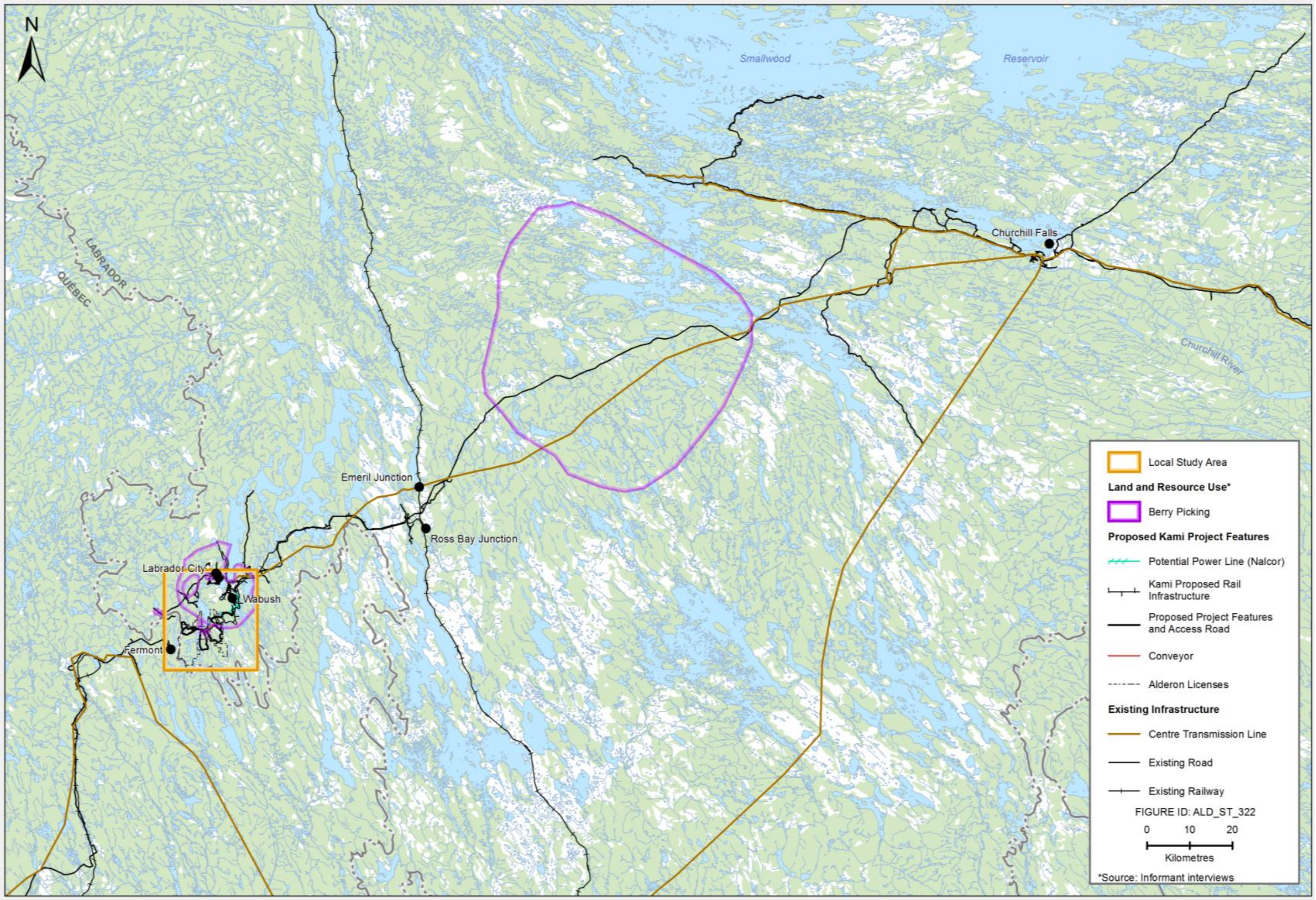


Figure 23.19 Berry Picking Areas, Regional Study Area



23.5.4.4 Snowmobiling

Snowmobiling is the most extensive recreational activity in the LSA. Informants indicated that snowmobiling exceeds all other land use activities. The Government of Newfoundland and Labrador has legislated mandatory trail passes for snowmobile riders in Labrador. The revenue from these passes is used for the maintenance and operations of the trail system (Figure 23.20). The cost of the 2011-2012 trail pass was $100 plus tax per sled for western Labrador (Labrador Winter Trails 2012). White Wolf Snowmobile Club in western Labrador maintains the White Wolf Trail, a network with approximately 500 km of trails (White Wolf Snowmobile Club, 2012), which average 14 to 16 feet in width (White Wolf Snowmobile Club, 2012). The trail network in western Labrador connects with 300 km of trails in Québec, which are maintained by The Lagoped Snowmobile Club, based in Fermont. Trails in western Labrador are also connected to the Electric Link Trail, which stretches 200 km and runs to Churchill Falls (Destination Labrador, 2012).

Trail passes are required for access to these trails. Typical annual permit sales are 1,800 permits for trail use in Labrador, and 500 in Québec. In any given year, approximately 27 percent of users are non-compliant (T. Kent, pers. comm.).

Although the trail system does not cross the large waterbodies, snowmobiles are frequently used outside of the trail system on all ponds and lakes in the area, as well as throughout the open terrain (Figure 23.21). The activity that overlaps mostly with snowmobiling in the LSA is cabin use. Also, snowmobiles are commonly used to access ice-fishing locations and for hauling firewood to cabins.

Snowmobiling is also carried out in the LSA, RSA and beyond for the annual Cain's Quest snowmobile race. The race follows a route of over 2,500 km, beginning in Labrador City, travelling north through Shefferville, QC, to Ungava Bay, east to coastal Labrador and returning to Labrador City. In 2012, Cain's Quest was held in March, with 35 teams participating. Participants competed for a $70,000 prize (Cain's Quest 2012). The race is supported by the provincial government as a prime winter tourism attraction for western Labrador (DIBRD and DTCR 2012).

As snowmobiles are commonly used in the pursuit of other outdoor activities, such as for hunting, ice-fishing, trapping, travelling to and from cabins and transporting firewood or other materials, their use in the LSA and RSA overlaps with many other land use activities. Most residents use the network of groomed trails in the area that extend from west of Fermont, Québec, to Churchill Falls approximately parallel with the TLH. Other long-distance routes within the RSA used for snowmobiling include the trail that extends from Emeril Junction, north along the east side of the railway corridor for approximately 80 km, where it turns east and continues to Churchill Falls, a distance of approximately 170 km. From Churchill Falls, trails continue east parallel with the TLH to Happy Valley-Goose Bay. A particularly large, off-trail snowmobiling area running south of the TLH and used for trapping, extends along the shoreline of Ossokmanuan Reservoir, further south beyond Panchia Lake to the northern end of Atikonak Lake (Figure 23.22).

Figure 23.20 Walking Trails in Labrador City and Wabush

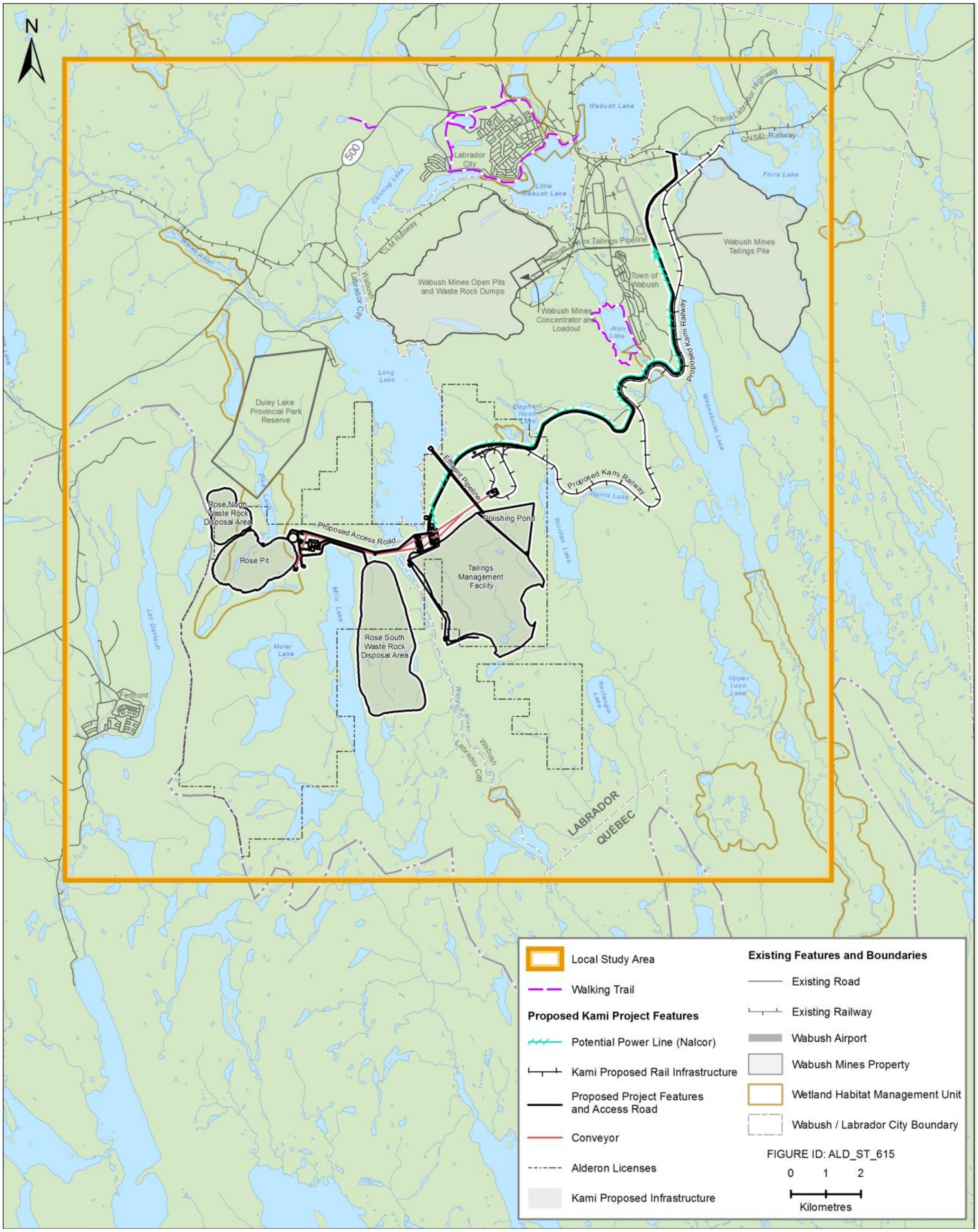


Figure 23.21 Snowmobile Activity, Local Study Area

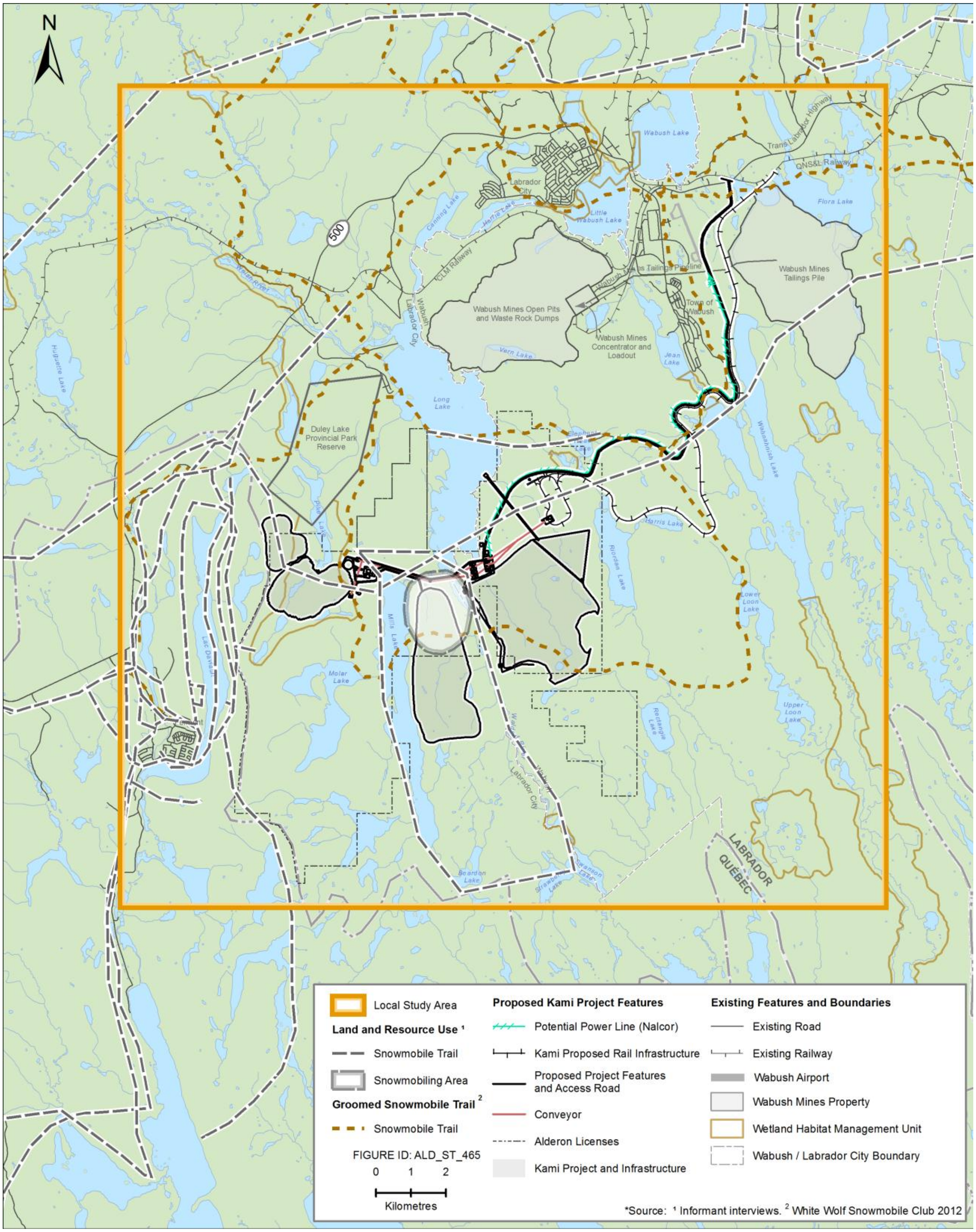
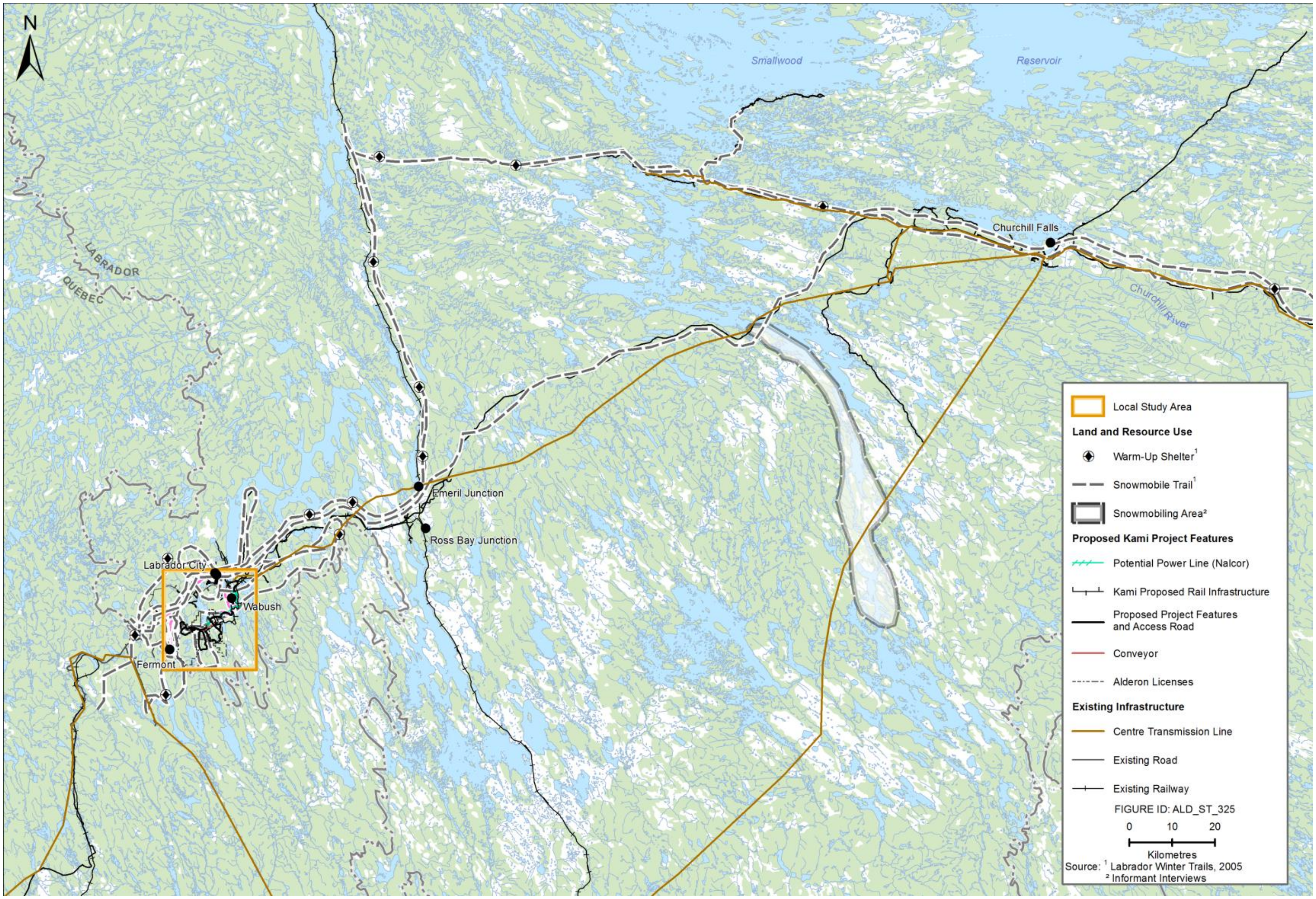


Figure 23.22 Snowmobiling, Regional Study Area



23.5.4.5 Skiing

Cross-country skiing is a popular winter sport in western Labrador and eastern Québec. The Menihek Nordic Ski Club in western Labrador was founded in 1975. The club is located 3 km from Labrador City and maintains more than 30 km of groomed trails. There are 16 km of recreational trails, including a 6 km lighted trail and the Koch Trail System, designed by 1982 World Cup Champion Bill Koch. Trails are accessible by permit only and the club offers a variety of options for access to the trails, including seasonal memberships and day, night or weekly passes. The cross-country ski season in Labrador West runs from late October until the end of April (Menihek Nordic Ski Club 2008). Menihek hosts an annual cross country ski event, the Great Labrador Loppet. The event takes place in late March or early April, on groomed trails extending between Fermont and Labrador City.

Menihek's groomed ski trails are located outside the LSA (Figure 23.23). However, informants identified additional un-maintained areas where cross country skiing takes place within both the LSA, and in the PDA near the access road.

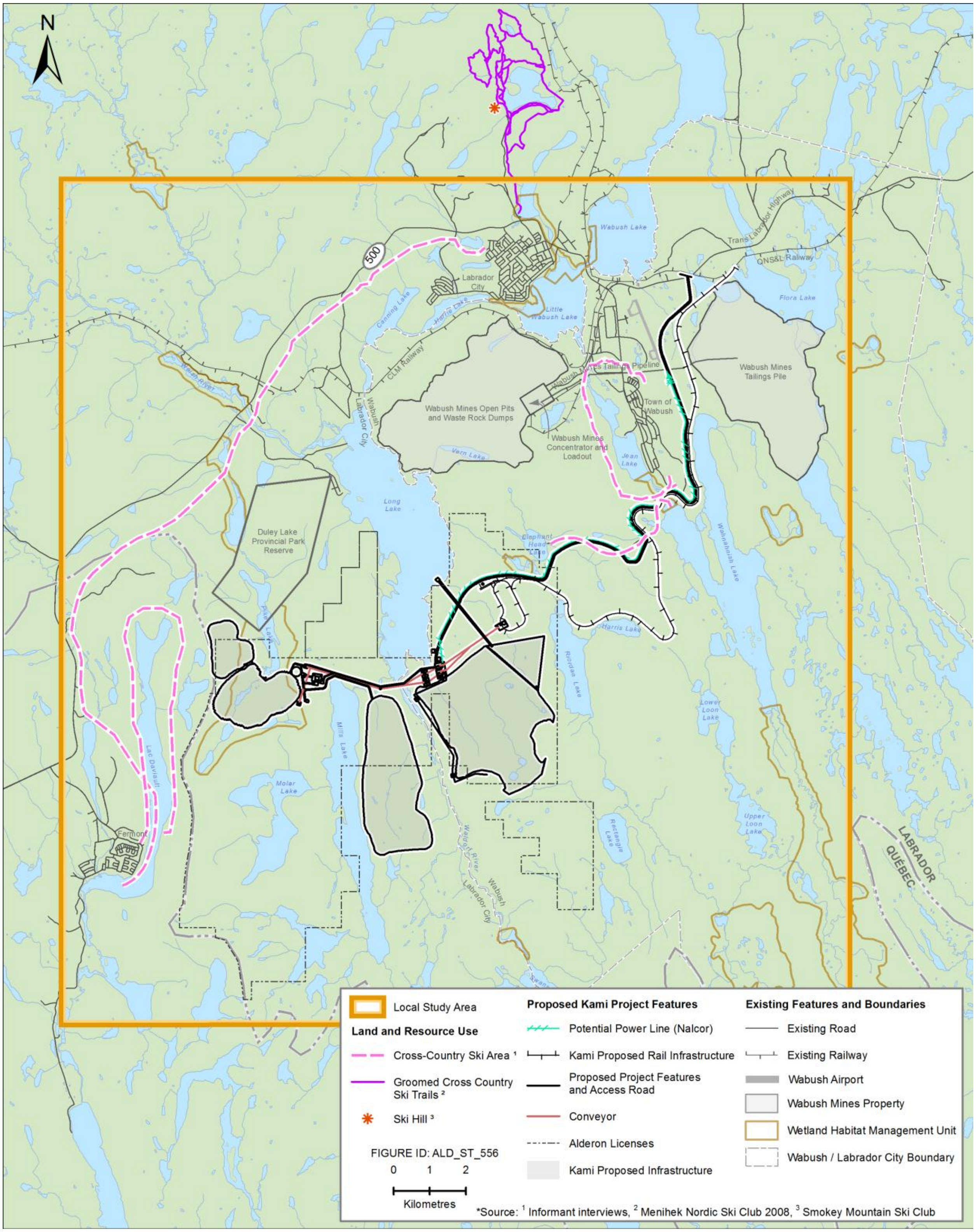
The Smokey Mountain Ski Club is located 5 km from Labrador City, outside the LSA (Figure 23.23). Facilities include 19 groomed runs, as well as a snowboard park. The club offers seasonal memberships and daily rates. The downhill skiing season extends from November 15 to April 15 (Destination Labrador 2012a).

23.5.4.6 Camping

There are two campgrounds in western Labrador: Duley Lake Campgrounds and Grand Hermine (Destination Labrador 2012). Duley Lake Campgrounds is located within the LSA, approximately 13 km east of Labrador City on the TLH. Grand Hermine is located west of the LSA, approximately 45 km from Labrador City on the TLH to Churchill Falls.

A campground has been proposed for the shores of Daviault Lake. Once completed, it will offer 100 campsites each fully serviced with water, sewer and electrical connections (St-Pierre 2012). The campground will principally serve seasonal tenants with a few sites being reserved for tourists. The campground will operate from the end of May to the end of October. The site for the proposed campground is outside the LSA.

Figure 23.23 Skiing Areas, Local Study Area



23.5.4.7 Bird Watching and Geocaching

Bird watching and geo-caching[1] are relatively recent activities in western Labrador, but have grown in popularity among local residents in recent years. Informants noted that the area used by residents for bird watching and geo-caching in the LSA is large, covering virtually the entire 515 km^2. Bird watching activities in or adjacent to the LSA include nocturnal bird surveys (owls), bird breeding surveys, a Christmas bird count, and a Great Backyard Bird Count. Although bird watching is conducted throughout the LSA, the number of actual birders resident in the LSA is likely small. Similar areas in the LSA are used for geo-caching as for bird watching, but to a lesser extent.

Bird watching takes place at a number of times each year within the RSA, depending on the species. The area where bird watching occurs is extensive, extending from Fermont to Churchill Falls (and further east along the TLH) and on both sides of a number of access roads, including the road to Lobstick Lake on Smallwood Reservoir. While the physical extent of bird watching in the RSA is broad, the numbers of actual birders from the region is not extensive. Similar areas in the RSA are used for geo-caching as for bird watching, but to a lesser extent.

23.5.5 Hunting, Trapping, and Guiding

23.5.5.1 Hunting

Hunting of small game and birds does occur at a number of locations in the LSA, but per the informant interviews, these activities are limited. Hunting in the LSA is primarily for birds and small game and is focused around the shorelines of waterbodies, as well as at some of the burnovers prevalent throughout the LSA (Figure 23.24). Informants frequently indicated hunting areas near waterbodies outside of the immediate Project footprint, including Wabush, Little Wabush and Wahnahnish lakes, as well as Riordan and Rectangle lakes. Some cabin users reported hunting small game and birds near Long Lake and Lac Daviault. Another popular area used for fall bird hunting is Waldorf River, at the south end of Long Lake, where there are wetlands suited to bird habitat.

Many of the hunting areas highlighted for the LSA are also used for snaring rabbits, which informant interviews indicate as a popular recreational activity among cabin owners. Informants also identified favoured hunting areas outside of the LSA, including the Ossokmanuan Reservoir area, Shabogamo Lake and the shorelines of Ashuanipi, Joseph and Atikonak lakes. Species taken by informants were similar for the RSA and LSA, typically including furbearers such as rabbit, beaver, marten and muskrat, as well as waterfowl. One informant hunted porcupine in LSA and beyond, within the RSA. The majority of informants who hunted bear reported doing so at areas outside of the LSA.

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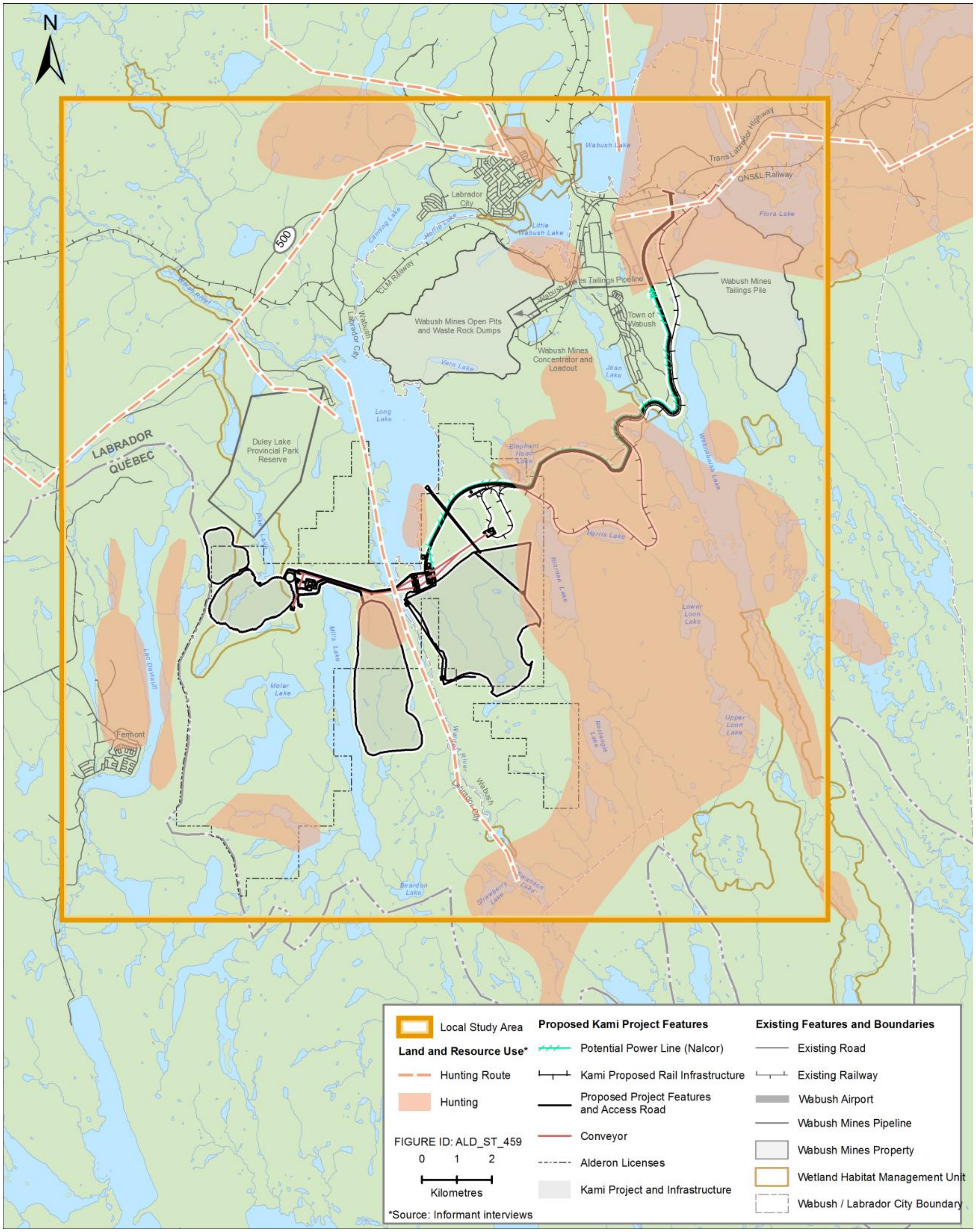
1 Geo-caching is an outdoor pursuit whereby members of the general public use a Global Positioning System (GPS) receiver and other navigational techniques to hide and find containers, called "geocaches" or "caches", anywhere in the world. GPS locations of caches are listed on the internet.

Figure 23.24 Hunting Areas, Local Study Area



Given the scarcity of moose and caribou in the region, and restrictions placed on caribou hunting, informants reported that black bear hunting is now a gaining in popularity. There were no informants who indicated that they hunted caribou in recent years, although several had done so before the George River herd became scarce. Three informants reported hunting bear, all reporting that they usually take at least one each per year. Areas where bear are hunted within the LSA are situated to the northeast and northwest of Labrador City and Wabush.

Interview data indicates that hunting within the LSA and the RSA is predominately a fall, winter, and early-spring activity, focused on migratory and non-migratory birds, and other waterfowl. Common species hunted in the RSA include Ptarmigan, Grouse, geese, and ducks. The numbers of individual species taken by hunters ranges from 10 or less, up to as high as the daily bag limit. A number of hunters reported taking up to 100 ptarmigan and grouse annually, depending on the year, as well as approximately 40 geese and 40 other migratory birds. Within the RSA, bird hunting generally occurs near waterbodies that are easily accessed by roads and highways, most notably the TLH and the access roads that parallel part of the south shore of Smallwood Reservoir west of Churchill Falls. Other locations within the RSA where bird hunting occurs include the shoreline of Ossokmanuan Reservoir and further south along Panchia Lake to the north shore of Atikonak Lake (Figure 23.25).

23.5.5.2 Trapping

Even though traplines cross and run close to various Project features, the level of trapping within the PDA is not extensive compared to that of the LSA and RSA. Several trappers who participated in the informant interviews mentioned that due to the number of cabins and land use activity that occurs in the LSA and PDA, they prefer to concentrate efforts in the RSA away from the communities and cabins.

Trapping in the LSA occurs along waterways, wetlands, and in wooded areas, and is largely a recreational activity. Trappers who participated in the informant interviews noted that they pursue trapping for enjoyment and aim only to cover their costs. The animal species that are harvested from the LSA includes the same species taken in the RSA (see description for RSA below), although those that trap in the LSA do so on a smaller scale and take far fewer animals. Popular locations for trapping in the LSA include much of the shoreline of Long Lake, both sides of Waldorf River, Riordan, Rectangle and Wahnahnish lakes, and the river system to the south, as well as on part of Wabush Lake. Trapping areas were also reported for the south shore of Walsh River and the area to the west and south in the province of Québec (Figure 23.26).

Figure 23.25 Hunting Areas, Regional Study Area

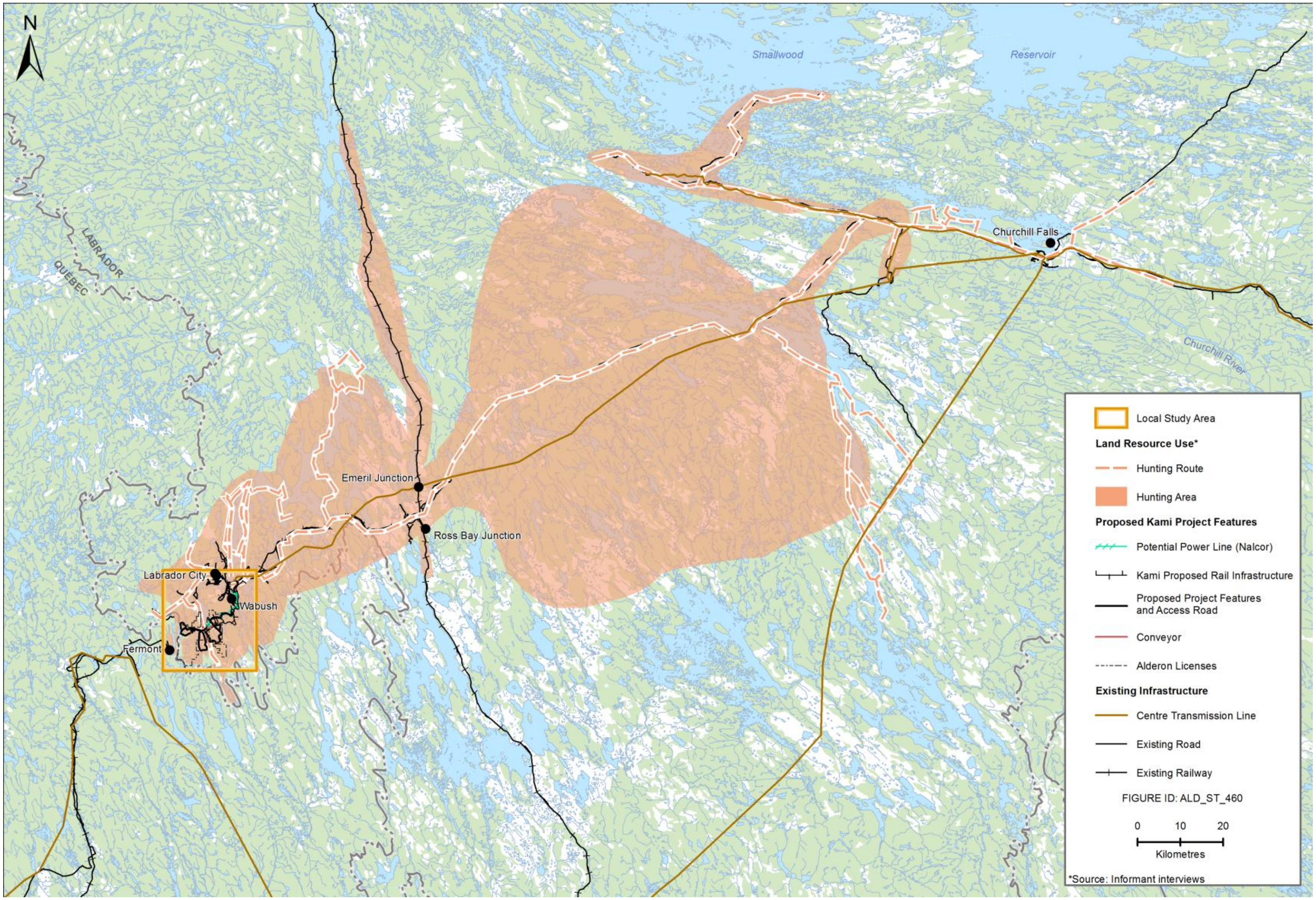
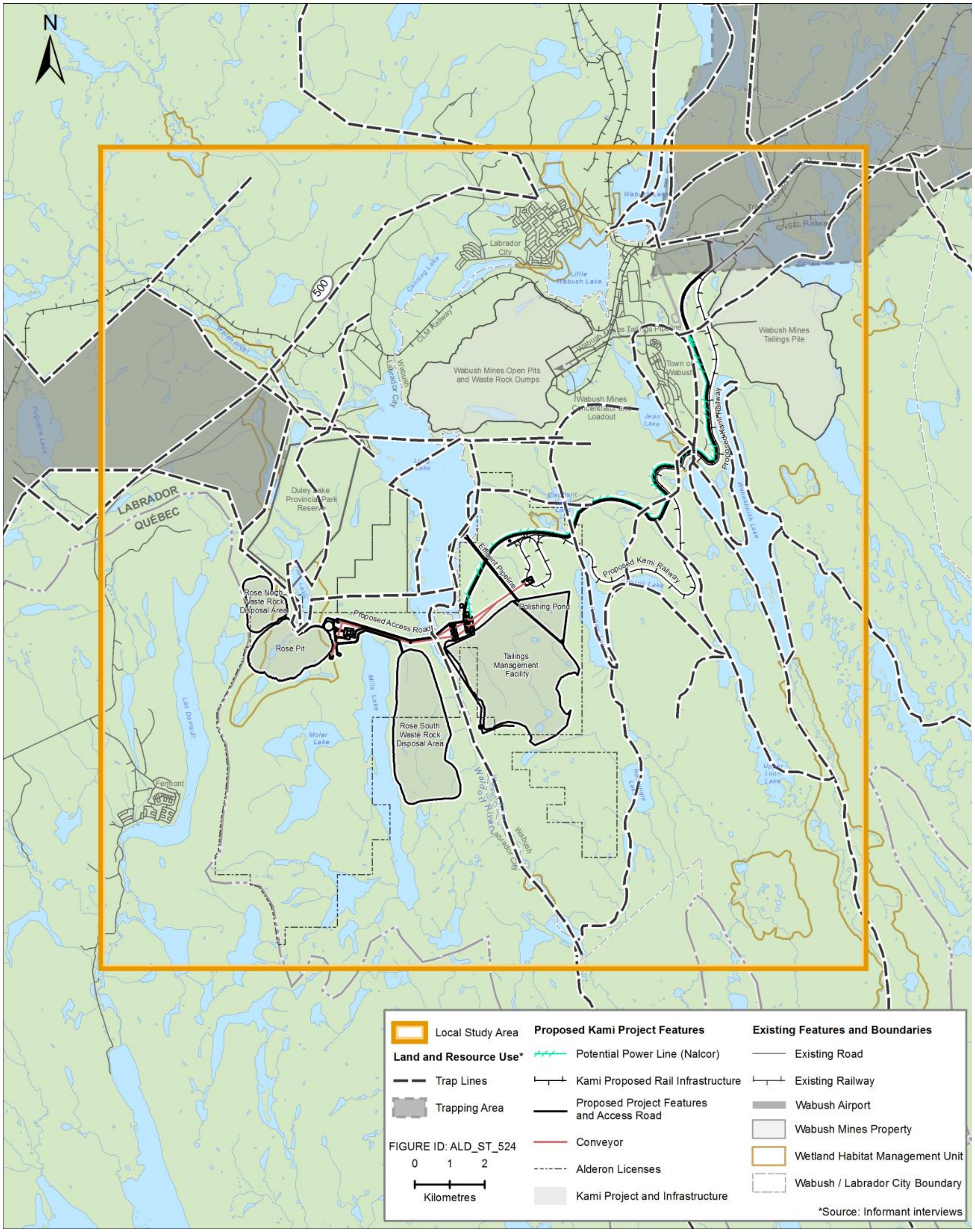


Figure 23.26 Trapping Areas, Local Study Area



23.5.5.3 Guiding and Outfitting

There are 177 outfitting companies listed on the Newfoundland and Labrador Tourism website directory, 44 of which are in Labrador. Of these 44, seven are within the perimeter of the RSA:

- Ashuanipi Fishing & Hunting Camps Limited (Albert Lake Lodge), Ashuanipi River;
- Black Spruce Lodge, Churchill Falls;
- Labrador Wildlife Expeditions Inc. (Sims River Camp), Sims River;
- Libby Brothers (Kepimets Lake Lodge), Kepmets Lake;
- Northeast Outdoors Lodge (Riverkeep Lodge), Atikonak Lake;
- Northern Lights Fishing Lodge (Gabbro Lake Lodge), Gabbro Lake; and
- Northern Lights Fishing Lodge (Shaw Lake Lodge), Shaw Lake (Newfoundland and Labrador Tourism 2012).

There are no outfitters in the LSA (Newfoundland and Labrador Tourism 2012).

One individual interviewed from Labrador City was a qualified guide. However, due to other work requirements, he no longer provides guiding services.

23.5.5.4 Forestry

The following sub-sections describes commercial forestry activity in western Labrador as well as individual firewood harvesting.

Commercial Forestry Activity

The Project is located within Forest Management District (FMD) 22, which covers an area of approximately 8 million hectares, making it the largest FMD in the Province. The district contains only sporadic commercial forest stands, predominantly comprising Black Spruce (*Picea mariana*), as well as other boreal species. While this FMD has not been utilized for large scale commercial harvesting, small scale commercial and subsistence harvesting have been carried out in the district (NLDNR 2011).

In 2011, NLDNR registered a Five-Year Operating Plan for FMD 22, covering the period from 2012 to 2016. Proposed activities outline commercial and domestic harvesting in the area for the five-year period. Combined, commercial and domestic harvesting is expected to occur at a rate of 7,778 m^3 each year (NLDNR 2011). There are forest stands classified as 'operational forest' which overlap with the PDA, however only stands located northwest of the PDA are proposed as harvest blocks (Figure 23.11). Approximately half of the proposed harvest blocks are within the LSA.

The NLDNR designates a large area of the Wabush municipal planning area as Productive Forest Land. These areas are described as land capable of producing at least 35 cubic meters per hectare of timber at rotation (NLDR 2012). There are two areas within the MPA that are designated Domestic Cutting Areas. These are located west of Jean Lake and east of Wabush Mountain (Town of Wabush 2004).

Currently, there is only one commercial forestry operation in western Labrador. One small-scale sawmill operation was reported within the LSA, near the Project rail line. Wood is harvested for the mill from a small-scale commercial forestry lot located near the TMF, east of Riordan Lake (Figure 23.27). The wood is cut and sawn for use in cabin construction and is sold through the mill.

Wood Harvesting

Wood harvesting for firewood occurs at a number of locations. Informants reported that wood is harvested from areas of burnover and is transported with snowmobile for use in cabins.

The majority of firewood is cut for personal use near cabins within the LSA. Firewood is harvested from the many burnovers throughout the area and is transported either by truck, ATV or snowmobile. Locations in the LSA where harvesting firewood takes place include an area on the west side of Long Lake, two locations adjacent to Waldorf River, at the north ends of Mills Lake and Lac Daviault, and to the north from the area near Duley Lake Provincial Park Reserve to Walsh River and just beyond (Figure 23.28).

Cutting of firewood for use at cabins is a relatively popular activity in the RSA, probably more extensive than that which was mapped. Given that most cabins are only used periodically in winter. The volume of wood cut, which is typically acquired in burnovers of softwood close to access roads or trails, is still probably not extensive (Figure 23.29). Firewood is usually cut in fall and transported by truck or ATV, or in winter with snowmobiles. No cutting of saw-logs was reported for the RSA.

23.5.6 Mineral Exploration

In Newfoundland and Labrador there are currently 16 mineral commodities in production. Six metal mines in the province produce iron ore, copper, zinc, cobalt, antimony and gold. Other operations mine slate, limestone and dolomite, amongst other commodities (NLDNR 2012a). The mining industry currently provides employment to 6000 individuals throughout the province. As of April, 2012, there were 12 producing mines in the Province; five of these were in Labrador (NLDNR 2012b).

Wabush Mines is the only active mining project in the LSA (Figure 23.29). Wabush Mines began mining iron ore from the Scully Mine in Labrador in 1965 and now operates a mine and concentrating plant at Wabush and a pellet plant and shipping facilities in Pointe-Noire, Québec. All ore is mined by open pit and sent through the Scully Mine concentrator. The final concentrate is transported 443 km by the QNS&L Railway to the port at Pointe-Noire for pelletizing and shipment.

Figure 23.27 Trapping Areas RSA

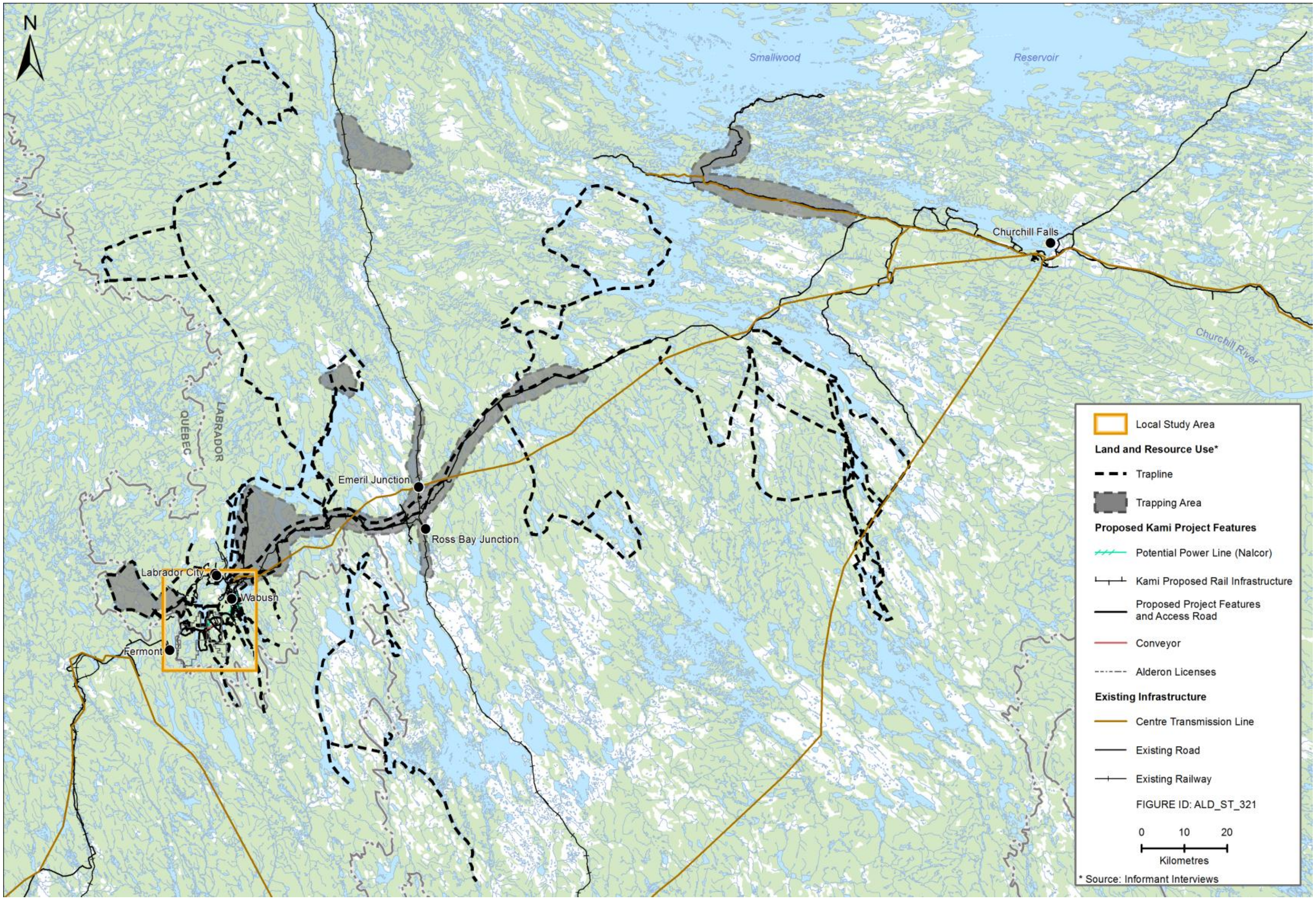


Figure 23.28 Wood Harvesting Areas, Local Study Area

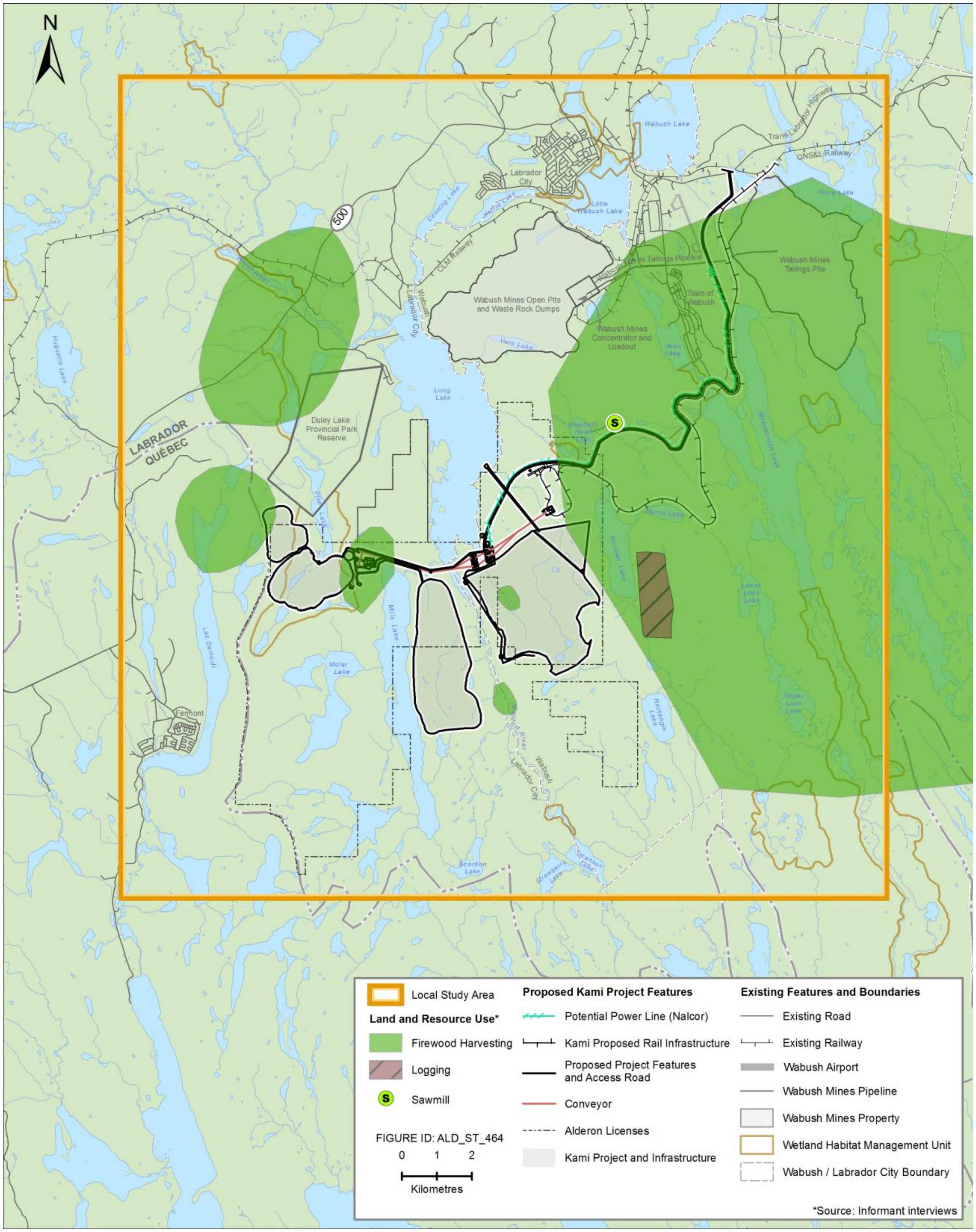
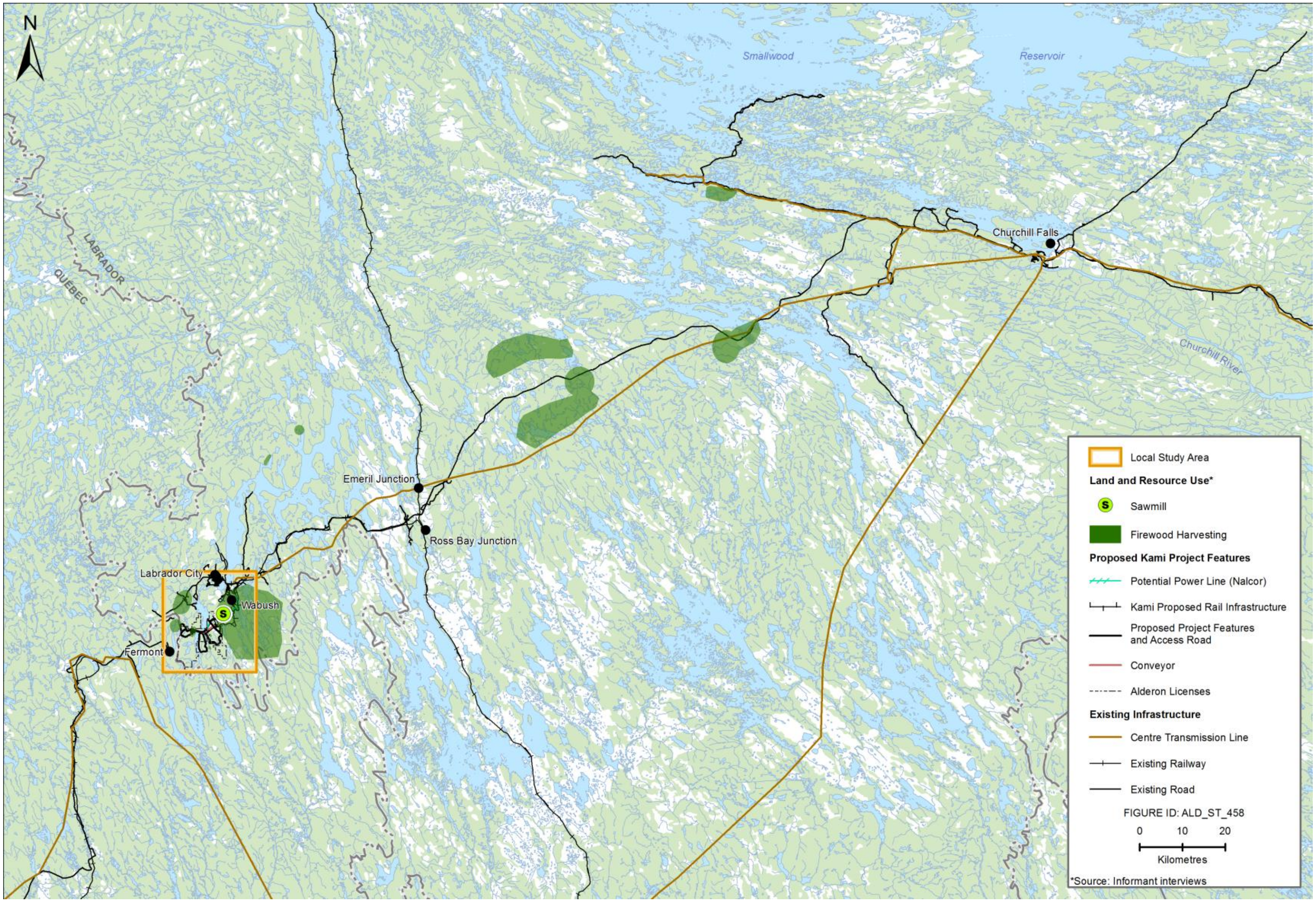


Figure 23.29 Wood Harvesting Areas, Regional Study Area



The Iron Ore Company of Canada (IOC) produces iron ore and dolomite north of Labrador City, within the RSA but outside of the LSA (Figure 23.29). IOC began producing iron ore from the Carol Lake Mine in 1962. The company is Canada's largest iron ore pellet producer and operates a mine, concentrator, and pellet plant at Carol Lake, port facilities in Sept-Îles, Québec and the 420-km QNS&L rail line that links the mine and the port. . IOC also operates a dolomite mine. The mine has been operating since 1986 and produces fluxed pellets. The QNS&L Railway is used to ship mined product.

There is also one inactive mine near the LSA. From 1999 to 2008, Shabogamo Mining and Exploration supplied quartzite to Bécancour Silicum Inc. of Québec which used the material to manufacture silicon metal. Shabogamo's contract ended in 2008, and the company is exploring alternative arrangements (NLDNR 2012b).

The Bloom Lake Mine was constructed by Consolidated Thompson in 2009 near the LSA in Fermont, Québec (Figure 23.30). A rail line crosses the Labrador – Québec border, overlapping the LSA to connect the mine with the QNS&L Railway and the port of Sept-Îles. In 2011, Consolidated Thompson was acquired by Cliffs Resources, who took over operations of the mine.

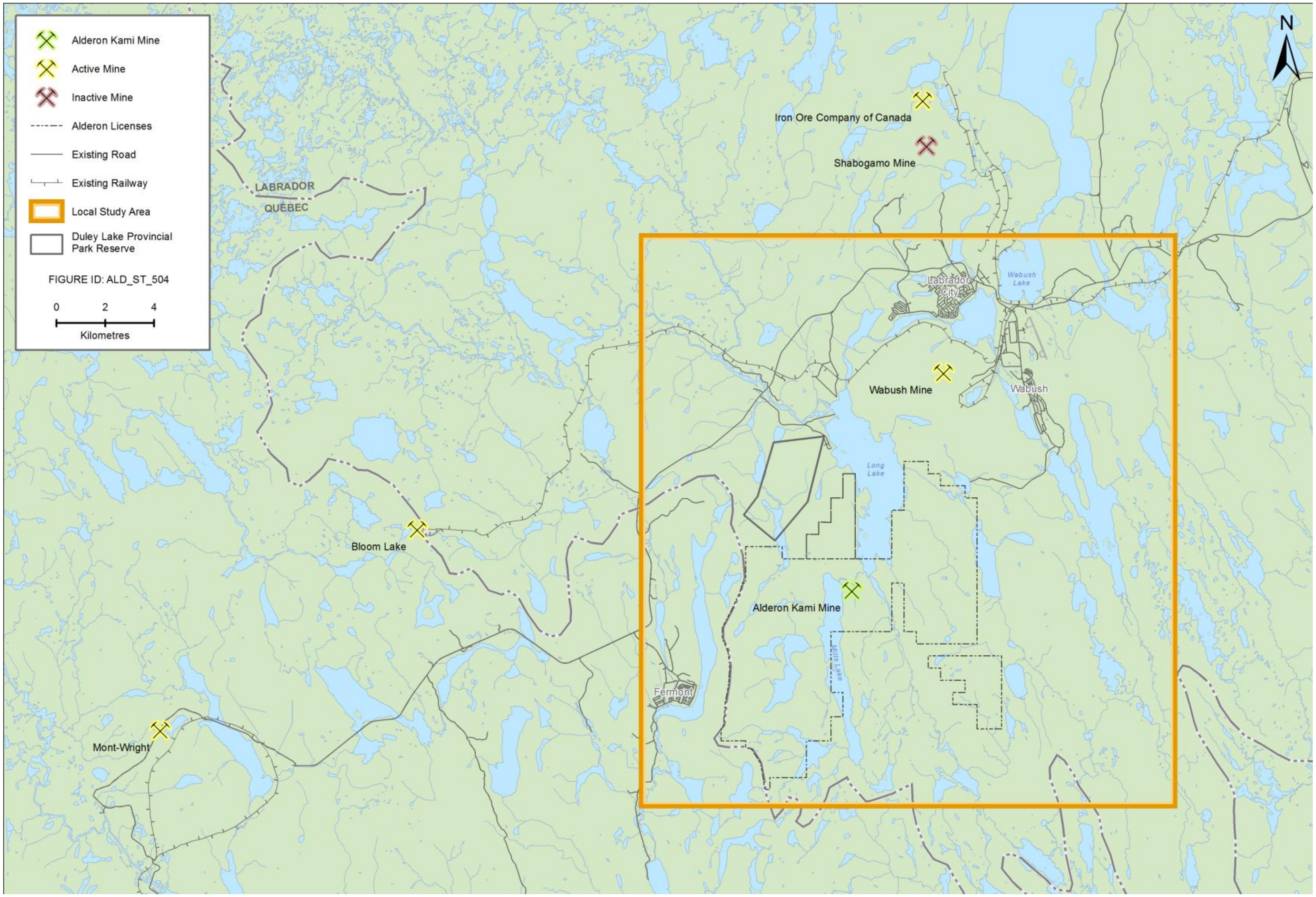
Mineral exploration in Newfoundland and Labrador continued to grow in 2011, with a substantial increase in exploration measured by several indicators. As in 2010, new developments in the iron ore sector dominated the industry; however strong gold and non-ferrous metal prices had a significant effect on exploration programs throughout the Province (NLDNR 2012a).

For 2011, exploration spending in the Province was expected to reach approximately $155 million, an all-time high. The total number of claims staked was 28,534, which was a slight decrease from 2010 levels. Drilling activity is estimated to increase to approximately 220,000 m, an increase of approximately 160,000 m in 2010 (NLDNR 2012a).

The NLDNR reported 42 major exploration properties as of 2011. Exploration was conducted for a range of mineral commodities, including:

- Gold;
- Zinc, lead, silver;
- Copper;
- Fluorspar;
- Iron;
- Molybdenum;
- Nickel;
- Rare earth elements;
- Antimony;
- Titanium;
- Uranium;
- Vanadium; and
- Tungsten.

Figure 23.30 Mines in Western Labrador



23.5.7 Agriculture

There is no commercial agriculture within the LSA or RSA (Land Management Division 2002).

23.5.8 Navigation

Based on the informant interviews, boating is a popular activity in western Labrador. As with fishing locales, informants frequently identified Long Lake and the Waldorf River as popular areas for boating. Other waterbodies commonly used for boating include Mills Lake, the southern end of Wabush Lake, and parts of Little Wabush Lake. It was reported that during the ice-free seasons, there are approximately 50 craft on Long Lake at any given time. Boating on Long Lake is usually pursued to access cabins, as well as for fishing and recreation. It was also reported that the Waldorf River is accessed by small motorboat or canoe for fishing or bird hunting (Figure 23.31).

There are marina's in western Labrador and in Fermont, none of which overlap with the PDA. In addition to the marina noted by informants located at the northern end of Long Lake (Figure 23.31), there is also a marina in Jean Lake. This marina and associated recreational area hosts an annual regatta (Labrador West, no date). Although not noted by informants, there is also a boat marina in Fermont on Lac Daviault which provides a variety of boating services including rentals (Chalet Rentals 2012).

Boating is also a popular activity in the RSA and is typically combined with fishing and accessing many of the remote cabins that are not accessible by road during the ice-free seasons. Informants reported that popular boating locations include many of the waterways to the north of Wabush, including Wabush and Little Wabush lakes, all of Shabogamo Lake and the many smaller rivers and ponds that connect with it. To the south of Ross Bay, Ashuanipi Lake and the adjoining rivers and ponds are also commonly used for boating in association with fishing and fall-hunting. Other locations where boating is common include parts of Lobstick Lake in Smallwood Reservoir, which is accessible by road, Ossokmanuan Reservoir, which is accessible from the TLH, as well as a river system to the west of the Lobstick Lake where boating is conducted in association with fishing (Figure 23.32).

23.5.9 Transportation

23.5.9.1 Rail

The QNS&L Railway was originally designed and constructed by IOC to move direct shipping ore from mines at Schefferville, Québec, to port facilities at Sept-Îles, Québec. The original main line was 360 miles long and was constructed between 1950 and 1954. The QNS&L Railway expanded in 1960 with the construction of a 37-mile branch from Ross Bay Junction to Labrador City. This line allowed QNS&L Railway to serve IOC's new Carol Lake Mine and the nearby Wabush Mine. The railway profile was well built and features a 0.4 percent ascending ruling grade for loaded train movements. The low grade profile allowed QNS&L Railway to operate the heaviest regular freight trains in North America when first opened and continues to do so to this day.

Figure 23.31 Boating Locations, Local Study Area

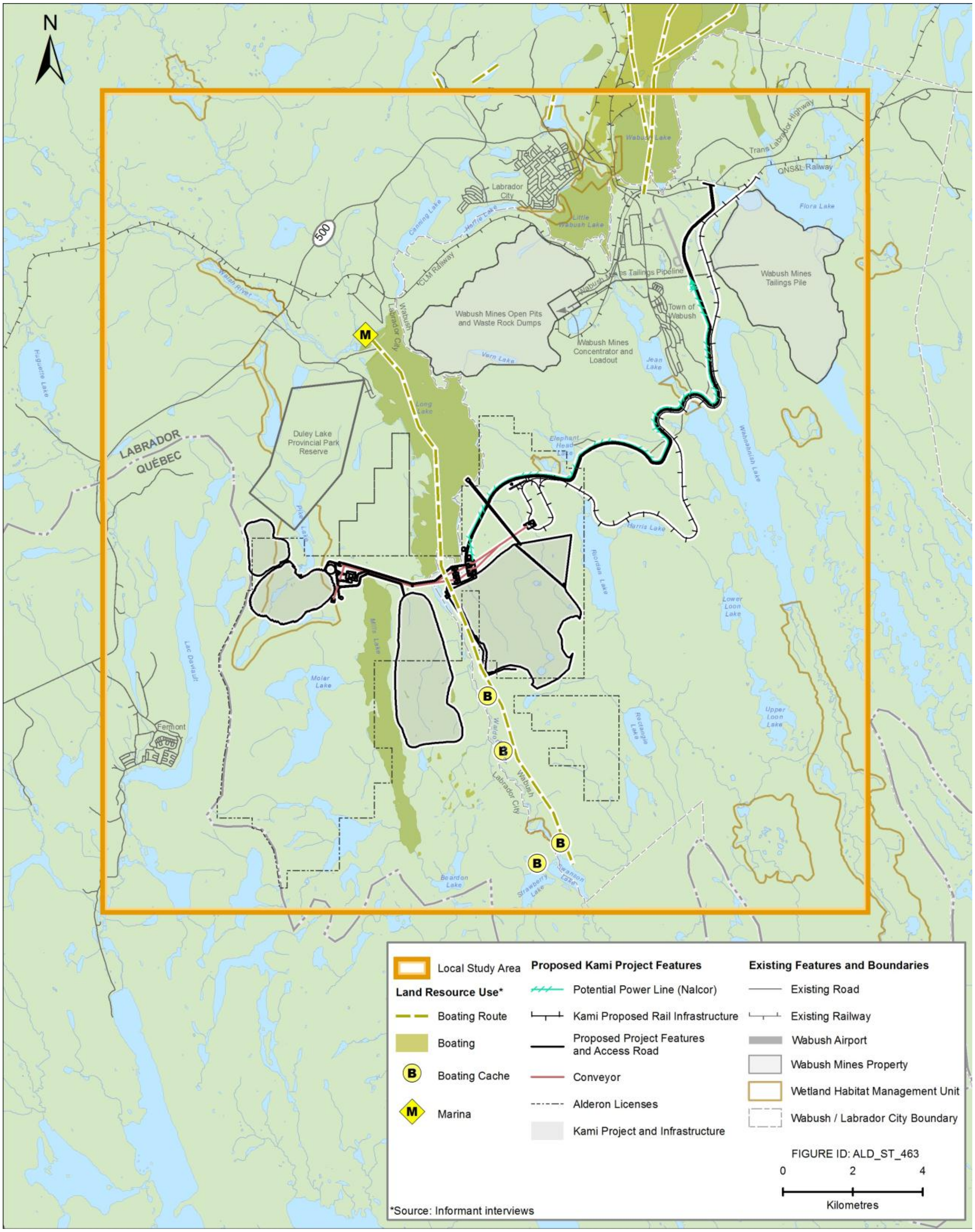
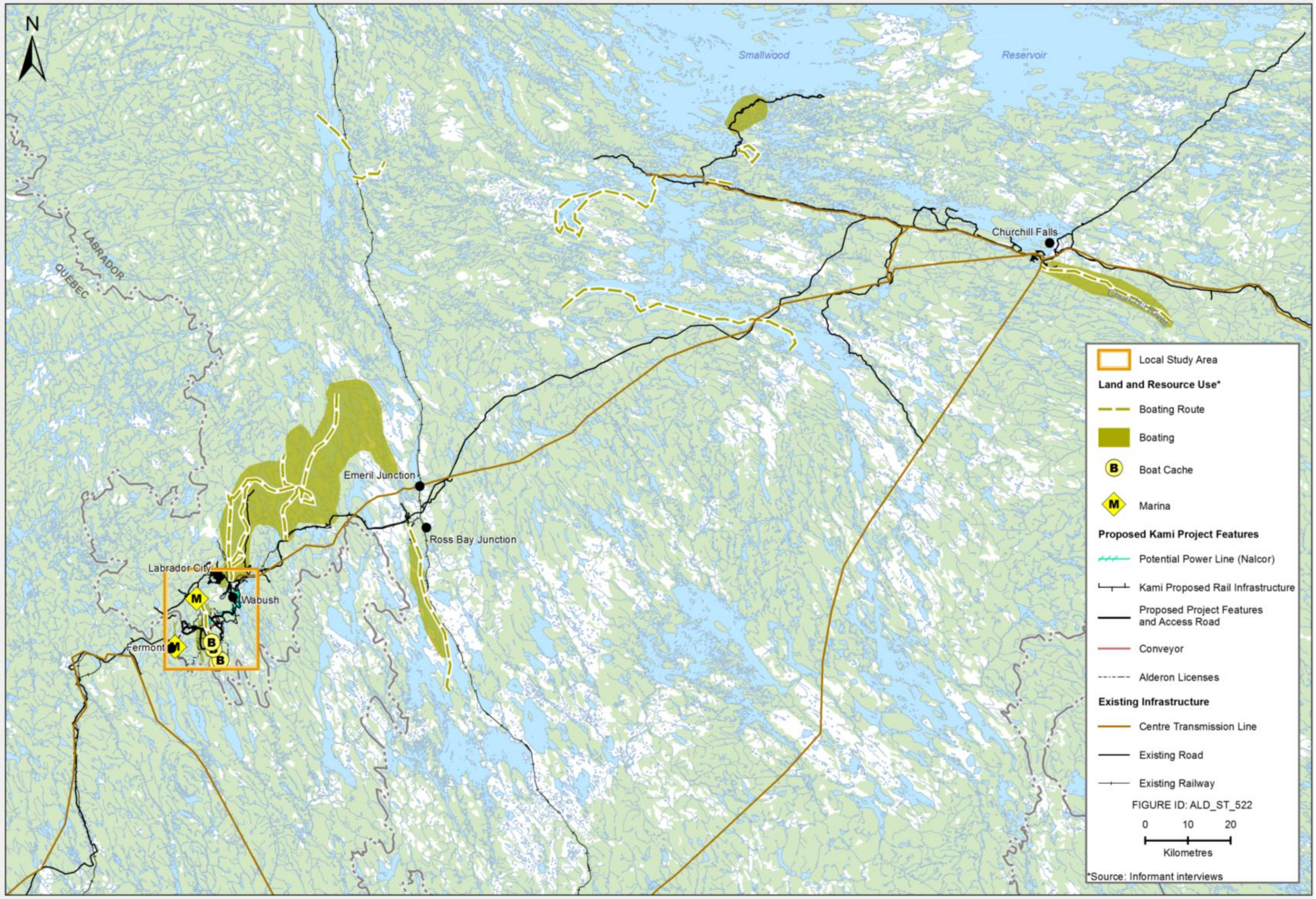


Figure 23.32 Boating Activity, Regional Study Area



The current single track main line of the QNS&L Railway stretches 260 miles between Sept Iles, Ross Bay Junction and Labrador City. The 132-mile portion of the original QNS&L main line between Ross Bay Junction and Schefferville was sold to Tshiuetin Rail Transportion (TSH) in 2005. TSH is jointly owned by three First Nations Groups including:

- Innu Takuaikan Uashat Mak Mani-Utenam;
- Naskapi Nation of Kawawachikamach; and
- Nation Innu Matimekush-Lac John.

The TSH maintains an interchange for all types of freight traffic with the QNS&L Railway at Ross Bay Junction.

The QNS&L Railway is considered a federally regulated railway by virtue of the fact that it crosses a provincial boundary. Federally regulated railways are governed by the provisions of the *Canada Transportation Act* (the Act) which is administered by the Canada Transportation Agency (CTA). The Act sets out that railway companies governed by its provisions must negotiate fair market rates with any shipper who desires to use the services of the railway to move goods. These are the so-called 'common carrier' provisions and are set out in Sections 113 to 115 of the Act. QNS&L Railway serves a number of clients as a result of its obligations under the Act.

Some of the major services QNS&L Railway provides under its common carrier obligations include:

- Unit train service for IOC;
- Unit train service for Cliffs Natural Resources (Wabush Mines and Bloom Lake Mine);
- Unit train service for Labrador Iron Mines (LIM);
- Passenger train service for TSH between Sept Iles and Ross Bay Junction;
- General freight / supply and maintenance train service operated by QNS&L Railway; and
- Unit train service for New Millennium Iron expected to commence in late 2012.

QNS&L Railway is wholly owned by Iron Ore Company of Canada. IOC in turn is majority owned (59 percent) by Rio Tinto, with minority owners Mitsubishi Corporation and the Labrador Iron Ore Royalty Income Fund.

23.5.9.2 Highways

Two highways connect the communities of the LSA with neighboring towns and provinces. Route 389 runs from western Labrador to Baie-Comeau, Québec. The route is 581 km, and takes approximately 8.5 hours to traverse due to inconsistent road conditions. The road surface is predominantly paved, but has extended gravel sections. Route 389 is owned and maintained by Transports Québec

In addition to Route 389, the TLH Phase I, runs through Labrador City. The highway starts at the Labrador-Québec border and travels through Labrador City and Wabush to Churchill Falls, and then to Happy Valley-Goose Bay. The TLH was formed by connecting this section of the highway (originally named Route 500), with Route 530, which runs south from Cartwright to the Québec border.

23.5.9.3 Airports

Air travel in the LSA and RSA is facilitated through two public airports and one aerodrome. The Wabush Airport is the public airport located in the LSA. It is the main air transportation hub for Wabush, Labrador City, and Fermont. It is located approximately 2 km northeast of Wabush. The Town of Wabush Municipal Plan designates all lands within the airport boundary and adjoining areas as Airport Industrial. Only uses directly related to the airport operation are permitted on these lands (Town of Wabush 2004). Details on carriers and capacity of the Wabush Airport is provided in Chapter 24 (Community Services and Infrastructure). The Wabush Water Aerodrome, located in the LSA, is a private airport on Little Wabush Lake.

The Churchill Falls Airport is located in the RSA, approximately 7 km northwest of Churchill Falls.

23.5.10 Sea Planes

There are two seaplane marinas in the LSA, one on Lac Daviault, and one within Labrador City on Little Wabush Lake. In addition to these two marinas, informants noted that several waterbodies in the LSA are used for seaplanes. It was not confirmed how many planes use Lac Daviault, but due to the presence of a sea plane marina, it is likely there are several.

Given the varied nature of land use activities that occur within the RSA (i.e., hunting, fishing and mineral exploration), it is likely that waterbodies in the RSA are used by seaplanes periodically.

23.5.11 Communication Towers

There are no communications towers situated within the PDA. There are four communications towers within the LSA. Two towers are located within Fermont, one in Labrador City, and one in Wabush.

There are an additional four communications towers in the RSA. There are three towers located along the TLH between Labrador City and Churchill Falls, and one tower in the town of Churchill Falls.

23.6 Assessment of Project-Related Environmental Effects

23.6.1 Change in Access

Change in access due to the Project could result from alteration of the landscape or waterbodies and implementation of restricted-access zones around Project activities and features, preventing access or altering access routes.

Construction

Project construction will generally result in decreased access due to alterations to the existing landscape and watercourses, and the creation of restricted-access zones surrounding construction activities. The following construction activities have the potential to result in a change in access (Table 23.7):

- Site preparation;
- Construction of site buildings and associated infrastructure;
- Construction of roads;
- Construction of the TMF;
- Construction of the railway and load-out facilities;
- Construction of the power line;
- Construction of stream crossings; and
- Installation of water supply infrastructure.

Some of the activities listed above will result in long-term changes to access. The footprint of the open pit, TMF, waste rock disposal areas, and buildings and associated infrastructure (including the conveyor), and their associated restricted-access zones, will remain in place throughout the life of the Project and access to these terrestrial areas will be restricted for public safety. A security office and gate will be installed on the access road near the location of the site buildings, which will restrict access to the site. This will also restrict access to the rail loop and load-out facilities. In addition, signs will be installed on the landscape and in waterbodies around the periphery of large Project features for public safety.

Installation of water supply infrastructure in Long Lake will also result in long-term restricted access around buried intake pipes, which will be protected by an underwater berm. Navigational warnings will be posted near the berm for public safety reasons and to avoid damage to the pipes.

The remaining construction activities, including actual construction of the site access roads, the power line, stream crossings, and the remainder of the rail line, will only require temporary access restrictions during construction. Access to the Project site will be by means of a new access road that will extend south from the TLH to the Project area. The existing roadwork on the property, presently used by cabin owners and other members of the public to access the country, will be taken out of service during construction. Cabin owners will be able to use the new road once it is constructed and throughout operation and maintenance.

Restricted access to resource harvesting areas co-located with Project construction activities includes hunting of small game, trapping, boating, snowmobiling, wood harvesting, berry picking, bird watching, and geo-caching. However, the area where these activities overlap with Project construction is minimal and there are large areas of land and waterbodies within the LSA where residents currently pursue these resource harvesting activities. The total footprint

(PDA) of disturbance and restricted access will occupy an area of approximately 22 km^2, or approximately four percent of the LSA.

Operation and Maintenance

Project operation and maintenance will result in decreased access due to alterations to the existing landscape and watercourses, and the creation of restricted-access zones surrounding construction activities. The following operation and maintenance activities have the potential to result in additional change in access (Table 23.7):

- Open pit mining, including blasting;
- Rail transport; and
- Progressive Rehabilitation.

Activities associated with the open pit will require the implementation of restricted-access zones for access public safety during blasting operations. Signs will be posted around the pit at a safe distance advising the public of activities. These restrictions will be in place throughout operation and maintenance.

The rail line will not cross any public roads.

Progressive rehabilitation involves rehabilitation of Project features that is completed, where practical, during operation and maintenance (i.e., prior to closure). Progressive rehabilitation of Project features, such as the TMF, could result in the re-opening of these areas to land and resource use upon closure of the Project, thereby increasing access within the LSA over the long term.

Decommissioning and Reclamation

Decommissioning and reclamation will result in restored access to several areas associated with the Project. The following activities have the potential to change access to land and resources (Table 23.7):

- Site decommissioning; and
- Site rehabilitation.

Site decommissioning will include removal of all site buildings, roads, and rail, contouring of waste rock disposal areas, and re-vegetation of these areas and the TMF. Although there will be access restrictions while decommissioning and rehabilitation are on-going, these activities will ultimately lead to restoration of access across most of the PDA.

One feature of the mine site that will not be fully rehabilitated is the open pit. During decommissioning a barrier will be erected around the pit and safety signs will be installed. The pit has a footprint of 280 ha, which is approximately 13 percent of the PDA and less than 1 percent of the LSA.

Effects Management / Mitigation Measures

Project activities will result in both adverse and positive effects on access to land and resource use within the PDA. The following features have been designed into the Project to minimize effects on access:

- The stream crossing at Waldorf River will consist of a span bridge to facilitate navigation; and
- Progressive rehabilitation at the TMF will begin during operation and maintenance so that access can resume upon closure of the mine.

In addition to Project design mitigation, the following effects management measures will be implemented:

- Navigation signage will be posted in the vicinity of any in-water Project features; and
- Alderon will work with the White Wolf Snowmobile Club and the Menihek Nordic Ski Club to address Project effects.

Characterization of Residual Effects

Residual environmental effects on access resulting from the construction phase will be adverse, reducing the area of land and water within the LSA by approximately four percent, and not extending beyond the PDA. Many of the restrictions will be continuous through the construction phase and throughout the life of the Project. Many of the access restrictions imposed due to Project construction will be reversible and will occur in a developed setting.

Residual environmental effects resulting from the operation and maintenance phase will be both adverse and positive. There will be small reductions in the areas restricted from land use, however the area available for land use within the LSA will remain reduced by approximately four percent. These restrictions to land and resource users will be continuous through operation and maintenance, and will occur in a developed setting. Reversal of Project effects will begin during this phase with progressive rehabilitation, which will shorten the overall rehabilitation time upon Project closure.

Residual environmental effects resulting from decommissioning and reclamation will be both positive and adverse. Although there will be restrictions to access during decommissioning and reclamation, the goal of this phase is to prepare the environment to return to a pre-Project state, including providing access to the site for land and resource use purposes. The open pit will remain post-decommissioning and reclamation, and restrictions to access for the purpose of public safety will remain. With the exception of the open pit, Project effects during this phase are reversible and will occur in a developed setting

There is a high degree of confidence in the effects predictions based on the informant interviews conducted in support of the Project.

23.6.2 Change in Level of Activity / Use

Change in level of activity / use due to the Project could result from changes in opportunity to pursue land and resource use activities, increased levels of dust and/or noise, and increased competition for resources due to increases in the local population.

Construction

The following activities associated with Project construction have the potential to cause changes to the level of land use due to changes in opportunity to pursue land and resource use activities, and increase levels of dust and/or noise (Table 23.7):

- Site preparation;
- Construction of roads;
- Construction of site buildings and associated infrastructure;
- Construction of TMF;
- Construction of railway and load-out facilities;
- Construction of power line;
- Construction of stream crossings;
- Installation of water supply infrastructure;
- Onsite vehicle / equipment operation;
- Waste management; and
- Transportation of personnel and goods to site.

In addition to placing restrictions on access, thereby reducing opportunities to pursue land and resource activities, as detailed in Section 23.6.1, many of the construction activities listed above will generate noise and dust which has the potential to influence where users choose to pursue land use activities. A comprehensive review and assessment of dust and noise emissions from the Project is provided in Chapter 14 (Atmospheric Environment).

During construction, dust will result from the use of heavy earth moving equipment handling overburden and traveling on unpaved roads. As discussed in Section 14.5, the effects of Project construction on air quality, with application of the required mitigation measures, will be moderate in magnitude, local, short-term, and will occur rarely.

During construction, noise will result from the use of heavy equipment at the site, and construction of site infrastructure. The communities of Fermont, Labrador City and Wabush are separated from the facilities by distances of the order of 5 to 10 km, and are unlikely to experience noise resulting from the civil works. The cabins on Long Lake and Riordan Lake are within 5 km, and in some cases are within a few hundred meters, and will experience some noise due to the construction. The railroad may affect cabins on these lakes, and will be within a few hundred meters of the residential areas of the town of Wabush. These disturbances will be temporary and the distances are sufficient that individual sound is unlikely to be distinguished.

Restrictions to access and elevated levels of noise and dust in the PDA could potentially result in reduced levels of land and resource use. However, given that land and resource activities such as hunting, trapping, boating, fishing, snowmobiling, wood harvesting, berry picking and bird watching, and geo-caching, take place throughout the LSA and RSA, there are many locations for users to pursue their chosen activities outside of the area affected by elevated noise and dust.

Due to Alderon policies restricting possession of firearms and angling gear by employees, it is anticipated that there will be no anticipated increase in competition for resources due to local population increase during construction.

Operation and Maintenance

Operation and maintenance has the potential to result in changes to the level of activity / use of the PDA and LSA due to changes in opportunity to pursue land and resource use activities, elevated levels of dust and noise, and increased competition for resources due to changes in the local population. The following activities have the potential to result in additional changes in level of activity / use (Table 23.7):

- Open pit mining;
- Ore processing;
- Concentrator operations;
- Water treatment and discharge;
- Rail load-out and silo discharge;
- Rail transport;
- Onsite vehicle / equipment operation and maintenance;
- Waste management;
- Transportation of personnel and goods to site; and
- Employment.

Noise and dust effects from the Project during operation and maintenance will be similar to those described for construction, but will occur more frequently.

The main sources of dust during operation and maintenance will include the use of heavy equipment on unpaved roads and material handling (loading and unloading of extracted ore and waste rock, stockpiling, reclaiming, conveying and conveyor transfer points, and rail loading). The amounts of dust created from these activities can varying depending on a number of factors including size of the matter being disturbed, local climatic conditions (wind speed / direction and precipitation), frequency of disturbance, the moisture and silt content of the material being disturbed, as well as mechanical stresses, including factors like material drop height and vehicle speed on unpaved roads (Golder Associates 2010). Typically, the distance that dust will travel from its source is mostly dependent on the size of the matter being disturbed and the local climatic conditions. In general, larger particulate matter will tend to be deposited closer to the source of the emissions than that of finer particulate (Golder Associates 2010). Dispersion modeling completed for the Project indicates that levels in exceedence of provincial standards will generally be limited to the PDA a few hundred meters in Figure 23.33. Land use activities including, firewood harvesting, hunting, berry picking, boating, do slightly overlap with portions of the PDA and the zone of impact related to emissions of total suspended particulate, as shown in Figure 23.33. These areas of overlap represent a very small portion of where the land use activities occur within the LSA and therefore, should not have minor effects on the activity level and use.

The main sources of noise during operation and maintenance will include the use of heavy equipment, drilling and blasting, processing facilities, movement of materials, and the railroad. Noise modeling completed for the Project shows that elevated noise levels will be experienced beyond the PDA, but it will not extend beyond the LSA (Figure 23.34). The land use activities conducted in this area will therefore, likely be affected by noise from the Project, however the land use activities that overlap with the zone of impact for the Kami Project are small compared to the other areas where these activities occur within the LSA.

Alderon will use the resident workforce where possible during the operation and maintenance phase. In 2015, 250 to 270 workers will be required for the first year of operations and maintenance. With the potential for many of these employees to bring their families, the level of in-migration will be influenced by the marital status and family size of employees who move to the area. Based on provincial marriage and family statistics, it is estimated that the employment of this workforce will result in approximately 565 new residents in western Labrador as of 2015, including approximately 135 employee spouses and 160 children. As operation and maintenance employment is expected to increase gradually, peaking at approximately 817 employees in 2020, the associated in-migration to western Labrador is estimated to be 1,700 residents.

This influx of people to the region will likely result in increased demand on land and resources in the areas not restricted by the footprint and restricted-access zones associated with the Project. However, given that the existing population of western Labrador pursue land and resource use activities, such as snowmobiling, throughout the region, and regulatory control over activities such as large game hunting and wood harvesting, it is unlikely that such a population change would result in changes so that the current use of lands and resources could not continue at current levels within the RSA over the long-term.

There will be increased competition for large game licenses, in particular moose, for which licenses are limited by DOEC, within the LSA as the overall number of licenses issues is determined by the species population, not human population. However, large game hunting (caribou, moose, black bear) was not identified as a popular activity by the informant interviews.

Figure 23.33 Maximum Predicted 24-hour Ground Level Concentration of Total Particulate Matter During Operation and Maintenance

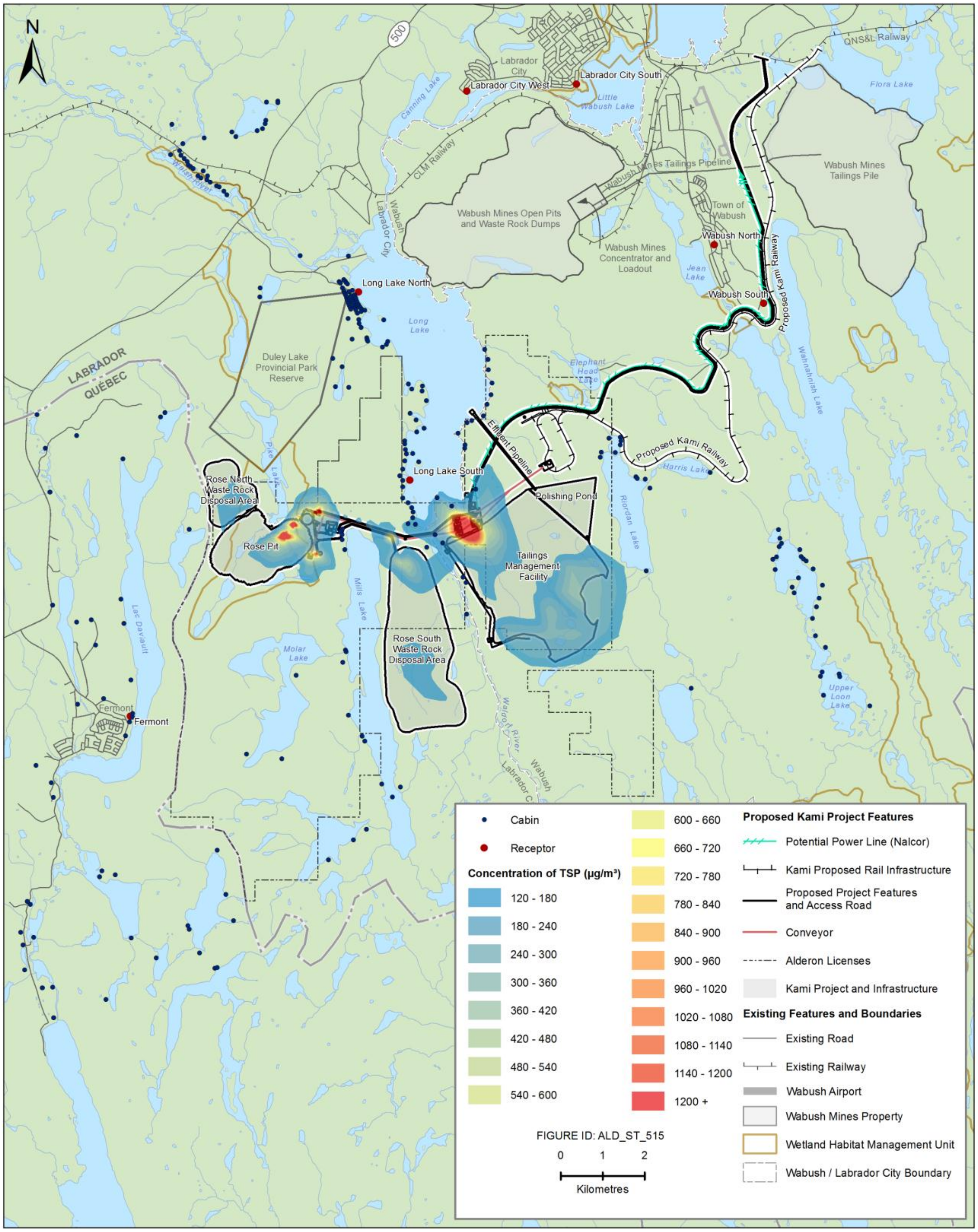
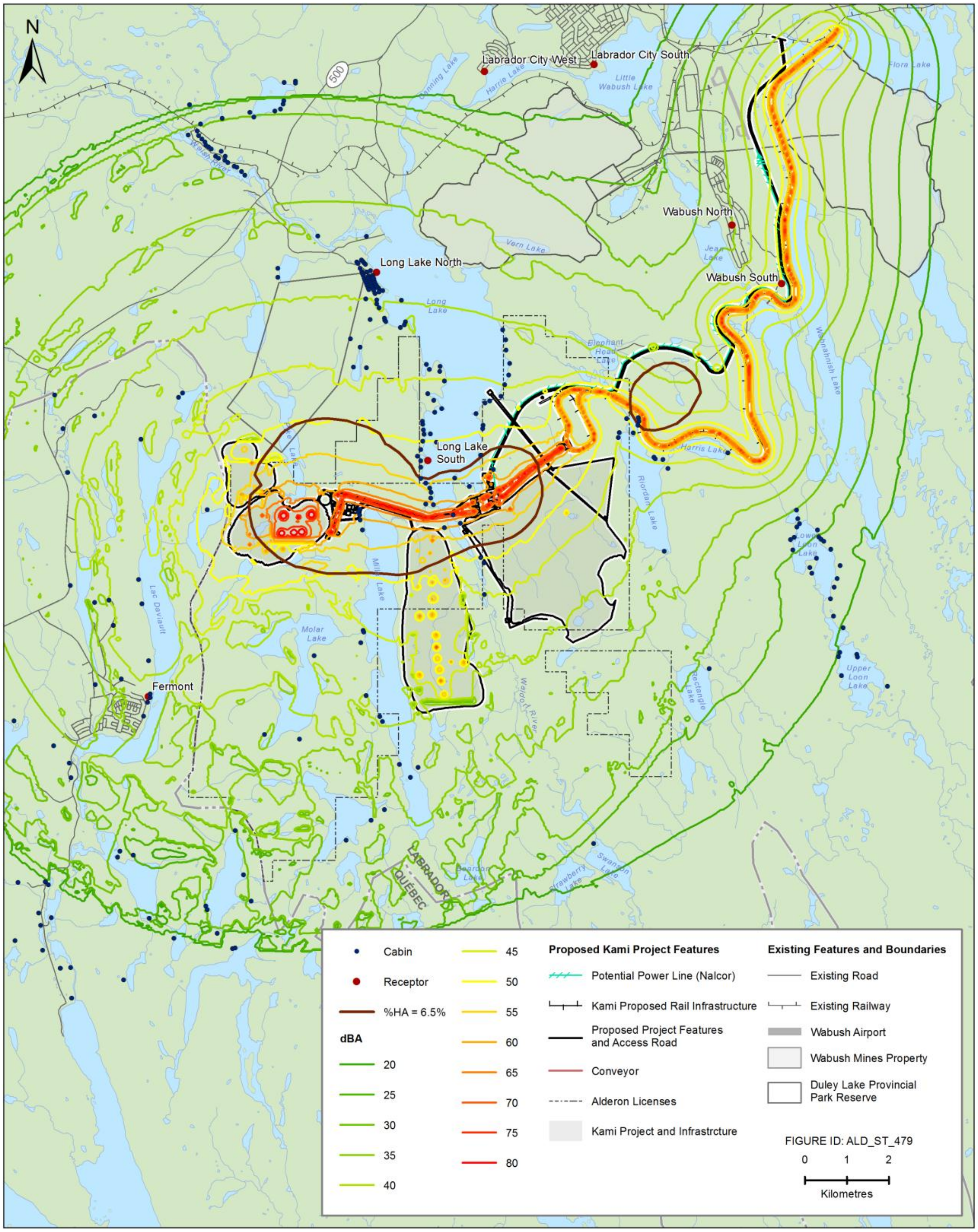


Figure 23.34 Predicted Sound Pressure (Noise) Levels During Operation and Maintenance



Decommissioning and Reclamation

Decommissioning and reclamation will result in restored access to many areas within the footprint of the Project. The following activities have the potential to change level of activity / use of lands and resources (Table 23.7):

- Site decommissioning; and
- Site rehabilitation.

Site decommissioning and rehabilitation will include removal of infrastructure responsible for generation of dust and noise, roads, and rail from the PDA, as well as contouring of waste rock disposal areas, and re-vegetation of these areas as well as the TMF. Once these activities are complete, all areas of the PDA, with the exception of the open pit, will be available for land and resource use opportunities. In addition, once the mine is closed employment in the region will be reduced and residents will have fewer economic resources at their disposal for pursing recreational land use activities.

Effects Management / Mitigation Measures

Mitigation for noise and dust resulting from construction and operation and maintenance will be managed through best practices such that they do not exceed Health Canada, Environment Canada, and provincial thresholds. The following effects management measures will be implemented to mitigate change in level of activity / use:

- Alderon will implement a no harvesting and firearms prohibition policy on the Project site.
- A dust suppression program will be implemented, as detailed in Chapter 14.
- Noise will be mitigated through measures such as maintaining a vegetated buffer between the Project and the nearby residents and cabins, as detailed in Chapter 14

Further detail regarding mitigation for dust and noise is provided in Chapter 14 (Atmospheric Environment).

Characterization of Residual Effects

Residual effects on change in activity / use resulting from the construction phase will be adverse. The area in which users are able to pursue their land use activities will be limited within the PDA and will decrease by approximately four percent within the LSA. Elevated dust and noise levels associated with construction will be short term and reversible, will not affect the majority of users, and will take place in a developed area.

Residual effects on change in activity / use resulting from the operation and maintenance phase will be adverse. Effects will be experienced in the PDA and will be continuous through operations and maintenance, will not affect the majority of users, and will occur in a setting that has been subject to adjacent open pit iron ore mining for more than 50 years. Elevated dust and noise levels associated with construction will be short term and reversible, will not affect the majority of users, and will take place in a developed area. Effects will be reversible upon Project closure.

Residual effects on change in activity / use resulting from decommissioning and reclamation will be positive, increasing the opportunities for activity / use of land and resources through removal of Project infrastructure and rehabilitation of the PDA. The positive effect will be reversible, long term, continuous, and will take place in a developed area.

23.6.3 Change in Cabin Use

Change in cabin use due to the Project could result from cabins that are within the PDA, by elevated noise and dust levels, and by changes in access to cabin areas. Within the Labrador City / Wabush / Fermont area, a total of 276 recreational cabins were identified through requests to Newfoundland and Labrador Crown Lands and Québec Ministere des ressources naturelles et de la faune, and were supplemented through direct consultation with cabin owners at various public events held by Alderon. Of the 276 cabins recorded, 233 are within the LSA. The number and precise locations of cabins will be refined as Alderon continues its on-going consultation with cabin owners.

Construction

The following construction activities have the potential to result in a change in cabin use (Table 23.7) through either overlap with the Project footprint, elevated noise and dust levels, or changes in access to cabin areas:

- Site preparation;
- Construction of roads;
- Construction of site buildings and associated infrastructure;
- Construction of TMF;
- Construction of railway and load-out facilities;
- Construction of power line;
- Construction of stream crossings;
- Installation of water supply infrastructure;
- On-site vehicle / equipment operation; and
- Transportation of personnel and goods to site.

The overall Project footprint will displace three existing cabins currently located within the PDA.

As discussed above, construction of Project features will result in the creation of dust, but these effects will be limited to the PDA.

The spatial footprint of the construction activities is essentially the same as that of the operational phase, and the equipment list is shorter. A quantitative noise analysis was performed for the operational phase, and it is assumed that the operational levels are higher than those to be found during construction as the operational model is based on the year of highest on-site equipment use, and maximum production rate. Therefore the potential effects on a change in cabin use due to noise generated from the construction of the Project would be similar to that determined for the operation of the Project, which is discussed below, under Operations and Maintenance.

Access to the majority of cabins during the ice-free months is either by boat, road, or along trails or wood-roads using ATVs. According to informants, once the ground is covered with snow and the lakes and other waterbodies are sufficiently frozen to bear weight, snowmobiles are the principal means of travel to and from cabins. During construction there will be temporary disruptions in access to cabin areas by road from the east. Road access to the cabins east of Long Lake is by roads from Wabush; construction of the Project will include modification of this road network. Road access to the Project site will be by means of a new gravel access road that will extend south from the TLH, by-passing Wabush, to the Project area. The existing roadwork on the property, presently used by cabin owners and other members of the public, will be taken out of service. Alderon will work with cabin owners to address project effects on access.

Watercourse crossings will be installed at all road and rail stream crossings. Although the majority will be culvert-type crossings, there will be bridges installed at the two major crossings to facilitate boating: Waldorf River and Jean Lake Rapids. During the summer informants reported that boats are used by cabin owners to access cabins and fishing areas though the Long Lake area. During construction there will be temporary disruptions to boat access routes through the Long Lake - Waldorf River junction while a bridge is installed. However, this interruption will be short term and the bridge will designed to permit boat traffic. The bridge will be designed to facilitate boat traffic. Navigation advisories will be issued during construction to make local residents aware of activities, and navigation signage will be posted once the bridge is in place and will remain throughout the life of the Project.

As previously discussed, construction of the Project will overlap with snowmobile trails. Alderon will work with the snowmobile associate and cabin owners to address Project effects. As discussed in Chapter 15 (Landforms Soils, Snow and Ice), there are no predicted Project effects on ice formation or thickness on the waterbodies outside the PDA; therefore, there will be no effects to use of snowmobiles to access cabins other than general restrictions due to restricted-access zones surrounding Project construction activities.

Operation and Maintenance

The following operation and maintenance activities have the potential to result in a change in cabin use (Table 23.7) through either elevated noise and dust levels, or changes in access to cabin areas:

- Open pit mining;
- Ore processing;
- Concentrator operations;

- Tailings disposal in TMF;
- Waste rock disposal on surface;
- Water treatment and discharge;
- Rail load-out and silo discharge;
- Rail transport;
- Onsite vehicle / equipment operation and maintenance; and
- Transportation of personnel and goods to site;

The main effect from the Project on cabins during operation and maintenance will result from noise and dust.

As discussed in Section 23.6.2 and Chapter 14 (Atmospheric Environment), elevated levels of dust will not extend far beyond the PDA, and will be limited to the LSA. Based on dispersion modeling, a total of four cabins are located in areas that are predicted to experience TSP (i.e., dust) levels in excess of the provincial standards over a 24-hour time period. The maximum predicted ground level concentrations of TSP over the annual time period however are not expected to extend beyond the PDA and will not result in levels that exceed regulatory standards at nearby cabins. The frequency of exceeding regulatory standards over the short term is therefore relatively small. Alderon will also implement a number of mitigation measures to reduce the effects of dust offsite as described in Section 14.6. Ambient air quality monitoring programs will also be implemented during Project operation.

There are no regulations regarding noise emissions in Newfoundland and Labrador. As discussed in Chapter 14 (Atmospheric Environment), although Health Canada does not publish regulations with respect to noise, and do not have noise guidelines, their publications provide guidance on the assessment methods for noise effects in EAs, with emphasis on the annoyance methods from the US EPA (1974).

Annoyance is calculated from the daytime and weighted nighttime sound levels by a response function to give percent highly annoyed (%HA). In short, the 15 daytime hours and 9 nighttime hours are energy averaged, with a bias of +10 dB applied to the nighttime before averaging. This bias reflects the greater sensitivity or responsiveness of the community to noise effects during this part of the day.

For the operations and maintenance phase of the Project, the %HA was calculated using the same procedure for the baseline and Project conditions. If, after mitigation has been applied, the %HA increases by 6.5 percent or more, the potential environmental effect may be substantial. In addition, Health Canada also advises proponents to adhere to a number of other guidelines that include World Health Organization (WHO) (1999) dealing with sleep disturbances and community noise. WHO have established a guideline of 30 dBA inside a dwelling to avoid sleep disturbance.

A detailed description of the noise sources during operation and maintenance and modeling is provided in Section 14.5.

The municipalities (Labrador City, Wabush, Fermont) will experience incremental increases in noise levels due to the Project, and will not exceed the Health Canada criterion of 6.5 percent. Southern Wabush will experience the greatest noise increase due to proximity to the rail, with an increase of 3 percent.

Long Lake is divided, with an acceptable change in %HA in the north of about 0.4 percent, and a general increase of about 5.3 percent in the south (Figure 23.34). There are, however, 20 cabins where the criterion of 6.5 percent is exceeded. These 20 cabins are all clustered at the south, and the sound levels there are largely due to the conveyor, crushers, processing plant, and rail line. The 6.5 percent criterion is shown as a red line on Figure 23.33. Health Canada deems any project related noise which leads to a change in %HA of 6.5 to be a community health effect and require mitigation. Alderon will implement mitigation measures to reduce significant adverse effects on these properties.

During the operation of the Project vibration may result from drilling and blasting within the Rose Pit mine and from the transport of the concentrate via rail. Vibration related to drilling and blasting is evaluated in Chapter 14 (Atmospheric Environment).

Ground-borne vibration is a potential concern to dwellings / buildings located with 75 m of a rail line or rail right-of-way. There are two cabins in the LSA located within 75 m of the rail line. These two cabins are included in the 20 cabins that will experience noise levels and do not increase the total number of cabins that are potentially affected by the Project.

Based on the above discussion, exceedance of the Health Canada criteria for noise, provincial standards for dust, and ground vibration set-back distances, a total of 20 cabins will be affected by Project operation and maintenance.

During operation and maintenance there will be modified access by road and snowmobile to some cabins in the PDA and LSA.

There will be continued modified access by road due to the modification of the existing road network, as described above. Alderon will work with cabin owners to address Project effects on access.

As previously discussed, the Project footprint and associated restricted-access zones will overlap with snowmobile trails. Alderon will work with the snowmobile association and cabin owners to address Project effects.

As discussed in Chapter 15 (Landforms, Soils, Snow and Ice), there are no predicted Project effects during operation and maintenance on ice formation or thickness on the waterbodies outside the PDA. Settled dust is not anticipated to cause a change in ice formation or thickness. A Project-specific Blasting Plan will be designed so that the vibrations will not affect ice on nearby lakes. Blasting will be used in the open pit and will be conducted in accordance with industry best available control technology, regulatory requirements, and will be in compliance with the Project EPP and is not anticipated to alter ice formation or damage the integrity of the ice outside the PDA. The effects of dust on snow are expected to result in a difference of less than 2 percent in duration of snow cover (see Chapter 15 Landforms, Soils, Snow and Ice).

Therefore there will be no effects to use of snowmobiles to access cabins other than general restrictions due to restricted-access zones surrounding Project construction activities.

Access to cabins along Waldorf River by boat will be maintained throughout operation and maintenance. Navigation advisories regarding the bridge at Waldorf River will remain posted throughout the life of the Project.

Decommissioning and Reclamation

The following decommissioning and reclamation activities have the potential to result in restored access to several areas and reduction in on-going noise and dust associated with the Project:

- Site decommissioning; and
- Site rehabilitation.

Decommissioning and reclamation will involve the removal of site buildings, rail, contouring of the waste rock disposal areas, and re-vegetation of these areas and the TMF. Although these activities will result in some noise and dust generation, it will be decreased from levels during operation and maintenance. The access road and stream crossings will be decommissioned pursuant to regulatory requirements at the time of mine closure.

Once reclamation is complete cabin owners will be able to traverse these areas on ATV and snowmobile to access their properties. As stated above, for reasons of public safety the open pit will remain restricted, with a berm constructed around its perimeter and signage will be posted.

Once decommissioning and reclamation activities are complete, and the PDA has returned to a pre-Project state, many areas will be suitable and accessible for construction of new cabins.

Effects Management / Mitigation

Alderon is committed to develop the Project within a sustainable development framework as described in its corporate environment policy. This includes a responsible approach to social, economic and environmental performance that is aligned with the evolving priorities of respective communities of interest. A broad spectrum of values that are shared with employees and communities of interest are underscored by ongoing efforts to protect employees, communities, customers and the natural environment. As such, Alderon is committed to meaningful engagement with cabin owners potentially affected by the Kami Project.

Alderon has been engaging with cabin owners in the Project area and acknowledges the concerns expressed. The company will continue to pursue further engagement with property owners potentially affected by the proposed mine development. Alderon has committed to the following guiding principles for engaging with property owners and mitigating significant adverse effects:

- Conduct an inventory of existing cabins and owners.

- Engage with property owners to hear their concerns about the potential effects of the Kami Project on their properties.
- Implement mitigation measures to reduce significant adverse effects on properties.

In addition to the strategy described above, the following effects management measures will mitigate Project effects on cabin use:

- Dust suppression program, as detailed in Chapter 14;
- Mitigation for noise, such as speed restrictions for vehicles on site roads;
- Mitigation for vibration due to the rail line, such as limiting train speed to 50 km/h or less;
    - The south end of Wabush is susceptible to vibration from the trains on three sides; Welded track sections will be used in this area to reduce vibration and ground borne noise.
- Navigation signage will be posted in the vicinity of the bridge at Waldorf River;
- Alderon will work with cabin owners to address Project effects on access;
- Alderon will work with the White Wolf Snowmobile Club and the Menihek Nordic Ski Club to address Project effects; and
- Development of a Project-specific blasting plan.

Characterization of Residual Project Environmental Effects

Residual environmental effects on cabin use resulting from the construction phase will be adverse, requiring the removal of at least three cabins and requiring changes to cabin access, however the effect will not extend beyond the PDA. The effects will be continuous through the construction phase, and throughout the life of the Project. The effects will be reversible upon Project closure and will occur in a developed area.

Residual environmental effects on cabin use resulting from the operation and maintenance phase will be adverse, requiring consultation with approximately 20 cabin owners in the LSA due to elevated noise and dust levels in the vicinity of their cabins. These effects will be continuous and long-term through the operation and maintenance phase, but will be reversible upon Project closure and will occur in a developed area.

Residual environmental effects on cabin use resulting from the decommissioning and reclamation phase will be positive, as this phase will involve the removal of Project infrastructure and most Project features will be prepared for the reclamation process. At the completion of the decommissioning and reclamation phase, most restrictions to access will be removed and most of the area will be available for cabin construction. The effects will be occur once and will be permanent.

There is a high degree of confidence in the effects predictions because of the informant interviews conducted with local residents, and the dust and noise modeling completed for the Project.

23.6.4 Change in Viewscape

Viewscape can be altered by physical features or works associated with the Project that are visible from outside the LSA. The presence, operation and maintenance of the mine will alter the aesthetics of the environment and could change land and resource users' perception of the area and discourage use. This has been analyzed using viewshed analysis and creation of before and after photosimulations.

Construction

Project construction activities that will physically alter the landscape are (Table 23.7):

- Site preparation;
- Construction of roads;
- Construction of site buildings and associated infrastructure;
- Construction of TMF;
- Construction of railway and load-out facilities;
- Construction of power line;
- Construction of stream crossings; and
- Installation of water supply infrastructure.

Activities that alter the landscape and affect the viewscape during construction will persist through the life of the Project.

The Project is located in an environment that is not visually pristine. There are currently two existing open pit mining operations in the LSA, each with tailings management and waste rock areas.

Operation and Maintenance

The following operation and maintenance activities will contribute to the alteration of the viewscape and they represent new and changing features on the landscape:

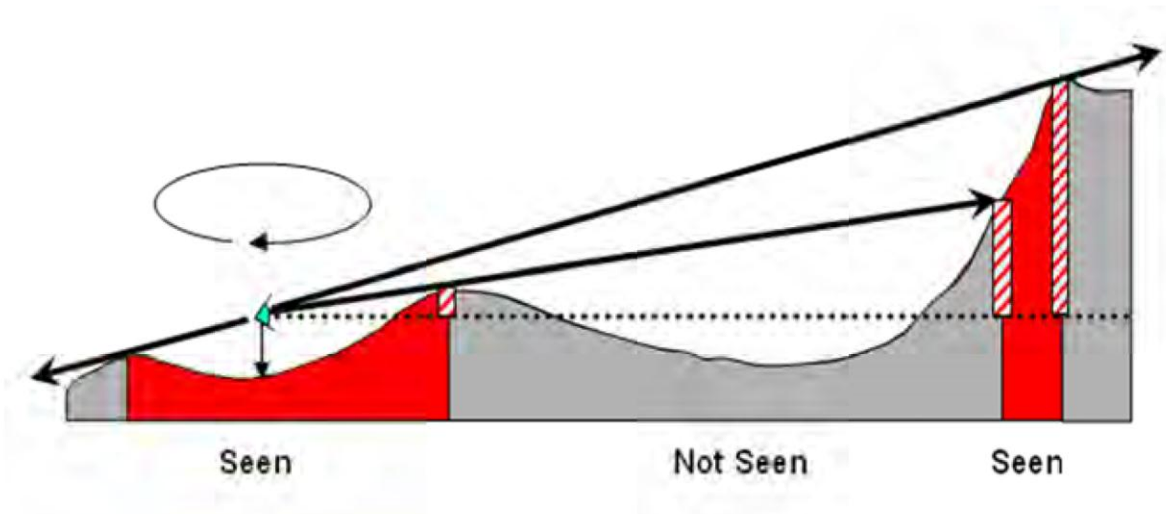
- Open pit mining;
- Ore processing;
- Tailings disposal in TMF;
- Waste rock disposal on surface;
- Rail load-out by silo discharge;
- Onsite vehicle / equipment operation and maintenance; and
- Progressive rehabilitation.

Viewshed Analysis

Effects to the viewscape were anslyzed using a viewshed model. The approach taken has been successfully applied to previous projects in the Newfoundland and Labrador (Nalcor 2009). A viewshed model, which generates a viewshed map, helps to predict whether or not a feature of the Project is likely to be visible from any given location within the visual assessment area. The viewshed map prepared for the operation and maintenance phase is based on two main inputs: a Digital Elevation Model (DEM), which is basically a model of the earth's surface, and vegetation cover.

An individual's viewscape depends on their distance from the Project feature, the line of sight as defined by the terrain, and the screening imposed by vegetation (Figure 23.35).

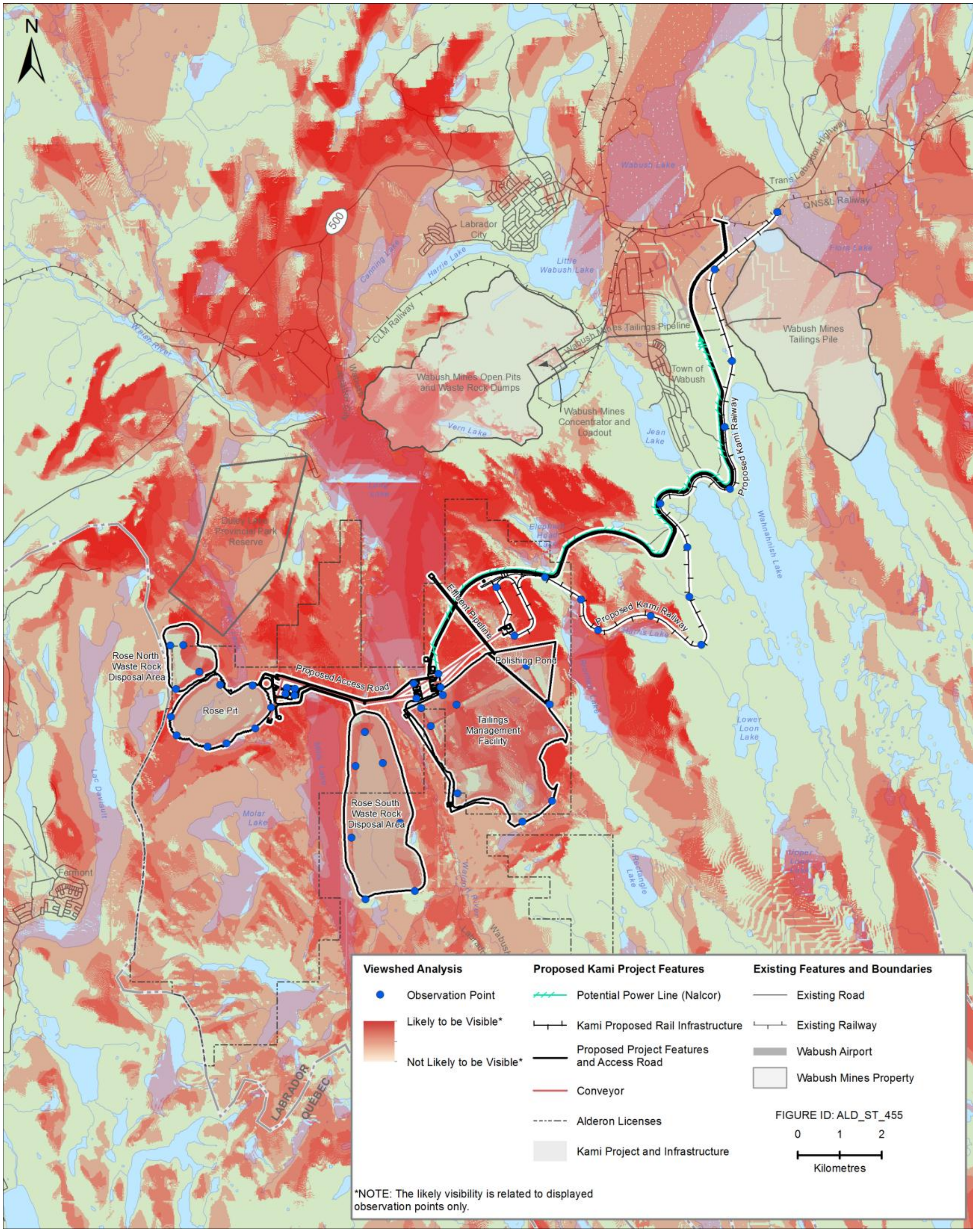
Figure 23.35 Graphic Representation of Viewshed Map Preparation



Viewshed modeling identifies cells in the DEM, which can be seen from one or more designated observation points. Each cell in the model output is given a value that specifies the number of observer points that can be seen from any given location within the Study Area.

Based on the viewshed analysis conducted for the Project (Figure 23.36), Project features will primarily be visible from Long Lake and adjacent lands extending from its shorelines. Project features are also likely to be visible from areas north of Long Lake, including the area near Canning Lake, east of Labrador City, and from the Wabush and Flora lakes areas. The Project may also be visible to the south, extending along the Waldorf River to Strawberry, Swanson and Beardon lakes. Project features are not likely to affect viewsheds from most residential areas of Labrador City and Wabush, including the Jean Lake Walking Trail. In Québec, the area from which Project features will most likely be visible lies to the north of Fermont, east of Lac Daviault. Viewsheds from the Lac Daviault area may be altered by Project features.

Figure 23.36 Viewshed Analysis Summary



Rose South and Rose North Waste Rock Disposal Areas are the Project Features that will be visible from the largest total area (Figure 23.37). These features may be visible from popular recreational and cottage areas, including portions of Long Lake, Riordan Lake and Lac Daviault. Both areas will also likely affect viewsheds from Mills Lake. Rose South will be visible from several areas identified as fishing locales by Labrador West residents. This primarily includes the Waldorf River area south of Long Lake, extending to and including Swanson, Strawberry and Beardon lakes.

Rose Pit will not be visible from Wabush or Labrador City (Figure 23.38). It is not likely to affect viewsheds from recreational areas such as the Jean Lake Walking Trail, Long Lake and the Duley Lake campgrounds or Fermont and Lac Daviault in Québec. It may be visible from adjacent lands and from portions of land in the Duley Lake Provincial Park Reserve, as well as areas north of Elephant Head Lake and west of Riordan Lake.

The Polishing Pond and tailings are likely to be visible from portions of Long Lake and its shorelines, along the Waldorf River, and from the Riordan and Harris lakes area (Figure 23.39). These Project features may also be visible from the Duley Lake campgrounds and from within a portion of the Duley Lake Provincial Park Reserve.

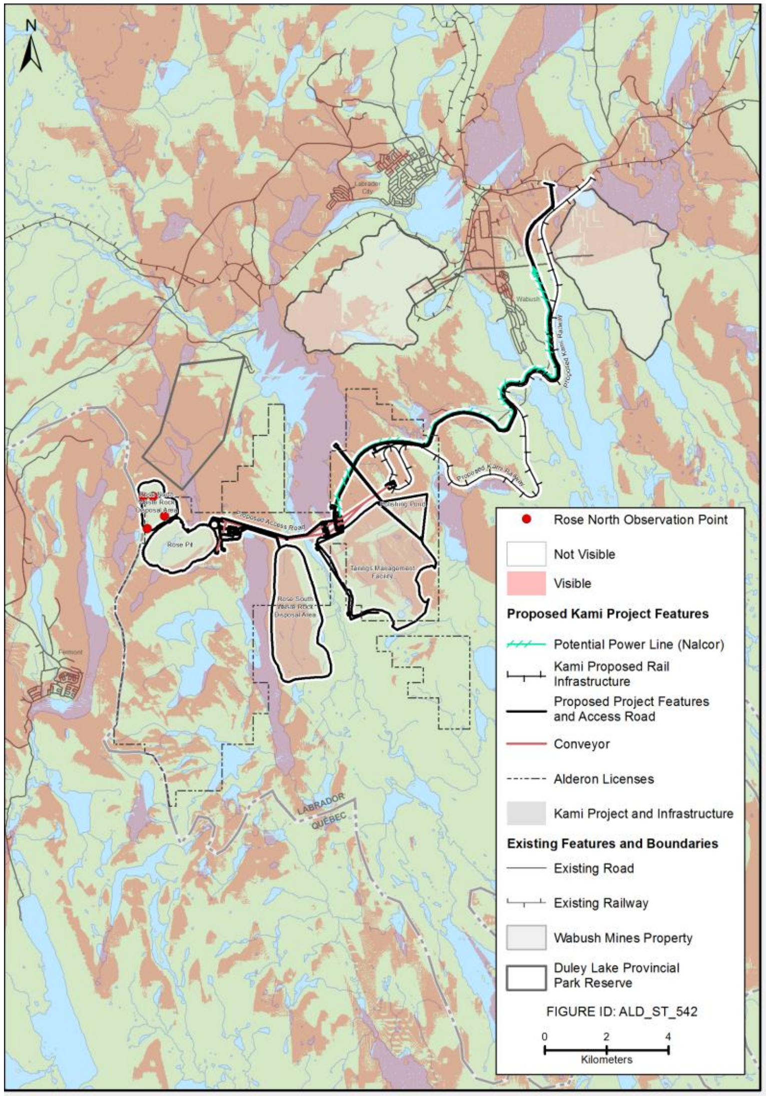
Project offices and the proposed substation area are anticipated to have little effect on existing viewsheds (Figure 23.39). Offices will be visible primarily from the nearby Mills Lake area, as well as in the area west of Long Lake to Riordan Lake and at various locations of higher elevations to the north. Substation visibility may have an effect on viewsheds from portions of Long Lake and its shorelines and along the Waldorf River.

The railway is likely to be visible primarily from lands adjacent to its corridor (Figure 23.40). Viewshed analysis also indicates that points along the railway will be visible from areas on the eastern shore of Long Lake extending north beyond Route 500. The railway may also affect viewsheds from Wabush and the western shoreline of Jean Lake, as well as from Wahnahnish Lake and its western shoreline.

Before and After Photosimulations

Site-specific photosimulations were created from photographs taken at the Project site, and provide a representative comparison of the ‘no Project’ and ‘with Project’ environments. Thirty-four photos were taken at select vantage points (Figure 23.41) within the LSA to illustrate what parts of the Project, if any, will be visible. The before and after photosimulations, with the location where the photo was taken, are provided in Figures 23.42 through 23.72.

Figure 23.37 Viewshed Analysis for the Waste Rock Disposal Areas



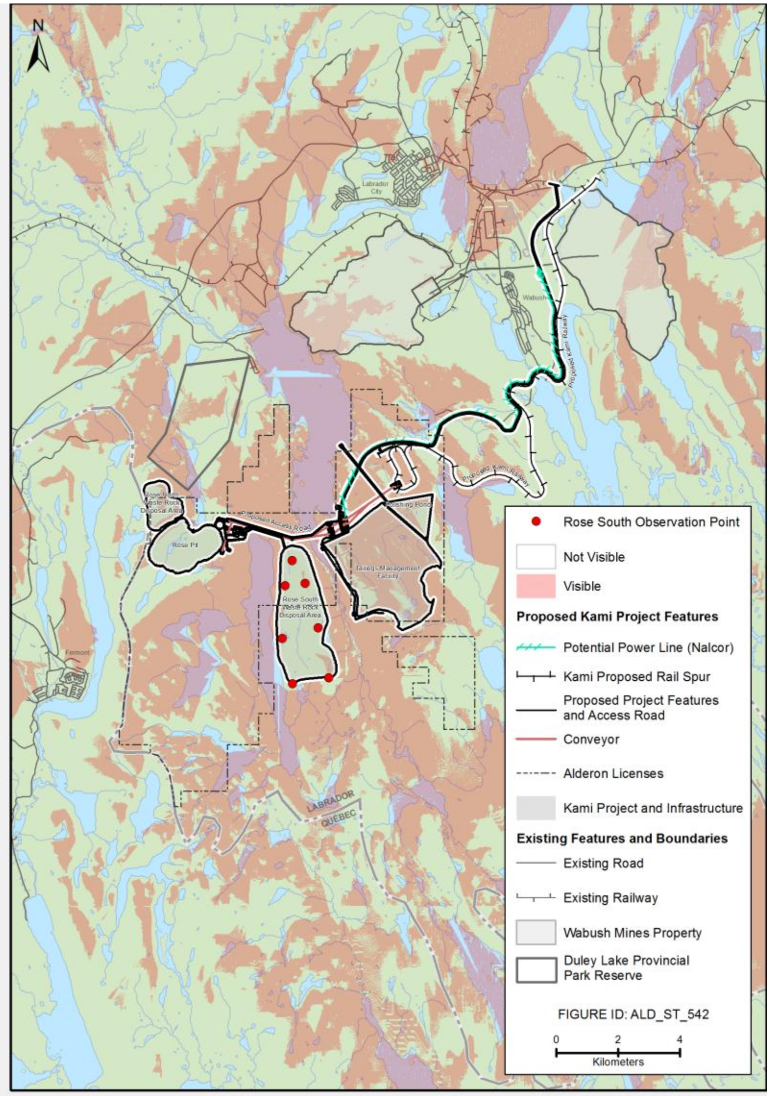
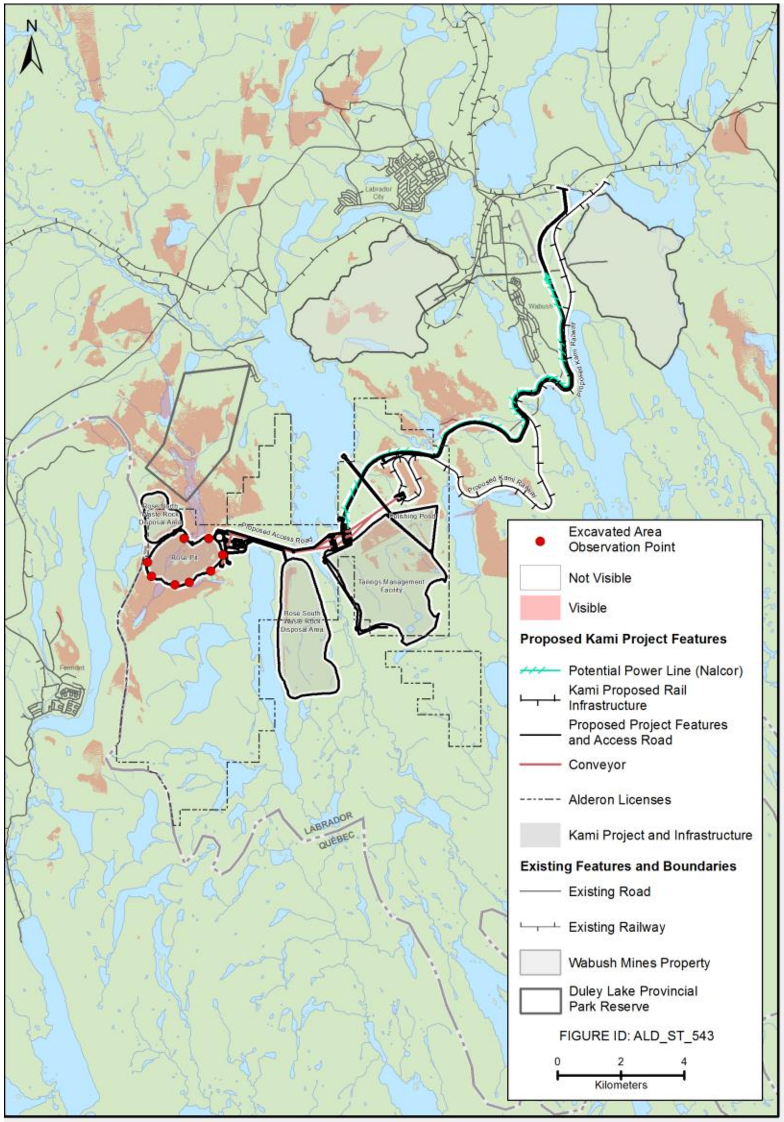


Figure 23.38 Viewshed Analysis for the Stockpiles and Rose Pit



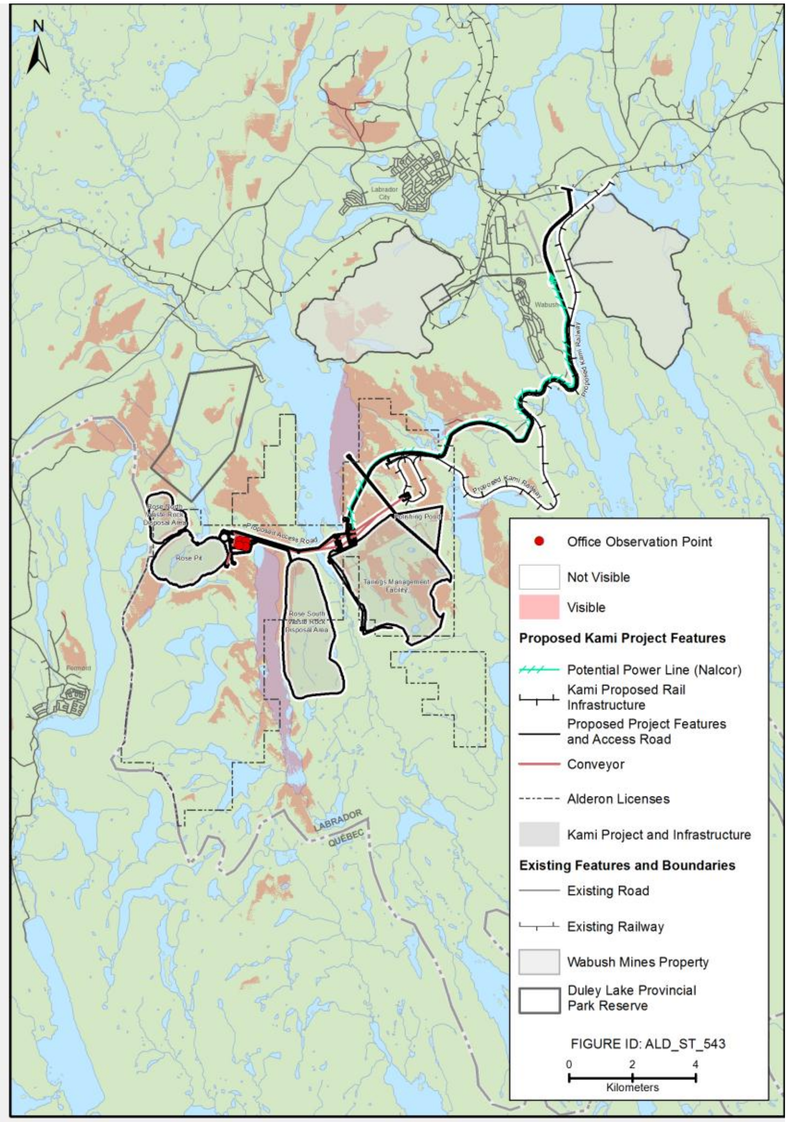
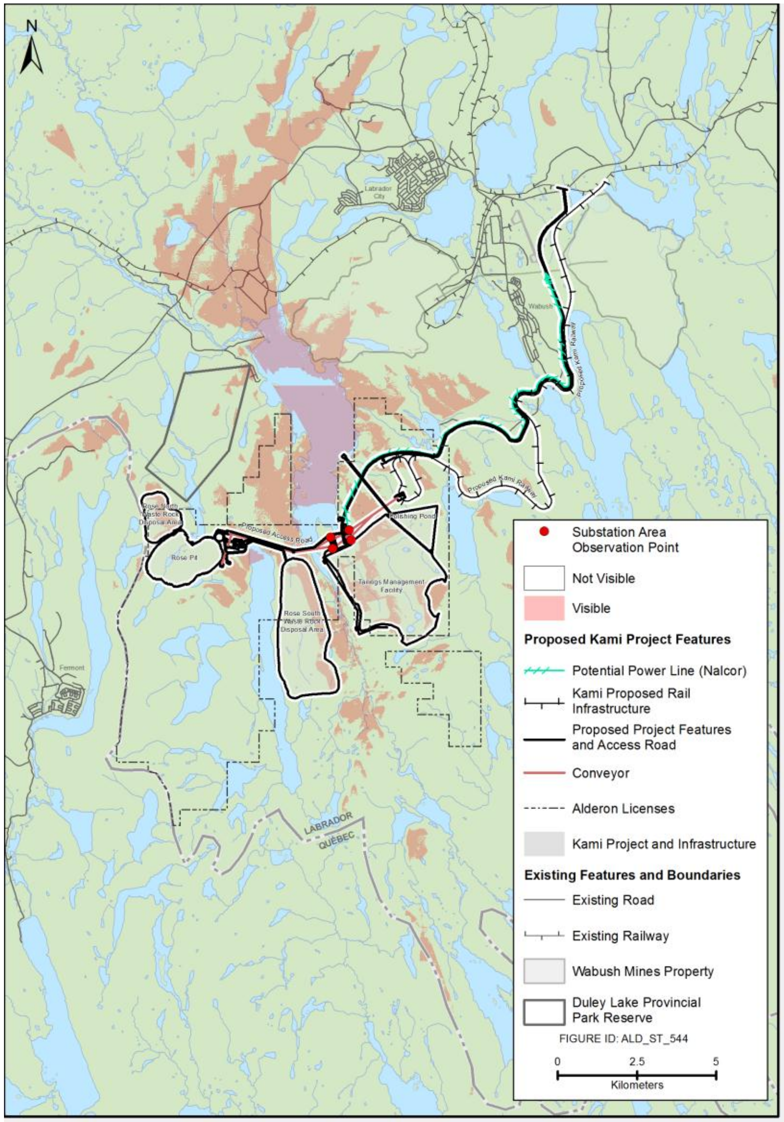


Figure 23.39 Viewshed Analysis for the Tailings Management Facility and Concentrator / Site Buildings



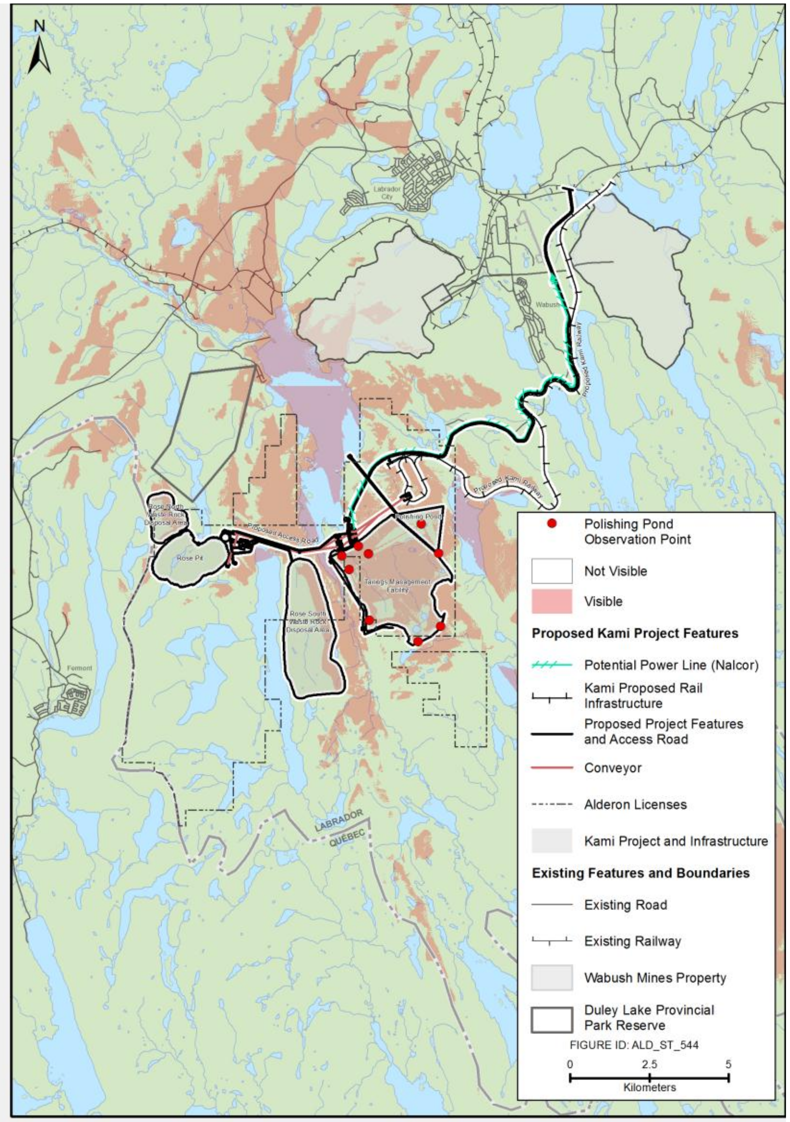


Figure 23.40 Viewshed Analysis for the Rail Line

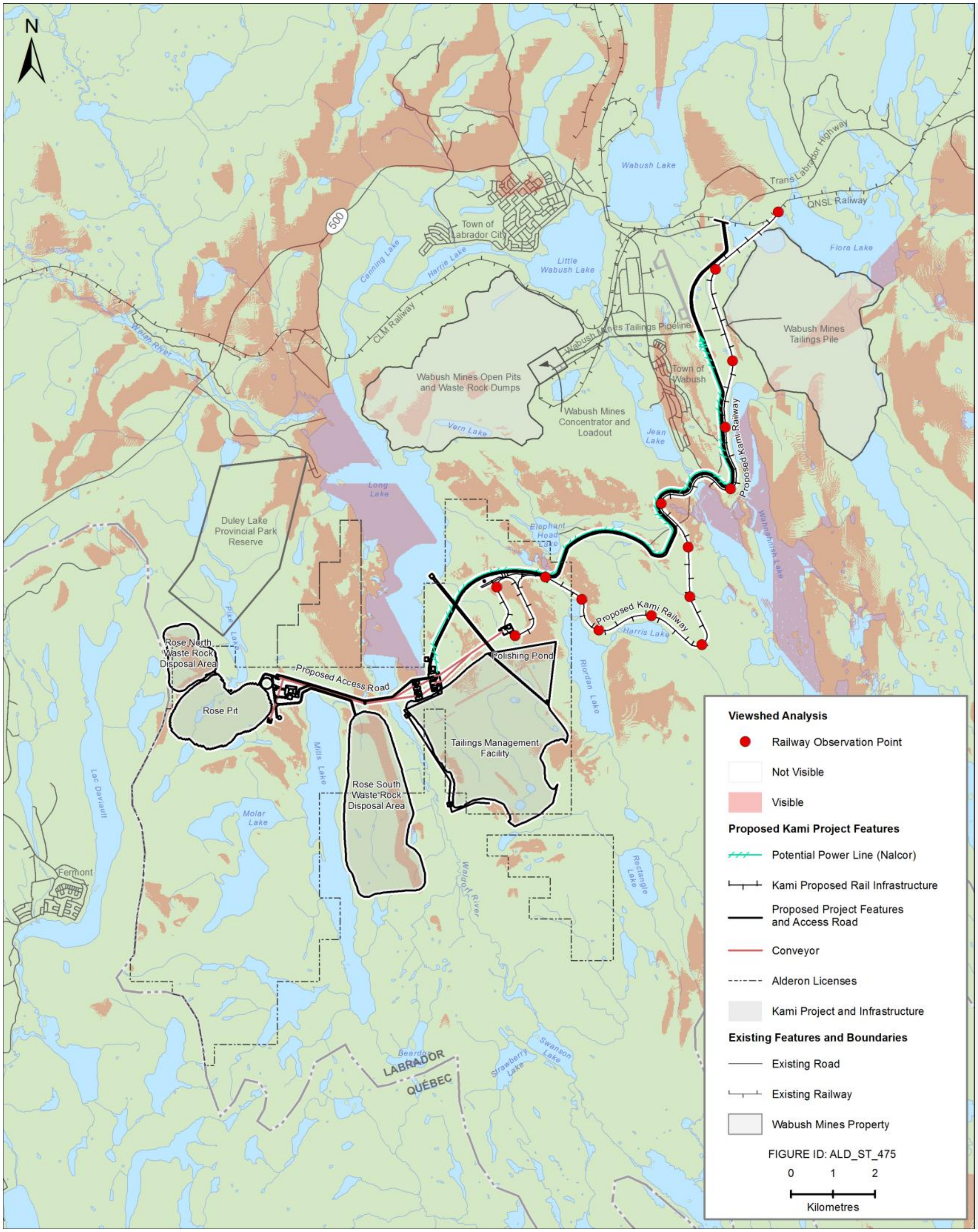


Figure 23.41 Photosimulation Locations

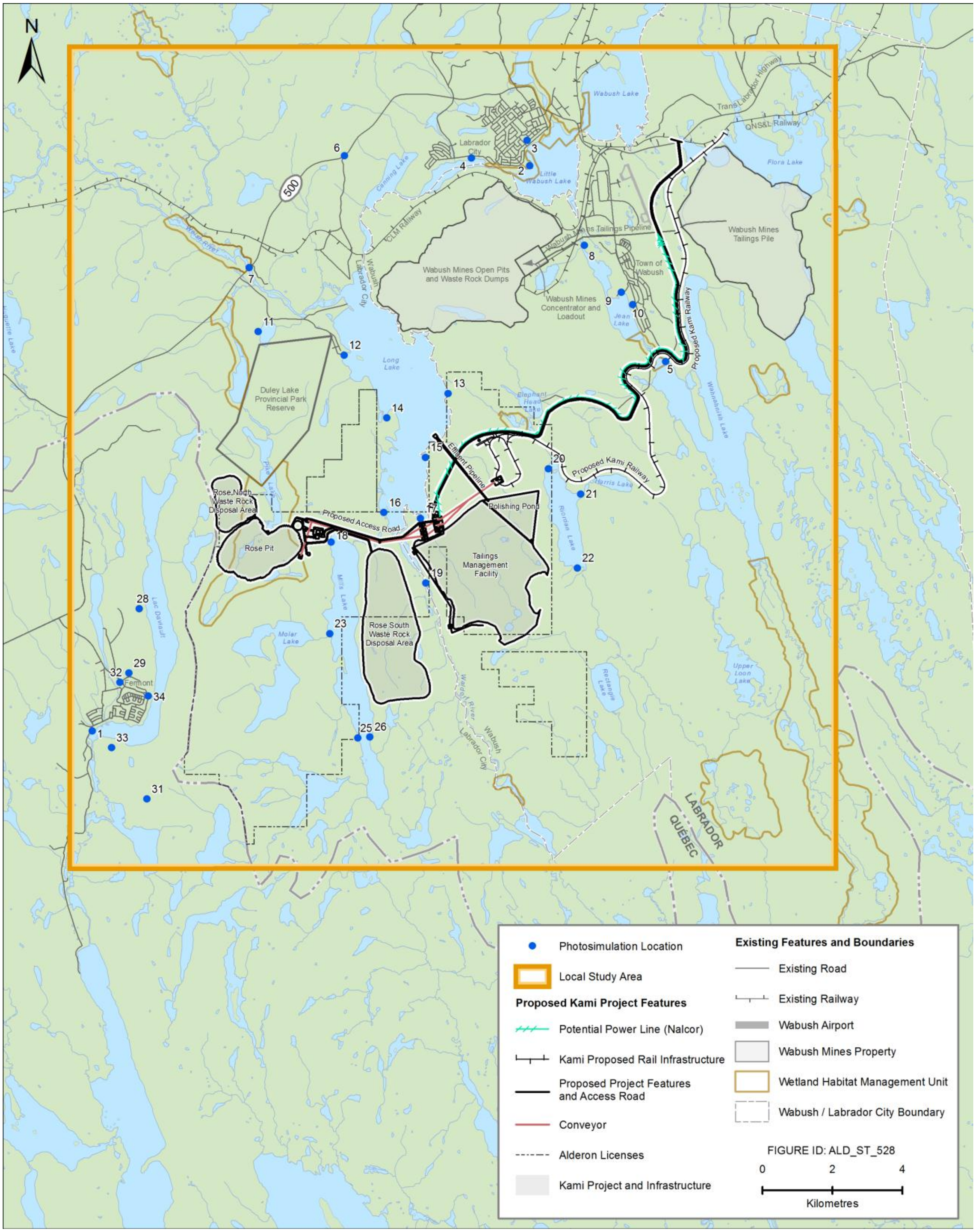


Figure 23.42 Photosimulation 1 – Fermont, Shore of Lac Daviault (1)

Before Project

Position of Camera

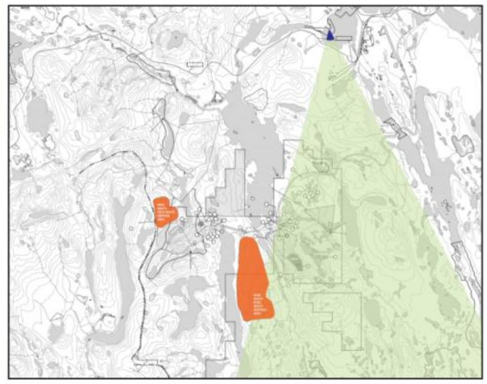
With Project

FIGURE ID: ALD_ST_001.CDR

Figure 23.43 Photosimulation 2 – Labrador City Park, Shore of Little Wabush Lake

Before Project

Position of Camera



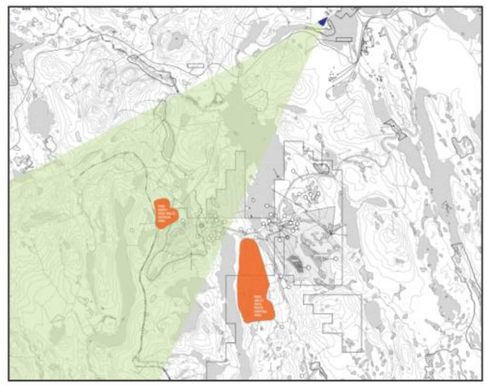
With Project

FIGURE ID: ALD_ST_002.CDR

Figure 23.44 Photosimulation 3 – Labrador City, Near School

Before Project

Position of Camera



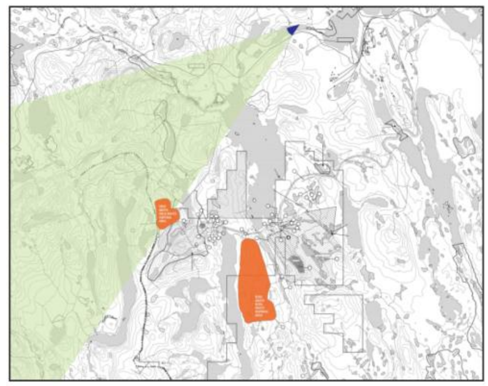
With Project

FIGURE ID: ALD_ST_003.CDR

Figure 23.45 Photosimulation 4 – Labrador City, Bartlett Drive

Before Project

Position of Camera



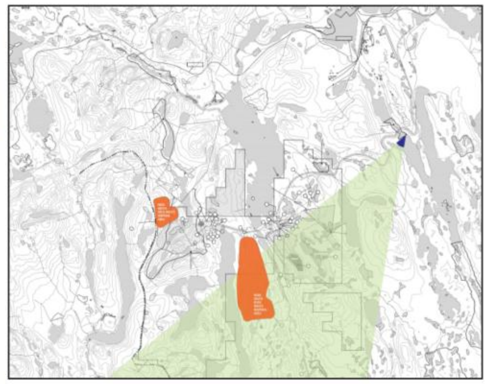
With Project

FIGURE ID: ALD_ST_004.CDR

Figure 23.46 Photosimulation 5 – Southern Wabush

Before Project

Position of Camera



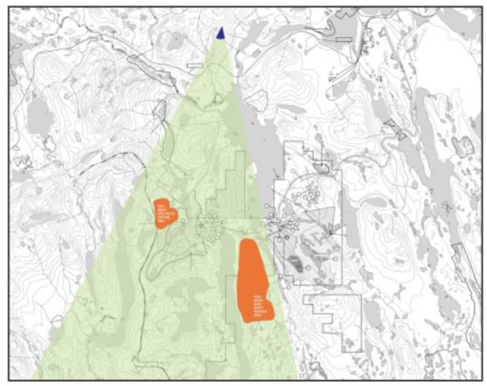
With Project

FIGURE ID: ALD_ST_005.CDR

Figure 23.47 Photosimulation 6 – Highway 500, High Elevation

Before Project

Position of Camera



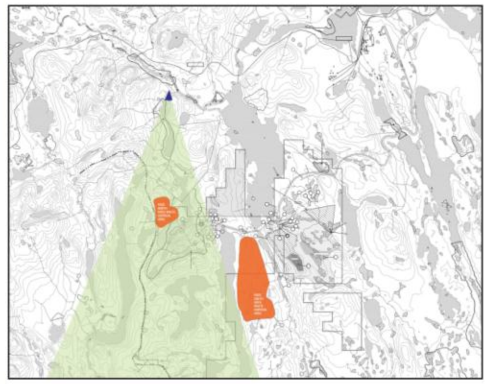
With Project

FIGURE ID: ALD_ST_006.CDR

Figure 23.48 Photosimulation 7 – Highway 500, Valley

Before Project

Position of Camera



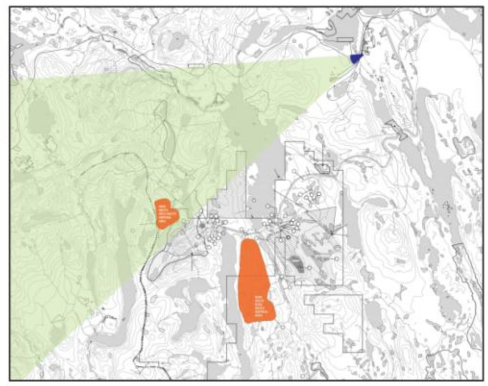
With Project

FIGURE ID: ALD_ST_007.CDR

Figure 23.49 Photosimulation 8 – Wabush, Industrial Area

Before Project

Position of Camera



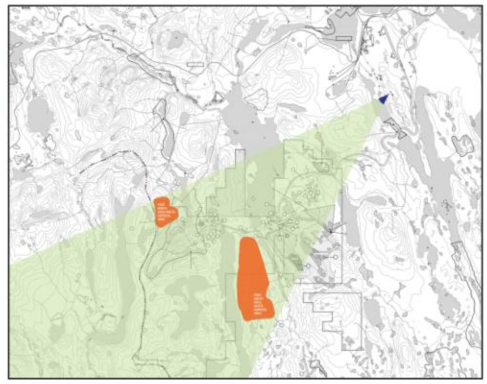
With Project

FIGURE ID: ALD_ST_008.CDR

Figure 23.50 Photosimulation 9 – Wabush, Shore of Jean Lake

Before Project

Position of Camera



With Project

FIGURE ID: ALD_ST_009.CDR

Figure 23.51 Photosimulation 10 – Wabush, New Housing Development

Before Project

Position of Camera

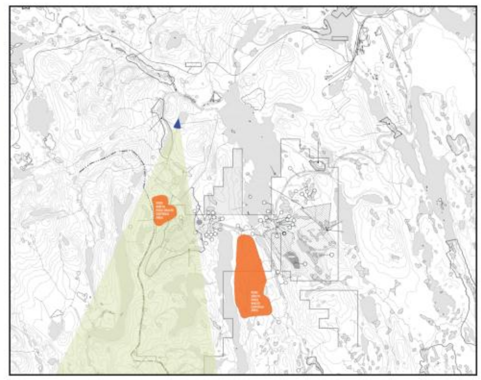
With Project

FIGURE ID: ALD_ST_010.CDR

Figure 23.52 Photosimulation 11 – North of Duley Lake Provincial Park Reserve

Before Project

Position of Camera



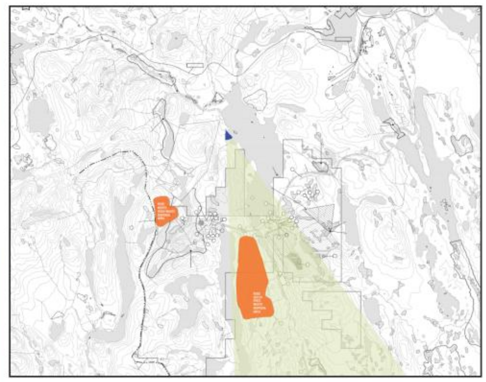
With Project

FIGURE ID: ALD_ST_011.CDR

Figure 23.53 Photosimulation 12 – Northwest Shore of Long Lake

Before Project

Position of Camera



With Project

FIGURE ID: ALD_ST_012.CDR

Figure 23.54 Photosimulation 13 – Eastern Shore of Long Lake

Before Project

With Project

FIGURE ID: ALD_ST_013.CDR

Position of Camera

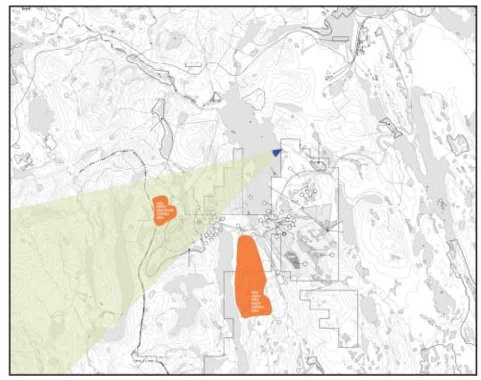
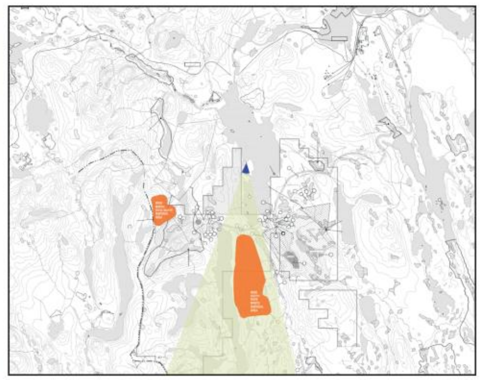


Figure 23.55 Photosimulation 14 –Western Shore of Long Lake

Before Project

Position of Camera



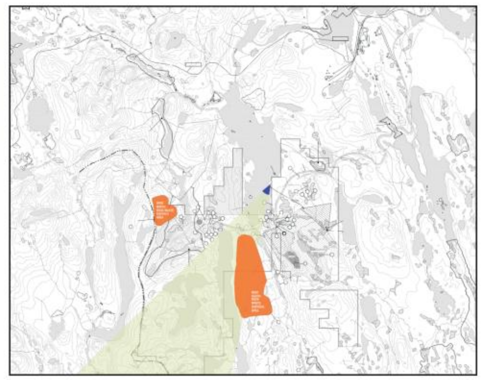
With Project

FIGURE ID: ALD_ST_014.CDR

Figure 23.56 Photosimulation 15 – Eastern Shore of Long Lake (2)

Before Project

Position of Camera



With Project

FIGURE ID: ALD_ST_015.CDR

Figure 23.57 Photosimulation 16 – Southwestern Shore of Long Lake

Before Project

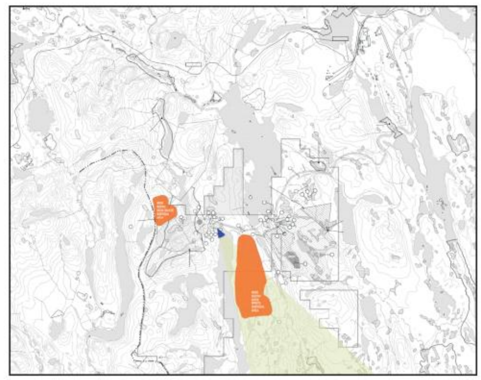
Position of Camera

With Project

Figure 23.58 Photosimulation 18 – Northwestern Shore of Mills Lake

Before Project

Position of Camera



With Project

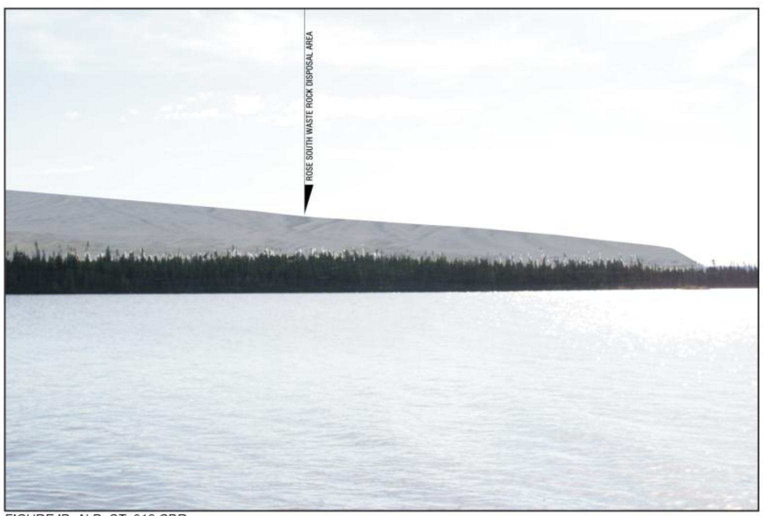
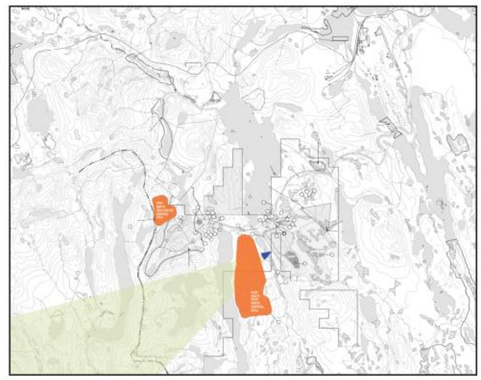


FIGURE ID: ALD_ST_018.CDR

Figure 23.59 Photosimulation 19 – Walsh River

Before Project

Position of Camera



With Project

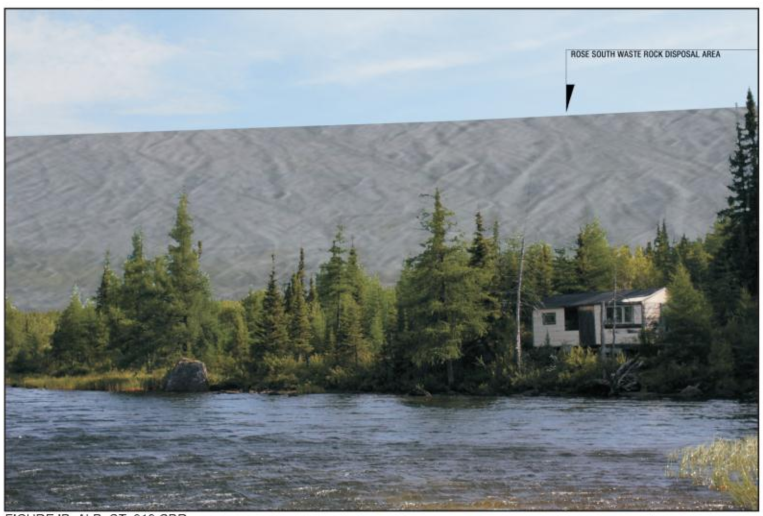
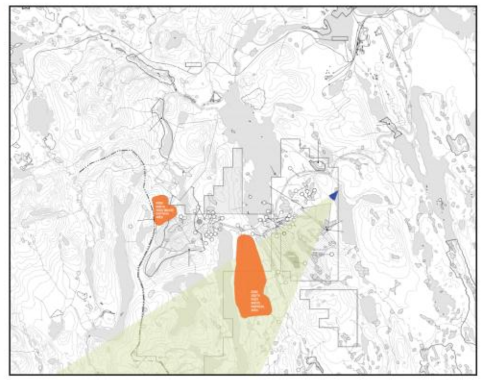


FIGURE ID: ALD_ST_019.CDR

Figure 23.60 Photosimulation 20 – Northern Shore of Riordan Lake

Before Project

Position of Camera



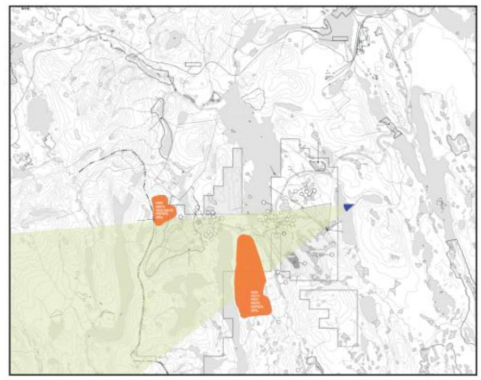
With Project

FIGURE ID: ALD_ST_020.CDR

Figure 23.61 Photosimulation 21 – Eastern Shore of Riordan Lake

Before Project

Position of Camera



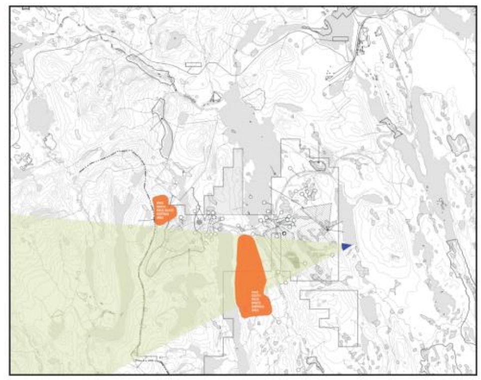
With Project

FIGURE ID: ALD_ST_021.CDR

Figure 23.62 Photosimulation 22 – Southern Shore of Riordan Lake

Before Project

Position of Camera



With Project

FIGURE ID: ALD_ST_022b.CDR

Figure 23.63 Photosimulation 23 – Western Shore of Mills Lake

Before Project

With Project

FIGURE ID: ALD_ST_023.CDR

Position of Camera

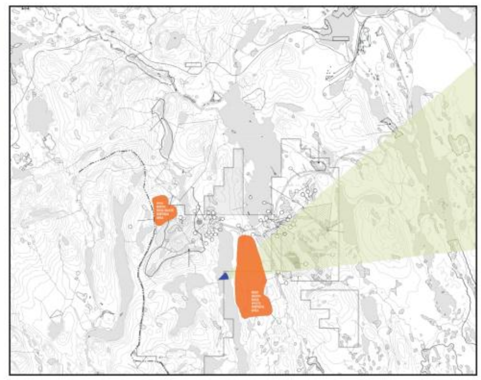
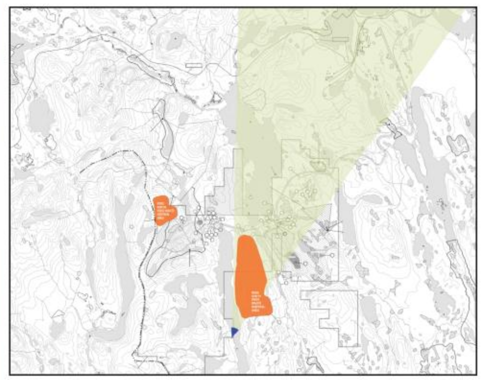


Figure 23.64 Photosimulation 25 – Southwestern Shore of Mills Lake

Before Project

Position of Camera



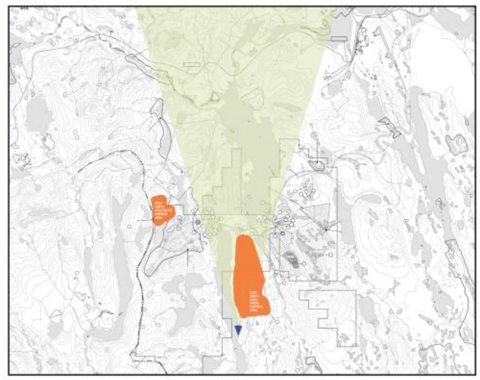
With Project

FIGURE ID: ALD_ST_025.CDR

Figure 23.65 Photosimulation 26 – Southeastern Shore of Mills Lake

Before Project

Position of Camera



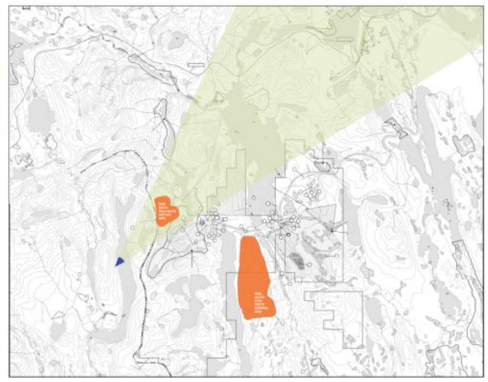
With Project

FIGURE ID: ALD_ST_026.CDR

Figure 23.66 Photosimulation 28 – Western Shore of Lac Daviault

Before Project

Position of Camera



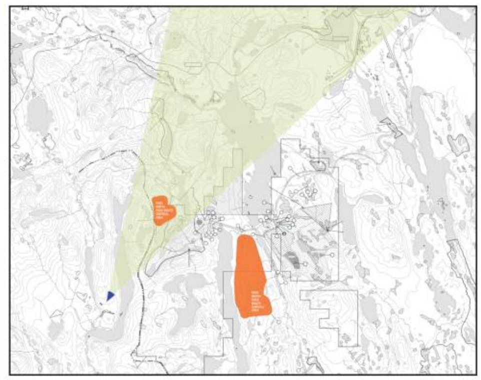
With Project

FIGURE ID: ALD_ST_028.CDR

Figure 23.67 Photosimulation 29 – Northern Fermont (1)

Before Project

Position of Camera



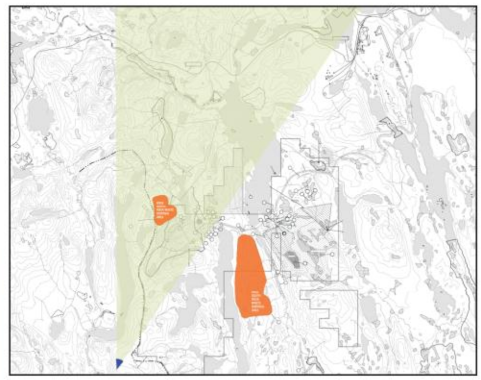
With Project

FIGURE ID: ALD_ST_029.CDR

Figure 23.68 Photosimulation 31 – South of Fermont

Before Project

Position of Camera



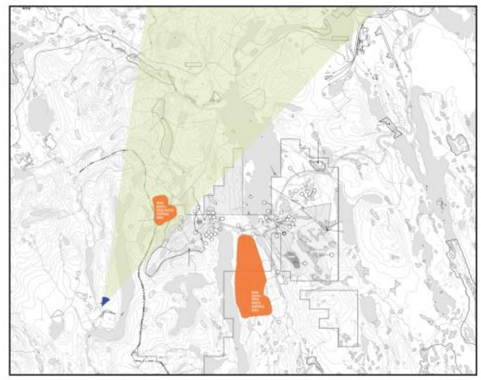
With Project

FIGURE ID: ALD_ST_031.CDR

Figure 23.69 Photosimulation 32 – Northern Fermont (2)

Before Project

Position of Camera



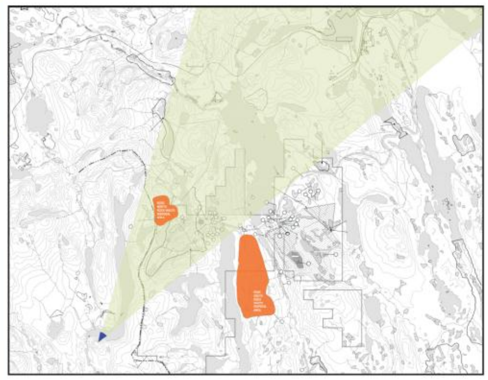
With Project

FIGURE ID: ALD_ST_032.CDR

Figure 23.70 Photosimulation 33 – Fermont Hiking Trail Peak

Before Project

Position of Camera



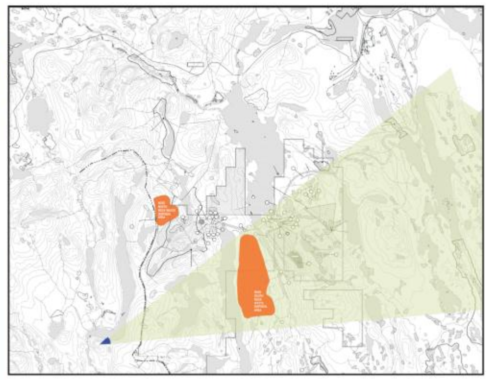
With Project

FIGURE ID: ALD_ST_033.CDR

Figure 23.71 Photosimulation 33b – Fermont Hiking Trail Peak

Before Project

Position of Camera



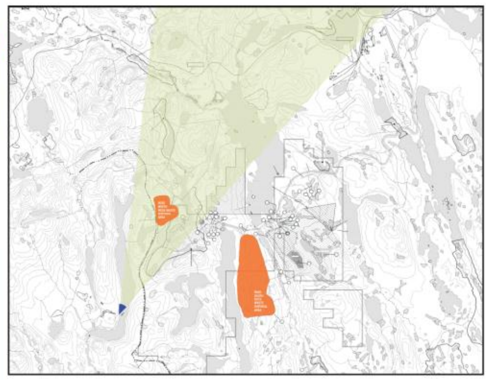
With Project

FIGURE ID: ALD_ST_033b.CDR

Figure 23.72 Photosimulation 34 – Fermont, Shore of Lac Daviault (2)

Before Project

Position of Camera



With Project

FIGURE ID: ALD_ST_034.CDR

Decommissioning and Reclamation

Decommissioning and reclamation will see the removal of Project infrastructure and the rehabilitation of the main landscape-based Project features such as the waste rock disposal areas and TMF, improving the viewscape over time.

The open pit will not be fully rehabilitated. During decommissioning, a barrier will be erected around the pit and safety signs will be installed for public safety. This one feature of the Project will remain on the landscape permanently.

Effects Management / Mitigation Measures

The presence of the Project on the landscape will affect the viewshed. Based on stakeholder comments, the following changes to the Project have been made as designed-in effects management:

- The location of the Rose South Waste Rock Disposal Area was moved to east of Mills Lake based on concerns from Fermont residents that it would be visible from their town; and
- The TMF will be progressively rehabilitated during operation and maintenance.

Characterization of Residual Project Environmental Effects

Residual environmental effects resulting from the construction phase will be adverse as Project activities will be visible from some locations in the LSA, but will affect a small proportion of the local population as it will not be visible from most residential locations. Effects will be continuous through the construction phase and will continue through the life of the Project. The effects will be reversible upon decommissioning, and will occur in an area that has experienced mining and other industrial activity continuously for the past 50 years.

Residual environmental effects resulting from the operation and maintenance phase will be adverse and will be experienced throughout the LSA. Effects will be continuous through operations and maintenance. As the photosimulations demonstrate that the Project is not visible from most municipal locations, it will affect a small proportion of the local population. The effects will be reversible upon decommissioning with the exception of the open pit, and will occur in a developed setting, and will occur in an area that has experienced mining and other industrial activity continuously for the past 50 years.

Residual environmental effects resulting from decommissioning and reclamation will be positive and will be experienced through most of the LSA. Effects will be continuous, permanent, reversible, and will occur in a developed setting.

There is a high degree of confidence in the effects predictions because based on viewshed analysis and photosimulations completed for the Project.

23.6.5 Change in Designated Land Use

The Project is located in close proximity to, and in some cases, overlaps with designated lands. These include a provincial park reserve, Habitat Management Units, and municipally zoned lands. Assessment of Project effects on Habitat Management Units and Duley Lake Provincial Park Reserve are addressed in Chapter 19 (Birds, Other Wildlife and Their Habitats, and Protected Areas) are therefore not discussed here. This assessment will focus on municipally zoned lands, included protected water supply.

Construction

Project construction activities with potential to have effects on municipally zoned lands are:

- Site preparation;
- Construction of roads;
- Construction of TMF;
- Construction of railway and load-out facilities;
- Construction of power line; and
- Construction of stream crossings.

Construction of the various features of the Project will overlap several municipal zones within the Labrador City MPA and Wabush MPA. Once constructed, these overlaps with municipal zones will be in place through operation and maintenance.

The portion of the Project that falls within the Labrador City MPA, which includes the open pit, both waste rock disposal areas, and portion of the conveyor, is predominantly located on Mining Reserve Rural lands.

Construction of several Project features including the rail line, TMF, conveyor, power line, and access road, fall within land classed as Rural by Wabush. The Rural zone requires town council permission for mining development (Town of Wabush 2004).

There are two Cabin Use zones within the Wabush MPA that overlap with the Project. The Cabin Use zone surrounding Riordan Lake is intersected by the rail line, occupying approximately 200 m^2 (less than one percent) of the land in that zone. The Cabin Use zone at the southeastern end of Long Lake is overlapped by Project infrastructure, occupying approximately 14 percent (approximately 4 km^2) of the zone.

The Project rail line also passes through the protected municipal watershed area for Wabush. The protected watershed area occupies an area of approximately 18 km^2 (land only). The Project will occupy approximately six percent of the land within the protected watershed area (approximately 1 km^2).

Development activity in Wahnahnish Lake watershed must be approved by the Wabush Municipal Council and the Water Resources Division of DOEC (Town of Wabush 2004). As stated above, the rail line, and associated development buffer, occupy approximately 1 km^2 within the watershed, 6 percent of the total watershed. These potential effect of a train derailment within the protected water supply are discussed in the assessment of Accidents and Malfunctions (Section 23.8).

In total, there are approximately 26 km^2 of municipally protected land in the LSA (approximately 18 km^2, of which approximately 6 percent (1.5 km^2) will overlap with the Project (1 km^2 in the protected water supply, and 0.5 in Cabin Use zones).

The northern extent of the Rose North Waste Disposal Area is approximately 405 m away from the Open Space Buffer zone which is co-located with Duley Lake Provincial Park Reserve. The interactions between the Project and Duley Lake Provincial Park Reserve are assessed in Chapter 19 (Birds, Other Wildlife and Their Habitats, and Protected Areas).

Operation and Maintenance

The interactions between Project construction and designated lands will continue throughout the life of the Project. The following operation and maintenance activities comprise the continuation of the interactions:

- Open pit mining;
- Ore processing;
- Waste rock disposal on surface;
- Rail load-out by silo discharge; and
- Rail transport;

Most of the activities listed above will be continued interactions between Project features and designated lands as identified for construction.

As stated above, the Project overlaps with three designated areas within the Wabush MPA: the Cabin Use zones at Riordan Lake and Long Lake, and the Protected Water Supply. These interactions will remain through the life of the Project. There are approximately 26 km^2 of municipally protected land in the LSA (approximately 18 km^2, of which approximately 6 percent (1.5 km^2) will overlap with the Project (1 km^2 in the protected water supply, and 0.5 km^2 in Cabin Use zones).

Decommissioning and Reclamation

Decommissioning and reclamation will result in the removal, rehabilitation, and/or reclamation of Project features from the landscape and waterbodies. Site decommissioning will include removal of rail, contouring of waste rock disposal areas, and re-vegetation of these areas and the TMF. This will include removal of the rail line from the Cabin Use zone and Protected

Municipal Water Supply. The access road and stream crossings will be decommissioned pursuant to regulatory requirements at the time of mine closure.

One feature of the mine site that will not be fully rehabilitated is the open pit. During decommissioning a barrier will be erected around the pit and safety signs will be installed. The adjacent Rose North Waste Rock Disposal Area, located approximately 400 m from the Park Reserve, will be contoured and re-vegetated.

Effects Management / Mitigation Measures

Alderon will continue to engage with the town councils of Labrador City and Wabush regarding the overlap of the Project with designated lands.

Characterization of Residual Project Environmental Effects

Residual environmental effects resulting from the construction phase will be adverse, reducing certain types of designated lands. The effect will not extend beyond the PDA. The effect will be continuous through the life of the Project. It will be reversible and will occur in a developed area.

Residual environmental effects resulting from the decommissioning and reclamation phase will be positive, resulting in removal of Project features from designated lands. The effect will not extend beyond the PDA and will be permanent. The effect will be reversible and will occur in a developed area.

There is a high degree of confidence in the effects predictions as the effect is limited to the overlap of the Project with designated lands.

23.6.6 Summary of Project Residual Environmental Effects

The residual environmental effects of the Project on the Other Current Use of Lands and Resources are summarized in Table 23.10.

Table 23.10 Summary of Project Residual Environmental Effects

Project Phase	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Frequency	Duration	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	
Change in Access											
Construction	• Install navigation signage for stream crossings and in-water Project features. • Work with local snowmobile and cross country ski organizations to address Project effects.	A	R	S	C	M	R	D	N	H	Continue engagement with local resource user groups such as the local snowmobile club and cross country ski club.
Operation and Maintenance		A/P	I	S	N	M	R	D	N	H	
Decommissioning and Reclamation		P/A	L	S	ST	S/P	R	D	N	H	
Change in Level of Activity / Use											
Construction	• Dust / noise management. • Alderon will implement a no harvesting and firearms prohibition policy for workers. • Work with local snowmobile and cross country ski organizations to address Project effects. • For reasons of public safety the open pit will remain restricted at decommissioning, with a berm constructed around its perimeter and signage will be posted.	A	R	S	C	S	R	D	N	H	
Operation and Maintenance		A	N	L	C	M	R	D	N	H	
Decommissioning and Reclamation		P	I	S	C	P	R	D	N	H	

Project Phase	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Frequency	Duration	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	
	• Site decommissioning will include removal of rail, contouring of waste rock disposal areas, and re-vegetation of these areas and the TMF.										
Change in Cabin Use											
Construction	• Dust / noise management. • Conduct an inventory of existing cabins and owners. • On-going engagement with cabin owners. • Install navigation signage for stream crossings and in-water Project features. • Work with local snowmobile organizations and cabin owners to address Project effects; • Develop Blasting Plan; and • Work with cabin owners to address Project effects on access.	A	R	S	C	P	R	D	N	H	
Operation and Maintenance		A	R	L	C	L	R	D	N	H	
Decommissioning and Reclamation		P	L	L	C	P	R	D	N	H	

Project Phase	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Frequency	Duration	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	
Change in Viewscape											
Construction	• Rose South Waste Rock Disposal Area was moved to minimize viewshed effects on residents of Fermont.	A	R	L	C	M	R	D	N	H	
Operation and Maintenance		A	R	L	C	M	R	D	N	H	
Decommissioning and Reclamation		P	I	L	C	P	R	D	N	H	
Change in Designated Land Use											
Construction	• Alderon will engage in on-going discussions with Labrador City and Wabush.	A	R	S	C	M	R	D	N	H	
Operation and Maintenance		A	N	S	C	M	R	D	N	H	
Decommissioning and Reclamation		P	I	S	C	L	R	D	N	H	

Project Phase	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Frequency	Duration	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	

KEY

Direction:
P Positive.
A Adverse.
N Neutral.

Magnitude:
L Low (affects a small group of land and resource users).
M Moderate (affects less than the majority of land and resource users across multiple activities).
H High (affects the majority of land and resource users across multiple activities).

Geographic Extent:
S Site: within the PDA.
L Local: within the LSA.
R Regional: within the RSA.

Frequency:
N Not likely to occur.
O Once: Occurs once.
S Sporadic: occurs sporadically.
R Regular: occurs on a regular basis.
C Continuous.

Duration:
S Short-term (restricted to construction phase).
M Medium-term (continues through operations and maintenance phase).
L Long-term (16 to 50 years).
P Permanent.

Reversibility:
R Reversible: the effect can be reversed to existing conditions.
I Irreversible: the effect cannot be reversed.

Environmental or Socio-economic Context:
U Undisturbed: Area relatively or not adversely affected by human activity.
D Disturbed: Area has been substantially previously disturbed by human development or human development is still present.

Significance:
S Significant.
N Not Significant.

Prediction Confidence:
Based on scientific information and statistical analysis, and effectiveness of mitigation or effects management measure
L Low level of confidence.
M Moderate level of confidence.
H High level of confidence.
N/A Not Applicable.

23.7 Assessment of Cumulative Effects

Subsequent to the assessment of Project effects discussed previously, an assessment was conducted of potential cumulative effects of the Project in combination with those of other projects and activities in the RSA. Potential cumulative effects on Other Current Use of Lands and Resources relate to Change in Access, Change in Level of Activity/Use, Change in Cabin Use, Change in Viewscapes, and Change in Designated Land Uses as a result of the Project in combination with those of other developments or activities in the RSA. A summary of results of the cumulative effects assessment is provided in Table 23.11.

The environmental effects of past and present projects and activities on Other Current Use of Lands and Resources in the RSA are reflected in the characterization of baseline conditions. IOC Labrador Operations, Wabush Mines, Mont Wright Mine, Bloom Lake Mine and Rail, and the towns of Fermont, Labrador City, and Wabush have the potential for cumulative effects with the Project. The current area of disturbance of these projects totals approximately 130 km^2, which is less than 0.3 percent of the RSA. Future projects and activities will also likely have effects on Other Current Use of Lands and Resources similar to those described for the Kami Project. There is no overlapping footprint between the Kami Project and other projects or activities, with the exception the overlap between the Project and the Municipal Planning Areas of Labrador City and Wabush.

The adverse effects of the Project on Other Current Use of Lands and Resources will be limited to the PDA, which is approximately 4 percent of the LSA. Other projects in the vicinity of the Kami Project are expected to have similar effects within their respective footprints (estimated to also be approximately 4 percent of their respective LSAs). Similar to the Kami Project, the majority of these effects will be reversible, while some will be permanent (i.e., open pit mines). The open pit mine of each project is only a portion of the estimated 4 percent of land affected in the LSAs. The distances between mine sites is a minimum of 10 km and in most cases 20 or more kilometres and there is extensive available adjacent lands of the same and/or similar type and habitat within their respective LSAs. It is not anticipated that the effects of dust and noise from other projects will overlap with those of the Kami Project to a degree that would significantly affect activities taking place within the LSA of each Project. Therefore, the cumulative effects of the Project acting in combination with other projects and activities on Level of Activity / Use are determined to be not significant.

As presented in Table 23.11, Project-related effects on Other Current Use of Lands and Resources will be not significant and will be mitigated through the use of well-established and proven mitigation measures.

The Project will result in reductions to access during the construction and operation and maintenance phases of the Project; however, with the exception of access to the Open Pit mine site, these effects will be reversible upon decommissioning reclamation. Alderon will work with cabin owners to address Project effects on access. In terms of Change in Access, the effects of the Project will be limited to the PDA, mostly reversible, and the environmental effects will not overlap with those of any other projects or activities.

The Project will result in adverse effects to Level of Activity/Use in that some areas of the Project will no longer be available for recreational activities including hunting and fishing. Effects will occur in a setting that has been subject to adjacent open pit iron ore mining for more than 50 years. Elevated dust and noise levels associated with construction will be short term and reversible, will not affect the majority of users, and will take place in a developed area. In terms of Level of Activity / Use, the effects of the Project will be limited to the PDA and will not overlap with those of any other projects or activities.

Project effects on Cabin Use will be limited to a few cabins within the PDA of the Kami Project and there are no overlapping effects between the Kami Project and other projects or activities with respect to Cabin Use.

There will be adverse effects to viewscapes as some features of the Project will be visible from locations within the LSA; however, this will only affect a small proportion of the local population as the Project will not be visible from most residential locations. Other projects and activities will have similar effects to viewscapes in their respective locations to those of the Kami Project; however, given the distances between projects, there are no overlapping effects between the Kami Project and other projects or activities with respect to viewscapes.

There will be adverse effects to Designated Land Uses in that the footprint of the Kami Project will reduce certain types of designated lands. These effects will be limited to the PDA and will be reversible. Other projects and activities will have similar effects to Designated Land Uses as those of the Project; however, like the Kami Project, these effects will be reversible during decommissioning and reclamation phases. The cumulative effects of the Project acting in combination with other projects and activities on Designated Land Uses are likely to be not significant.

Overall, environmental effects on Other Current Use of Lands and Resources will be limited to the PDA. Other Current Use of Lands and Resources take place throughout the LSA and RSA, and there are many locations for users to pursue their chosen activities outside of the area affected by the Kami Project and other projects and activities in the RSA. Because of the localized nature of environmental effects on Other Current Use of Lands and Resources, the mitigation measures that will be implemented for the Kami Project, and regulatory control over activities such as hunting, fishing and wood harvesting, it is unlikely that the cumulative effects of the Kami Project in combination with other projects and activities would result in changes so that the levels and distribution of Other Current Use of Lands and Resources could not continue at current levels within the RSA over the long-term.

In summary, the cumulative effects on Other Current Use of Lands and Resources of all past, present, and reasonably foreseeable projects and activities, in combination with the environmental effects of the Project, are considered not significant.

Table 23.11 Summary of Potential Cumulative Effects to Other Current Use of Lands and Resources

VEC Existing Condition (Past & On-Going Activities)	• The PDA overlaps with the Municipal Planning Areas of Labrador City and Wabush. • Activities in the RSA include snowmobiling, cross-country and downhill skiing, boating, berry picking, birding and geocaching, recreational fishing, hunting and trapping, small scale commercial and subsistence wood harvesting, and mineral exploration. • Infrastructure in the RSA includes railways, highways, airports, seaplane marinas, and communication towers.		
Kami Project Residual Environmental Effects	• The Project will result in reductions to access during construction with some long-term loss of access within the Project footprint; however, these effects will be reversible, with the exception of access to the open pit mine. • The Project will result in adverse effects to Level of Activity / Use for recreational activities in the footprint of the mine. With the exception of the open pit mine, these effects will be reversible. • Three cabins will be displaced as a result of the Project and additional cabins will be affected by dust and noise emissions. These effects will be reversible during decommissioning and reclamation. • Some features of the Project will be visible from locations within the LSA; however, only a small proportion of the local population will be affected. • There will be changes to Designated Land Uses in the PDA of the Project. These effects will be reversible. • With implementation of the proposed mitigation measures, the residual environmental effects of the Project on Other Current Use of Lands and Resources are predicted to be not significant.		
Other Projects / Activities	**Likely Effect Interaction (Y/N)**	**Rationale**	**Cumulative Effects**
IOC Labrador Operations	Y	• Located approximately 20 km northeast of the Project, it may act cumulatively with the effects of the Kami Project on Changes in Level of Activity / Use and Designated Land Uses.	• Reduction in Level of Activity / Use. • Change in Designated Land Use.
Wabush Mines (Cliffs Resources)	Y	• Located approximately 10 km north of the Project, it may act cumulatively with the effects of the Kami Project on Changes in Level of Activity / Use and Designated Land Uses.	• Reduction in Level of Activity / Use. • Change in Designated Land Use.
Mont Wright Mine (Arcelor Mital)	Y	• Located approximately 25 km west of the Project, it may act cumulatively with the effects of the Kami Project on Changes in Level of Activity / Use and Designated Land Uses.	• Reduction in Level of Activity / Use. • Change in Designated Land Use.
Bloom Lake Mine and Rail Spur (Cliffs Resources)	Y	• Located approximately 20 km west of the Project, it may act cumulatively with the effects of the Kami Project on Changes in Level of Activity / Use and Designated Land Uses.	• Reduction in Level of Activity / Use. • Change in Designated Land Use.

Schefferville Iron Ore Mine (Labrador Iron Mines)	N	• Located approximately 200 km away from the Project area. There are no anticipated overlapping environmental effects between this project and the Kami Project.	• N/A
DSO Iron Ore Project (Tata Steel Minerals Canada)	N	• Located approximately 200 km away from the Project area. There are no anticipated overlapping environmental effects between this project and the Kami Project.	• N/A
Lower Churchill Generation Project (Nalcor Energy)	N	• Located approximately 375 km away from the Project area. There are no anticipated overlapping environmental effects between this project and the Kami Project.	• N/A
Infrastructure or other projects at Port of Sept-Îles	N	• Located approximately 815 km away from the Project area. There are no anticipated overlapping environmental effects between this project and the Kami Project.	• N/A
Urbanization	Y	• The Project is located in the Municipal Planning Areas of Labrador City and Wabush. Urbanization may act cumulatively with the effects of the Kami Project on Designated Land Uses.	• Change in Designated Land Use.

Cumulative Effects Summary (Kami Project + All Relevant Projects / Effects)	**Direction**	**Magnitude**	**Geographic Extent**	**Duration**	**Frequency**	**Reversibility**	**Significance**	**Confidence**
	A	L	R	P	C	I	N	H

Summary: The potential residual environmental effects of the Kami Project may act cumulatively with effects from other past, present, or planned projects and activities on Level of Activity / Use and on Designated Land Use. The cumulative effects of the Kami Project combined with the IOC Labrador Operation, Wabush Mines, Mont Wright Mines, Bloom Lake Mine and Rail Spur, and urbanization will result in a decrease in some Levels of Activities / Use and changes to Designated Land Uses within the respective footprints for each project. These decreases will be very limited in area, and mostly reversible. All other environmental effects from the Kami Project, Change in Access, Cabin Use, and Viewscapes, will not act cumulatively with other past, present or planned projects. Therefore, the cumulative effects of the Project acting in combination with other past, present and planned projects and activities on Other Current Use of Land and Resources are determined to be not significant.

Note: Environmental effects descriptors and their definitions are as used in the assessment of Project-related environmental effects (See Table #.3),

23.8 Assessment of Accidents and Malfunctions

Three potential accident or malfunction scenarios could cause effects to Other Current Use of Lands and Resources. These are:

- Train derailment and consequent spill of materials or contaminants;
- Forest fire caused by the Project; and
- Breach of the polishing pond.

In the unlikely event of any of these scenarios, effects on Other Current Use of Lands and Resources could occur. The potential interaction of these events are summarized in Table 23.7. The interactions are ranked as 2 and, therefore, are assessed in more detail.

Train Derailment

Fuel will be transported along the rail line to the Project site and ore concentrate will be transported from the Project site to the QNS&L rail line. The rail line extends along a portion of the Town of Wabush protected water supply area. Transport will include diesel fuel and iron ore concentrate. Worst case scenarios for a train derailment include the release or deposition of 180,000 gallons of diesel fuel or 6,000 to 8,100 tonnes of iron ore concentrate near or within the Wabush protected water supply area. In addition to short-term disruptions to land and resource use activities in the affected area, and noise during clean-up activities, there is the potential for contamination of the drinking water supply for Wabush if the derailment occurred within the protected water supply.

Measures to prevent derailment include manual inspection of all railway components, electronic wayside inspections during transport, and both manual and electronic track inspections. In the event of a derailment, response measures include: spill containment through absorbent booms and pads, temporary containment pits, diking and surface water control structures, liquid and solids cleanup and waste removal, site cleanup, and physical reclamation or removal and replacement of contaminated soils.

Forest Fire

Project activities involving the use of heat or flame could result in a fire. The extent and duration of a resulting fire would be dependent on response efforts and meteorological conditions. A forest fire has the potential to alter the landscape and deplete forest and brush cover, thereby reducing or eliminating the distribution of flora and fauna currently harvested. It could also reduce the ability to travel on the land and result in loss of cabins. If a forest fire were large, it has the potential to affect a large number of users and activities.

Fire suppression water will be extracted from Long Lake and will be kept pressurized at the pumping station near the concentrator area. Staff will be trained to prevent and control fires and a plan for preventing and combating forest fires will be incorporated into the Project Emergency Response Plan.

Polishing Pond Breach

A breach or failure of the polishing pond dyke could lead to discharge of impounded water into the downstream stream (TD-02), which empties into Long Lake. This breach would be expected to cause localized flooding and some erosion and sedimentation near the breach point. Effects from erosion along TD-02 and sedimentation on receiving waters in Long Lake are not likely to affect land use. This is because TD-02 is located within the PDA and will is not be available for land use, and because Long Lake is anticipated to recover rapidly from any sedimentation resulting from such a breach (Section 4.5). Any effect to fisheries would be localized and temporary. Therefore, a polishing pond dyke breach would not significantly reduce current levels of land use and harvesting in the affected areas.

The dykes located at the polishing pond and TMF will be designed to standards of the Canadian Dam Association (CDA) Dam Safety Guidelines. The CDA Guidelines will be used to guide the hazard consequence assessment process, and associated design standards for the dykes at the TMF. The dam design and hazard consequence classification process is subject to a risk assessment process to minimize and reduce risk of breach and subsequently to reduce risk to acceptable levels. The outlet structures and TMF will be designed to accommodate the 100-year storm. In addition, an emergency spillway will be incorporated into design to provide relief of larger runoff events such as the from the Probably Maximum Precipitation event.

Summary

The residual environmental effects of Project-related accidents and malfunctions on Other Current Use of Lands and Resources are summarized in Table 23.12.

Table 23.12 Summary of Residual Environmental Effects for Other Current Use of Lands and Resources – Accidents and Malfunctions

Accidental Event / Malfunction Scenario	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	
Change in Access											
Train Derailment	• Implementation of the Project EPP and Emergency Response Plan.	A	M	S	S	U	R	D	N	H	
Forest Fire		A	H	L	S	U	R	D	S	H	
Polishing Pond Dyke Breach		A	M	L	S	U	R	D	N	H	
Change in Level of Activity / Use											
Train Derailment	• Implementation of the Project EPP and Emergency Response Plan.	A	M	S	S	U	R	D	N	H	
Forest Fire		A	H	L	M	U	R	D	S	H	
Polishing Pond Dyke Breach		A	M	L	S	U	R	D	N	H	

Accidental Event / Malfunction Scenario	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	
Change in Cabin Use											
Train Derailment	• On-going consultation with cabin owners. • Implementation of the Project EPP and Emergency Response Plan.	A	M	S	S	U	R	D	N	H	
Forest Fire		A	H	L	M	U	R	D	S	H	
Polishing Pond Dyke Breach		A	M	L	S	U	R	D	N	H	
Change in Viewscape											
Train Derailment	• Implementation of the Project EPP and Emergency Response Plan.	A	M	S	S	U	R	D	N	H	
Forest Fire		A	H	L	M	U	R	D	S	H	
Polishing Pond Dyke Breach		A	M	L	S	U	R	D	N	H	
Change in Designated Land Use											
Train Derailment	• Implementation of the Project EPP and Emergency Response Plan.	A	H	S	M	U	R	D	S	H	
Forest Fire		A	M	L	M	U	R	D	N	H	

Accidental Event / Malfunction Scenario	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	

KEY

Direction:
P Positive.
A Adverse.
N Neutral.

Magnitude:
L Low (affects a small group of land and resource users).
M Moderate (affects less than the majority of land and resource users across multiple activities).
H High (affects the majority of land and resource users across multiple activities).

Geographic Extent:
S Site: within the PDA.
L Local: within the LSA.
R Regional: within the RSA.

Frequency:
U Unlikely.
O Once: Occurs once.
S Sporadic: occurs sporadically.
R Regular: occurs on a regular basis.
C Continuous.

Duration:
S Short Term (restricted to construction phase).
M Medium Term (continues through operations and maintenance phase).
L Long Term (16 to 50 years).
P Permanent..

Reversibility:
R Reversible: the effect can be reversed to existing conditions.
I Irreversible: the effect cannot be reversed.

Environmental or Socio-economic Context:
U Undisturbed: Area relatively or not adversely affected by human activity.
D Disturbed: Area has been substantially previously disturbed by human development or human development is still present.

Significance:
S Significant.
N Not Significant.

Prediction Confidence:
Based on scientific information and statistical analysis, and effectiveness of mitigation or effects management measure.

L Low level of confidence.
M Moderate level of confidence.
H High level of confidence.

N/A Not Applicable.

23.9 Determination of Significance of Residual Adverse Environmental Effects

23.9.1 Project-related Residual Environmental Effects

Change in Access

As described above, any potential adverse effects of the Project on change in access would occur primarily as a result of Project construction. Any such effects, if they did occur, would therefore be restricted to the LSA.

With the proposed mitigation measures in place, the residual environmental effect of change in access is predicted to be adverse but not significant during the construction, operation and maintenance, and decommissioning and reclamation phases. This is because land and resource use is not currently restricted to the PDA; the most frequented areas for land use activities are currently outside the PDA and restrictions would not affect the majority of users. Loss of access to the PDA will reduce the area available within the LSA by approximately four percent. This determination may be made with a high level of confidence based on the results of the background research, informant interviews, and data analysis.

Change in Level of Activity / Use

As described above, any potential adverse effects of the Project on change in level of activity / use would occur primarily as a result of Project construction and noise and dust generated during both construction and operation. Any such effects, if they did occur, would therefore be restricted to the LSA.

With the proposed mitigation measures in place, the residual environmental effects of change in level of activity / use during is predicted to be not significant during the construction, operation and maintenance, and decommissioning and reclamation phases. Land and resource use is not currently restricted to the PDA. The presence of the Project will reduce the lands and waterbodies available for land and resource use by approximately four percent, and will not affect the majority of users. Elevated noise and dust levels will occur occasionally and will not extend far beyond the PDA. There are no land and resource use activities that occur solely within the PDA, and any regional land use activities that are disrupted by the Project, such as removal of snowmobile trails or cross country ski trails, will be addressed in consultation with user groups. This determination is made with a high level of confidence based on the results of the background research and informant interviews, and noise and dust dispersion modeling.

Change in Cabin Use

As described above, any potential adverse effects of the Project on cabin use would occur as a result of overlap with the Project footprint during construction, and noise and dust during operation and maintenance.

With the proposed mitigation measures in place, the residual environment effect on cabin use is predicted to be not significant during the construction, operation and maintenance, and decommissioning and reclamation phases. This determination is made with a high level of confidence based on the results of background research, and noise and dust dispersion modeling.

Change in Viewscape

As described above, any potential adverse effects of the Project on the viewscape would occur as a result of the presence of the Project on the landscape during the construction and operation and maintenance phases.

The residual environment effects on the viewscape is predicted to be not significant during the construction, operation and maintenance, and decommissioning and reclamation phases. Although the Project may be seen from select locations in the LSA, it will not be a unique feature on the landscape as there are currently two operating mines in the LSA. In addition, in response to public comments efforts have been made to re-locate Project features (e.g., Rose North Waste Rock Disposal Area) to locations where they would have reduced visibility from adjacent municipalities. In addition, the Project is taking place in a region that has been subject to mining and industrial development for the past 50 years. This determination is made with a high level of confidence based on the results of the viewshed analysis and before and after photosimulations.

Change in Designated Land Use

As described above, any potential adverse effects of the Project on designated land use would occur as a result of overlap with the Project footprint during the construction and operation and maintenance phases.

With the proposed mitigation measures in place, the residual environment effect on designated land use is predicted to be not significant during the construction, operation and maintenance, and decommissioning and reclamation phases. There is overlap between the rail line and the Cabin Use zone at Riordan Lake and the Wabush protected water supply, however this footprint overlap is small (approximately 13 percent of the Cabin Use zones, mainly at the southern end of Long Lake, and approximately 6 percent of the land within the Wabush protected water supply). This determination is made with a high level of confidence due to background research and the limited physical overlap of the Project with designated lands.

23.9.2 Cumulative Effects

The potential residual environmental effects of the Kami Project may act cumulatively with effects from other past, present, or planned projects and activities on Level of Activity / Use and on Designated Land Use. The cumulative effects of the Kami Project combined with the IOC Labrador Operation, Wabush Mines, Mont Wright Mines, Bloom Lake Mine and Rail Spur, and urbanization will result in a decrease in some Levels of Activities / Use and changes to Designated Land Uses within the respective footprints for each project. These decreases will be very limited in area, and mostly reversible. All other environmental effects from the Kami Project, Change in Access, Cabin Use, and Viewscapes, will not act cumulatively with other past, present or planned projects. Therefore, the cumulative effects of the Project acting in combination with other past, present and planned projects and activities on Other Current Use of Land and Resources are determined to be not significant.

23.9.3 Accidents and Malfunctions

Change in Access

The residual adverse environmental effects on access from a train derailment and subsequent clean-up to during Project construction, operation and maintenance, or site decommissioning and rehabilitation are predicted to be not significant because environmental effects would be of moderate magnitude and geographically restricted to the PDA. In the event of a materials spill, the principal environmental effect would consist of disruptions in access during clean-up operations, which may be managed by routine implementation of the EPP. There is a high level of confidence in the prediction based on existing knowledge obtained from review of projects of similar scope and depth to the current Project.

The residual adverse environmental effects on access from a forest fire during Project construction, operation and maintenance, or site decommissioning and rehabilitation are predicted to be significant because environmental effects could be have a high magnitude, affecting the majority of users in the area. However, the effect would be short-term and would not likely extend beyond the LSA. There is a high level of confidence in the prediction based on existing knowledge obtained from review of projects of similar scope and depth to the current Project.

The residual adverse environmental effects on access from a breach of the polishing pond during Project construction, operation and maintenance, or site decommissioning and rehabilitation are predicted to be not significant because environmental effects would be of moderate magnitude and would not likely extend beyond the LSA. There is a high level of confidence in the prediction based on existing knowledge obtained from review of projects of similar scope and depth to the current Project.

Change in Level of Activity

The residual adverse environmental effects on current levels of activity access from a train derailment and subsequent clean-up during Project construction, operation and maintenance, or site decommissioning and rehabilitation are predicted to be not significant because environmental effects would be of moderate magnitude and geographically restricted to the site. In the event of a materials spill, the principal environmental effect would consist of disruptions in access during clean-up operations, which may be managed by routine implementation of the EPP. There is a high level of confidence in the prediction based on existing knowledge obtained from review of projects of similar scope and depth to the current Project.

The residual adverse environmental effects on current levels of activity a forest fire during Project construction, operation and maintenance, or site decommissioning and rehabilitation are predicted to be significant because environmental effects could be have a high magnitude, affecting the majority of users in the area. However, the effect would be short-term and would not likely extend beyond the LSA. There is a high level of confidence in the prediction based on existing knowledge obtained from review of projects of similar scope and depth to the current Project.

The residual adverse environmental effects on current levels of activity from a breach of the polishing pond during Project construction, operation and maintenance, or site decommissioning and rehabilitation are predicted to be not significant because environmental effects would be of low magnitude and geographically restricted to the site. There is a high level of confidence in the prediction based on existing knowledge obtained from review of projects of similar scope and depth to the current Project.

Change in Cabin Use

The residual adverse environmental effects on cabin use from a train derailment and subsequent clean-up during Project construction, operation and maintenance, or site decommissioning and rehabilitation are predicted to be not significant because environmental effects would be of low magnitude and geographically restricted to the site. In the event of a materials spill, the principal environmental effect would consist of disruptions in access during clean-up operations, which may be managed by routine implementation of the EPP. There is a high level of confidence in the prediction based on existing knowledge obtained from review of projects of similar scope and depth to the current Project.

The residual adverse environmental effects on cabin use from a forest fire during Project construction, operation and maintenance, or site decommissioning and rehabilitation are predicted to be significant because environmental effects could be have a high magnitude, affecting the majority of users in the area. However, the effect would not likely extend beyond the LSA. There is a high level of confidence in the prediction based on existing knowledge obtained from review of projects of similar scope and depth to the current Project.

The residual adverse environmental effects on cabin use from a breach of the polishing pond during Project construction, operation and maintenance, or site decommissioning and rehabilitation are predicted to be not significant because environmental effects would be of moderate magnitude and would not likely extend beyond the LSA. There is a high level of confidence in the prediction based on existing knowledge obtained from review of projects of similar scope and depth to the current Project.

Change in Viewscape

The residual adverse environmental effects on viewscapes resulting from a train derailment and subsequent clean-up during Project construction, operation and maintenance, or site decommissioning and rehabilitation are predicted to be not significant because environmental effects would be of moderate magnitude and geographically restricted to the site. In the event of a materials spill, the principal environmental effect would consist of disruptions in access during clean-up operations, which may be managed by routine implementation of the EPP. There is a high level of confidence in the prediction based on existing knowledge obtained from review of projects of similar scope and depth to the current Project.

The residual adverse environmental effects on viewscapes from a forest fire during Project construction, operation and maintenance, or site decommissioning and rehabilitation are predicted to significant because environmental effects could be have a high magnitude, affecting the majority of users in the area. However, the effect would be short-term and would not likely extend beyond the LSA. There is a high level of confidence in the prediction based on existing knowledge obtained from review of projects of similar scope and depth to the current Project.

The residual adverse environmental effects on viewscapes from a breach of the polishing pond during Project construction, operation and maintenance, or site decommissioning and rehabilitation are predicted to be not significant because environmental effects would be of moderate magnitude and geographically restricted to the site. There is a high level of confidence in the prediction based on existing knowledge obtained from review of projects of similar scope and depth to the current Project.

Change in Designated Land Use

The residual adverse environmental effects on areas of designated land use from a train derailment and subsequent clean-up during Project construction, operation and maintenance, or site decommissioning and rehabilitation are predicted to be significant. The environmental effect would be of high magnitude as it has the potential to affect the drinking water supply for all residents of Wabush. It would be geographically restricted to the site. In the event of a materials spill, the principal environmental effect would consist of disruptions in access during clean-up operations, which may be managed by routine implementation of the EPP. There is a high level of confidence in the prediction based on existing knowledge obtained from review of projects of similar scope and depth to the current Project.

The residual adverse environmental effects on areas of designated land use from a forest fire during Project construction, operation and maintenance, or site decommissioning and rehabilitation are predicted to be not significant because environmental effects could be of moderate magnitude and would not likely extend beyond the LSA. There is a high level of confidence in the prediction based on existing knowledge obtained from review of projects of similar scope and depth to the current Project.

23.9.4 Overall Residual Effects Conclusion

The Project is not likely to result in significant adverse residual effects on Other Current Use of Lands and Resources.

23.10 Follow-up and Monitoring

Follow-up and monitoring programs for some VECs will be indirectly applicable to Other Current Use of Lands and Resources. In addition, Alderon will continue to liaise with government departments and agencies, community groups, and other stakeholders to provide Project-specific information periodically to facilitate their planning regarding Other Current Use of Lands and Resources.

23.11 Next Steps

Prior to construction, a Project EPP will be developed. It will include mitigation measures for Other Current Use of Lands and Resources. In addition, Alderon will continue to liaise with stakeholders including cabin owners.

23.12 Summary

Given the proposed development plan for the Project, there are no likely significant residual environmental effects to Other Current Use of Lands and Resources.

However, mitigation will be required so that local residents are able to pursue their land and resource use activities. Mitigation measures for Other Current Use of Lands and Resources can be grouped into three broad categories: mitigation incorporated into Project design; policies and plans that will be developed; and Project-specific mitigation measures.

Mitigation incorporated into Project design includes designing stream crossings at large waterbodies to facilitate boating, progressive rehabilitation, changing the location of the Rose South Waste Rock Disposal Area to minimize viewscape effects from Fermont, and working with cabin owners to address Project effects on access.

Policies and plans that will be developed include a no firearms / harvesting policy for workers, an EPP and Emergency Response Plan, and Project-specific Blasting Plan. This also includes Alderon's intent to pursue on-going consultation / engagement with land and resource user groups including cabin owners.

Project-specific mitigation for Other Current Use of Lands and Resources includes installation of navigation signage around Project features that are present in waterbodies, including bridges and other watercourse crossings, working with local snowmobile and cross country ski organization to address Project effects, and installation of hazard warning signs around the open pit after decommissioning as public safety measure.

In addition, several mitigation measures developed to address effects on the Atmospheric Environment, specifically those related to noise and dust dispersion, will also mitigate effects on Other Current Land and Resource Use.

24.0 COMMUNITY SERVICES AND INFRASTRUCTURE

The Project effects, including accidents and malfunctions, and cumulative effects are assessed for Community Services and Infrastructure. Proposed effects management, including mitigation, measures, an evaluation of residual and cumulative effects, determination of significance and suggestions for follow-up work and monitoring are also presented.

24.1 VEC Definition and Rationale for Selection

The Project has the potential to affect the ability of nearby communities to deliver physical and social services and infrastructure. As such, Community Services and Infrastructure has been identified as an area of concern by the general public and stakeholders. The communities most likely to be affected are those in Labrador City and Wabush in western Labrador and Fermont, Québec. These Towns will provide Project-related services and infrastructure and will be the primary places of residence of the Project labour force.

The effects on Community Services and Infrastructure, both adverse and positive, will derive largely from the Project's economic effects through employment and demands on business, services, and infrastructure, such as highways, medical facilities, and accommodation. This includes the effects of Project workers living in the region, including Project-related in-migration by workers and their families. The effects on Community Services and Infrastructure are assessed for a total of eleven measurable parameters: road and air transportation capacity; water / sewer capacity; power capacity; landfill capacity; health care facility and services capacity; school and training facility and services capacity; police officer / population ratio; municipal administrative capacity; existing inventory of infrastructure for both men and women in the community; recreational facility and services capacity; and accommodation and building lot availability.

24.1.1 Approach to Assessment of Effects

The assessment of environmental effects has been discussed with the regulator, most notably at an April 2nd, 2012 meeting with:

- Newfoundland and Labrador Department of Environment and Conservation;
- Newfoundland and Labrador Department of Advanced Education and Skills;
- Newfoundland and Labrador Department of Tourism, Culture and Recreation; and
- Newfoundland and Labrador Department of Municipal Affairs.

This meeting saw agreement on the geographic scopes, information sources, and methods for the Community Services and Infrastructure VEC assessment. Selected additional sources regarding labour force information were identified.

The meeting also included a discussion about the planned approach to the assessment, which included:

- Ensuring the assessment examined both potential negative and positive effects;
- Fully recognizing the current and expected labour force shortage in the province as a whole and western Labrador in particular;
- Emphasizing effects management, including measures that have been designed into the Project; and
- The use of follow-up and adaptive management to adjust effects management initiatives in those cases where the outcomes are less satisfactory than had been predicted.

Baseline data on demographics related to the Community Services and Infrastructure VEC were drawn from secondary sources, including:

- Statistics Canada and other agencies and departments of the Government of Canada;
- The Newfoundland and Labrador Statistics Agency and other agencies and departments of the Government of Newfoundland and Labrador;
- Institute de statistiques du Québec and other agencies and departments of the Government of Québec; and
- Municipal governments and local and regional authorities and boards.

In addition, information about services and infrastructure was also collected through organization websites, personal and telephone interviews with the above types of groups, and agencies at the community level. A full list of references and sources is provided in Chapter 28.

A wide range of the most recently available data on baseline conditions and, where appropriate and available, trends, are presented in the Existing Environment (Section 24.5) section of this chapter and also in the Socio-economic Baseline Report (Appendix J). Information is also presented on current capacities and hence the ability of the communities to handle any additional demands.

The information available through these sources provides a reliable description of the existing environment for the purpose of the environmental assessment.

24.1.2 Issues

Alderon has engaged and consulted with a variety of stakeholders, Aboriginal groups, and members of the public throughout the EA process, and is committed to being responsive to questions and concerns that arise. Accordingly, these issues are included in the assessment of the VEC. Details on the issues raised by stakeholders are provided in Table 24.1.

Table 24.1 Issues Raised by Stakeholders

Issue	Community / Organization	Summary of Comments Raised During Consultation and Engagement Activities	Response / Location in the EIS
Availability of Housing for Workers	Wabush / Fermont / Lab City	Concerns with Fly-In / Fly-Out policy and temporary work camps. Support for housing full time workers in communities of Labrador City and Wabush. Concern with influx of workers in Fermont (workforce is fully employed). Questions include: • Where will workers come from and where will they live? • Will permanent housing be built and if so what will happen after the Project is completed?	Alderon will engage with the relevant agencies and organizations, particularly the Labrador West Regional Task Force and the Labrador West Community Advisory Panel, to provide Project information and to identify and discuss potential Project-related implications for local services and infrastructure, including those of Project-related in-migration. Alderon will also engage with government agencies and communities to establish a Project accommodations strategy, which will address housing concerns. The strategy may include measures such as the use of temporary accommodations and the development of new housing. Alderon will consider employing a fly-in / fly-out workforce during the construction phase of the Project. During operations and maintenance, Alderon aims to hire a residential workforce. Additional information on housing is provided in Sections 24.5.13; 24.6.1 and 24.6.2.
	Cabin Owners	An important issue for me is housing.	
	Lab West Status of Women	Main issues include housing, specifically low-income housing and availability of construction workers to build new houses.	
		Concern about the potential effects of temporary construction workers in Lab West. Will couple's accommodation be provided during construction?	
		Permanent and temporary housing is an issue. Industry needs to be involved to solve these issues.	
Temporary Construction Camp	Labrador City	Temporary workcamps could help with the severe housing issue but only for temporary accommodations during the construction phase of the Project. There should not be camps developed in residential areas, including Harrie Lake subdivision. Work camps shouldn't impact municipal infrastructure (sewage, recreation, etc.) Consultants have provided overtures on where camps can go in terms of artesian wells. The Town should be part of planning and discussion for construction camp. There is a land availability issue in Labrador City. Questions include: • Is Alderon considering building	

Issue	Community / Organization	Summary of Comments Raised During Consultation and Engagement Activities	Response / Location in the EIS
		workcamps for workers? • Why don't companies build apartments instead of workcamps that can be used by residents after the Project?	
	Wabush	Want sub-contractors to stay in existing workcamps. Size it to accommodate those people. Camp would be self-sufficient - own sewage treatment, etc. Alderon would transfer this to Wabush once construction phase is complete.	
	Wabush	Is Alderon planning to build workcamps or implement a fly-in, fly-out operation?	
Increased Air Travel	Le mouvement citoyen de Fermont	Will measures be in place to ensure that the airport system available to the region is not under 'heavy' pressure and leading to increase in tariffs?	Alderon will engage with the relevant agencies and organizations, particularly the Labrador West Regional Task Force and the Labrador West Community Advisory Panel, to provide Project information and to identify and discuss potential Project-related implications for local services and infrastructure, including those of Project-related in-migration. Alderon will work with the Town of Wabush to accommodate increased air traffic, and associated activity at the airport. More information is presented in Sections 24.5.11; 24.6.1 and 24.11.
	Wabush / Lab City	Airport operates one runway and no fire hall is located at the airport. This restricts the landing of larger aircraft. Concern of increased traffic at / around airport from Project. Request that Alderon lobby to have additional airlines service the airport.	
Increased Railway Traffic	CIM Conference	Aren't you concerned that the QNS&L railway is becoming over utilised?	The capacity of the QNS&L has been studied for many different potential future traffic volumes, including traffic associated with the Project. These studies have identified infrastructure improvement strategies that will maintain acceptable levels of service for all traffic on QNS&L. Implementation of these strategies have been incorporated into the negotiations for a rail haulage contract between Alderon and QNS&L. Additional information is found in Chapter 2 and Section 24.5.11.1.
	Labrador City	The actual railway line and its railway are issues of concern. Has Alderon consulted with QNS&L about the projected total rail traffic in 2015-2020?	
	Innu of Matimakush Lac-John	Increased traffic from the Project may slow down the passenger train and delivery of goods (food and fuel) from Sept-Iles to Schefferville	

Issue	Community / Organization	Summary of Comments Raised During Consultation and Engagement Activities	Response / Location in the EIS
Increased Road Traffic	Le mouvement citoyen de Fermont	What measure will be in place by Alderon to minimize the negative impacts concerning the use of Route 389?	Alderon will build a new road to avoid Grenfell Drive to access the mine site, eliminating concerns with increased traffic and safety. The location of this road is shown in Section 2.5.5. More information about current traffic conditions and potential effects from the Project is found in Sections 24.5.11; 24.6.1; and 24.11.
	Cabin Owners	An important issue to me is that Duncread is being used and abused with regards to speed and the number of trucks.	
	Wabush / Fermont / Lab City	Concern of heavy equipment and increased traffic on Grenfell Drive in Wabush. Concerns include road maintenance costs, vibration, property values, and child safety. The road is already overloaded. Questions include: • Can the project utilize alternative roads? • Was any consideration given to accessing the site from Hwy 500 / 389 through Duley Lake provincial park to west of Long Lake? • Could the road be widened and traffic lights installed?	
Potential Effects on Community Infrastructure	Fermont / Lab City / Le mouvement citoyen de Fermont	Will blasting affect foundations or municipal infrastructure? Will you assess all existing foundations?	To address concerns about blasting, Alderon has committed to developing a Project-specific Blasting Plan. Effects of the Project on the atmospheric environment, including air quality, noise, vibration and dust have been assessed and mitigation measures identified. During Project activities, blast noise and vibration will be monitored and will comply with regulatory standards. Alderon will establish safety zones for blasting and will follow best practices to minimize damage from blasting. See Section 24.6.1 and Chapter 14 (Atmospheric Environment) for more information.
	Le mouvement citoyen de Fermont	Will blasting have an impact the communication towers and make everyday life difficult to the people of Fermont?	
	Labrador City	Impacts on community services and quality of life.	Alderon will engage with the relevant agencies and

Issue	Community / Organization	Summary of Comments Raised During Consultation and Engagement Activities	Response / Location in the EIS
	Wabush	An increased population of the community will create other issues including sewage treatment. No operational sewage plant in industrial area, maybe Alderon can partner for future benefit.	organizations, particularly the Labrador West Regional Task Force and the Labrador West Community Advisory Panel, to provide Project information and to identify and discuss potential Project-related implications for local services and infrastructure, including those of Project-related in-migration. Additional information is presented in Sections 10.4; 24.6.1, 24.7 and 24.10.
	Wabush	Public Works and residents identified potential and additional wear and tear of public roads due to project.	Alderon will build a new road to avoid Grenfell Drive to access the mine site, eliminating concerns with increased traffic and safety. The location of this road is shown in Section 2.5.5. More information is available in Sections 24.5.11; 24.6.1.
	Wabush	Rail and road crossing located between Jean Lake and Wahnahnish Lake is located exactly where the water pump house is currently situated for the Town of Wabush.	The Project road and rail crossing at Jean Lake / Wahnahnish Lake will make use of an existing crossing. Alderon is working with the Town of Wabush to ensure that effects on municipal infrastructure are identified and mitigated. See Section 24.6 for more information.
Potential Effects on Community Services	Lab West Status of Women	The main issues identified included health services, childcare, and community infrastructure (stores and grocery store).	Alderon will engage with the relevant agencies and organizations, particularly the Labrador West Regional Task Force and the Labrador West Community Advisory Panel, to provide Project information and to identify and discuss potential Project-related implications for local services and infrastructure, including those of Project-related in-migration. More information is found in Sections 10.4; 24.5; 24.6.1; 24.7.
		Daycare, social impact of mining work and lack of childcare, employment issues in the service sector.	
	Fermont	Others use the services in Fermont such as health services, arena, pool, etc. We are worried about the effect of the new project on our municipal services.	
		In the service sector, it is a challenge to maintain and retain employees. There is a lack of workforce and support services. Industry needs to be involved to solve these issues.	

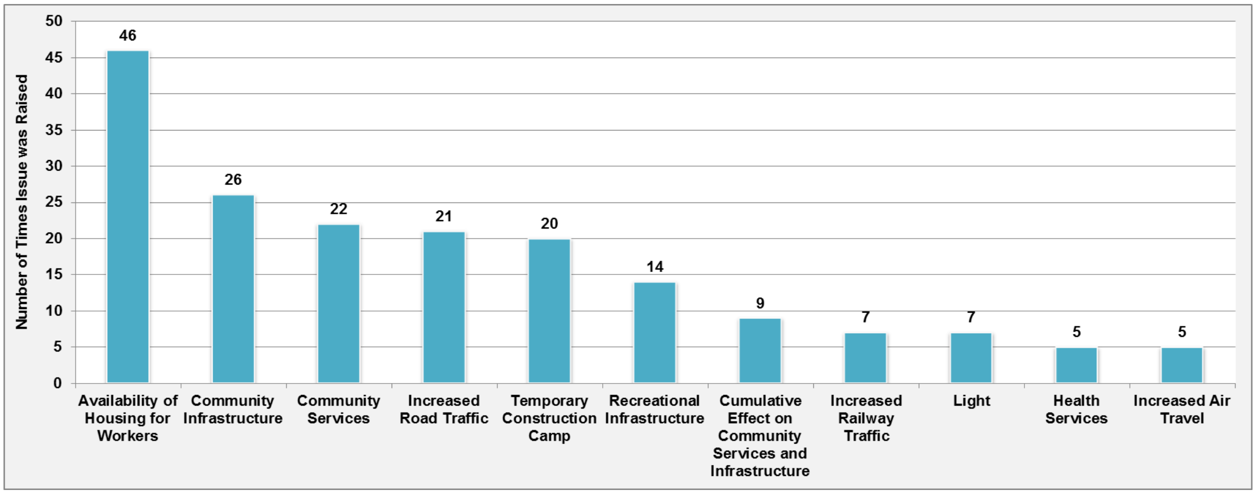
Issue	Community / Organization	Summary of Comments Raised During Consultation and Engagement Activities	Response / Location in the EIS
	Wabush	Fire fighting service was removed from Wabush airport by Transport Canada when jet service was removed. Wabush and Labrador City do not have capacity to provide fire fighting service.	Alderon will engage with the relevant agencies and organizations, particularly the Labrador West Regional Task Force and the Labrador West Community Advisory Panel, to provide Project information and to identify and discuss potential Project-related implications for local services and infrastructure, including those of Project-related in-migration. Additional information is available in Sections 10.4 and 24.5.6.
	Innu Nation	Innu Nation have a program in place with Voisey's Bay, where every person over 60 years old gets a monthly allowance of approximately $500. Suggested that Alderon should consider such a program, as this has been very helpful for the community.	Alderon is committed to building mutually beneficial and respectful relationships with all Aboriginal groups. Alderon's current Aboriginal engagement processes are described in Chapter 10, and its Aboriginal Relations Policy is outlined in Section 1.1.1. Alderon is currently negotiating a benefits agreement with Innu Nation.
Potential Effects on Recreational Infrastructure	Fermont	Concern that there are only two good beaches in the entire area (Fermont and Duley Lake).	Due to their spatial separation, the Project will not interact with the beach areas on Long Lake and in Fermont. More information regarding Project location is provided in Section 2.4.
	Fermont	Need to identify how to enhance quality of life, perhaps with the creation of a new recreational area.	• An assessment of the effects of the Project on community health, including quality of life, is provided in Section 25.6.
	Fermont	Potential effects of the Project on land use such as snowmobile and ski.	Alderon will continue to engage with local snowmobile groups to address Project concerns. See Section 23.5.4 and 23.6.1.

Issue	Community / Organization	Summary of Comments Raised During Consultation and Engagement Activities	Response / Location in the EIS
	Fermont	Potential effects on Lac Daviault, recreational activities, boating, planned camp ground - these are important for Fermont community members.	The Project will not overlap with Lac Daviault and will therefore not affect current use of the lake for boating or camping. Based on viewshed analysis only some waste rock disposal areas will be visible from the western shores of Lac Daviault. Modeling of noise levels resulting from the Project will not exceed Health Canada guidelines at Lac Daviault. Modeling of dust dispersion indicates that dust levels at Lac Daviault will not be elevated as a result of the Project. See Section 23.6.2, 23.6.4 and Chapter 14 (Atmospheric Environment)
	Fermont	There is a trail that goes approximately 2 km from pit, will it be affected?	Existing recreational infrastructure within the Project area is described in Section 24.5.9. Access to the trail is not anticipated to be affected by the Project.
	Fermont	What are the effects on ice on Daviault Lake during blasting?	To address concerns about blasting, Alderon has committed to developing a Project-specific Blasting Plan. Effects of the Project on the atmospheric environment, including air quality, noise, vibration and dust have been assessed and mitigation measures identified. During Project activities, blast noise and vibration will be monitored and will comply with regulatory standards. See Section 23.5.2.1, 23.6.3 and Chapter 14 for more information.
	Labrador City	Project is located in some of the last wilderness in the area.	Section 23.5 includes a description of current land use in the vicinity of the Project. With the exception of the two existing mines, western Labrador can be classified as largely undeveloped. The effects of the Project on the use of land and resources are assessed in Section 23.6.

Issue	Community / Organization	Summary of Comments Raised During Consultation and Engagement Activities	Response / Location in the EIS
	Labrador City / Wabush	Concerns about the potential effects of dust and noise in the Duley Lake Park are which would disturb park owners and users.	Noise levels and dust emissions have been measured and predicted carefully to help design the Project so that regulatory standards are met. Occasionally, operating noise might be audible in the distance, but will be within regulatory limits and monitored routinely for compliance with those limits. Mitigation measures for all potential effects, including dust emissions have been identified, including dust suppression, equipment preventative maintenance programs, and engineering controls such as covered conveyors. More information about potential effects of dust and noise are provided in Section 14.6.
	Wabush	Jean Lake and Elephant Head Road are recreation areas.	The Project will not overlap with the recreation areas at Jean Lake and Elephant Head Road. Alderon is working with the Town of Wabush to ensure that effects on municipal infrastructure are identified and mitigated. See Section 24.6 for more information.
	Wabush	Potential effects on snowmobile trails. It will be important to discuss with snowmobile association.	Alderon will work with local snowmobile groups to address Project concerns. See Section 23.5 for a description of existing snowmobiling activity and Section 23.6 for an assessment of Project effects on snowmobiling and associated mitigation measures.

The number of times primary issues have been raised is shown on Figure 24.1.

Figure 24.1 Frequency of Issues



24.2 Environmental Assessment Boundaries

24.2.1 Spatial Boundaries

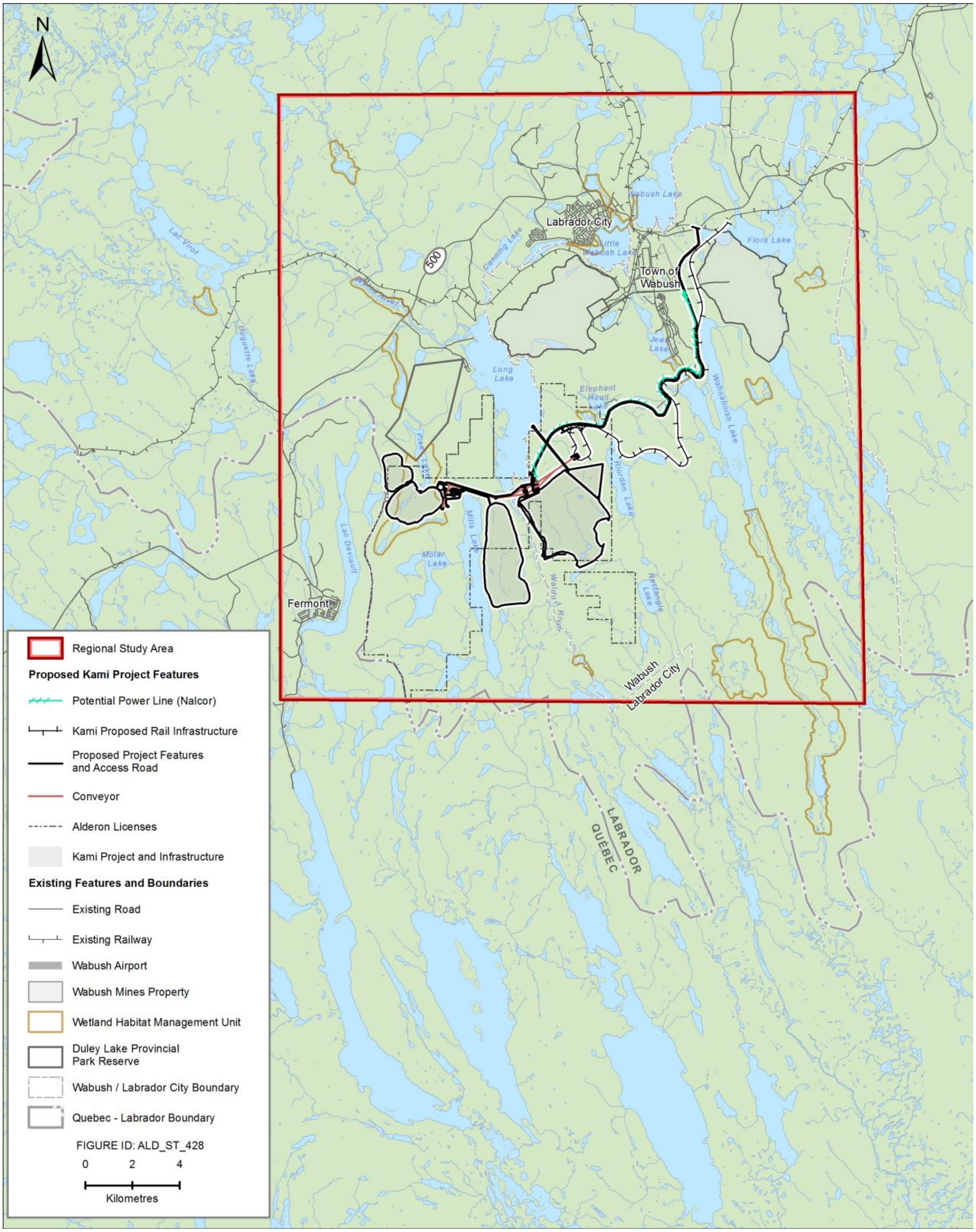
The Regional Study Area (RSA) is the spatial area within which the significance of an effect, including cumulative effects, is determined. It is based on the geographic extent of the interactions with the Project, the draft assessment Guidelines, the availability of appropriate data, as well as the administrative boundaries described below.

The RSA for Community Services and Infrastructure is western Labrador, which includes the Towns of Labrador City and Wabush, and the Town of Fermont, Québec. The RSA includes the main municipalities that will be affected by the Project activity and expenditures and which are of concern to the public and are in the draft Guidelines. These are the areas that will provide services and infrastructure to the Project and its employees and where any Project-related demands will be experienced. Figure 24.2 shows those communities that are included in the RSA and their location relative to the Project.

24.2.2 Temporal Boundaries

The temporal boundaries for the assessment of the potential environmental effects of the Project on Community Services and Infrastructure include the periods of construction (approximately two years), operation and maintenance (approximately 17 years), and decommissioning and reclamation (approximately two years). During all seasons and phases there will be public and government interest in the scale and distribution of the services and infrastructure effects of the Project.

Figure 24.2 Communities in the Community Services and Infrastructure RSA



24.2.3 Administrative Boundaries

The basic building units for the Community Services and Infrastructure VEC are geographic data regions. The environmental effects on Community Services and Infrastructure will be felt at the community level since they will provide the majority of Project-related services and infrastructure. The effects of the Project will be felt within the administrative area of Economic Zone 2, Hyron Regional Economic Development Corporation, which includes the communities of Labrador City, Wabush and Churchill Falls. Some Project effects will also be felt within the Town of Fermont. The monitoring of demands on Community Services and Infrastructure is the responsibility of the relevant government departments and agencies, as part of their normal planning processes. Alderon will assist by liaising with them, as requested, and through the timely provision of information about Project activity and plans.

24.3 Establishing Standards or Thresholds for Determining the Significance of Effects

The effects of the Project on Community Services and Infrastructure cannot be characterized using the standard descriptors for biological and physical VECs. Therefore the following unique set of descriptors is used:

- **Direction:**
  - Adverse;
  - Positive; or
  - Neutral.
- **Magnitude:**
  - reduction: reduces existing levels;
  - neutral: adds nothing to existing levels; or
  - increase: adds to existing levels.
- **Geographic Extent:**
  - Western Labrador; or
  - Fermont.
- **Frequency:**
  - not likely to occur;
  - occurs once;
  - occurs sporadically at irregular intervals;
  - occurs on a regular basis and at regular intervals; or
  - continuous.
- **Duration:**
  - construction phase;

- operations and maintenance phase; or
- decommissioning and reclamation.

The significance criteria described below are based on changes in measurable parameters which are described in Section 24.4.1.

A significant adverse residual effect from the Project is one when demands from the Project exceed the existing capacity of the infrastructure component or the quality of the associated service the system on an ongoing and consistent basis during the life of the Project.

A significant positive residual effect from the Project occurs when system changes enhance the capacity of the infrastructure component or the quality of the associated service on an ongoing and consistent basis during the life of the Project.

24.4 Potential Project-VEC Interactions

Each Project activity and physical work for the Project is listed in Table 24.2, and each interaction is ranked as 0, 1, or 2 based on the level of interaction each activity or physical work will have with Community Services and Infrastructure. The effects of the Project on expenditures on Community Services and Infrastructure associated with supplies and services and employment that are involved in all of the Project activities and works are grouped as "Expenditures" and "Employment" in the table.

The transportation of personnel and goods to the site during construction and operations and maintenance could place additional demands on transportation services and infrastructure. This is ranked as 2 and is, therefore, carried through to the assessment.

Table 24.2 Potential Project Effects to Community Services and Infrastructure

Project Activities and Physical Works	Potential Effects			
	Changes in Municipal Services and Infrastructure		Changes in Housing and Accommodations	
	Western Labrador	Fermont	Western Labrador	Fermont
Construction				
Site Preparation (including clearing, excavation, material haulage, grading, removal of overburden and stockpiling)	0	0	0	0
Construction of Roads	0	0	0	0
Construction of Site Buildings and Associated Infrastructure (maintenance facilities, offices, plant, crushers, concentrator, conveyors, gatehouse, pumphouses, substation, security fencing, sanitation system)	0	0	0	0
Construction of Mine Tailings Management Facility (TMF)	0	0	0	0

Project Activities and Physical Works	Potential Effects			
	Changes in Municipal Services and Infrastructure		Changes in Housing and Accommodations	
	Western Labrador	Fermont	Western Labrador	Fermont
Construction of Railway and Load-out Facilities (silos)	0	0	0	0
Construction of Power Line	0	0	0	0
Construction of Stream Crossings	0	0	0	0
Installation of Water Supply Infrastructure (wells, pumps, pipes)	0	0	0	0
Onsite Vehicle / Equipment Operation	0	0	0	0
Waste Management	1	0	0	0
Transportation of Personnel and Goods to Site	2	0	0	0
Expenditures	2	2	2	2
Employment	2	2	2	2
Operation and Maintenance				
Open Pit Mining (including drilling, blasting, ore and waste haulage, stockpiling, dewatering)	1	0	0	0
Ore Processing (including crushing, conveying, storage, grinding, screening)	0	0	0	0
Concentrator Operations (gravity and magnetic separation, tailings dewatering, tailings thickener, concentrate conveyance to load-out)	0	0	0	0
Tailings Disposal in TMF	0	0	0	0
Waste Rock Disposal on Surface	0	0	0	0
Water Treatment (including mine water and surface runoff) and Discharge	0	0	0	0
Rail Load-Out by Silo Discharge	0	0	0	0
Rail Transport	0	0	0	0
Onsite Vehicle / Equipment Operation and Maintenance	0	0	0	0
Waste Management	1	0	0	0
Transportation of Personnel and Goods to Site	2	0	0	0
Fuel Storage and Dispensing	0	0	0	0
Progressive Rehabilitation	0	0	0	0
Expenditures	2	2	2	2
Employment	2	2	2	2

Project Activities and Physical Works	Potential Effects			
	Changes in Municipal Services and Infrastructure		Changes in Housing and Accommodations	
	Western Labrador	Fermont	Western Labrador	Fermont
Decommissioning and Reclamation				
Site Decommissioning	0	0	0	0
Site Reclamation (building demolition, grading, scarifying, hydroseeding)	1	0	0	0
Accidents and Malfunctions				
Train Derailment	2	2	2	2
Forest Fire	2	2	2	2
Dyke Breach	2	2	2	2

KEY

0 No measurable interaction will occur. Assessment of effects is not required.

1 Identified interactions that are well understood, are subject to prescribed environmental protection measures or normal regulatory processes, and/or which can be mitigated / optimized through the application of standard management measures and practices. Based on past experience, the potential effects resulting from these interactions are rated not significant

2 Identified interactions that may result in more substantive effects and/or public or regulatory concern. These interactions require more detailed analysis and consideration in the environmental assessment, in order to predict, mitigate and evaluate potential effects

The Project mainly causes effects on Community Services and Infrastructure through expenditures on supplies and services and employment that are involved in all of the Project activities and works. These expenditures and this employment are expected to have substantive effects and are of public and regulatory concern. As such, these interactions require more detailed analysis and consideration in the environmental assessment in order to predict, manage and evaluate the potential effects, and are accordingly ranked as 2.

All other Project activities and physical works have been ranked as 0 or 1 and are not considered in the assessment. For instance, waste management during construction, operations and maintenance and decommissioning and reclamation is ranked as 1 since there will be no landfill at the Project site. An integrated Waste Management Plan will also be developed and implemented throughout the Project so that as much Project-related waste as possible will be reused and recycled. Only residual waste produced by the Project during these phases will be sent to the landfill in western Labrador. While this will have effects on the capacity of the landfill, they are not likely to be significant since the landfill, when fully operational, will have a lifespan of approximately 18 years with the potential to increase its capacity. Waste management is, therefore, not carried through the assessment.

Similarly, blasting associated with open pit mining during operations and maintenance has been ranked as 1 as there is the potential for it to affect the structural integrity of buildings near the Project site. However, Alderon will have established safety zones for blasting in accordance with a Project-specific Blasting Plan. and will follow best practices so that any effects will be not significant. Blast noise and vibration will be monitored and comply with limits imposed by regulators.

24.4.1 Selection of Effects and Measurable Parameters

The environmental assessment of Community Services and Infrastructure is focused on the following effects:

- Change in municipal services and infrastructure; and
- Change in housing and accommodations.

The measurable parameters used for the assessment of the change in Community Services and Infrastructure, and the rationale for their selection, are provided in Table 24.3.

Table 24.3 Measurable Parameters for Community Services and Infrastructure

Environmental Effect	Measurable Parameter	Rationale for Selection of the Measurable Parameter
Change in Municipal Services and Infrastructure	• Health care facility and services capacity.	• Project activity and Project-related population and business growth may exceed the capacity of existing services and infrastructure.
	• School and training facility and services capacity .	• Project activity and Project-related population and business growth may exceed the capacity of existing services and infrastructure.
	• Police officer / population ratio.	• Project activity and Project-related population and business growth may exceed the capacity of existing services and infrastructure.
	• Municipal administrative capacity.	• Project activity and Project-related population and business growth may exceed the capacity of existing services and infrastructure.
	• Water / sewer capacity.	• Project activity and Project-related population and business growth may exceed the capacity of existing services and infrastructure.
	• Power capacity.	• Project activity and Project-related population and business growth may exceed the capacity of existing services and infrastructure.
	• Landfill capacity.	• Project activity and Project-related population and business growth may exceed the capacity of existing services and infrastructure.
	• Recreational facility and services capacity .	• Project activity and Project-related population and business growth may exceed the capacity of existing services and infrastructure.
	• Availability of services and infrastructure for women.	• Project activity and Project-related population and business growth may exceed the capacity of existing services and infrastructure.
	• Road and air transportation capacity	• Project traffic may contribute to traffic congestion

Environmental Effect	Measurable Parameter	Rationale for Selection of the Measurable Parameter
Change in Housing and Accommodations	• Accommodations and building lot availability.	• Project activity and Project-related population and business growth may exceed the capacity of existing services and infrastructure.

24.5 Existing Environment

This section begins with a discussion of the demographics and labour force of western Labrador and Fermont since the interaction of the Project with Community Services and Infrastructure is related to the Project's labour force and Project employment will likely incur demographic change. The section continues with a description of the current situation and recent trends in western Labrador and Fermont with respect to:

- Employment and social services;
- Health services and social programs;
- Training and education services and programs;
- Safety and security;
- Municipal administrative capacity;
- Municipal services and infrastructure;
- Recreational services and infrastructure;
- Availability of services and infrastructure for women;
- Transportation infrastructure;
- Commercial and industrial infrastructure; and
- Housing and accommodations (residential and tourist).

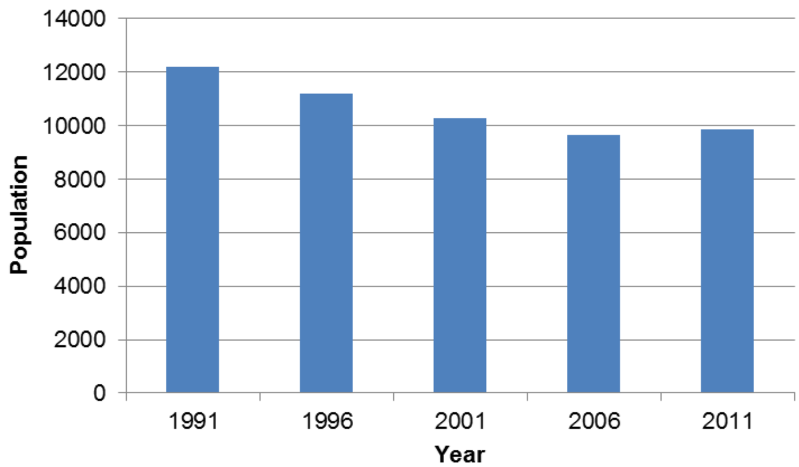
This will include a discussion of the existing capacity of these services and infrastructure, where such information is available, and any changes or improvements that are planned or have been publicly announced.

24.5.1 Demographics

24.5.1.1 Western Labrador

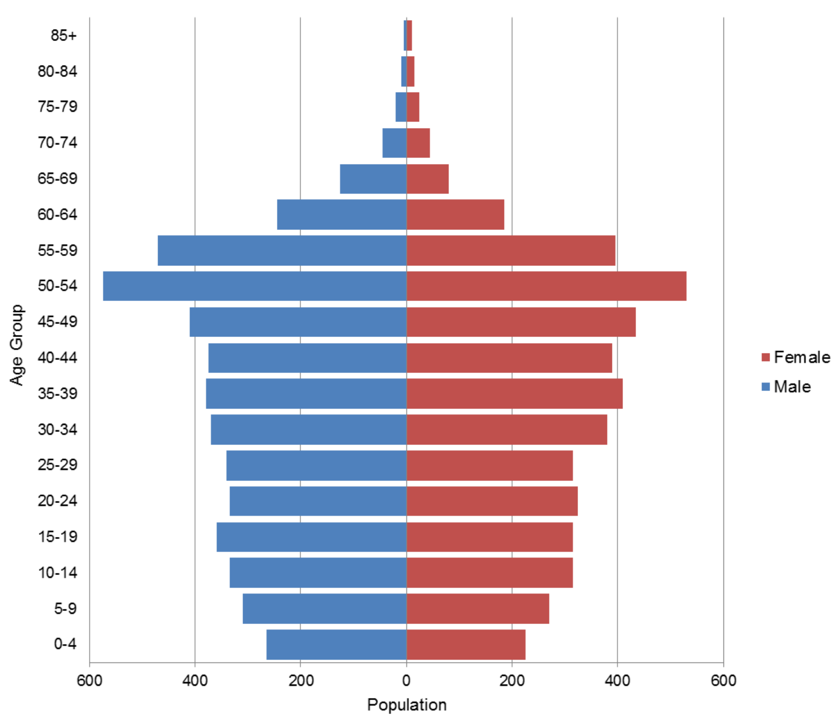
Population changes for western Labrador over the past 20 years have followed similar trends to the Province and Labrador, with the population stabilizing in recent years after a long period of population decline. In 2011, the population of Economic Zone 2, including Churchill Falls, Labrador City and Wabush, was 9,862 (Statistics Canada 2012a). This represents a population increase of 1.8 percent from 2006, marking the first time the census population count has increased since 1991. As shown in Figure 24.3, Economic Zone 2 experienced a population decline from 1991 to 2006. In total, the population decreased by just over 20 percent during this period. In 2011, the population of this region represented 36.8 percent of Labrador's total population.

Figure 24.3 Population of Economic Zone 2, 1991-2011



There are more men than women living in the region, as shown by Figure 24.4. In 2006, 51.6 percent of the population was male, compared to 48.4 percent female. The most populated 5-year age group was 50-54 years, which comprised 11.5 percent of the regional population. This age group represents the highest percentage of the population for both males and females.

Figure 24.4 Population by Age and Gender, Economic Zone 2, 2006



24.5.1.2 Fermont

Fermont was initially built to accommodate the 1,600 employees working at ArcelorMittal Mines Canada's Mont-Wright iron mine and their families (CLD de la MRC de Caniapiscau 2012b). The population continued to grow following the establishment of the Town, briefly reaching a peak of 4,500 residents in 1980 (Rouleau 2010).

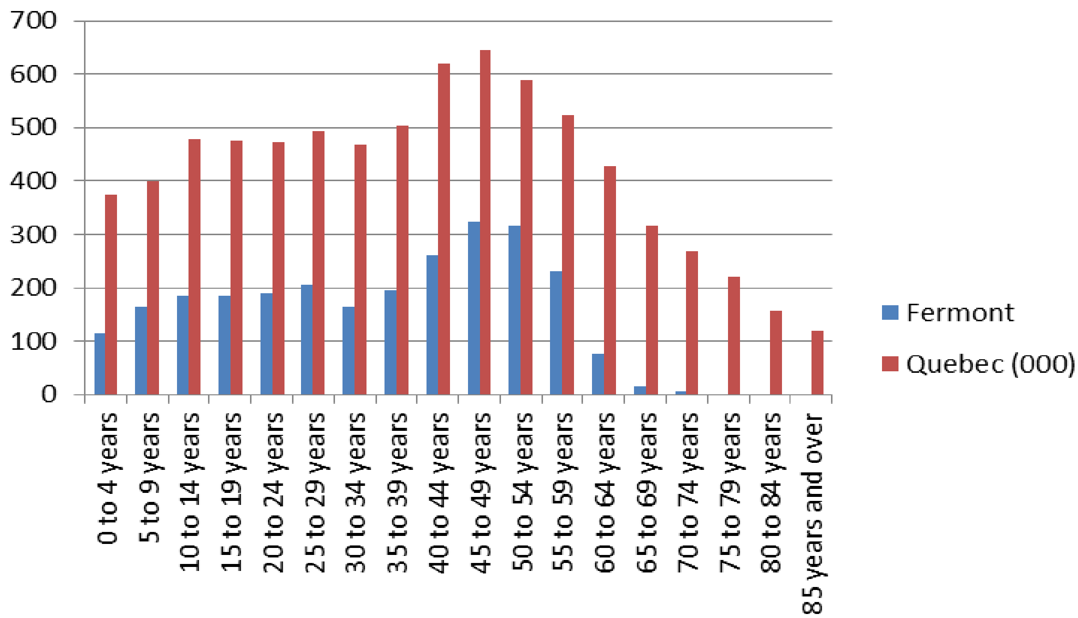
Table 24.4 shows the population change for the Town of Fermont and the Province of Québec from 1986 to 2011. The trend shows a decline in the Town's population between 1986 and 2006, which differs from the trend of slow growth for the Province as a whole. From 3,735 inhabitants in 1991, the population of Fermont declined by 29.5 percent over the following 15 years. Over the past five years, the population has once again begun to climb. According to the most recent Census data, the population of Fermont was 2,874 in 2011, which represents an increase of 9.6 percent since the last Census in 2006 (Statistics Canada 2012a). Population growth is largely attributed to interregional immigration (Rouleau 2010).

Table 24.4 Population Growth, Fermont and Québec, 1986 to 2011

Year	Fermont		Québec	
	Number	% Change	Number	% Change
1986	3592	N.D.	6,532,461	N.D.
1991	3735	4.0%	6,895,963	5.6%
1996	3234	-13.4%	7,138,795	3.5%
2001	2918	-9.8%	7,237,479	1.4%
2006	2633	-9.8%	7,546,131	4.3%
2011	2874	9.6%	7,903,001	4.7%
Sources: Bureau de la Statistique du Québec 1998; Statistics Canada 2007; Statistics Canada 2012a				

With a median age of 37.7 years, the population of Fermont is, on average, younger than the population of the Province of Québec, which has a median age of 41 years. The age structures of the populations of Fermont and Québec are illustrated in Figure 24.5. The proportion of persons aged 14 years and less in Fermont in 2006 was 17.9 percent (down from 19.3 percent in 2001), compared to the provincial average of 16.6 percent in 2006 (down from 17.8 percent in 2001). The proportion of persons aged 65 years and more in Fermont in 2006 was 0.8 percent (0.4 percent in 2001), compared to the provincial average of 14.3 percent in 2006 (up from 13.3 percent in 2001).

Figure 24.5 Age Structure of Population, Fermont and Québec, 2006



Source: Statistics Canada 2007

In the Census of 2006, persons aged between 25 and 64, which includes the main labour pool, accounted for 81.5 percent of the population of Fermont compared to 69.1 percent of the population in the Province of Québec. The relatively high proportion of people of working age in Fermont is tied largely to work-related inter-regional migration. The low proportion of residents aged 15 to 24 reflects the fact that residents must leave Fermont to attend post-secondary institutions.

According to 2006 Census data, the proportion of males (55 percent) and their average age (38.8 years) was higher than the females (45 percent and 36.3 years, respectively) in Fermont. The higher proportion of males to females in the municipality is explained by the mono-industrial basis of the local economy and the traditionally high participation rates of males in the mining industry.

24.5.2 Labour Force

24.5.2.1 Western Labrador

Employment conditions were also strong in Economic Zone 2, where participation rates were higher, unemployment rates were lower, and the average annual income was higher than figures for Labrador and for the entire Province in 2006 (Table 24.5).

Table 24.5 Labour Force Characteristics, Economic Zone 2, 2006

	Labrador City	Wabush	Churchill Falls	Economic Zone 2
Total Population, 15 years and older	5,935	1,460	525	7,395
Labour Force	4,325	1,045	380	5,745
Participation Rate (%)	72.9	71.6	72.4	72.5
Unemployment Rate (%)	8.9	8.1	5.3	8.6
Median Income, 2005	$30,884	$36,091	$51, 732	NA
Source: Statistics Canada 2007, Community Accounts, no date				

In 2006, the labour force of Economic Zone 2 consisted of 5,745 individuals (Table 24.6). The participation rate is much higher in Economic Zone 2 (72.5 percent in 2006) than in the Province (59.1 percent) and Labrador (68.8 percent). Unemployment rates in Labrador City, Wabush and Churchill Falls are also well below those for the Province and for Labrador.

Table 24.6 Labour Force Characteristics by Gender, Economic Zone 2, 2006

	Total	Males	Females
Labour Force	5,745	3,350	2,395
Participation Rate (%)	72.5	82.2	62.2
Unemployment Rate (%)	8.6	5.8	12.7
Employment Rate	66.3	77.5	54.4
Source: Statistics Canada 2007, Community Accounts, no date			

The labour force of Economic Zone 2 was comprised of 3,350 males (58 percent) and 2,395 females (32 percent) in 2006 (Table 24.6). As was the case for Labrador, in Economic Zone 2 the male participation rate was substantially higher than for the rate for females. The unemployment rate for males was low at 5.8 percent, while for females the unemployment rate was 12.7 percent (Statistics Canada 2007; Community Accounts, no date).

24.5.2.2 Fermont

Table 24.7 presents a summary of labour force activity for Fermont and the Province of Quebec in 2006. According to the latest available figures from the Census, the total labour force was 1,725 people in 2006 and total employment was 1,655 people (Statistics Canada 2007). The total labour force participation rate was 80.0 percent, which is considerably higher than the participation rate for Québec, which was 60.9 percent (Statistics Canada 2007). In 2006, Fermont counted an unemployment rate of 4.1 percent, which was significantly lower than the Québec average of 7.0 percent (Statistics Canada 2007).

Table 24.7 Labour Force Activity, Fermont and Québec, 2006

	Fermont	Quebec
Labour Force	1,725	4,015,200
Employed	1,655	3,735,505
Unemployed	70	279,695
Participation Rate (%)	80.0	64.9
Employment Rate (%)	76.8	60.4
Unemployment Rate (%)	4.1	7.0
Source: Statistics Canada 2007		

In 2006, women represented 44 percent of the total population aged 15 years and over, but only 33.3 percent of the total labour force (Statistics Canada 2007). As shown in Table 24.8, the participation rate for men was 95 percent while that for women was 60.5 percent. Whereas in Québec, the unemployment rate among men and women was less than a full percentage point, there is a marked difference between the rates for women and men in Fermont. In 2006, the unemployment rate for men was 0.9 percent while that for women was 10.4 percent (Statistics Canada 2007).

Table 24.8 Labour Force Activity Statistics, By Gender, Fermont, 2006

	Men	Women
Labour Force	1,145	575
Employed	1,135	520
Unemployed	10	60
Participation Rate (%)	95.0	60.5
Employment Rate (%)	94.2	54.7
Unemployment rate (%)	0.9	10.4
Source: Statistics Canada 2007		

24.5.3 Employment and Social Services

24.5.3.1 Western Labrador

The Department of Advanced Education and Skills offers Income Support services to western Labrador through its office in Wabush. Between 2005 and 2009, the number of people using Income Support in Labrador City decreased from 435 to 255, a decrease of 41 percent, and the incidence of use fell from 6.2 percent to 3.5 percent. Similarly, in Wabush during the same time period, the number of individuals using Income Support dropped by nearly 40 percent and the incidence of use fell from 2.3 percent to 1.4 percent (Table 24.9) (Community Accounts, no date).

Table 24.9 Use of Income Support, Western Labrador, 2005 and 2009

Income Support	Labrador City		Wabush	
	2005	2009	2005	2009
Individuals*	435	255	40	25
Incidence (Percentage of Population)	6.2	3.5	2.3	1.4

Notes:
* Data on the total number of individuals may be underreported. These numbers are calculated by adding the total number of adults and the total number of children for each case or family as we refer to it in the Income Support table on Community Accounts.

Source: Community Accounts, no date

There is one Service Canada office in Labrador City. Service Canada provides individuals with access to a number of government programs, including employment and training programs and Employment Insurance. The Western Labrador Employment Corporation is a community-based organization, with a volunteer board of directors, which provides support to persons with developmental disabilities in finding and maintaining employment.

Western Labrador also has the Employment Connection Centre, which opened in 2005. It is a sponsored program of the Western Labrador Young People's Association and it provides employment counseling services to unemployed and underemployed individuals in Labrador City and Wabush. The Centre is funded by the Government of Canada under the Employment Insurance account in Partnership with the Government of Newfoundland and Labrador through the Canada-Newfoundland and Labrador Labour Market Agreement. The Employment Connection Centre is located in Labrador City and it employs four staff (Employment Connection Centre 2012).

24.5.3.2 Fermont

In Québec, Income Support is managed by the Ministère de l'Emploi et de la Solidarité Sociale (MESS). In 1969, the Québec government first began to administer Income Support. Since 1995, Income Support programs have been divided into two categories. Aide sociale targets individuals who are able to work but may face temporary constraints that limit their ability to work. Solidarité sociale is geared toward individuals who are not apt and have severe constraints related to their physical or mental health that are permanent or of indefinite duration.

In 2000, the total number of individual beneficiaries of Income Support between the ages of 0 and 64 in the Côte-Nord Region was 7,637 or 8.3 percent of the total population (MESS 2011). The rate for Québec was higher than the region and sat at 9.7 percent (MESS 2011). Since then the rates have declined. In 2009, there was a slight increase, but only to 5.3 percent and 7.4 percent for the region and Province, respectively (MESS 2011). Between February 2011 and February 2012, the total incidence of Income Support usage among people aged 0 to 64 sat at 3,642, which corresponds to 4.4 percent of the total population of the region. At the provincial level, the rate was 7.2 percent (MESS 2012). Table 24.10 provides a summary of the Income Support usage among individuals aged 0 to 64 in Côte-Nord and the Province of Québec for 2000, 2009 and 2012.

Table 24.10 Income Support Usage, Côte-Nord Region and Province of Québec (2000, 2009, 2012)

	Côte-Nord			Québec		
	2000	2009	2012	2000	2009	2012
Individuals	7,637	4,422	3,642	618,896	491,729	475,580
Incidence (Percentage of Population)	8.3	5.3	4.4	9.7	7.4	7.1
Source : MESS 2011, 2012; Marcotte 2012, pers. comm.						

Job search and placement services are available in Fermont. The Carrefour jeunesse emploi de Duplessis in Fermont offers career guidance, business planning assistance and placement services to youths between 16 and 35 years of age (Carrefour jeunesse emploi de Duplessis 2012). Residents 36 years old and above can use the services of the Centre local d'emploi located within the same office.

The CLD (Centre locale de développement) de la MRC de Caniapiscau is a non-profit organization that promotes economic development and tourism in region. It does this in part through strengthening partnerships between local private businesses, local government, and non-profit organizations and cooperatives, and unions. The mandate of the CLD is to support entrepreneurship by offering a range of services to enterprises, elaborating and implementing local action plans for the economy and employment; acting as a consultant to the local employment center, and collaborating on local tourism development (CLD de la MRC de Caniapiscau 2012b).

24.5.4 Health Services and Social Programs

24.5.4.1 Western Labrador

Health services in Labrador are provided by the Labrador-Grenfell Regional Health Authority (Labrador-Grenfell Health). It is an integrated health and community services board that delivers primary and secondary health services to the residents of the region, including: acute care, diagnostic and clinical support services; community health and wellness; dental services; health protection services; long term care; mental health and addictions services; residential services; and therapeutic intervention, rehabilitation and other rehabilitation services (Labrador-Grenfell Health, no date).

Labrador-Grenfell Health provides health and community services to approximately 37,000 people in Labrador and on the Northern Peninsula of Newfoundland. It employs more than 1,660 staff and operates three hospitals, three community health centres, 14 community clinics and two long-term care homes (Labrador-Grenfell Health, no date).

Facilities and Services

The Captain William Jackman (CWJ) Memorial Hospital, located in Labrador City, is a fully accredited health facility which serves western Labrador. It has 20 beds, six of which are designated long-term care beds for levels three and four nursing care. Fourteen beds are for acute care. Inpatient units provide care to medical, surgical, obstetrical, pediatric, respite, palliative and intensive care patients.

The hospital is served by six family physicians, a general surgeon, and an anaesthesiologist. There are also a number of visiting specialists who come to the hospital on a regular basis (Labrador-Grenfell Health 2007). In western Labrador, dental services are provided by fee-for-service dentists. There are two dentists in the area with one other who visits for two weeks each month.

With regard to maternity care, family physicians in western Labrador have traditionally provided non-emergent obstetrical services for patients with surgical support available for emergency cases when required. In 2011, family physicians in western Labrador expressed concerns regarding this model of care and began advising their prenatal patients to travel outside the region for deliveries. Labrador-Grenfell Health then commissioned a review of the model of care in western Labrador to determine its appropriateness. This review has been completed and a report is being considered by the Health Authority. In the meantime, family physicians in the area will continue to provide coverage with support from locum obstetricians / gynaecologists, who have been recruited by Labrador-Grenfell Health and retained until February 5, 2012 (Labrador-Grenfell Health 2011).

Construction of a new hospital for western Labrador started in 2010 and is expected to be completed in 2013, with occupancy expected in early 2014. Once complete, it will have 14 acute and 14 long-term care beds, general laboratory and x-ray services, a computed tomography (CT) scanner, surgery suites, satellite dialysis and community services (NLDHCS 2011a). The project is expected to cost $90 million, with $23.7 million being allotted from the 2011 budget (The Labradorian 2011).

In August of 2011, the provincial government announced that $643,600 would be given to the CWJ Memorial Hospital to purchase several pieces of equipment, including; a haematology analyzer and backup, coagulation analyzer and backup, two sleep study recorders, hearing aid analyzer, a non-invasive ventilator, two gastroscopes, maxi-move patient lift, and initial funding for a digital fluoroscopy room for x-ray services (NLDHCS 2011b).

There is a Medical Clinic in Wabush which is staffed by one doctor, who is also the physician for Wabush Mines. The Churchill Falls Community Clinic provides primary health care to the community. The clinic has two holding beds, basic trauma and resuscitation equipment and a defibrillator. Emergency patients are med-evaced to the appropriate referral centre. The clinic is staffed by a family physician, a regional nurse II, a part-time community health nurse, a full-time personal care attendant, and a full-time clerk typist (Labrador-Grenfell Health 2007).

There is currently no seniors’ residence in western Labrador, however, land has been identified for one by the Towns of Labrador City and Wabush and a promotional package has been developed to attract a developer to build, own and operate a seniors’ complex at that site (Labrador West, no date).

Despite the need for a seniors' home in the area, the western Labrador Community Needs Assessment report indicates that local infrastructure is increasingly able to deal with the bulk of the population's health care needs, particularly as a result of recent investments in medical equipment and the construction of a new hospital. The assessment report also states that, although the existing physicians' practices are not calling for a recruitment campaign to bring other general practitioners to the community, the population could support one or two additional general practitioners (Labrador West Chamber of Commerce 2010).

Community Service Programs

Labrador-Grenfell Health has a Child, Youth and Family Services office in western Labrador. It has the mandate to provide child protective intervention services, youth services, adoption services, family and rehabilitative services, community corrections, child care services and residential services (LabradorGrenfell Health 2007).

Mental Health Services are provided at the CWJ. It has two addictions counselors, one addictions coordinator / officer, 4.5 mental health counselors as well as the regional mental health and addictions clinical manager. There is a need for a full-time psychiatrist in Western Labrador. One psychiatrist visits the area twice a year while Labrador-Grenfell health tries to recruit someone on a more permanent basis (Vrbanic 2011a). Wait times for mental health counseling in Labrador City are up to four to six weeks, as position vacancies are a challenge to the department (Aura Environmental Research and Consulting Ltd. 2008).

Shelters

Hope Haven, a shelter and resource facility for women and children escaping domestic abuse, opened in 2004. With 10 employees, Hope Haven has the capacity to house nine residents for a six-week period. In 2008, Hope Haven handled 59 crisis telephone calls and accommodated 59 individuals (32 women, 27 children). Hope Haven had at least one resident 70 percent of the 2008 calendar year (260 days) (Goss Gilroy Inc. 2009). The shelter was expected to expand with the addition of ten new affordable housing units during the summer of 2008, but plans were put on hold due to construction delays (CBC News 2008).

The Western Labrador Status of Women Council provides supportive counseling for women in crisis, single mothers, senior care, sexual harassment / assault, senior women, women's health issues, child care, family dating violence and discrimination. It also provides outreach-general information sessions, mediation services and referrals to agencies, such as legal aid, social service supports, and employment services (Labrador West Status of Women Council, no date).

Both of these organizations are at capacity and strained, with requirements continuing to grow. Between 2007 and 2009, total occupancy days increased 7 percent at Hope Haven, from 286 to 321. The lack of hotel availability on short notice is a significant operational issue for Hope Haven, as local hotel room capacity is one of their key client overflow placement options (Labrador West Chamber of Commerce 2010).

There are no emergency accommodations for men or youth in western Labrador. Based on information provided by stakeholders to the Labrador West Community Plan on Housing and Homelessness (2011), a general-purpose emergency accommodation facility is needed in the area.

Ambulance Service

Labrador-Grenfell Health operates road ambulances, has specialized equipment to facilitate medical evacuation by snowmobile and provides physician / nursing escorts and paramedic services (Labrador-Grenfell Health 2007). Until recently, it operated a provincial air ambulance service out of St. Anthony. In June 2010, however, the Province relocated this service to Happy Valley-Goose Bay in the hope of providing better response times for transfers. In addition, a medical flight specialist team will be located in Happy Valley-Goose Bay in order to enhance patient care by providing additional medical professionals locally and reducing patient wait times (Stewart 2010a).

On April 1, 2011, responsibility for the operation and maintenance of Labrador-Grenfell Health's Air Transportation Services was transferred to the Provincial Department of Transportation and Works, Government Air Services (Labrador-Grenfell Health, no date).

IOC also services Labrador City and surrounding area with an industrial ambulance that serves as a back-up to the Town's ambulance.

24.5.4.2 Fermont

Medical care in Fermont is provided through the Centre de santé et des services sociaux de l'Hématite (CSSSH). The clinic is part of the Québec network of centers offering integrated medical and social services. It provides both preventative and curative services to the residents of Fermont as well as the non-Aboriginal residents of Schefferville (CLD de la MRC de Caniapiscau 2012c).

Facilities and Services

Medical services consist primarily of family medicine and emergency care. The clinic has a staff of seven doctors, 15 nurses, three pharmacists, one psychologist, one social worker and laboratory technicians. Specialists are brought in throughout the year to conduct consultations. Visiting specialists include an ophthalmologist, dermatologists, orthodontists, an otolaryngologist, speech therapist, and two psychologists (CLD de la MRC de Caniapiscau 2012b).

In 2009-2010, there were 2.5 doctors per 1,000 inhabitants, which was higher than the Québec average of 2.24 (CSSSH 2010; CIHI 2012). Since the opening of the Bloom Lake mine, demand for health services in Fermont has increased substantially. The number of client files at the CSSSH has doubled and the number of inpatients has risen 38 percent. The number of patients from Labrador has increased 447 percent over the past few years (Pelletier 2011). Pressure has come not only from the rising resident population, but also from miners who fly in and fly out.

Now, with a resident and non-resident population totaling approximately 4,000 people (Collard 2012, pers. comm.), the ratio has dropped to 1.75 doctors for every 1,000 people.

The health center has a five bed intake capacity, two beds for observation and an isolation chamber for patients with respiratory ailments (Collard 2012, pers. comm.). The emergency room is open 24 hours a day, seven days a week. There is also a medical laboratory, radiology department, dental clinic, and physiotherapy center on site (Gouvernement du Québec 2004).

Other services include:

- Psychological counseling;
- Nurse services;
- Community and individual nutrition counseling;
- Maternal and infant care;
- Early childhood stimulation;
- School nurse;
- Support for clients with chronic conditions such as cancer;
- Disease prevention through vaccination and other activities;
- Home care; and
- Help-line for those in psychosocial distress and to obtain information about health resources.

Private clinics complete the health services available in the Town. The closest center for emergency surgical procedures, emergency procedures requiring anesthesia, and specialized medical imaging exams is Labrador City (CLD de la MRC de Caniapiscau 2012b). Residents may go to the hospital in Sept-Îles for services that are not available locally.

Community Service Programs

The Point de Service Fermont provides various social services to the community, including a youth center and reinsertion program for people with intellectual handicaps and rehabilitation services for people with physical handicaps (Gouvernement du Québec 2004). The Centre de réadaptation de la Côte-Nord provides services for individuals with drug or alcohol dependencies (Gouvernement du Québec 2004).

Shelters

The Maison d'aide et d'hébergement de Fermont (MAHF) is a women's help center and shelter for women experiencing violence and their children (MAHF 2012). Affiliated with the shelter is Centr'action, which provides a community space along with sport and social programming to improve the quality of life of women in Fermont (MAHF 2012). Additionally, MAHF operates the Résidence l'Entre-Temps, which provides temporary accommodations and support services to clients and their families facing psychological crisis, convalescence, a loss of autonomy or a family crisis (MAHF 2012). The residence offers its services as an extension of those provided through the CSSSH.

Ambulance

An ambulance service operates within the urban boundary and along Route 389 to the southern boundary of the MRC. The ambulance service employs four full-time and two part-time drivers.

24.5.5 Training and Education Services and Programs

24.5.5.1 Western Labrador

Childcare and Early Childhood Education

Wee College Childcare Centre in Labrador City accepts children aged two to six years and can accommodate 48 children on a part-time basis. Labrador City also has an after-school program for children aged 6 to 12 years. It can accommodate 57 part-time children (NLDCYFS 2011a). In 2011, the provincial government announced funding of more than $685,000 to build a new regulated childcare facility in western Labrador and to support and renovate the existing childcare centres. The new facility, Building Blocks, opened in April 2012 and provides 60 additional full-time spaces (NLDCYFS 2011b).

However, with an increase in dual income families and approximately 400 children under the age of five in the community (and close to 100 babies born in the area annually), the demand for institutional daycare spaces will continue to outstrip supply even upon completion of the new childcare facility (Labrador West Chamber of Commerce 2010).

Primary, Elementary and High School

There are four schools in Labrador City and Wabush (Table 24.11). Three are managed by the Labrador School Board and one is managed through the Conseil Scolaire Francophone Provincial de Terre-Neuve-et-Labrador.

Table 24.11 Schools, Enrolment and Number of Teachers, Labrador City / Wabush, 2011-2012

School	Location	Grades	Physical Capacity	Enrolment		Total Teachers	
				2006-07	2011-12	2006-07	2011-12
A.P. Low Primary	Labrador City	K-3	600	412	412	26	27
Menihek High	Labrador City	8-12	800	633	626	36	38
Centre educatif L'ENVOL	Labrador City	K-8, 10, 12		29	26	5	6
J. R. Smallwood Middle	Wabush	4-7	1,000	449	418	25	30
		Total	**2,400**	**1,523**	**1,482**	**92**	**101**

The physical capacity for students in western Labrador schools is approximately 2,500. In 2011-12, the total school enrolment was approximately 1,500. Between the 2006-07 and 2011-12 school years, the total student enrolment in western Labrador decreased by 2.7 percent, from 1,523 to 1,482. During that time, the total number of teachers increased by 9.8 percent giving a student to teacher ratio of 14.7 in 2011-12. This is down from 16.6 in 2006-07 (Community Accounts, no date).

In 2012, Menihek High School and C'entre educatif L'ENVOL will both receive roofing upgrades. Including these projects, more than $3.1 million has been spent on upgrading these two schools since 2004 (NLDE 2012).

Post-Secondary

Post-secondary education is available in western Labrador through the College of the North Atlantic, which has a campus in Labrador City. Approximately 300 full-time and part-time students are registered there each semester. An additional 1,000 students participate in continuing education evening courses (College of the North Atlantic, no date). The western Labrador CNA campus is the only campus in the Province to offer a two-year Mining Technician program and has been designated CNA's Mining Centre of Excellence. In 2007, a millwright and an electrical program began to be offered. In 2008, a welder program was added to the campus' trade offerings.

Expansion of western Labrador's College of the North Atlantic campus was announced in August 2009, and the building was completed in August 2011. The total cost was $21.2 million and was funded by the provincial and federal governments' Knowledge Infrastructure Program. The new 4,700 m^2 building includes modern trades shops, science labs, computer labs, smart classrooms and a learning resource centre and it is designed to allow for growth in enrolment and program offerings (NLDE and NLDLAA 2009). The campus does not have housing accommodations for students, however, which poses a problem for students coming from outside of western Labrador (Higdon 2011a).

Table 24.12 lists the programs offered at the western Labrador CNA campus, as well as the number of students that were enrolled in each program in Fall 2010 and 2011. In addition, Table 24.12 gives the capacity for students in each program. During Fall 2010, programs at the campus could accommodate 225 students and only 124 were enrolled. Similarly, 124 students enrolled in these programs in Fall 2011 while there was a capacity for 224. Since the new campus has opened, the program capacity has changed slightly with one less space in the welding program. This is because booths in the welding shop are larger and can accommodate 14 rather than 15 students (Sawyer 2012, pers. comm.). None of the programs were at capacity in 2011 and, notably, the mining technician programs were only at half of their capacity.

Table 24.12 Enrolment by Program, CNA, Labrador City Campus, Fall 2010 and 2011

Trade Program	2010		2011	
	Number of Seats	Capacity	Number of Seats	Capacity
Welder	13	15	12	14
Construction / Industrial Electrician	16	16	14	16
Industrial Mechanic (Millwright)	13	16	15	16
Mining Technician (1st-year)	17	30	14	30
Mining Technician (2nd year)	4	30	13	30
Adult Basic Education	15	18	12	18
CAS Transfer: College- University	28	40	19	40
CAS Transition	6	20	7	20
Office Administration (Executive)	10	20	16	20
Engineering Technology (First Year)	2	20	2	20
Total Number of Students	**124**	**225**	**124**	**224**
Source: Sawyer 2012, pers. comm.				

There is one private training institution, RSM Safety Institute, Inc., in Labrador City. It is a subsidiary of RSM Mining Services and offers 40 to 50 occupational health and safety training services for the mining and construction industries. These include Accident Investigation, Forklift Operation and Safety, Excavation and Trenching Safety and Safety for Supervisors. Class sizes at the Institute range from one to 40 participants, depending on the type of course and time of year. Courses are offered on a monthly schedule but are also available on an as-needed basis and typically are no longer than two days. Courses are generally offered in English, and some are offered in French (McCarthy 2006, pers. comm.).

24.5.5.2 Fermont

Childcare and Early Childhood Education

Day care services are available in Fermont. The largest daycare center is Le Mûr-Mur. As of fall 2011, the wait list was 160 people with a wait time of two to three years (Corbeil 2011). Council priorities include increasing the capacity of the daycare by another 150 spaces and increasing the budget to hire more daycare workers (Pelletier 2011). In addition to this center, there are ten home day-care businesses currently registered in Fermont (CLD de la MRC de Caniapiscau 2012a).

Primary, Elementary and High School

Three schools serve the Fermont community. École primaire des Découvertes offers elementary education in French. During the 2009-2010 school year, 217 students were enrolled from kindergarten to grade 6 (CLD de la MRC de Caniapiscau 2012b). The Polyvalente Horizon-Blanc provides high school education in French. 148 students were enrolled in 2009-2010 (CLD de la MRC de Caniapiscau 2012). Together, the schools employ about 30 teachers (Rousseau 2012, pers. comm.). Both are part of the Commission Scolaire du Fer, the region’s French school board. It is estimated that the high school could accommodate 240 students while the elementary school could accommodate 300 (Rousseau 2012, pers. comm.).

Fermont School is the only English language school in the area. It delivers elementary education from pre-kindergarten to grade 6 (CLD de la MRC de Caniapiscau 2012b). The independent school employs four full-time teachers and has a capacity of 26 students (Keane 2012, pers. comm.). Only students eligible for English schooling in Québec as per the stipulations of Bill 101 are admissible. Since there is no English high school, many students wishing to pursue their studies in English attend high school in Labrador City (Keane 2012, pers. comm.).

Post-Secondary

The Commission Scolaire du Fer provides adult education services and high school equivalency testing through its Centre d'éducation des adultes (CLD de la MRC de Caniapiscau 2012b). For college-level courses or technical training, students must leave the region.

24.5.6 Safety and Security

24.5.6.1 Western Labrador

Police

Police services are provided to Labrador City and Wabush by the Royal Newfoundland Constabulary (RNC). As of May 15, 2011, the RNC had 33 employees in western Labrador, of which 22 were police officers and 11 were civilian staff. Of the police officers, 17 were male and five were female (RNC, no date). This number is up from 15 police officers in 2009. In 2011, there were 222 police officers per 100,000 population in western Labrador. This is larger than the police to population ratios in the RNC’s other jurisdictions - Corner Brook (199 officers per 100,000 population) and the Northeast Avalon (175 officers per 100,000 population) (RNC 2011).

In 2010, there were 3,200 calls for police service in western Labrador. This was up by 9.0 percent from 2009 when there were 2,938 calls for service but down by 2.4 percent from 2008 when there were 3,280 calls (RNC 2011). Community crime rates in western Labrador are generally well below provincial averages (on average 29 percent below the RNC's reported crime rate in its other jurisdictions for the 2009 fiscal year of April 1, 2009 to March 31, 2010), although there is a perception that drug-related crimes in particular are getting worse and are not captured in the crime rate data the RNC collects (Labrador West Chamber of Commerce 2010).

The Fly-in / Fly-out contractor workforce of other projects in western Labrador does not appear to have put a strain on the detachment's overall ability to service the community (Labrador West Chamber of Commerce 2010). In recent years, the replacement of police officers to the western Labrador detachment has been greatly impeded by the rise in housing prices and the lack of available housing. To address this issue, the RNC’s 2009-2010 budget allocated $1.5 million to acquire accommodations for RNC police officers serving in western Labrador (RNC, no date).

Fire

The Labrador City Fire Department provides fire protection services to that community. In 2008, the Department answered 104 emergency calls, up from 60 in 2004 (Labrador City Fire / Rescue 2008). The Department has five full time, paid firefighters, and 36 volunteer firefighters, and offers protection to IOC properties. The Labrador City Fire Department has two pumpers with capacities of 500 litres and 1,000 litres and a pick-up truck. In addition, they have a fully equipped rescue vehicle with heavy hydraulics and a Hazardous Materials unit (Town of Labrador City 2010). The Labrador City 2012 budget states that a new aerial fire truck will be purchased in 2012 to enhance the fire department's response capabilities. The budget also recommends that a full-time fire inspector position be established to enhance the department's Fire and Life Safety program (Town of Labrador City 2011).

The Town of Wabush operates a volunteer fire department consisting of 24 firefighters (Labrador West, no date). They protect the residents of Wabush and offer backup to the Town of Labrador City. This department also provides services to Wabush Mines and the Wabush Airport. The Town of Wabush has requested $1,000,000 in funding to build an extension to the Wabush fire hall (Town of Wabush, no date (a)).

The Towns of Wabush and Labrador City have an agreement to come to the aid of each other if called.

24.5.6.2 Fermont

Police

The Sûreté du Québec maintains a station in Fermont, which handles resident security, crime prevention, and road safety activities for the Town of Fermont and the Mouchalagne River area (Sûreté du Québec 2008). The station employs 13 staff members including two support staff and eight patrol officers (CLD de la MRC de Caniapiscau 2012b). Presently, there is a ratio of 1 police officer to 359 residents. An auxiliary station in Schefferville serves the Town of Schefferville as well as the Caniapiscau, Juillet Lake and Vacher Lake areas.

Fire

The fire department undertakes preventative inspections and responds to fires, disasters and other calls of distress. The department is run by a director and 28 part-time volunteer firefighters.

24.5.7 Municipal Administrative Capacity

24.5.7.1 Western Labrador

Labrador City and Wabush are both incorporated Towns with their own Town Councils, which are elected every four years. Each Town has a Mayor, a Deputy Mayor and five Councilors.

The Town of Labrador City has 62 staff and approximately 40 volunteers. The Town plans to hire a number of new employees in 2012. The Town of Wabush has approximately 70 staff and there are plans to hire more part-time and full-time staff in the near future (Aylward 2012, pers. comm.).

24.5.7.2 Fermont

The Town of Fermont's operations are directed by a Mayor and six Councilors. The Town administration oversees departments that are responsible for municipal tax collection, local infrastructure works, leisure and sport facilities, and emergency services. The Town currently employs 154 people and there are no plans to hire additional staff in the near future (Arsenault 2012, pers. comm.). The MRC (Municipalité Régionale de Comté) de Caniapiscau has five employees and there are no immediate plans to hire.

24.5.8 Municipal Services and Infrastructure

24.5.8.1 Western Labrador

For many years the Towns of Labrador City and Wabush existed as separate entities, but in the last decade they have worked closely together in a number of areas including economic development, to achieve economies of scale, as well as mutual goals. The mines provide grants to both municipalities. The concern of both towns is the ability to maintain community infrastructure, particularly as much of it is now over forty years old.

The Labrador City Planning Area covers an area greater than 446 km^2 in western Labrador. Almost the entire landmass within the Town's planning area has either commercial mineral reserves or high potential to contain mineral resources that are economically feasible to develop. Because of these valuable mineral reserves, the Council's intent is to protect these areas from development that would hinder future developments of these mineral reserves. All lands within Labrador City's Municipal Planning Area boundary not falling within other land-use designations are designated Mining Reserve - Rural. Within the designated Mining Reserve - Rural areas, aggregate extraction and related operations may be permitted (Town of Labrador City 2010).

The Wabush Municipal Planning Area covers approximately 428 km^2 and includes the developed areas of the Town, Scully Mine site and tailings disposal area, Wabush Airport, Wahnahnish Lake Public Water Supply Area, and a very large area of rural lands to the south of the Town. All the lands within the Wabush Planning Area other than those designated for urban and other specific purposes are designated as rural. Within the designated rural areas, agriculture, forestry, open space recreation, and activities connected with the conservation of resources shall be permitted. Uses that are complimentary to these uses - mining and aggregate extraction, cemetery, and outdoor assembly - may also be permitted at Council's discretion (Town of Wabush, no date (b)).

The Town of Labrador City is responsible for a variety of municipal services, including maintenance, construction and operation of streets and sidewalks, including snow and ice removal, integrated solid waste management, potable water treatment and distribution, sanitary sewer collection and distribution, storm water management and control and fly control and lawn sweeping.

The Town of Wabush provides full water and sewage service, a volunteer fire brigade, garbage collection, street lighting, snow clearing, neighbourhood playgrounds, and community recreation facilities.

Private developers are responsible for servicing future expansions to the municipal infrastructure of western Labrador, such as roads, sidewalks and municipal piped systems for newly designated areas for future development (Town of Labrador City 2010).

Water

Beverly Lake, which is located northeast of Labrador City, is the Town's only municipal water supply. This lake is expected to be able to supply enough water for the Town's current population and any future growth up to 2017 (Town of Labrador City 2010). The water is pumped from Beverly Lake to a 500,000-gallon water tower. The pump house was rebuilt in the early 1990s with two pumps at 3,700 gallons/minute. There is also an emergency diesel system, which can pump about 3,300 gallons/minute (Town of Labrador City 2010).

The water from the lake is chlorinated but no fluoride is added. Since the lake is very close to the Trans Labrador Highway, it has been advised that an impermeable barrier should be installed in this area to protect the water supply (Town of Labrador City 2010). The Town of Labrador City's 2012 budget states that water infrastructure will be extended with the construction and commissioning of a new water storage reservoir and sewage lift station (Town of Labrador City 2011).

Dumbell Lake is designated as a future water supply for Labrador City. If demands on the current water supply increase due to greater activity in the commercial / industrial sector, it may not be able to meet both domestic and industrial demands. The Town's intent is to reserve Dumbell Lake as an extra source of water supply to compliment the Beverly Lake system in the long term plans for the Town (Town of Labrador City 2010).

The municipal water supply in Wabush comes from Wahnahnish Lake, which is located south of the Town. The Town of Wabush has a grid distribution network which services approximately 700 households and businesses (Labrador West, no date).

Sewer

Labrador City is serviced with separate sanitary and storm sewers. The sanitary sewers empty into one of two sewage treatment plants that discharge into Little Wabush Lake. The storm sewer system also empties into Little Wabush Lake. A contact stabilization plant discharging effluent of secondary quality into Harrie Lake serves the Harrie Lake Subdivision. With a treatment capacity for about 5,000 people, the plant treats about 180,000 gallons/day (Town of Labrador City 2010). According to the Town of Labrador City's 2012 budget, there are plans to replace the Harrie Lake Sewage Treatment Plant building (Town of Labrador City 2011).

The second plant is located on the shore of, and discharges into, Little Wabush Lake. It treats about 1.6 million gallons/day to primary effluent quality. The sludge is removed at a rate of six loads, averaging five tonnes once every eight weeks. This plant has a treatment capacity for about 20,000 people. Since the water intake is so high, primary treatment is considered sufficient for the system (Town of Labrador City 2010). The Town of Labrador City's 2012 budget states the construction and commissioning of a new water storage reservoir and sewage lift station will involve an extension of the sewer infrastructure (Town of Labrador City 2011).

Labrador City's current wastewater distribution system is at or near capacity and it is becoming a challenge to keep effluent quality near allowable standards. A significant rise in population would require a plant retrofit to meet these standards, including an expansion of the capacity of the primary and secondary digester tanks for the storage and processing of sludge (Boland 2012, pers. comm.).

The Town of Wabush maintains one primary sewage treatment plant. In 2008, over $850 000 of municipal, provincial and federal funds were made available to upgrade the treatment plant. As of April 2010, the project was nearing completion. The Town of Wabush has submitted an application for funding in the amount of $7,000,000 to enhance the Town's sewer infrastructure to meet the current and future needs of the community (Town of Wabush, no date (a)).

Power and Communications

Power is provided to western Labrador by Nalcor Energy. Labrador City and Wabush are equipped with technological and telecommunications infrastructure with advanced fibre optic cables throughout communities and industrial sites (Labrador West, no date).

The hydro-electric availability in western Labrador comes from Churchill Falls. The Churchill Falls generating station, the largest underground power station in the world, generates 5,428 MW of power. By comparison, all other sources of power in the province including gas turbine, diesel and oil - 45 sites in all - generate 1,847 MW of power. The proposed Lower Churchill hydro-electric development, which includes the Muskrat Falls and Gull Island projects, will produce a further 2,800 MW of power. Western Labrador has the lowest average cost for power in the province. The Churchill Falls generating station provides 225 MW to Twin Falls to service the mining industry in western Labrador. Western Labrador currently has 127 MW of recall power available for industrial development. With the development of the Lower Churchill, Labrador will have increased energy capacity (Labrador West, no date).

The Labrador Interconnected System consists of the electrical distribution system that services electrical customers in the Town of Labrador City and the Town of Wabush as well as the Towns of Happy Valley-Goose Bay, North West River, Sheshatshiu and surrounding areas. Newfoundland and Labrador Hydro purchases power for electrical consumers within the Labrador Interconnected System (LIS) at a cost of approximately one quarter cent a kilowatt hour (Hyron Regional Economic Development Corporation 2008).

The electrical distribution system that serves western Labrador is a combination of the electrical distribution system formerly serving the Town of Wabush which was designed and built by

Wabush Mines, together with the electrical distribution system for Labrador City which was designed, planned and constructed by the Iron Ore Company of Canada. Wabush Mines fully financed and constructed a state-of-the-art, stand-alone system for the towns of Labrador City and Wabush in the 1960's. For one dollar, Newfoundland and Labrador Hydro took control of the electrical system serving the Town of Wabush. In addition, Wabush Mines paid approximately $3 million to Newfoundland and Labrador Hydro to provide for the cost of upgrading this system. The Iron Ore Company of Canada made an almost identical deal in 1992 with the system they constructed, putting NLH in possession of two systems along with millions of dollars for maintenance with the understanding that upgrading the current network would be fairly modest. A tax in the range of one cent per kilowatt hour calculated on all electrical production in the province, whether exported or not, would realize approximately $400 million on an annual basis without unduly burdening the electrical consumer (Hyron Regional Economic Development Corporation 2008).

Western Labrador is at its peak in terms of electrical consumption and with recent interruptions in electricity it's evident the capacity is being exceeded with the current electrical infrastructure (Hyron Regional Economic Development Corporation 2008).

Nalcor Energy is continuing its $20 million, multi-year capital project to upgrade the distribution system in Labrador City to meet load growth in the area. The project includes the construction of two new terminal stations and the conversion of the existing distribution system to a higher voltage to enable more electrical load. The system upgrade process began in 2009 and is expected to be complete in 2013 (Nalcor 2012).

Solid Waste

For decades, garbage in Labrador City and Wabush was processed by an incinerator, but this practice ended on May 30th, 2010 when the incinerator permanently ceased operations (CBC News 2010). On June 1, 2010, a temporary landfill site began accepting domestic and commercial waste. The temporary site is not yet fully operational as it does not accept construction and demolition waste, white goods or scrap metal. These types of waste are temporarily being accepted at the old incinerator site. Contracts to build new landfill infrastructure have been awarded and upgrades are expected to be completed during the 2012 construction season. The new landfill should be complete and the old incinerator site should be closed in late 2012. Once the new landfill site is fully operational it should have a life span of 10 to 15 years. However, with further cell development, it would have the capacity to accept waste beyond that time period (Reccord 2012, pers. comm.).

24.5.8.2 Fermont

The Town of Fermont was established in 1974 to accommodate the workers of the Mont-Wright iron mine established by the Québec Cartier Mining Company. The Town, which has an area of 470.7 km^2, is located in the MRC de Caniapiscau in northeastern Québec, within the Côte-Nord Administrative Region of the Province of Québec.

Fermont serves as the seat of the MRC de Caniapiscau. The Mayor of Fermont holds the role of Prefect of the Council of the MRC of Caniapiscau and is joined by two other representatives.

Responsibilities of the MRC include territorial planning, realty assessment for property taxes, waste management, emergency planning, local economic development and employment assistance, tourism, and representation of local interests at regional meetings (CLD de la MRC de Caniapiscau 2012b).

The territory of the MRC also includes the Town of Schefferville, located 200 km north of Fermont. Prior to its decommissioning in 1985, the Town of Gagnon was also included within the MRC. Also present on the territory are two First Nations communities: Matimekush-Lac John and the Naskapi First Nation of Kawawachikamach. The Matimekush and Lac John reserves are located adjacent to Schefferville while Kawawachikamach is located 15 km north of Schefferville.

Water

The Town of Fermont draws its water from Perchard Lake (CLD de la MRC de Caniapiscau 2012b). Municipal records for 2011 show the volume of water being drawn from the lake as varying between 66,391 m^3 in July to 91,538 m^3 in January (MDDEPQ 2011). The average consumption rate for potable water among Fermont residents is 1,000 liters/person/day, which is considerably higher than the Québec average of 300 to 450 l/person/day (Archambault 2010).

Concerns about meeting water demand prompted the municipal government to undertake studies of groundwater resources to be exploited in the future, however none were discovered (Pelletier 2011). In order to better meet demand, Council has identified a need for a new water filtration plant. The projected cost of the improvements would be $15 million (Pelletier 2011). Plans for the plant have yet to be approved.

Sewer

Fermont is outfitted with a sewer system, two pumping stations and a wastewater treatment plant. In the mid-2000s elevated levels of cyanobacteria in Carheil Lake led to up-grades to the wastewater treatment system including the construction of a new wastewater treatment plant and replacement of an existing pumping station (Beaulieu 2007). The current system is equipped with three aeration basins. After 20 days the treated wastewater is clean and discharged into the river (Archambault 2010). The wastewater treatment plant was designed to handle 2,380 m^3 of wastewater per day on average, which is equivalent to the wastewater produced by a population of 2,700 people and is less than the current population. It has a maximum handling capacity of 4,069 m^3 per day (Hudon 2012, pers. comm.; Désy 2012, pers. comm.).

Power and Communications

Power is derived from hydro-electric power supplied by Hydro-Québec. Normand station provides electricity to Fermont (Hydro-Québec 2012). The station has a total capacity of 315 kV of which 34 kV is directed toward the Town of Fermont.

Rising electricity consumption and frequent black-outs since 2008 have prompted Town Council to push for improvements to the system and increase electrical supply so as not to present a constraint to development. In terms of existing unused capacity, Hydro-Québec was unable to comment at the present time (Lapierre 2012, pers. comm.). However, the company is confident it will be able to meet growing demand. The additional capacity required by large projects, including large residential projects, is assessed on a case by case basis (Lapierre 2012, pers. comm.). An emergency transmission line of 46 kV runs from Wabush to Fermont.

Solid Waste

Waste management services are managed by the Town of Fermont. The Town collects residential and commercial waste once per week by truck. It also manages the disposal of industrial, construction, and toxic wastes. Recyclable materials are collected, separated, and shipped to processing centers in the South. Non-recyclable materials are disposed of in an empty mine shaft previously exploited by ArcelorMittal (Hudon 2012, pers. comm.). In 2011, the Town collected and disposed of 16,525 m^3 of waste. Domestic waste accounted for 51 percent of the total (Hudon 2012, pers. comm.; Désy 2012, pers. comm.). Though information was not available concerning the total capacity of the mine, it is estimated to be large enough to collect waste for the next 50 to 75 years.

24.5.9 Recreational Services and Infrastructure

24.5.9.1 Western Labrador

Western Labrador is served by a variety of recreational infrastructure, including two ice arenas, a recreation centre, three private fitness clubs and a curling club (Labrador West Chamber of Commerce 2010).

The Labrador City Arena houses the Town's recreation department and hosts several community events throughout the year, including First Night Celebrations, Halloween Activities, Arena Dances and more. This facility is a one rink building with the ability to host large tournaments, games and activities and has a capacity of 1,800 people. This building has five dressing rooms, a meeting room and is also home of the Polaris Figure Skating Club and Labrador West Minor Hockey Association. The Wabush Arena is home to many activities throughout the year. This facility is host to the Wabush Figure Skating Club, Labrador West Minor Hockey, Recreation and Olympic Hockey.

The Mike Adam Recreation Complex in Wabush has a pool, gym, workout room, bowling alley, and teen centre.

An assessment of the recreation services and needs is being conducted by the Labrador City Recreation Commission and, when complete, it will provide clarity on the question of the financial sustainability of the local recreational infrastructure, as well as the issue of maintaining adequate accessibility to these opportunities for lower income families in the community (Labrador West Chamber of Commerce 2010).

24.5.9.2 Fermont

In terms of community spaces, Fermont has a youth center, gallery and public library. The public library is combined with the school library of the Polyvalente Horizon-Blanc. A new multifunctional community facility is being constructed. It will include a community hall and auditorium / event venue with a capacity of 300 (Michaud 2012, pers. comm.).

Fermont has a number of recreational and sports facilities, including:

- Two municipal parks;
- A ball field;
- A soccer field, divisible into two smaller fields;
- Two tennis courts;
- A bowling alley and billiards room;
- An indoor swimming pool;
- An arena for skating and hockey;
- A marina equipped with a large sailboat, four small sailboats, a dozen kayaks, eight pedal boats, four windsurfers, six canoes, and two zodiacs (for safety purposes only);
- A beach with supervised swim area;
- A weight room with cardio machines;
- A gymnasium, divisible into two small basketball courts (shared with the Polyvalente); and
- A rhythmic gymnastics room (shared with Polyvalente).

The majority of these were built between 1971 and 1974. While the municipal Service des Loisirs et de la Culture maintains them, most of the programming is provided by various sport and recreation associations (Michaud 2012, pers. comm.). Several of the facilities are designed to maximize use of the spaces. For instance fields and gyms can be divided into smaller playing areas to accommodate more activities. Additionally, the Town shares several facilities with the high school.

There is no overcrowding at these facilities, other than the weight room, which is at capacity and not accepting new members. To alleviate pressure, ArcelorMittal is building a new gym and weight room, which will be open to the public, at the mine (Michaud 2012, pers. comm.).

There are also a number of recreational facilities that are more regional in scale. From Fermont, residents have easy access to a network of hiking trails and campsites. Sentier Taïga is a 4 km trail starting from the beach in Fermont. Mount Daviault features three interpretive walks varying in length from 0.7 to 1.5 km. Hikers can climb to a belvedere at the summit. The mountain is also a popular site for bird watching and harvesting wild fruit (CLD de la MRC de Caniapiscau

2012b). Mountain biking trails are also being developed (Tremblay 2012, pers. comm.). Mount Daviault has a number of trails managed by the CLD de la MRC de Caniapiscau.

Another trail at Carheil Lake follows the river for one km and offers views of waterfalls. Mount Severson can be explored using seven trails, totaling 30 km, which are managed by the Town of Fermont. The mountain is a popular site for rock climbing. Hiking is also possible further afield in the Groulx Mountains.

There are two recognized campsites in the vicinity of Fermont, one at Carheil Lake and the other at Mount Severson. Outside of the area, there is camping at the site of the former Town of Gagnon and at the Refuge du prospecteur at kilometer 336 (CLD de la MRC de Caniapiscau 2012b). The new campsite will be located north of the Town site on Daviault Lake and is set to open in July 2012. It will provide 100 fully-serviced campsites, most of which have been reserved by season campers. The campground will include a pumping station as well as a boat launch.

24.5.10 Availability of Services and Infrastructure for Women

24.5.10.1 Western Labrador

Concern has been expressed about service and infrastructure requirements of women and their access to same. Most municipal services and infrastructure in western Labrador are equally available to men and women. However, there are some services and infrastructure for which the demand is highly gendered: obstetric care, childcare and shelters or emergency accommodations.

In western Labrador, family physicians typically provide obstetric care but there is some concern in the community over whether or not this is the best care model. A review of this service has been completed and while the associated report is being considered, family physicians continue to provide obstetric care. However, it is possible this will change in the near future as a consequence of the review.

Daycare is often considered a women's issue given that it is commonly the concern of women within both single-mother and dual parent / guardian households. As was mentioned in Section 24.5.5, daycare spaces are in high demand in western Labrador, despite the expansion of some existing centres and the construction of a new one with capacity for 60 children on a full-time basis. The number of children requiring care in western Labrador in the coming years is predicted to soon exceed the available supply, given a continuation of recent rates of population growth.

There is a single women's shelter in western Labrador which accepts just women and their young children who require temporary accommodation. Other support services in the area provide counseling for women in crisis. All of these services are at capacity and a need has been identified for additional emergency services and temporary accommodation in western Labrador, particularly for men and youth, since no such services currently exist.

24.5.10.2 Fermont

The services and infrastructure that are specific to women in Fermont are the same as those in western Labrador: obstetric care, childcare and emergency accommodations. Demand for health services and infrastructure has increased in recent years in Fermont due to mining-related employment. Like western Labrador, childcare spaces are limited in the community, with 160 children on wait lists. Emergency accommodations and crisis support are available only to women in Fermont; men requiring free temporary accommodations currently have no place to go.

24.5.11 Transportation Infrastructure

24.5.11.1 Western Labrador

Roads

The TLH is the primary public road in Labrador. Phase I of the TLH (Route 500) runs between western Labrador and Happy Valley-Goose Bay. This section of the TLH is a two-lane highway between Labrador City and Happy Valley-Goose Bay. It has a service level of “A” (free-flowing traffic), with a capacity to carry 1,000 vehicles per hour. Traffic counts completed in 2011 indicate that approximately 1,400 vehicles travelled this section of highway each day. This is up from approximately 200 vehicles per day in 2006 (Morrissey 2012, pers. comm.).

In western Labrador, Route 500 of the TLH connects with Québec Route 389, which runs 570 km north from Baie-Comeau to the Québec-Labrador border. The capacity of Route 500 west of Labrador City is approximately 1,700 passenger cars per hour in each direction. In 2011, the Average Annual Daily Traffic on Route 500 from western Labrador to Québec was approximately 1,600 vehicles (Morrissey 2012, pers. comm.). The majority of the road from Baie-Comeau to western Labrador is paved and upgrades to Route 389 from Baie-Comeau and Fermont are currently being explored (Hyron Regional Economic Development Corporation 2008).

The 2011-2012 provincial budget allocated $68.2 million to continue hard-surfacing of Phase I of the TLH (along with $3.5 million from the Federal Government) (Government of Newfoundland and Labrador 2011a). The widening and surfacing of Phase 1 of the TLH is behind schedule. The project was to be completed in 2011, but is now expected to be finished in 2014, and possibly as late as 2019. The project was originally estimated to cost $290 million, but as of March 2011, the province had spent $501.3 million and estimated it will cost another $428 million to complete the project (CBC News 2012a).

Upgrades to roads in Wabush, which were started in 2011, will continue throughout 2012. The Wabush Town Council has submitted an application for $10,000,000 in funding to address road work and sidewalk restoration from 2012 to 2015 (Town of Wabush, no date (a)).

With regard to the local road network, there is evidence of increased travel between Wabush, Fermont and Labrador City. Paving of additional sections of the Trans Labrador Highway is resulting in increased travel volumes to the coast and ferry crossings to the island (Labrador

West Chamber of Commerce 2010). There has also been concern about the increasing number of large trucks operating in residential areas of western Labrador (Higdon 2011a).

Airport

Labrador City and Wabush are serviced by the Wabush Airport, which is located within 5 km of each Town's centre. The airport is owned and operated by Transport Canada which provides air traffic control services including navigational landing aids, runway, apron and taxiway maintenance and fuel ground and terminal services. The airport hosts five airlines that provide regularly scheduled flights: Air Canada Express, Provincial Airlines Ltd., Pascan Aviation, Air Inuit and Air Liaison (Transport Canada 2012a). The paved runway strip is 1,948 m in length and it is capable of handling jet service. The airport also provides services to Fermont, Quebec.

In 2010, as a result of increased mining and exploration activity in the region, the Wabush Airport showed a 28 percent increase in traffic volume over the previous year, servicing just under 100,000 passengers. This was the largest single year increase in eight years. This growth is expected to continue into the foreseeable future as new workers travel in and out of the area increasing both commercial and charter traffic (Transport Canada 2011a).

Due to the rise in passenger and aircraft movements at the Wabush Airport, improvements to the airport were announced in 2011. These improvements included a $1.7 million roof restoration for the Air Terminal and Maintenance Buildings which completed by early Fall 2011. Parking upgrades to the South Airport Terminal Building were also planned. Transport Canada has hired consultants to complete a new Master Plan for Wabush Airport, which should be published in 2012. Transport Canada will use recommendations from this new master plan to decide what additional upgrades, if any, should be completed at Wabush Airport to ensure that it continues to meet the needs of western Labrador well into the future (Cayouette 2012, pers. comm.).

Between 1996 and 2000, cargo volumes were at approximately 100,000 tonnes each year. In 2004, it volumes rose to just under 400,000 tonnes but fell back to 100,000 tonnes in 2003 and 2004 (Newfoundland and Labrador Business Caucus, no date). Air cargo usage seems to be a method of last resort for moving goods in and out of Newfoundland and Labrador with the exception of small package courier business or must-move-now items for the oil and gas industry (Newfoundland and Labrador Business Caucus, no date). A study of air transportation in the Province recommended that the provincial government identify support for economic sectors that have the potential to increase cargo traffic (NLDB, no date).

Railway

IOC (Iron Ore company of Canada) operates the 420-km Québec North Shore and Labrador Railway (QNS&L), which IOC built to move iron ore to Sept-Îles. It also provides regularly scheduled, year-round, passenger service (NLDTW 2006). In 2005, Tshiuetin Rail Transportation Inc. (TRT) acquired the northern section of the QNS&L Railway line (the Menihek Subdivision), which runs between Emeril Junction, situated on the TLH, 63 km from western Labrador, and Schefferville, Québec. TRT now operates this portion of the rail line for passenger and freight rail services (Labrador West, no date).

Wabush Mines has its short own railway, the Wabush Railway, connecting the mine with the QNS&L Railway. The Bloom Lake Railway, opened by Consolidated Thompson, consists of approximately 31 km of single-track railway located in the Province of Newfoundland and Labrador. The railway connects the Bloom Lake Mill's load-out system with the existing QNS&L Railway close to Wabush Mines. Both of these railways transport iron ore and are operated by Labrador West Rail Services.

24.5.11.2 Fermont

Roads

Fermont is accessible by road, air, and rail. Provincial route 389 provides a land transportation link between Fermont and Baie-Comeau for a distance of 570 km. The road was initially built by companies involved in resource exploitation in the area (CLD de la MRC de Caniapiscau 2012b). It is made up of paved and gravel sections and some portions have been identified as being substandard and dangerous. In 2004, the Ministère du Transport du Québec (MTQ 2012) approved the Route 389 Restoration Plan, which identifies several risk areas and sections requiring upgrades, including the section linking Fermont to Fire Lake. The construction works are scheduled to take place over a period of ten years starting in 2011. Given the heavy use of this road, the Town Council has asked for the schedule to be condensed to five years (Pelletier 2011).

Airport

The closest airport to Fermont is located in Wabush, Labrador, approximately 35 km away. The services provided at Wabush Airport have been described in Section 25.5.11.

Railway

Rail service linking Sept-Îles and Schefferville stops at Emeril Junction, 90 km from Fermont (CLD de la MRC de Caniapiscau 2012c). The railway has been described in Section 25.5.11. ArcelorMittal Mines Canada also operates a railway, which is 420 km long and transports iron ore concentrate from Mont-Wright to Port-Cartier. On average, five full trains return from Mont-Wright each day. Each train carries 14,900 tonnes of concentrate in 160 cars. A round trip takes about 25 hours (ArcelorMittal Mines Canada 2012).

24.5.12 Commercial and Industrial Infrastructure

24.5.12.1 Western Labrador

There are three types of commercial designations in Labrador City: Central Business District, Commercial General, and Commercial Highway. The allowed uses in these three areas are mainly commercial and retail in nature. The Central Business District is designed to be a central town core with a mix of commercial and public uses. The Labrador City Town Council promotes the infilling of this zone with commercial uses to create a more compact downtown development (Town of Labrador City 2010).

There are two Commercial Highway designated areas: one on Circular Road and the other off of the TLH, west of Avalon Drive. To facilitate future demands, a third area for Commercial Highway development will be established off the TLH west of the intersection of the TLH and Circular Road (Town of Labrador City 2010).

There are three neighbourhood commercial zones in Labrador City which are designated Mix Development (Town of Labrador City 2010).

Labrador City is surrounded by Crown land for which mineral rights have been secured, primarily by the Iron Ore Company of Canada, and as such the release of such lands for development requires discussion with the mineral leaseholders whose interest is in not prematurely divesting leases that may contain economically feasible deposits (Labrador West Chamber of Commerce 2010).

Light industrial land in Labrador City is designated in the vicinity of Airport Road and on vacant lands to the north and south of the TLH at the intersection of Circular Road. There are quite a number of commercial uses within the light industrial area. The Labrador City Town Council encourages new commercial uses to locate in the Central Business District or in the Commercial General or Commercial Highway designated areas. The Light Industry district will be reserved for light industrial uses to make the best use of available land (Town of Labrador City 2010).

Land surrounding Wabush is not held by Crown land mineral leases but industrial land availability remains a key issue. A Request for Proposals has been issued for the addition of a 40-acre business park to potential mining service sector tenants by the Town of Wabush (Labrador West Chamber of Commerce 2010). Phase I of the Wabush Business Park is now full and there are 67 acres of land available in Phases II and III, however, the Town of Wabush's 2012 budget indicates that there have been requests for 47 acres from new businesses (Town of Wabush, no date (a)).

The Labrador West Community Needs Assessment report and the Town of Labrador City's most recent municipal plan have identified a lack of availability light industrial and commercial land to support the economic development of the local mining service sector. The report recommends that the existing Municipal Joint Planning Committee establish a timeline for the completion of required evaluation to confirm and assess priority land parcel mining value relative to its potential value for commercial and light industrial development (Labrador West Chamber of Commerce 2010). According to the municipal plan, this land must be located in an area that has good access to highways and within reasonable distance of the main core of other businesses within the Town (Town of Labrador City 2010).

24.5.12.2 Fermont

There is a limited availability of industrial land in Fermont, and Council has identified the expansion of the industrial park as a priority. A minimum of 36 new lots will be established and serviced, primarily to respond to the short-term demand from businesses supplying and servicing ArcelorMittal and Cliff Resources (Pelletier 2011). The MRC is also developing a new commercial park for Fermont (Bélanger 2012, pers. comm.).

24.5.13 Housing and Accommodations (Residential and Tourist)

24.5.13.1 Western Labrador

In Labrador City, the number of occupied dwellings increased by 3.2 percent between 1991 and 2006, from 2,695 to 2,780. In 2006, 78.8 percent of these were owned and 21.4 percent were rented. By 2011, the number of occupied private dwellings increased 2.8 percent to 2,859. The average value of a home in Labrador City in 2006 was $107,604 and the average monthly rent was $521 (Statistics Canada 2007, 2012).

Between 1991 and 2006, the number of occupied private dwellings in Wabush increased from 680 to 690 (1.5 percent). The majority (84.1 percent) was owned and 15.2 percent was rented in 2006. By 2011, the number of occupied private dwellings increased 6.2 percent to 733. The average value of a home in Wabush was $86,216 in 2006 and average monthly rent was $401 (Statistics Canada 2007, 2012).

In recent years, many new people have been drawn to western Labrador due to increased mining activity in the area and plans for expansion at the IOC's Labrador City mine. This has led to a shortage of housing and a major increase in housing prices. The price of a single family bungalow has increased more than 120 percent in the last couple of years. Canada Housing and Mortgage Corporation statistics indicate that from 2004-2008 the average price for a house in western Labrador increased from $73,300 to $181,000 (150 percent). Between 2007 and 2008 alone, the average price of housing increased by 34 percent (RNC, no date). In 2010, the average sale price across all housing types in western Labrador was approximately $250,000, with the breakdown of average costs by housing type as follows:

- New mini-homes = $200,000;
- Bungalows = $220,000 - $320,000;
- Townhomes = $180,000 - $230,000; and
- Duplexes = $175,000 - $270,000 (Cleary 2010).

Rental properties have increased their rates, as well. In 2010, renters were paying between $900 and $1,200 each month (Labrador West Chamber of Commerce 2010). There are reports that, in the spring of 2011, a bungalow was renting for $4,500 per month and homes that sold for $150,000 a few years before were selling for over $300,000 (Cleary 2010).

Adding to the need for housing is the fact that many people are choosing to remain in western Labrador once they retire. Past trends indicate that approximately 65 percent of retirees have chosen to maintain residency in western Labrador (Labrador West, no date). However, the increasing rents mean that some low-income seniors are being displaced from homes (Jancewicz 2011). Despite a large and growing aging population in western Labrador, there is currently no seniors' residence in the community (Labrador West Chamber of Commerce 2010).

Affordable and Social Housing

While western Labrador does not have a “street” homeless population, it has become apparent over the last five years that homelessness is becoming a problem in the area. There is a growing problem of hidden homelessness (individuals or families living in locations not intended for human habitation (e.g. abandoned buildings) and/or continuously moving between temporary housing arrangements) and an increasing number of people who are at risk of losing their homes (Labrador West Housing and Homelessness Coalition 2011). There are even reports of renters being evicted from their apartments once the buildings have been purchased by mining companies so that the units can be used to house mine workers (The Canadian Press 2012).

Leveraging provincial funding for low-income housing is difficult for families in western Labrador because median salaries in that area are significantly above provincial averages. In January 2012, the Newfoundland and Labrador Housing Corporation changed the income required to qualify for social housing in western Labrador from $32,500 to $65,000 to help more people access affordable units. This is double the limit for the rest of the Province. As of January 31, 2012 ten families were on a waiting list for social housing in western Labrador (CBC News 2012b).

Labrador West Housing and Homelessness Coalition received funding in July 2011 to create a position for a Housing Support Worker. The person in this position will provide men and women with assistance that includes researching available housing options, helping people access government programs and services, and mediating interactions with landlords. The position was originally intended to be a one-year term was extended for another year in March 2012 (Higdon 2012).

Affordable and social housing is obviously in great need in western Labrador. The most significant shortage of housing is in the rental apartment category, since no new units were constructed between 2005 and 2010. Private sector developers have been responding to the local housing market demand, but largely through the importing of mini-homes, not the construction of rental units. The business case for affordable rental units is difficult to create in the context of a northern, resource-based community where long-term certainty on market conditions is elusive compared to southern, diversified, urbanized communities.

According to the Labrador West Community Needs Assessment report (Labrador West Chamber of Commerce 2010), permanent population growth from direct and indirect job creation in the mining sector can be expected to bring over 900 new residents to the community by the end of 2012, creating a demand for 395 new housing units. At the time that this report was prepared, 169 units were expected to be constructed during the summer construction season of 2011 and 2012, the short-term gap between supply and demand for permanent housing in the community is in the range of 226 units (this includes both owning and rental) (Labrador West Chamber of Commerce 2010).

To help solve the housing crisis, municipal councils in Labrador City and Wabush are encouraging local real estate developers to build new homes of all sizes in an effort to make housing more affordable. In addition, some mining companies are building additional accommodations for workers and offering housing subsidies (Jancewicz 2011).

New residential construction is underway in Wabush and Labrador City. The Wabush trailer park is expanding with the addition of 30 mini-homes. Installation of these homes began in 2010 and should be complete in 2012 (Stewart 2010b). Two other subdivisions are under construction and approximately 60 homes will be completed during summer 2012 (LaFosse 2012, pers. comm.). The most recent municipal plan for the Town of Wabush indicates that there is plenty of vacant land for future residential development in Wabush (Town of Wabush, no date (b)). In Labrador City, the construction of a 90-home subdivision is about to begin and some of these homes may be ready in 2013. Construction of 18 homes at an existing subdivision is also underway and a new 104-unit apartment building should be complete in fall 2012 (Colbourne 2012, pers. comm.).

Temporary Accommodation

Labrador City has four hotel / motel, bed-and-breakfasts and inns, which offer more than 100 rooms between them, and Wabush has one hotel with 83 rooms (Newfoundland and Labrador Tourism 2012b). The newest of these is the Northern Inn and Suites in Labrador City, which has 24 rooms, and it is fully pre-booked on a year-long lease by an IOC contractor (Labrador West Chamber of Commerce 2010). Construction on an 84-room hotel is almost complete and it is expected to open for business in 2012 (Colbourne 2012, pers. comm.).

The use of short-term accommodation as housing for contract workers in western Labrador has led to a shortage of room availability for travelers, sports teams and client overflow for the local women’s shelter. There are many reports of travelers being unable to find rooms in western Labrador during the summer of 2010 (Labrador West Housing and Homelessness Coalition 2011).

IOC owns and operates the Labrador Lodge, a worker camp which was constructed to provide accommodations and logistical support for contractors and workers servicing IOC mining operations in Labrador City. In 2011, the company expanded its temporary workers camp and doubled its capacity (Vrbanic 2011b). Also, in 2011, a former Labrador City school was refurbished and turned into 80 apartments to house IOC workers. In March 2012, IOC completed the first of two apartment buildings in Labrador City, which will provide short-term accommodations to new employees relocating to western Labrador. The building has 32 two-bedroom units and 16 three-bedroom units. IOC is also completing 25 townhouses in Wabush and is planning to complete an additional 107-unit apartment building in Labrador City before the end of summer 2012 (VOCM 2012).

24.5.13.2 Fermont

Based on 2006 data, apartments and single-detached houses were the two most common dwelling types, representing 26.4 percent and 26 percent of the total housing stock respectively (Statistics Canada 2007). In a report on the environmental impact assessment for the Bloom Lake iron mine, the Ministère du Développement durable, Environnement et Parcs du Québec

(MDDEPQ) noted that current housing types do not respond to the preferences of the current population, which is for single-detached dwellings even among single people (MDDEPQ 2008). Since 1977, Fermont has featured a trailer park with space for 218 mobile homes. In 2010, the park was near capacity with only a few spaces near the entrance available (Rouleau 2010). These mobile homes are owned by private households.

The majority of housing in Fermont was constructed prior to 1986. In 2006, the number of pre-1986 dwellings was 1,120 indicating that 69.7 percent of homes were between 38 and 26 years old. In 2006, 6.1 percent of dwellings required major repairs (Statistics Canada 2007).

Housing availability is a major issue in Fermont. Mining companies, such as ArcelorMittal and Consolidated Thompson, and service organizations such as the CSSSH and the regional school board, own 90 percent of the 1,607 housing units, which they reserve for their employees (Arsenault 2012, pers. comm.). Very little free-market housing is available, making it very difficult for people not working for the major employers to find housing. For those employed in small businesses, where salaries are lower, the cost of buying and renting may be prohibitive (Rouleau 2010). The lack of market housing also creates an issue for retired employees as they are not permitted to stay in their company units once they have finished working. As a result, many relocate to other regions.

To respond to the needs of low-income households, Habitat de Fermont manages 12 affordable housing units. Only households that have lived in Fermont for at least a year and whose annual income is less than $30,000 per year are eligible for a unit. Currently, applicants face a wait time of eight to nine months. Habitat de Fermont plans to build 12 more units in the short term (Deschênes 2012, pers. comm.).

In order to respond to current demand and projected population growth, efforts are being made to renovate and expand the housing stock. The period between 2006 and 2011 saw the construction of 234 new private dwellings. In 2011, the Town Council called for the construction of 500 new houses and 150 new rental units by 2014 (Pelletier 2011). The projected construction needs were based on the expansion of the ArcelorMittal and Cliff Resources mines and the demand resulting from employment multipliers.

New construction is concentrated on the north side of the Town (Bélanger 2012, pers. comm.). Multiple land developers from across the Province of Québec are currently engaged in the projects. As of May 1st, 2012, an estimated 80 lots were still available for construction of detached bungalows (Bélanger 2012, pers. comm.).

There are several constraints to the provision of new housing. One is the speed with which the Town is able to make necessary infrastructure expansions (Bélanger 2012, pers. comm.). Another important constraint is the high cost of construction, an issue common to many isolated resource towns. The cost of housing construction is 1.5 to 2 times that in Sept-Îles and Baie-Comeau, bringing the average cost of a new dwelling to $300,000 (Pelletier 2011). Substantial financing by the mining companies and government is thus necessary. In order to service new residential development, water, waste-water and road infrastructure will need to be constructed (Pelletier 2011).

Temporary Accommodation

Short-term accommodations are available through the Hotel de Fermont, local bed and breakfasts, and workers accommodations. Habitations Boréales also offers short and long-term rooms or units.

In order to house temporary workers and Fly-in / Fly-out (FIFO) workers, Cliff Resources is building two or three new hotels with a capacity of 200-300 rooms and importing trailers to respond to immediate housing demands (Bélanger 2012, pers. comm.). The Town of Fermont and the RCM of Caniapiscau have stipulated a strong preference for permanent housing.

24.6 Assessment of Project-Related Effects

This section provides an assessment of Project-related effects, first on Municipal Services and Infrastructure and then on Housing and Infrastructure.

24.6.1 Municipal Services and Infrastructure

This section provides the assessment of the effects of the Project on Municipal Services and Infrastructure in both western Labrador and Fermont during each of the three Project phases. A review of the observed effects of previous projects is provided as a background. The potential effects of the Project are then stated, followed by a description of the management of the Project effects, and the characterization of the residual effects taking into consideration the management measures.

24.6.1.1 Construction

Potential Effects

This section provides a general review of the observed effects of mining and other construction projects on Community Services and Infrastructure to provide a background for understanding the potential effects of the Project. There is also discussion of the observed community effects of the FIFO commute work system, which is the preferred alternative for use during Project construction and the subject of discussions with western Labrador municipalities, and is being carried forward for assessment purposes, and of the potential for in-migration. Potential negative effects that are discussed include: an increase in social problems, such as alcohol and substance abuse, related to increased wages; increased housing prices brought on by Project-related population growth; increased demands on community services and infrastructure; health and safety issues associated with long shifts and commute work; and construction-related property damage. Potential positive effects on Community Services and Infrastructure are also discussed and these include: creation of improved community infrastructure, such as roads and schools; increased availability of services; and a general feeling of optimism within the community resulting from Project employment and an improved way of life.

Construction Projects and Communities

Construction activity associated with large projects can affect local communities, both positively and adversely. Positive effects include the creation of associated infrastructure such as roads and schools, improved health care and community services and a general feeling of optimism and hope among residents. Adverse effects can include increased demands on existing municipal infrastructure, health and security systems and increased crime (House 2000).

The Regional Municipality of Wood Buffalo, Alberta (particularly in Fort McMurray) is experiencing rapid construction-related growth. This growth is associated with multiple projects and cannot be directly related to a particular project. However, the data indicate that growth in the Fort McMurray area has substantially affected community health and the ability to provide adequate community services. For example, there has been a substantial increase in alcohol and substance abuse associated with the rising number of high-paying jobs and the associated influx of permanent and temporary workers.

In 2007, the Alberta Alcohol and Drug Abuse Commission reported a 25 percent increase in the number of substance abuse clients over the previous year. This was one factor that contributed to the establishment of a Drug and Alcohol Council for Safe Alberta Workplaces (Alberta Alcohol and Drug Abuse Commission 2007). Rapid growth is also placing substantial burdens on local municipalities, service agencies and individuals and their families (RMWB 2006). Housing and rental accommodation prices have risen dramatically, as have demands on the health care system.

In contrast, in Iceland, the construction of aluminum smelters and associated hydroelectric projects has brought about a number of positive changes to communities. These include increased availability of services and improved infrastructure. Residents of affected communities are also enjoying a renewed spirit and feel a sense of optimism as a result of the projects, although some people feel that the pace of life has become too fast (NYSIR Consulting Services and University of Akureyri Research Institute 2006).

Within the Labrador region, there is limited published information regarding how the construction phase of large projects such as the Voisey's Bay Mine / Mill or the TLH have affected individuals and local communities. Residents of southern Labrador reported experiencing only very limited effects on community life from the construction of Phase II of the TLH (Red Bay to Cartwright) (Russo Garrido and Stanley 2002). In terms of services and accommodation, construction created no measurable change in the number of hotels, bed and breakfasts, restaurants or stores in the region, with the exception of the establishment of a few small businesses. The few reported adverse effects were construction-related car damage as a result of loose gravel and concerns over increased dust levels (Russo Garrido and Stanley 2002).

On the Island, research into the construction of the Hibernia offshore oil production platform indicates that fears about its adverse effects on communities were never realized (Community Resource Services Ltd. 1996, 2003; Jones 1998; House 2000; Storey and Hamilton 2003). Demands on community infrastructure, increased crime, higher housing and other costs of living, or social and cultural disruptions did not occur to the extent that had been expected by some local residents (Community Resource Services Ltd. 1996; Jones 1998). Likewise, some anticipated benefits to the communities, such as improved municipal services, did not materialize (Storey and Hamilton 2003).

Construction activities in Newfoundland related to the petroleum industry have led to the development of a range of associated infrastructure, including construction and fabrication sites and infrastructure (House 2000; Community Resource Services Ltd. 2003). For example, the Bull Arm Fabrication and Construction Site was established for the Hibernia platform construction. Since that project ended, the site has been used for a number of major construction projects, including fabrication and assembly work for the Terra Nova, White Rose and Voisey's Bay projects (Community Resource Services Ltd. 2003). Another benefit that has been discussed with regard to the Hibernia platform construction project has been its effects on community well-being. Working on the project increased confidence among residents of Newfoundland and Labrador in their abilities and accomplishments (House 2000). The completion of the platform, primarily by residents of Newfoundland and Labrador, has also resulted in more Newfoundland and Labrador firms competing successfully in the oil industry internationally.

An important factor in community well-being is the scale and pace of project activity, their management and the degree to which community outcome objectives are achieved. In Fort McMurray, the cumulative effects of multiple projects meant that the capacity of some local services and infrastructure was exceeded; the insufficient resources resulted in an increase of problems (RMWB 2006).

In the Hibernia case, the communities in the area were dealing with a single project and a clear community objective had been identified, minimizing social disruption. The main management tool used to achieve this was a self-contained construction camp. In the Hibernia case, isolation of the project and insulation of the community from the project were successful to the point that quality of life indicators indicated improvements during the construction of the project (Jones 1998).

Community Effects of Fly-in / Fly-out

Large industrial projects at remote locations commonly use FIFO commute work systems during construction. This typically involves:

- A roster system in which workers spend a fixed period at the construction site followed by a fixed period away, usually in their home communities (rosters may vary widely influenced among other things by the nature of the work, the level of responsibility of the worker, and the place of residence of the employee);
- An extended workday of between 10 and 12 hours, commonly with overtime beyond this (work may often continue around the clock with day and night shifts, sometimes with a mid-roster changeover); and
- Transportation to and from the site and accommodations at the site being provided by the employer.

Work arrangement options have improved considerably as a result of:

- Improvements in transportation (availability, efficiency, safety, lower relative cost);

- Evolving corporate strategies with respect to efficiency (lean production) and cost effectiveness; and
- Expansion into increasingly remote areas, particularly in the case of the resource sector (Shrimpton and Storey 1992, 1994).

Not all commute systems follow the model described above; however, the general characteristics of the work system are comparable. Although the total number of construction workers employed under these arrangements cannot be confirmed, there is evidence that it has grown substantially over the last 25 years and more particularly in the last decade. In the Regional Municipality of Wood Buffalo, Alberta, for example, 10,500 commute workers lived in accommodations complexes associated with oil sands project construction and operations in 2006 (RMWB 2006).

The use of a camp as a means of accommodating workers in relatively remote locations has become the standard model. In an environment where labour is in short supply, valued employees are being offered more benefits, other than wages, which help balance work and family life. These include work schedules that try to accommodate worker needs, transportation benefits that allow workers greater choice in where they can live, work that offers more satisfaction, and accommodations that maximize worker satisfaction during the work period (e.g., high quality rooms, food services, communications links and recreation options).

The commute system may not be ideal for every worker and worker's family. However, construction workers must travel to where the work is. While money may still be the main driver of what people do and where they do it, place and belonging are important variables in most people's lives and in their lifestyle decision-making processes. Presumably, many choose to commute long distances to work because the alternatives are less attractive. Commute workers and their families may experience emotional problems associated with cycles of presence and absence from the home, including mood swings, sleep loss, anxiety, marital stress and difficulties associated with finances and alcohol (Shrimpton et al. 1995). The cycle of extended periods of presence and absence can challenge domestic relationships. This can have implications for the mental health of commute workers, as well as broader issues for family and community life.

The combination of commuting and long shifts also raises a number of health and safety issues. Issues of shift length, fatigue and job safety, as well as the link between fatigue and accidents, have been examined in the literature on industrial health and safety (Shrimpton et al. 1995). Coates (1991), for example, found that miners working 12 hour shifts who went home at the end of each shift had fewer complaints of sleep and emotional disorders than those who worked the same shifts on a rotational schedule at a commute mine.

Commute operations are usually associated with remote construction sites, which make it difficult for employees to get away from the job. Problems with co-workers or superiors can be stressful if the individuals are in constant contact. During long shifts and rotations, workers need quiet and privacy. While accommodation, recreation and meals are important, it is the overall social environment of the site that has the largest effect on worker satisfaction and stress management (Shrimpton et al. 1995). Employee outlook and attitudes have a major influence on the social environment of the accommodations complex and by extension an influence on labour turnover and productivity at the workplace.

Many aspects of the commute system are commonly viewed as advantageous by workers and their spouses and children (Shrimpton et al. 1995). Apart from a steady income these include separation of family life from work life, extended periods together when the worker is home, greater spousal independence (albeit this can be problematic for some), and more time to engage in recreational and subsistence activities, and in some cases to hold second jobs or run small businesses.

While wages and benefits at commute construction operations may be similar to those at conventional ones, employees often earn higher take-home pay because of the long hours and overtime. Work-site living costs are paid and can therefore add to their disposable income.

In the Voisey's Bay Mine / Mill EIS (VBNC 1997), most of the issues raised by North Coast residents about the social and economic effects associated with mining development were related to the effects on families and community. There was concern that project-related changes would aggravate existing social problems (Williamson 1996). The fears reflected the vulnerability of communities already suffering from serious social problems, as well as residents' anxiety towards a major development of a new industry. However, those raising the concerns were people who, for the most part, had little to no experience with permanent, relatively high-paid work or with the challenge of a regular pattern of absence of a spouse or parent.

Community attitudes towards change associated with large-scale development are strongly influenced by previous experience. The Isthmus of Avalon, for example, has experienced the development and closure of the Long Harbour phosphorus reduction plant, the development, closure and redevelopment of the Come by Chance refinery and the construction of the Hibernia offshore oil platform. This is a considerable amount of accumulated local knowledge of project effects. Therefore, when new development projects are proposed, such as a second oil refinery, nickel processing plant for Voisey's Bay concentrate and an LNG terminal, they have been less likely to generate the unrealistic fears and expectations that tend to be seen in communities that have never experienced such developments (Fuchs and Cake 1986).

In-migration of Construction Workers

A number of factors influence whether construction workers commute to a project site from their communities or relocate to a community closer to the site (in-migration). They include:

- The role of organized labour. It is common for work on large projects to be carried out by unionized construction workers, but relatively few such workers may be found in the area around this construction site. In making the decision to relocate, workers will assess the merits of the job, the implications of the commute, the alternatives to relocation, other employment alternatives and other similar factors. In a market situation in which labour is in short supply, workers can make greater demands on employees. As such, preferences for commute work can be expressed and relocation to an area near the construction site may not be the only option.

- The length of the individual work contract. Some jobs (e.g., catering personnel) will be required throughout the life of a project. Others may be of shorter duration (e.g., concrete finishers) or may involve more sporadic employment (e.g., carpenters). Short and sporadic employment opportunities discourage relocation.
- Competition for workers and incentives to obtain and retain labour. In tight labour markets especially, project proponents and their contractors may have to offer incentives to make theirs a project of choice for workers. Wage levels are a key factor, but other types of incentive are becoming increasingly important. These include transportation and work schedule arrangements, which draw workers from a wider geographic area but allow them to stay in their home communities and commute. For many the social and economic costs of commuting may be perceived to be less than the costs of relocating.
- Government and local community policies and objectives. When the objective is to minimize the boom-bust cycle that is frequently associated with large construction projects, one strategy is to discourage worker and family relocation. This reduces investment in community services and infrastructure that may not be required. On the other hand, if long-term construction provides a long term basis for sustainable development, planning for and investment in new services and infrastructure may occur. Managing this growth will require the identification of community objectives, a realistic appraisal of the costs and benefits of alternative actions and determination of responsibilities for those actions. These in turn will require good communication among all key stakeholders.
- Cost of living. Workers evaluate availability and cost of housing and accommodation in a prospective new residential location with costs in their current community of residence. For workers with homes elsewhere, any decision to move can be influenced by the length and certainty of the prospective period of employment, the costs of relocation and home purchase or rental, and day-to-day living costs. Those who are not homeowners may have more flexibility in making this decision but are influenced by company policy on paid travel.
- Personal preferences of workers. Factors influencing worker preferences include a broad range of considerations, for example:
    - Construction work culture. Construction workers are used to moving from job to job without relocating their households each time. In the Hibernia construction project, for example, employment at the Bull Arm site peaked at 5,779, yet few workers chose to relocate and live in the area (Storey 1995);
    - Demographic considerations. These may include the marital status of the worker and the stage in the family life cycle of the worker (e.g., no children, infant children, school-aged children), each of which will play a part in any relocation decision. Single workers have the most flexibility and could choose to relocate to a new community near the construction site, but at the same time, they could choose to relocate to other, larger centres if travel costs are not a budget burden;

- Family members' needs and preferences. Workers with families need to consider such factors as spousal occupation or employment opportunities, education of children and, generally, the family's attachment to community and kin. If the worker is frequently away, family and community may be seen as an important support mechanism, one which would be given up by relocation; and
- Personal issues. Some workers dislike flying, others find long travel times tiring and debilitating; for some these may be factors that encourage relocation. Others may view a construction job simply as an opportunity to earn high wages for a period with long term goals in mind. These could include retirement, the opportunity to pay off debt or savings to pursue an alternative career. Depending on the goals in question and other cost factors, these could either encourage or discourage relocation.

Individual worker decisions are complex and consequently difficult to predict with any accuracy. Evidence from other projects can give some insight to what might happen with this Project; however, the dynamic nature of the current labour market could create changes before the start of Project construction, which could affect worker location and relocation decisions.

Experience suggests that construction workers do not relocate where the potential employment period is finite and short-term. In the recent Canadian labour market environment, where demand has been high and the supply limited, high wages and other incentives will give workers greater choice and flexibility about where they will choose to live.

Such choices were evident in the need for Voisey's Bay Nickel Company (VBNC) to modify its transportation policies and pay for workers travelling from outside Labrador to its mine and mill operation. In addition, the decision to construct an accommodations complex at the Duck Pond mine in central Newfoundland was based on workers' preferences to commute rather than relocate to the area (Aur Resources 2006). The proposal by VBNC to establish an accommodations complex for the construction of its Long Harbour smelter and refinery is based on the belief that this will be necessary to attract sufficient skilled labour to the project (VBNC 2007).

For Labrador City and Wabush, both traditional residential mine towns, commute work has not been part of their history; people work and live in the community. Recently, however, the boom in the iron ore industry has affected small businesses in the area such as restaurants and specialty stores, which are suffering from an employee shortage. Labour is in short supply because workers already have a job somewhere else, having been employed by the mines. Attracting additional workers has proved difficult in the short term because of the lack of housing in the region for those returning or moving to the town to work. While these infrastructure issues were being addressed, workers may have been reluctant to accept positions at the mine or in supporting industry sectors.

This has not been the case in Newfoundland and Labrador; however, changes in the labour market may require the use of temporary immigrants. Such immigrants live outside Canada, but have permission to work here temporarily. There is a long history of overseas workers coming to other parts of Canada for seasonal and temporary work, particularly in the agriculture, tourism and health sectors. In the past 20 years, foreign workers in the construction industry have been limited; however, the number of temporary permits granted in recent years has increased substantially. In Alberta, for example, 22,392 temporary workers were admitted in 2006, more than double the number in 2003 and more than three times the number in 1997 (Alberta Federation of Labour 2007). Given anticipated national demand for workers in the future, the number of permits granted is expected to continue to increase and all provinces and territories are expected to try to meet their skilled labour needs by attracting temporary immigrant workers.

Effects Management / Mitigation

The Project accommodations strategy will mitigate adverse construction worker/resident interactions, workforce demands on municipal services and infrastructure, and housing price inflation, while the use of FIFO will minimize Project-related construction-phase in-migration to western Labrador. Measures being considered as part of the accommodations strategy include the use of temporary accommodations and the development of new housing in western Labrador. By expanding the local housing stock, such new housing would both benefit the Project and provide a legacy for Wabush and Labrador City. Alderon is in the process of finalizing MOUs with the Town of Labrador City and the Town of Wabush to further develop and implement the Project accommodations strategy.

However, the number of construction workers and families who do choose to relocate to western Labrador cannot be predicted with certainty and thus, the emphasis is on effects management. Other strategies that Alderon will adopt to minimize effects on Community Services and Infrastructure during construction include:

- Constructing an access road to the Project site to minimize Project-related traffic on the TLH and on roads, such as Grenfell Drive, within the nearby communities;
- Supplying water during construction through groundwater wells. A fire suppression water supply will be also come from Long Lake and a diesel emergency pump will be provided at the Long Lake pumphouse to supply water in case of a power failure;
- Working with Nalcor Energy to meet the Project power demand and not place additional pressure on existing supply;
- Bussing workers between their accommodations and the Project site;
- Providing a first-aid office at the construction site, with a nurse, an emergency response team and emergency vehicles; and
- Providing construction workers with pre-employment physicals and an induction orientation addressing health, safety, environment and human resources policies and practices.

At the workplace, advice and mentoring will be provided with respect to money management, alcohol and substance abuse, family adaptation and coping mechanisms and other similar issues that result from working on a project of this type and scale. These approaches will help to reduce effects that might otherwise manifest into increased demands on policing, health and other social services.

Managing and provision of many infrastructure and service elements is the responsibility of a wide range of government departments and private sector organizations. Alderon will consult regularly with the relevant agencies and organizations to provide Project information, and to identify and discuss potential Project-related implications for local services and infrastructure. This will include continued collaboration with the Labrador West Regional Task Force, a community development group comprised of representatives of local mining companies, municipalities and the provincial government, and with the Labrador West Community Advisory Panel. The Community Advisory Panel is a community-led social development group comprised of representatives of mining companies, municipalities, the Newfoundland and Labrador Government, the Innu Nation, local interest groups, education institutions, environmental organization, and organizations involved in health care, social services and community well-being. Alderon will also support and participate in joint initiatives to monitor the effects of mining project on municipalities.

As part of its ongoing monitoring for management strategy, Alderon will continue to evaluate potential Project-related implications of the use of local, regional and provincial services and infrastructure. This will include direct Project requirements as well as indirect and induced increases in use of and demand for services and infrastructure by Project workers and their families.

Characterization of Residual Project Effects

This section assesses the residual Project construction phase effects on Municipal Services and Infrastructure in western Labrador and the Fermont. Due to their proximity and infrastructure, Labrador City and Wabush will be the primary hub for the Project, through which non-local labour will arrive and depart, and materials and equipment will be shipped. As a result, most of the Project effects on services and infrastructure are expected to occur there. These include the effects of:

- The movement of personnel and some material and equipment through the Wabush Airport;
- The movement of personnel, materials and equipment by road through western Labrador;
- Increased demands on services and infrastructure by commute workers living in accommodations in western Labrador; and
- Increased demands on services and infrastructure arising from Project-related in-migration.

The construction phase will, at peak, directly employ over 800 workers. However, as has been described above, experience indicates that construction workers do not relocate when the potential employment period is finite and short-term, preferring to work on a FIFO basis and leave their spouses and children in their home community. In addition, in a labour market situation where the supply is limited, high wages and other incentives will give workers greater choice and flexibility about where they will choose to live, such that many workers will likely choose to commute rather than relocate. This is reflected in the large number of construction workers who currently commute on a regular basis from Newfoundland and Labrador to Alberta.

The rest of this section assesses the residual Project construction phase effects on Municipal Services and Infrastructure in western Labrador and the Fermont for each of the measurable parameters.

Health Care Facility and Services Capacity

Western Labrador

A number of investments have been recently made to improve the delivery of health care services in western Labrador, including the purchase of new equipment and the construction of a new hospital, which should be complete in 2013. The western Labrador needs assessment report indicates that local infrastructure has been increasingly able to deal with the bulk of the population's health care needs, particularly as a result of these recent investments. However, there are indications that the region could support one or two additional general practitioners, and this need may become more urgent should the population increase. There are also issues regarding the lack of a seniors' complex and the uncertain future of obstetrical services in the area (Labrador West Chamber of Commerce 2010).

While the construction phase will require a peak of over 800 workers, they will place little pressure on primary health care or emergency services beyond that which can be provided by the current system capacities. Construction workers are generally in the prime of life, relatively fit, and unaccompanied by family members. For workers from outside western Labrador, pre-employment physicals will take place in the worker's home community to reduce any increased demand in western Labrador for health services. Most of the construction workers' health problems should be able to be handled by the on-site medical staff. In the case of an emergency that cannot be treated at site, workers will be transported to the hospital in western Labrador.

Primary health care services, in particular community clinics and hospital emergency room (minor emergency) drop-in services, can be expected to experience some effects from any increase in the local population. However, Alderon's Safety, Health and Environmental Emergency Response Plan will include policies and procedures that will reduce the likelihood of accidents to as low a level as is reasonably practical. They will also include an emergency response protocol that will involve the emergency health services in western Labrador; however, such events will be rare and easily accommodated. Safety orientations will be mandatory and provided for all new employees and site visitors.

The healthcare and other needs of construction workers will be a consideration of the Project accommodations strategy. Alderon will also work with Labrador-Grenfell Health and the health care facilities in western Labrador to help them determine the need for additional primary health care resources, such as doctors and nurses.

Fermont

Since 2009, the demand for medical services in Fermont has been increasing due to the influx of workers associated with other mining projects in the area. The number of patients from Labrador who are using the Fermont clinic has increased 447 percent over the past few years (Pelletier 2011). However, during the construction phase most workers' medical needs should be able to be taken care of at the onsite medical office or in western Labrador. This, in combination with the use of Alderon's Safety, Health and Environmental Emergency Response Plan and liaison with Fermont's health authority, will minimize the effects of the Project on health services in Fermont.

School and Training Facility and Services Capacity

Western Labrador

The use of FIFO during construction will minimize in-migration of workers and their families to western Labrador. As a result, it is not likely that many additional children requiring education services will move to the area during the construction phase. The small number of families who do relocate with children may require the use of childcare and education services in western Labrador. It is not certain how many families with school-aged children will be moving into the region but additional teachers may be required to maintain the current student-to-teacher ratios, depending on the number and age distribution of incoming children.

The number of daycare spaces in western Labrador has increased in recent months with the expansion of existing child care centres and the construction of a new centre. However, it is expected that even more spaces will be required to accommodate the natural population growth of the area and the increase in dual-income families. It is not likely that child care availability will be affected by construction phase employment since most workers will not be bringing families into the community.

According to the Labrador West Community Needs Assessment, the four primary, elementary and high schools in the region have the classroom and staffing capacity to handle current and projected student populations. The physical capacity for these schools is more than 2,400 students and the total enrolment in the area in 2011-12 was approximately 1,500 indicating there is space for approximately 900 more students. Also, as indicated in Section 24.5.5, the total student enrolment in western Labrador has been decreasing since 2007 and the number of teachers has been increasing. In fact, family sizes in western Labrador are generally declining, as they are throughout the province and Canada (Labrador West Chamber of Commerce 2010).

Monitoring and planning for enrolment changes is part of the mandate of the Labrador School Board. Alderon will work with the Board to provide Project information to facilitate this planning process and will participate in programs (if available) promoting the completion of a Grade 12 education. Where increases in the number of students results in new thresholds such that it becomes feasible to offer new courses or programs, then such increases could be beneficial to the students.

Post-secondary education in western Labrador is provided primarily by CNA. Enrolment in programs related to mining operations may increase during Project construction. As indicated in Section 24.5.5.1, however, the program capacity at CNA has surpassed actual enrolment for the last several years. In fall 2011, CNA programs were able to accommodate 224 students but had a total enrolment of 124 students. In particular, the mining technician programs, which will provide training to potential Project workers, had a combined capacity of 60 students and a total enrolment of 27 students, indicating there is space in these programs for additional students.

Alderon has met with CNA representatives to discuss requirements for Project-related training and to inform them about potential Project demands on training facilities in western Labrador. The CNA has the ability to customize courses related to Project needs and Alderon will meet regularly with CNA representatives to discuss this possibility prior to the start of construction.

<u>Fermont</u>

The elementary and high schools in Fermont are currently under capacity and have room for approximately 80 and 90 students, respectively. Daycare services in Fermont, on the other hand, are seriously over-capacity with wait times of up to three years (Corbeil 2011). However, it is not likely that any workers employed during the Project’s construction phase will choose to live in Fermont. Therefore, the Town should not experience any effects on school and training facility and services capacity as a result of construction-phase activities or employment.

Police Officer / Population Ratio

<u>Western Labrador</u>

In 2011, the police officer-to-population ratio in western Labrador was 222 per 100,000. This ratio was greater than those in the RNC’s other jurisdictions, suggesting that the region has ample capacity to police the population (RNC 2011).

Policing services can be affected by increases in population and disposable income. Demands on local policing and other social service providers may increase if money is spent on alcohol, drugs, gambling or prostitution, or if it increases income differentials among community residents. Experience with other projects indicates that there will be some potential for increased demand. However, as mentioned in Section 24.5.6, the work forces of other mining projects in the area do not appear to have put additional demands on the police resources in western Labrador. Also, despite some problems recruiting officers in recent years due to shortage of housing in the area, the western Labrador RNC detachment has the highest officer to population ratio in the Province.

RNC monitoring of criminal and antisocial behaviour, and the allocation of additional resources where necessary, to at least maintain the current officer-to-population ratio can help to reduce any adverse socioeconomic effects. General site security will help minimize demands on the local police system, and policing will be a consideration in the Project accommodations strategy. Alderon will liaise with police about Project activities and cooperate in arrangements that will help to reduce any potential Project-related social disruption.

Fermont

In Fermont there is currently a ratio of one police officer to 359 residents. The national ratio in 2011 was one officer to 498 residents. This indicates that there is a higher level of policing in Fermont than the national average. The police officer to population ratio will not be affected by Project construction, however, since workers will be housed in western Labrador and will not place additional demands on the Fermont police force. Mine site security and the provision of Project information to the Town of Fermont and the local police force will also minimize any effects on policing.

Municipal Administrative Capacity

Western Labrador

The Towns of Labrador City and Wabush currently have 62 and 70 staff, respectively. Labrador City also has approximately 40 volunteers (Aylward 2012, pers. comm.). Officials at both municipalities report that administrative personnel are very busy and that there are plans to hire additional employees in the near future. The effects of the construction of the Project on municipal administrative capacity in western Labrador will be limited due to the Project accommodations strategy and associated MOUs with the Towns of Labrador City and Wabush. In addition, Alderon will liaise with municipal officials about Project activities and cooperate in arrangements that will help to reduce any potential Project-related administrative requirements.

Fermont

The Town of Fermont currently employs 154 people and has no plans to hire additional staff (Arsenault 2012, pers. comm.). Project construction will not affect the municipal administrative capacity of Fermont. Since construction workers will be living in western Labrador, it is unlikely that Project construction workers will be using Fermont's municipal services.

Water / Sewer Capacity

Western Labrador

It is expected that Beverly Lake, Labrador City's primary water supply, will be able to supply enough water for the Town's current population and any future growth up to 2017. In addition, another source of water has been identified in the event that demands on the current supply increase due to greater activity in the commercial / industrial sector (Town of Labrador City 2010). The use of FIFO will serve to minimize in-migration during construction, and the Project accommodations strategy and associated MOU include provisions to ensure such that the design capacity for the system is not expected to be exceeded.

There are two sewage treatment plants in Labrador City with a combined treatment capacity for about 25,000 people. There is also a treatment plant in Wabush which has received upgrades in the last two years. Further enhancements to the sewer infrastructure in western Labrador are planned for 2012. However, the wastewater distribution system is near capacity and an increase in population would require a plant retrofit to expand storage and processing capacity and to ensure that effluent meets the allowable standards (Boland 2012, pers. comm.). Demands placed on the existing system during construction may exceed the capacity of the existing sewage system. There is time, however, for municipal authorities, in consultation with Alderon, to plan for Project-related population growth and to address any current and future issues surrounding the capacity of the wastewater distribution system. Any enhancements to water and sewer infrastructure that may be planned to accommodate Project-related demands will ultimately benefit all residents of western Labrador.

Fermont

There is concern in Fermont regarding the capacity of the water supply and its ability to meet the high demand for water by residents. The water distribution system in Fermont requires upgrades and plans for a new water filtration plant are being considered by the Town Council (Pelletier 2011). Likewise, the Town's sewer system is working beyond its capacity. However, the Project should not affect the water supply during the construction phase as most workers will live in western Labrador and will not place additional demands on the Fermont water and sewer systems. As in western Labrador, Alderon will consult with the municipality of Fermont to discuss potential demands on water and sewer as a result of Project construction and any planned upgrades will benefit of the community.

Power Capacity

Western Labrador

Alderon is working with Nalcor Energy on the construction of a new switching station and transmission line which will supply construction phase power to the Project site.

Western Labrador is at its peak and may already be exceeding the capacity of its current electrical infrastructure (Hyron Regional Economic Development Corporation 2008). However, in addition to the current plan for new infrastructure to provide electricity to the Project, Nalcor Energy is continuing its $20 million, multi-year capital project to upgrade the distribution system in western Labrador to meet load growth in the area and it is in the preliminary stages of designing one or more transmission lines between Churchill Falls, Wabush and Labrador City. Nalcor Energy is aware of the power requirements for the Alderon Project during its construction phase, as well as power requirements for other projects in western Labrador, and is considering these needs in its system upgrades and transmission line design. The Lower Churchill Hydro Generation Project could also potentially supply more power to the region. As a result, Project construction will not affect Nalcor Energy's ability to supply electricity to its customers in Labrador City and Wabush.

Fermont

Frequent black-outs in Fermont indicate that the power distribution system is working beyond its capacity (Lapierre 2012, pers. comm.). However, Project construction should not affect this system as Alderon and Nalcor Energy are working together to put the proper electrical infrastructure is in place before construction. Since Project workers will be living in western

Labrador during construction, Project staff will not be placing any additional demands on the power supply in Fermont.

Landfill Capacity

<u>Western Labrador</u>

Typically, mining companies in western Labrador manage their own solid waste at their project sites (Reccord 2012, pers. comm.). Alderon, however, will not have a landfill at the Project construction site but waste materials will be reused and recycled wherever possible. Potential sources of nonhazardous or solid wastes generated by the Labrador Project components include domestic waste (e.g., office and lunchroom wastes) and construction wastes. These wastes will be segregated as recyclable and non-recyclable, with recyclable material collected and transported to a licensed recycling facility using authorized local services in compliance with the applicable Newfoundland and Labrador regulations.

Efforts will be made to minimize the amount of waste generated by application of 4-R principals (reduce, reuse, recycle and recover) to the extent practical. With approval of the appropriate authorities, residual waste will be disposed in the temporary landfill in western Labrador. As mentioned in Section 24.5.8, the region's permanent landfill will not likely be fully operational until late 2012 but this is before the planned start of construction in late 2013 or early 2014. When the landfill becomes operational it will have a life span of approximately 15 years at current use levels. Project-related use of the landfill will reduce this life-expectancy, however, the landfill has the potential for a longer lifespan should further cell expansion be required.

In order to minimize effects on landfill capacity, an integrated Waste Management Plan will be developed and implemented throughout the Project. It will identify the types of waste materials produced by the Project, provide general direction in dealing with the handling, storage, transport, treatment and disposal of waste materials, and incorporate the basic waste management principles of reduce, reuse, recycle, recover and residual disposal. Alderon will liaise with the Towns of Labrador City and Wabush to provide Project information and to discuss potential effects on the local landfill. This will allow the Towns to make plans, which may include expanding the landfill, to minimize any Project-related effects on waste management.

<u>Fermont</u>

There will be no landfill at the Project site but Project construction waste will likely be sent to the landfill in western Labrador. Should waste from the Project be sent to the landfill in Fermont, it will decrease the capacity of the landfill but these effects will not be significant since it is estimated to have a lifespan of 50 to 75 more years. Alderon will work with the Town of Fermont to plan for any increased demand on landfill capacity during Project construction.

Recreational Facility and Services Capacity

Western Labrador

Western Labrador is generally well-served by indoor and outdoor recreation and leisure facilities, including ice rinks and fitness clubs. An assessment of the recreational needs in western Labrador is ongoing (Labrador West Chamber of Commerce 2010). The requirement for such infrastructure and services will be a consideration in the Project accommodations strategy and associated MOUs with the Towns of Labrador City and Wabush, and any potential increase in demand from population growth related to the Project and a vibrant local economy may help to facilitate the upgrade to current facilities or construction of new facilities, which would benefit the entire community.

Fermont

Fermont is well-equipped with recreational and sports facilities, including a skating arena, an indoor pool and outdoor sport fields. These sport venues are able to handle the current demand with the exception of the conditioning centre which is at capacity and no longer accepting new members (Michaud 2012, pers. comm.). An additional weight room is being built by a mining company in the area and this will be open to the public. Also, a new multi-functional community centre / event venue is being constructed.

Given that most workers will live in western Labrador, it is unlikely that the Project will have effects on the recreational facilities in Fermont during the construction phase.

Availability of Services and Infrastructure for Women

Western Labrador

The majority of municipal services and infrastructure in western Labrador are equally available to and accessed by men and women. There are some exceptions, however: obstetrical care, childcare and shelters and associated counseling. The first of these services is available to women only due to the nature of obstetrical care. In western Labrador, family physicians typically provide care to expectant mothers but there is some concern in the community over whether or not this is the best model of care. A review of this service has been completed and while the associated report is being considered, family physicians continue to provide obstetrical care. This is a short-term situation, however, so the future of obstetrical care in western Labrador is uncertain.

Daycare is discussed here because it is often effectively a women's issue. As mentioned in Section 24.5.5, daycare space is in high demand in western Labrador, despite the expansion of some existing childcare centres and the construction of a new centre with space for 60 full-time children. Based on normal population growth, the number of children requiring child care in western Labrador in the coming years is predicted to exceed the available supply.

The only shelter in western Labrador accepts just women and their young children who require temporary accommodation. No temporary shelter exists for men living in the area. Other support services in the area provide counseling for women in crisis. All of these services are at capacity and a need has been identified for additional emergency services and temporary accommodation in Western Labrador, particularly for men and youth, since no such services currently exist.

During Project construction, obstetrical and daycare services are not likely to be affected since much of the workforce will work on a FIFO basis and will not be bringing families with them. Pregnant Project workers not currently residing in western Labrador may place some additional pressure on obstetrical services. However, male Project workers who currently do not live in western Labrador will not likely be bringing wives and children with them during the construction phase and, therefore, there will be very few additional women in the community requiring maternity or daycare services.

Fermont

The services and infrastructure that are specific to women in Fermont are the same as those in western Labrador: obstetrical care, childcare and emergency accommodations. Demand for health services and infrastructure has increased in recent years in Fermont due to mining-related employment. Like western Labrador, childcare spaces are limited in the community, with 160 children on wait lists. Emergency accommodations and crisis support are available only to women in Fermont so men requiring free temporary accommodations currently have no place to go. These services and infrastructure will not be affected by Project construction activities and employment, however, since workers will be housed in western Labrador and will not rely on services and infrastructure within the Town of Fermont.

Road and Air Transportation Capacity

Western Labrador

Currently, there is some congestion on and concern about speeding vehicles on Grenfell Drive, which is the main collector street in Wabush. It appears that there has been increased traffic within Labrador City and Wabush lately and there has also been an increase in the number of large trucks operating in residential areas (Higdon 2011b). The construction of an access road to the Project will minimize Project-related traffic on local roads.

Construction workers not already resident in western Labrador will arrive by airplane through Wabush Airport on charter and regular flights and will then be transported by bus to the construction site. This will not represent a substantial increase in traffic volume and will be within the design capacity of the highway.

During construction, materials and equipment will be transported by truck to the Project site, increasing traffic in western Labrador. Approximately 5,400 truckloads of materials and equipment will have to be moved to the Project site and western Labrador during the construction phase. This amounts to approximately 13 truck trips each day. However, traffic volumes will still be well within the design capacity of that portion of the TLH (a minimum of 1,000 vehicles/hour). Continued upgrades to Route 500, both east and west of western

Labrador, will further improve the quality of the highway, while the new access road will minimize the effects on local roads.

Concerns regarding the effects of additional traffic on health and safety will be addressed by the construction of a Project access road, which will minimize Project-related traffic on community roads. Also, Alderon's Safety, Health and Environmental Emergency Response Plan will include policies and procedures that will reduce the likelihood of accidents on the road.

All non-local construction workers will arrive and leave through Wabush by air. This will measurably increase demand on services and infrastructure at the Wabush Airport. In 2010, the airport serviced just under 100,000 passengers and, in 2011, a number of upgrades were made to better accommodate the increased flow of traffic through Wabush Airport (Transport Canada 2011a). Transport Canada is completing a new Master Plan for the Airport, which should be completed by the end of May 2012. Based on this plan, additional upgrades may be undertaken which will make the airport better able to accommodate Project-related traffic (Cayouette 2012, pers. comm.).

The effect of the Project on airfares is unpredictable, since ticket prices are based on a number of factors, including the cost of fuel, season of travel and inflation. However, it is possible that increased demand for seats on flights in and out of Wabush will lead to adjustments in airfares. A recent study of air transportation in Newfoundland and Labrador acknowledges that high airfares have been a long-standing issue with respect to air travel to Newfoundland and Labrador. It notes that international fares from Newfoundland, particularly over the North Atlantic, are quite high relative to other Canadian cities and that domestic fares from Labrador are relatively higher.

The provincial government has a strategy to attract new flights and enhance the level of air services to, from and within Newfoundland and Labrador. Under this strategy, it is anticipated that airfares may decline over time as new flights are introduced and general market conditions prevail (NLDB, no date). Therefore, increased traffic at Wabush Airport as a result of the Project could benefit airport users through the addition of flights to and from Wabush and a decrease in airfares. Project-related demands on the airport could also lead to the enhancement of air cargo service to and from Labrador, which has been identified as an important growth area in the provincial air strategy.

In order to minimize any adverse effects of additional road and air traffic, Alderon will liaise with local authorities in order to provide them with the necessary information for them to plan and manage the expected traffic volumes and access issues. Alderon has met with various authorities, such as the Department of Transportation and Works and the Towns of Labrador City and Wabush and will continue to meet regularly with them throughout Project construction.

Fermont

Project-related effects on the highways surrounding Fermont during the construction phase will be minimized by the fact that almost all workers will live in western Labrador. However, most of the workers currently living in Fermont may choose to commute to the Project site each day since the Town is only approximately 25 km from Labrador City. As discussed in Section 24.5.11, the capacity of Route 500 between Fermont and western Labrador is approximately 1,700 passenger cars/hour in each direction (Morrissey 2012, pers. comm.). In 2011, Route 500 saw traffic volumes of about 1,600 vehicles/day, indicating that there is capacity to handle the additional vehicles. Route 389 between Fermont and Baie-Comeau is in poor condition in some sections and requires a number of upgrades. These have begun and should be complete in the next four to five years (Pelletier 2011).

Wabush Airport also serves Fermont, so the effects on air transportation capacity have been addressed in the previous section.

Alderon will work with transportation and municipal authorities to plan for and manage any additional demands on the road and air transportation systems in Fermont.

24.6.1.2 Operations and Maintenance

Potential Effects

The literature on the perceived social effects of mining projects has gradually expanded its concerns from issues of worker safety and occupational health to include community stability, cultural integrity and indigenous rights (Bridge 2004). Effects related to community stability would include changes to community services and infrastructure.

There is little available literature on the effects of mining projects on municipal services and infrastructure for communities similar to western Labrador in the North American context. Long-term studies on social effects of mining have been carried out for analogous communities in Australia. In Canada, studies of social effects have tended to focus on remote northern Aboriginal communities, former boom towns coping with mine closures, and the effects of FIFO operations. However, the available literature suggests several common effects which may apply generally across different geographic contexts.

Infrastructure capacity may be stressed by the increased demand related to mining. In Australia, residents of mining communities reported that mining developments had led to power shortages (Petkova et al. 2009). Community members also discussed increased traffic and more frequent accidents. Residents of the coal-producing Bowen Basin region identified maintenance and funding for roads among the community effects of mining (Brereton et al. 2008).

Investments related to mining development can result in improvements to municipal infrastructure (Brereton et al. 2008). In a study of resident perceptions on mining impact in the Muswellbrook, Australia, residents noted improvements such as road upgrades, as well as the building of new recreational facilities and upgrades to existing facilities. Residents also acknowledged mining company donations to welfare and charity organizations. Through consultation with communities, infrastructure improvements can bring benefits and facilitate other economic development, such as tourism (MMSD 2002).

Mining may also affect the availability of residents to be active in their communities. Petkova et al. (2009) note that atypical work schedules can leave mining employees with less time to participate in community organizations and other voluntary activities. As a result, community groups may lack in support due to reduced members and leaders, despite population growth. Non-mining businesses also sometimes have difficulties competing with the mining industry to attract and retain staff (Petkova et al. 2009).

The capacity of health care facilities and services may be affected by mining development. Shandro et al. 2011 found three main themes emerging from interviews with health care professionals in the mining town of Tumbler Ridge, BC:

- Mining cycles of boom and bust can result in very different demographic structures, requiring different health care facility and services capacities;
- A sudden increase of mine employees in the community can strain available health services beyond capacity; and
- Health care service providers feel overworked as they attempt to meet the demand for health services.

Health care professionals in Tumbler Ridge, BC, also reported that women's health was being adversely affected by lack of services (Shandro et al. 2011). Residents discussed increased occurrences of sexually transmitted diseases, pregnancies, and domestic abuse during mining boom times. The capacity of health care and social services was not sufficient to address these issues. Globally, women tend to receive a greater share of social costs and a lesser share of benefits related to mining operations (MMSD 2002).

Population increases may also strain community policing resources. In communities effected by coal mining, residents felt that criminal and anti-social behavior had increased (Lockie et al. 2009). Police reported that increased crime was proportional to the temporary and permanent population growth the community had experienced.

There is little available formal research on law enforcement responses to rapid population growth (Ruddell 2011). In an analysis of law enforcement response to population growth in Fort McMurray, Ruddell (2011) found that the police force did not increase at an adequate rate in response to population growth and increased occurrences of criminal offences.

In conclusion, mining projects can have a wide range of negative and positive effects on Municipal Services and Infrastructure. Negative effects relate to the additional demands on the services and infrastructure as a result of people in-migrating for operations and maintenance phase employment. Positive effects are a consequence of the effects of employment and expenditures, which can benefit the communities through the creation of increased wealth and new infrastructure.

Management of Project Effects

The Project accommodations strategy will mitigate operations and maintenance phase workforce demands on municipal services and infrastructure. Alderon is in the process of finalizing MOUs with the Town of Labrador City and the Town of Wabush to further develop and implement the Project accommodations strategy.

Managing and provision of many infrastructure and service elements is the responsibility of a wide range of government departments and private sector organizations. As during the construction phase, Alderon will also consult regularly with the relevant agencies and organizations, particularly the Labrador West Regional Task Force and the Labrador West Community Advisory Panel, to provide Project information and to identify and discuss potential Project-related implications for local services and infrastructure. Many required improvements to the services and infrastructure in question will have been made during the construction phase. Furthermore, because the operations and maintenance labour force is not required until 2015 and will gradually increase between then and 2020, there is time for the communities of western Labrador to prepare for these demands on services and infrastructure.

As part of its ongoing monitoring for management strategy, Alderon will continue to evaluate potential Project-related implications of the use of local, regional and provincial services and infrastructure. This will include both direct Project requirements and the use of and demand for services and infrastructure by Project workers and their families. Alderon will also support and participate in joint initiatives to monitor the municipal effects of mining projects, and adopt a number of other strategies, which have been discussed in Section 24.6.1, to minimize the effects of the Project during operations and maintenance.

Characterization of Residual Project Effects

The effects on Community Services and Infrastructure during operations and maintenance will relate primarily to the increased demand on services and infrastructure as a result of in-migration to the area. Due to the lack of available skilled workers in western Labrador, the majority of employees will be in-migrants, and while it is likely that some, and perhaps many, local residents will be hired for operations and maintenance, this will likely open up positions in other companies that will need to be filled by in-migrants.

In 2015, an estimated 259 workers will be required for the pre-production period. With the potential for many of these employees to bring their families, the level of initial in-migration will be influenced by the marital status and family size of employees who move to the area.

Where possible, in-migrant employees will be drawn from the provincial labour supply. In 2006, married people represented approximately 50 percent of the total provincial population in the 20 to 49 year age group. Approximately 41 percent were single (never married), while the remaining nine percent of this age group were people who were separated, divorced or widowed. There was an average of about one child at home per family in 2006 (Statistics Canada 2007). Based on these statistics, it is estimated that of the 259 direct employees required during the pre-production year, approximately 130 will be married, 106 will be single, and 23 will be separated, divorced or widowed. This means that there is a potential for the in-migrants to include 130 employee spouses. With an average of one child at home per family, it is estimated that approximately 153 children could move to the area with employees. In total, this will potentially result in an estimated 542 new residents in western Labrador as of 2015.

Operations and maintenance employment is then expected to increase to approximately 500 positions in 2017 to 2019, contributing to an estimated in-migration of approximately 1,045 new residents. Employment will peak at approximately 817 positions in 2020 with an estimated peak of approximately 1,700 new residents.

As has been discussed in the Economy, Employment and Business VEC, the Project will also result in indirect and induced employment. However, the Project economic impact analysis (SCI and Locke 2012) indicates a high level of 'leakage' of these multiplier employment effects from the Hyron region. Furthermore, the multiplier employment that does occur in western Labrador is by its nature (e.g. work in the companies providing industrial goods and services, and work in retail and personal services) likely to see increased labour force participation by existing employees, and increase utilization or productivity of the existing workforce, rather than the creation of new positions. Given this, Project multiplier effects will result in only minor additional in-migration of workers and families during the operations and maintenance phase.The remainder of this section assesses the residual Project operation and maintenance phase effects on Municipal Services and Infrastructure in western Labrador and Fermont for each of the measurable parameters, based on direct Project activity and Project-related in-migration.

Health Care Facility and Services Capacity

<u>Western Labrador</u>

As mentioned in Section 24.5.4, a new hospital is being built in western Labrador to replace the CWJ Memorial Hospital. However, with 14 acute care beds and 14 long-term care beds, the new hospital may not have the capacity to provide adequate health care to approximately 1,700 new residents during the operations and maintenance phase. Despite recent and planned improvements in health care in western Labrador, there are reports that the communities could support additional general practitioners (Labrador West Chamber of Commerce 2010). The need for more doctors in the region will likely escalate should such population growth occur.

Alderon will monitor system use and continue communications with Labrador-Grenfell Health and the health care facilities in western Labrador to determine the need for additional primary health care resources, such as doctors and nurses, so that Project-induced demands do not overwhelm the current health care system.

In addition, Alderon's Safety, Health and Environmental Emergency Response Plan will include policies and procedures that will reduce the likelihood of accidents to as low a level as is reasonably practical. They will also include an emergency response protocol that will involve the emergency health services in western Labrador. However, such events will be rare and easily accommodated. Safety orientations will be mandatory and provided for all new employees and site visitors.

<u>Fermont</u>

Section 24.5.4 indicates that more and more people from western Labrador are crossing the border to use the health facilities in Fermont. It is not clear whether these people are residents

of Labrador City and Wabush or if they are members of the FIFO workforce associated with mining projects in western Labrador. In any case, pressure on the health services and facilities in Fermont has been increasing in recent years (Pelletier 2011). Project operations and maintenance will likely add to the demands on Fermont's health care system with the expansion of the population of western Labrador by up to 1,700 people between 2015 and 2020. If the health services and facilities in Labrador City and Wabush are not able to handle this population increase, some residents and Project workers may choose to go to Fermont for care.

Alderon's Safety, Health and Environmental Emergency Response Plan will help to minimize any demands on Fermont's health care system that would result from work-related injuries. Alderon will also provide Project information to the CSSSH prior to the start of the operations and maintenance phase so that it is can prepare for an increase in demand for health care.

School and Training Facility and Services Capacity

<u>Western Labrador</u>

At the start of the operations and maintenance phase, approximately 259 workers will likely move into western Labrador, with the potential to bring with them in the order of 153 children, many of them school-aged. By 2020, it is estimated that the approximately 817 Project employees will be accompanied by approximately 482 children. Some employees may not have children when they arrive in western Labrador but may decide to start a family after they have settled into the community. Children of operations and maintenance employees will require schooling and, therefore, place increased demands on the education system of western Labrador. The four primary, elementary and high schools in the region have the classroom and staffing capacity to handle current and projected student populations.

As discussed in Section 24.5.5, these schools can handle approximately 1,000 more students than they currently enroll. Also, recent statistics indicate that the total student enrolment in western Labrador has been decreasing since 2007 and the number of teachers has been increasing. In fact, family sizes in western Labrador are generally declining, as they are throughout the province and Canada (Labrador West Chamber of Commerce 2010). Therefore, schools in western Labrador already have the capacity to accommodate all of the children of operations and maintenance workers, even at peak employment in 2020 when there could be as many as 472 additional children.

With regard to daycare, there is concern that the number of available daycare spaces will not accommodate the natural population growth of western Labrador and the increase in families with dual-incomes. This is despite the recent expansion of existing child care centres and the construction of one new centre. As a result, the Project operations and maintenance phase will have effects on the capacity of child care in the area as Project employees bring young children with them.

Alderon will work with the Labrador School Board and the provincial Department of Child, youth and Family Services throughout the Project to provide any relevant information on education needs during the operations and maintenance phase to minimize the effects on school and training facility and services capacity.

Fermont

Project operations and maintenance will not affect the capacity of education and training facilities and services since people employed by the Project during this phase will most likely choose to live in western Labrador rather than Fermont. Alderon will provide Project information to the local school board and relevant authorities prior to and during operations so that they are prepared for any additional demand on child care spaces and availability of education and training services.

Police Officer / Population Ratio

Western Labrador

Currently, crime rates in western Labrador are generally well below provincial averages (approximately 30 percent below the RNC's reported crime rate in its other jurisdictions for the 2009 fiscal year) (RNC 2011). Also, the recent mining-related increase in the local population does not appear to have placed additional demands on the region's security system (Labrador West Chamber of Commerce 2010). However, the addition of over 800 more residents and their families to the area at peak employment will likely place increased demand on RNC services in western Labrador.

Alderon will have a number of policies in place that should aid in minimizing any issues that could overwhelm the current capacity of security services. For instance, advice and mentoring will be provided to employees with respect to money management, alcohol and substance abuse, family adaptation and coping mechanisms and other similar issues that result from working on a project of this type and scale. These approaches will help to reduce effects that might otherwise manifest into increased demands on policing, health and other social services.

The RNC monitors criminal and antisocial behavior in the community, and allocates additional resources where necessary, to at least maintain the officer-to-population ratio and manage any adverse socio-economic effects of population increase. Alderon will liaise with police about Project activities and cooperate in arrangements that will help to reduce any potential Project-related problems.

Fermont

The current ratio of one police officer to 359 Fermont residents is higher than the national ratio of one officer to 498 residents, indicating that police resources in Fermont are above average. It is not likely that the police officer to population ratio will be affected by Project operations and maintenance since the workforce and their families associated with this phase will likely choose to live in western Labrador. The small number of Project workers that will choose to live in Fermont, and any workers visiting the Town for recreational purposes, will have received advice and mentoring that has been mentioned above. This should aid in minimizing any behaviours that would require intervention by police officers in Fermont. In addition, Alderon will provide Project information to the local police force so that it is prepared for additional demands and have a plan in place to allocate police resources appropriately.

Municipal Administrative Capacity

Western Labrador

During Project operations and maintenance, demands on municipal administrative capacity will increase as up to approximately 1,700 new residents, including workers and their family members, move into the area at peak Project employment. As mentioned in Section 24.5.7, the Towns of Labrador City and Wabush have plans to hire additional staff based on current demands (Aylward 2012, pers. comm.). As the population of the area grows, municipal services, such as recreation, planning and permitting and security and safety services, will be in higher demand. However, since the operations and maintenance phase is not expected to start until 2015 and peak employment will not occur until 2020, the municipalities have time to consider how to accommodate the predicted Project-related effects on municipal administrative capacity.

Fermont

As a result of Newfoundland and Labrador's benefits strategies, cultural and language barriers and the distance from the Town of Fermont to the Project site, it is not likely that operations and maintenance workers will be moving into Fermont. However, there could still be some effects on the Town's municipal administrative capacity if members of the growing population of western Labrador cross the border into Québec to make use of some of Fermont's recreation and other municipal services. Alderon will work with the Town of Fermont to provide Project information which will allow the municipality to prepare for any increase in the demand of administrative services during Project operations and maintenance.

Water / Sewer Capacity

Western Labrador

Water requirements during operations and maintenance will be extracted from Long Lake and stored in water reservoirs at the plant prior to use. A fire suppression water supply will also come from Long Lake and a diesel emergency pump will be provided at the Long Lake pumphouse to supply water in case of a power failure. Labrador City's water supply is expected to serve the current population and future growth until 2017 and a back-up water source has been identified. The in-migration of up to 1,700 additional people will place additional demands on the water system but these demands should not exceed the current system's capacity.

Sewage and wastewater generated throughout the mine and process facilities will be treated at two engineered treatment facilities located on site. The selection of the type and size of units will be made during detailed engineering and will comply with regulations. As discussed in Section 24.5.8, the wastewater distribution system is near capacity in Labrador City and the effluent is barely meeting allowable standards (Boland 2012, pers. comm.). Despite recent and planned enhancements, an engineering study would need to be completed to identify necessary upgrades to the system in the event of a significant population increase. The movement of approximately 1,700 people into the communities by 2020 will certainly place demands on the sewer systems in western Labrador, which will exceed their capacity. However, there is ample time before peak employment for Alderon to discuss Project-related demands on these systems with the Towns of Labrador City and Wabush and to plan for a potential plant retrofit.

<u>Fermont</u>

As has been noted, the main cause of additional Project-related operations and maintenance demand for services and infrastructure will be population increase, but little such increase is expected in the case of Fermont. Accordingly, little new Project-related demand for water and sewer services is expected. However, Alderon will regularly consult with the municipality of Fermont on all potential operations and maintenance phase demands for services and infrastructure.

Power Capacity

<u>Western Labrador</u>

During operations and maintenance, the Project will require 100 to 120 MW of power which will be supplied by the construction of a switching station that will be located west of Wabush Lake and North of the QNS&L rail line. A transmission line will also be constructed by Nalcor Energy from this switching station to the Project site main substation. During operations and maintenance, back-up power will be provided by four 1,200 kW diesel powered generator sets. This new infrastructure will provide all of the power required for operations and maintenance so the Project itself will not place additional demands on the system serving residents of western Labrador.

The influx of workers and families into western Labrador will place extra demands on the area's power distribution infrastructure, which is already near capacity. However, Nalcor Energy will have time, working in consultation with Alderon and other project proponents, to plan for the increased demand. In addition, Nalcor Energy is already updating western Labrador's electrical infrastructure to increase its capacity so that it can serve the area's increasing population into the future.

<u>Fermont</u>

As with water and sewer services, little new Project-related operations and maintenance phase demand for power is expected, but Alderon will regularly consult with the municipality of Fermont on all potential operations and maintenance phase demands for services and infrastructure.

Landfill Capacity

<u>Western Labrador</u>

As discussed in Section 24.5.8, Alderon will not have a landfill at the Project site. During operations and maintenance, waste materials will be reused and recycled wherever possible. Residual Project waste will be disposed of in the region's permanent landfill which is expected to be operational in late 2012 will have a lifespan of approximately 15 years. Additional residents in western Labrador during operations and maintenance will reduce the lifespan of the landfill. However, the capacity of the landfill could be increased with further cell development. An integrated Waste Management Plan will be used to minimize Project-related waste and Alderon will provide relevant information to western Labrador's municipalities so they can plan for possible expansion of the landfill.

<u>Fermont</u>

Waste produced during the Project operations and maintenance phase will not Fermont since, in the absence of an on-site landfill, it will be sent to the landfill in western Labrador. Also, as the majority of Project employees will live in Labrador City or Wabush during this phase, there is little danger of additional residential waste reducing the Fermont landfill's capacity. However, Alderon will provide the Town of Fermont with relevant Project information that will help the town plan for the future of waste management in the community.

Recreational Facility and Services Capacity

<u>Western Labrador</u>

There are a number of indoor and outdoor recreation facilities, including skating rinks, sports fields and private fitness clubs, in western Labrador and it is currently undergoing an assessment of the recreation needs of the area.

During Project operations and maintenance, the workers and their families who will move into the area will likely rely on the municipal and private recreation facilities in western Labrador for exercise and entertainment. Since most workers will choose to live in western Labrador, the effects of the increased demand will more likely be felt there, rather than in Fermont. This additional use of recreation centres will have effects on their capacity, which could prompt plans for the upgrading of existing facilities or the construction of new ones. Also, there will be time, with the operations and maintenance workforce gradually increasing to over 800 in 2020, for western Labrador to prepare for any potential demands on recreation facilities.

<u>Fermont</u>

Fermont is known to have a large number of recreation and sports facilities. Some of the types of facilities that exist in Fermont are not available in western Labrador, including a large swimming pool. Most of the sports and recreation centres in Fermont are adequate to meet the current demand but the local conditioning centre is beyond its capacity and construction of a new weight centre is being planned by a mining company for use by the Town residents (Michaud 2012, pers. comm.). Recreation services and infrastructure could be affected by Project operations and maintenance if the capacity of western Labrador's recreation facilities is exceeded by the number of new residents during this phase of the Project. Current and new residents of Labrador City and Wabush may travel to Fermont to use the recreation facilities there, placing additional pressure on them.

Alderon will communicate concerns about the effects of Project operations and maintenance-phase employment on the recreation services and facilities of Fermont to the municipality so that the town has time to plan for any increases in demand. This could benefit the residents of

Fermont if it is planning results in the upgrading of existing recreation infrastructure or the construction of new sports facilities.

Availability of Services and Infrastructure for Women

Western Labrador

Concerns over the availability of specific services and infrastructure for men and women in Western Labrador have been described in Section 24.5.10. During the operations and maintenance phase, obstetrical, daycare and emergency accommodation services and infrastructure will be affected since this phase will gradually add up to 1,700 new residents to the area over time. Female Project workers and wives of male Project workers will rely on maternal care that is provided in Western Labrador. The future of this service, as has been mentioned previously, is uncertain and currently under review. Additional pressure will also be placed on daycare facilities since many Project employees will have young children who may require childcare if both parents are working. The community may see a rise in the number of men looking for temporary or emergency accommodation as people move into the community for Project employment and competition for available and affordable housing increases.

Alderon will work with the authorities responsible for all of these services and related infrastructure, including Labrador-Grenfell Health and the Towns of Labrador City and Wabush, to minimize the effects of operations and maintenance phase employment on the existing inventory of infrastructure for men and women in the community. There is time for the relevant authorities to plan for increasing demands on obstetrical and childcare services and emergency accommodations by considering the construction of new daycare centres and emergency shelters for men and women. Additionally, Alderon will provide Project requirements to Labrador-Grenfell Health as input to its decision regarding the obstetrical model of care.

Fermont

Obstetrical care, childcare and emergency accommodations services and infrastructure, which are aimed at helping primarily women in Fermont, may be affected by Project operations and maintenance. While Project workers are unlikely to move into Fermont as a result of a number of previously discussed factors, some residents may use Fermont's services and infrastructure should those in Western Labrador reach capacity. To minimize the effects of operations and maintenance employment on existing infrastructure for men and women in Fermont, Alderon will provide Project information to relevant authorities so they can plan for potential increases in demand.

Road and Air Transportation Capacity

Western Labrador

As has been previously discussed, it is anticipated that the operations and maintenance phase labour requirements will lead to population increases. The workers may travel by buses provided by Alderon to the Project site or they may use their personal vehicle to get to the worksite each day. They and their family members will also generate new non-work traffic flows.

There is already some concern about traffic volumes in western Labrador as a result of mining activity. Driving speed on some local roads has also been an issue in Wabush, in particular. However, the creation of an access road to the Project site by Alderon will minimize the amount of Project-related traffic on the road system in western Labrador. Carpooling or company buses will further minimize the affect of Project-related traffic in western Labrador. Also, the portion of the TLH to the east and west of Labrador City and Wabush has the capacity to carry 1,000 vehicles/hour and the current traffic volume is approximately 1,400 vehicles/day, indicating that the highway can handle more traffic (Morrissey 2012, pers. comm.).

Traffic through Wabush Airport has been on the rise in recent years due to the increasing mining and exploration activity in the region (see Section 24.5.11). During operations and maintenance, Project workers will not be on rotating shifts like those of construction workers. Therefore, Project-related demands on the airport will mostly relate to the population increase, and will not be as great during the operations and maintenance phase as they will be during the construction phase.

Alderon has met with various authorities, such as the Department of Transportation and Works, the Wabush Airport and the Towns of Labrador City and Wabush, and will continue to liaise with these authorities throughout the life of the Project, to help them plan for and manage any road and air traffic volumes and access issues.

Fermont

Highway 500 between Fermont and western Labrador has the capacity to carry 1,700 passenger cars in each direction/hour and it is currently used by only approximately 1,600 vehicles each day (Morrissey 2012, pers. comm.). Therefore, it has the capacity to accommodate additional traffic. With the move from construction to operations and maintenance, Project-related road traffic will decrease significantly. There may be some use of Route 500 by residents of western Labrador who may travel to Fermont to use some of the Town’s services and infrastructure, although, the number of people who will do this is expected to be small. Therefore, the effects of Project operations and maintenance on Fermont’s road transportation capacity will be minimal.

Effects of the operations and maintenance phase on air transportation are those described above for Wabush Airport, which also serves Fermont.

24.6.1.3 Decommissioning and Reclamation

Potential Effects

Decommissioning and reclamation activity is currently scheduled to commence in 2031. The methods used will be those that are best practice at that time. As such, the scale and duration of decommissioning and reclamation activity are unknown, but likely much smaller and shorter-term than was the case during construction or operations.

Management of Project Effects

The decommissioning and reclamation phase effects management initiatives will be specific to the activity, but comparable to those used during the other Project phases.

Characterization of Residual Project Effects

While the effects of decommissioning and reclamation on Municipal Services and Infrastructure will likely be much smaller and shorter-term than was the case during construction or operations and maintenance, their actual scale and duration will only be clear closer to decommissioning.

24.6.2 Housing and Accommodations

24.6.2.1 Construction

Potential Effects

The potential effects of construction projects have been discussed in Section 24.6. It is concluded that the effects will primarily be a function of the level of in-migration to the area and the consequent increase of demand on services and infrastructure, including housing and accommodations. However, experience suggests that few construction workers relocate where the potential employment period is finite and short-term. In addition, in a labour market situation where the supply is limited, high wages and other incentives will give construction workers greater choice and flexibility about where they will choose to live, such that many workers will likely choose to commute rather than relocate. This is reflected in the large number of construction workers who currently commute on a regular basis to Alberta.

Effects Management / Mitigation

As was described for Municipal Services and Infrastructure (Section 24.6.1), the Project accommodations strategy will mitigate adverse construction worker/resident interactions, workforce demands on municipal services and infrastructure, and housing price inflation, while the use of FIFO will minimize construction-phase in-migration to western Labrador. Measures being considered as part of the accommodations strategy include the use of temporary accommodations and the development of new housing in western Labrador. By expanding the local housing stock, such new housing would both benefit the Project and provide a legacy for Wabush and Labrador City. Alderon is in the process of finalizing MOUs with the Town of Labrador City and the Town of Wabush to further develop and implement the Project accommodations strategy.

It is also likely that some of the construction workforce will come from western Labrador, but they will already have their own housing and hence create no additional demand.

Characterization of Residual Project Effects

This section assesses the residual Project construction phase effects on Housing and Accommodations in western Labrador and Fermont.

Accommodations and Building Lot Availability

Western Labrador

The peak construction workforce will be over 800 employees, some of whom will be existing residents of western Labrador. As was noted above, the Project accommodations strategy and use of FIFO will mitigate workforce demands on municipal infrastructure, including housing. Measures being considered as part of the accommodations strategy include the use of temporary accommodations and the development of new housing in western Labrador. By expanding the local housing stock, such new housing would both benefit the Project and provide a legacy for Wabush and Labrador City. Alderon is in the process of finalizing MOUs with the Town of Labrador City and the Town of Wabush to further develop and implement the Project accommodations strategy.

Fermont

The Project will not have effects on housing and building lot availability in Fermont during the construction-phase since almost all workers will reside in western Labrador.

24.6.2.2 Operations and Maintenance

Potential Effects

The availability of accommodations and building lots may be reduced as mining operations lead to population increases. In a 2008 survey of coal mining communities in Australia's Bowen Basin region, an inadequate supply of permanent accommodation in all towns led to rapid increases in rental and purchase prices (Petkova et al. 2009).

Management of Project Effects

The largest effect of the operations and maintenance phase will likely be on the local housing market since available and affordable accommodation is already scarce in western Labrador (see Section 24.5.13). The Project accommodations strategy will mitigate operations and maintenance phase workforce demands on housing and house price inflation. Measures being considered as part of the accommodations strategy include the development of new housing in western Labrador; by expanding the local housing stock, such new housing would both benefit the Project and provide a legacy for Wabush and Labrador City. Alderon is in the process of finalizing MOUs with the Town of Labrador City and the Town of Wabush to further develop and implement the Project accommodations strategy.

Municipal councils have made the development of affordable homes a priority in western Labrador and approximately 200 new homes in Labrador City and Wabush, as well as a 104-unit apartment building, will be constructed within the next year. The increased demand for residential and commercial land and the provision of additional municipal services may also generate positive effects from local employment and business income multipliers and from additional local tax revenues.

Characterization of Residual Project Effects

This section assesses the residual Project operation and maintenance phase effects on Housing and Accommodations in western Labrador and Fermont.

Accommodations and Building Lot Availability

<u>Western Labrador</u>

The effects on Housing and Accommodations during operations and maintenance will relate primarily to the increased demand as a result of in-migration to the area. Due to the lack of available skilled workers in western Labrador, the majority of operations and maintenance employees will be in-migrants, and any hired locally will likely have to be replaced by in-migrants.

As was discussed in Section 24.6.1, in 2015, an estimated 259 workers will be required for the pre-production period. With the potential for many of these employees to bring their families, the level of initial in-migration will be influenced by the marital status and family size of employees who move to the area.

Where possible, in-migrant employees will be drawn from the provincial labour supply. In 2006, married people represented approximately 50 percent of the total provincial population in the 20 to 49 year age group. Approximately 41 percent were single (never married), while the remaining nine percent of this age group were people who were separated, divorced or widowed. There was an average of about one child at home per family in 2006 (Statistics Canada 2007). Based on these statistics, it is estimated that of the 259 direct employees required during the pre-production year, approximately 130 will be married, 106 will be single, and 23 will be separated, divorced or widowed. This means that there is a potential for the in-migrants to include 130 employee spouses. With an average of one child at home per family, it is estimated that approximately 153 children could move to the area with employees. In total, this will potentially result in an estimated 542 new residents in western Labrador as of 2015.

Operations and maintenance employment is then expected to increase to approximately 500 positions in 2017 to 2019, contributing to an estimated in-migration of approximately 1,045 new residents. Employment will peak at approximately 817 positions in 2020 with an estimated peak of approximately 1,700 new residents.

As mentioned in Section 24.6.1, the Project will also result in indirect and induced employment. However, the Project economic impact analysis (SCI and Locke 2012) indicates these positions will likely be filled by the existing workforce in western Labrador. Therefore, Project multiplier effects will result in only minor additional in-migration of workers and families during the operations and maintenance phase and will not significantly affect housing availability.

As has been described in Section 24.5.13, the current stock of housing in western Labrador is stretched beyond its capacity. The mining boom in the area has drawn many people to Labrador City and Wabush in recent years. Many existing residents are also choosing to remain in western Labrador after retirement. A very limited housing supply coupled with an increasing population has produced a steep increase in housing prices and rents and many residents are unable to find affordable housing. This, in combination with the lack of a seniors' home, limited hotel room availability, and shelters that are at capacity, has produced a housing crisis in western Labrador.

Project-related in-migration will further exacerbate this housing problem during the operations and maintenance phase. Local residents working on the Project may also place additional demands on the local housing market through the purchase of new and existing homes. However, given the Project accommodations strategy and associated municipal MOUs, and provided the appropriate municipal planning mechanisms are in place, these demands can be addressed in a timely manner. The fact that Project operations and maintenance will not start until 2015, and peak employment will not occur until 2020, will assist western Labrador and Fermont in preparing for this growth. Furthermore, some positive effects will be generated from local employment and business income multipliers and from additional local tax revenues generated.

Municipal councils in Labrador City and Wabush are already encouraging local developers to build new homes of all sizes in an effort to make housing more affordable. New parcels of land have been approved for housing developments in Labrador City and Wabush (Vrbanic 2011b). In recent years, other mining companies have been expanding workers' camps and creating apartment units to accommodate new employees in order to alleviate the pressure on the western Labrador housing market (Jancewicz 2011).

Project operation and maintenance is certain to generate increased demand for local hotels, inns and other types of temporary accommodations, which are already beyond their capacity, to satisfy the needs of visiting contractors, regulators and others. Alderon will work with the municipalities and members of western Labrador's business community to discuss and plan for the effects of operations and maintenance phase employment on temporary accommodations. Planning could result in the construction of new hotels, which will be a benefit to the residents of and visitors to western Labrador.

Fermont

Given provincial benefits initiatives, combined with cultural and language differences and the greater relative distance from the Project mine site, the likelihood that individuals and any family members will move to Fermont to take up Project operations and maintenance phase employment is very low. However, Alderon will liaise with the Town of Fermont to provide Project information, which will help the town prepare for possible increased demand on housing and accommodations in the area.

24.6.2.3 Decommissioning and Reclamation

Potential Effects

Decommissioning and reclamation activity is currently scheduled to commence in 2033. The methods used will be those that are best practice at that time. As such, the scale and duration of decommissioning and reclamation activity are unknown, but likely much smaller and shorter-term than was the case during construction or operations.

Management of Project Effects

The decommissioning and reclamation phase effects management initiatives will be specific to the activity, but comparable to those used during the other Project phases.

Characterization of Residual Project Effects

While the effects of decommissioning and reclamation on Housing and Accommodations will likely be much smaller and shorter-term than was the case during construction or operations, their actual scale and duration will only be clear closer to decommissioning.

24.6.3 Summary of Project Residual Effects

A summary of the environmental effects assessment and prediction of residual environmental effects resulting from interactions ranked as 2 on Community Services and Infrastructure is provided in Table 24.13. Only the interactions ranked as 2 were considered further in the assessment of Project-related environmental effects. All other interactions previously ranked as 0 or 1 were rated as not significant.

Table 24.13 Summary of Project Residual Effects: Community Services and Infrastructure

Project Phase	Mitigation / Management Measures	Residual Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	
Municipal Services and Infrastructure (Western Labrador)											
Construction	• Accommodation strategy. • Work with the Labrador West Regional Task Force and the Labrador West Community Advisory Panel. • On-site medical services. • Transportation arrangements. • Construction of access road to site. • Supply water during construction with wells. • Work with Nalcor Energy to ensure Alderon's power demand will not place additional pressure on existing power supply. • Human resource policies and practices. • Liaison with agencies.	A	L	WL	MT	C	N/A	N/A	N	H	Alderon will liaise with local authorities and provide updates on Project activities and plans on a regular basis.
Operation and Maintenance		A	M	WL	LT	C	N/A	N/A	N	M	
Decommissioning and Reclamation		A	L	WL	MT	C	N/A	N/A	N	H	

Project Phase	Mitigation / Management Measures	Residual Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	
Municipal Services and Infrastructure (Fermont)											
Construction	• Accommodation strategy. • On-site medical services. • Human resource policies and practices. • Supply water during construction with wells. • Liaison with agencies.	A	L	F	MT	C	N/A	N/A	N	H	Alderon will liaise with local authorities and provide updates on Project activities and plans on a regular basis.
Operation and Maintenance		A	L	F	LT	C	N/A	N/A	N	H	
Decommissioning and Reclamation		A	L	F	MT	C	N/A	N/A	N	H	
Housing and Accommodations (Western Labrador)											
Construction	• Accommodation strategy. • Transportation arrangements. • Human resource policies and practices. • Liaison with agencies. • Work with the Labrador West Regional Task Force and the Labrador west Community Advisory Panel.	A	M	WL	MT	C	N/A	N/A	N	H	Alderon will liaise with local authorities and provide updates on Project activities and plans on a regular basis.
Operation and Maintenance		A	M	WL	LT	C	N/A	N/A	N	M	
Decommissioning and Reclamation		A	L	WL	MT	C	N/A	N/A	N	H	

Project Phase	Mitigation / Management Measures	Residual Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	
Housing and Accommodations (Fermont)											
Construction	• Accommodation strategy. • Transportation arrangements. • Human resource policies and practices. • Liaison with agencies.	A	L	F	MT	C	N/A	N/A	N	H	Alderon will liaise with local authorities and provide updates on Project activities and plans on a regular basis.
Operation and Maintenance		A	L	F	LT	C	N/A	N/A	N	H	
Decommissioning and Reclamation		A	L	F	MT	C	N/A	N/A	N	H	

KEY

Direction:
P Positive.
A Adverse.

Magnitude:
L Low: A change experienced by less than 5% of households.
M Moderate: A change experienced by 5% to 33% of households.
H High: A change experienced by more than 33% of households.

Geographic Extent:
WL Western Labrador.
L Labrador.
F Fermont.

Duration:
ST Short-term.
MT Medium-term.
LT Long-term.
P Permanent - will not change back to original condition.

Frequency:
O Occasionally, once per month or less.
S Occurs sporadically at irregular intervals.
R Occurs on a regular basis and at regular intervals
C Continuous.

Reversibility:
R Reversible.
I Irreversible.
N/A Not Applicable.

Environmental or Socio-economic Context:
U Undisturbed: Area relatively or not adversely affected by human activity.
D Developed: Area has been substantially previously disturbed by human development or human development is still present.
N/A Not Applicable.

Significance:
S Significant.
N Not Significant.

Prediction Confidence:
Based on scientific information and statistical analysis, and effectiveness of mitigation or effects management measure
L Low level of confidence.
M Moderate level of confidence.
H High level of confidence.

24.7 Assessment of Cumulative Effects

Subsequent to the assessment of Project environmental effects discussed previously, an assessment was conducted of the potential cumulative effects of the Project in combination with those of other past, present, and future projects and activities. Potential cumulative effects on Community Services and Infrastructure relate to Changes in Municipal Services and Infrastructure and Changes in Housing and Accommodation as a result of Project activities in combination with those of other projects and activities in the RSA. A summary of the results of the cumulative effects assessment is provided in Table 24.14.

The environmental effects of past and present projects and activities on Community Services and Infrastructure in the RSA are reflected in the characterization of baseline conditions. The RSA consists of the Towns of Labrador City and Wabush in western Labrador and Fermont in eastern Quebec. The Town of Labrador City is responsible for a variety of municipal services, including maintenance, construction and operation of streets and sidewalks, including snow and ice removal, integrated solid waste management, potable water treatment and distribution, sanitary sewer collection and distribution, storm water management and control, and fly control and lawn sweeping. The Town of Wabush provides full water and sewage service, a volunteer fire brigade, garbage collection, street lighting, snow clearing, neighbourhood playgrounds, and community recreation facilities. Private developers are responsible for servicing future expansions to the municipal infrastructure of western Labrador, such as roads, sidewalks and municipal piped systems for newly designated areas for future development. The Town of Fermont, Quebec is located in the MRC (Municipalité Régionale de Comté) de Caniapiscau in northeastern Québec, within the Côte-Nord Administrative Region of the Province of Québec. Municipal services include water, sewer, waste, power, and communications.

In recent years, many new people have been drawn to western Labrador due to increased mining activity in the area and plans for expansion at the IOC's Labrador City mine. This has led to a shortage of housing and a major increase in housing prices and rental rates. Labrador City has four hotels / motels, bed-and-breakfasts and inns, which offer more than 100 rooms between them, and Wabush has one hotel with 83 rooms. Construction on an 84-room hotel is almost complete and it is expected to open for business in 2012. The use of short-term accommodation as housing for contract workers in western Labrador has led to a shortage of room availability for travelers, sports teams, and client overflow for the local women's shelter.

Housing availability is also a major issue in Fermont, Quebec. Mining companies, such as ArcelorMittal and Consolidated Thompson, and service organizations such as the CSSSH and the regional school board, own 90 percent of the 1,607 housing units, which they reserve for their employees. Very little free-market housing is available, making it very difficult for people not working for the major employers to find housing. Short-term accommodations are available through the Hotel de Fermont, local bed and breakfasts, and workers accommodations. Habitations Boréales also offers short and long-term rooms or units.

Table 24.14 Potential Cumulative Effects to Community Services and Infrastructure

VEC Existing Condition (Past & On-Going Activities)	Key existing community services and infrastructure constraints: • Limited availability of accommodations and building lots. • High housing prices and rents. • Shortage of daycare spaces. • Municipal infrastructure, such as that for hydro-power and sewer, are at capacity. • Lack of a seniors' facility. • Women's shelters at capacity.		
Kami Iron Ore Mine and Rail Infrastructure Project Residual Effects	• Associated in-migration for direct employment will require new accommodations for approximately 800 employees during peak construction and operation, with the latter demand equally divided between family and single-person households. The associated increased population will place further demands on accommodations and other identified Community Services and Infrastructure constraints. • Project-related effects will be low to moderate in magnitude, mitigated through the use of well-established and proven mitigation measures, and rated not significant.		
Other Projects / Activities	**Likely Effect Interaction (Y/N)**	**Rationale**	**Cumulative Effects**
IOC Labrador Operations	Y	• The operation of this project has contributed to the existing conditions and will continue to place demands on Community Services and Infrastructure in the RSA. Planned expansion may increase demands on Community Services and Infrastructure.	• Ongoing demand for Community Services and Infrastructure from the existing 2,000 employees, and potential incremental demand from an additional estimated 1,000 permanent employees, should expansion occur.
Wabush Mines (Cliffs Resources)	Y	• The operation of this project has contributed to the existing conditions and will continue to place demands on Community Services and Infrastructure in the RSA. Planned expansion may increase demands on Community Services and Infrastructure.	• Ongoing demand for Community Services and Infrastructure from the existing 460 employees, and potential incremental demand from an additional 40 permanent employees, should expansion occur.
Mont-Wright Mine (ArcelorMittal)	Y	• The operation of this project has contributed to the existing conditions and will continue to place demands on Community Services and Infrastructure in	• Ongoing demand for Community Services and Infrastructure from the existing 1,000 employees, and potential incremental demand from an additional 900 permanent employees, should

		the RSA. Planned expansion may increase demands on Community Services and Infrastructure.	expansion occur.
Bloom Lake Mine and Rail Spur (Cliffs Resources)	Y	• The operation of this project has contributed to the existing conditions and will continue to place demands on Community Services and Infrastructure in the RSA. Planned expansion may increase demands on Community Services and Infrastructure.	• Ongoing demand for Community Services and Infrastructure from the existing 160 employees, and potential incremental demand from an additional estimated 160 permanent employees, should expansion occur.
Schefferville Iron Ore Mine (Labrador Iron Mines)	Y	• The operation of this project will place demands on Community Services and Infrastructure in the RSA.	• Incremental demand for Community Services and Infrastructure from 170 permanent employees.
DSO Iron Ore Project (Tata Steel Minerals Canada)	Y	• The operation of this project will place demands on Community Services and Infrastructure in the RSA.	• Incremental demand for Community Services and Infrastructure from 190 permanent employees during Phase 1.
Lower Churchill Generation Project (Nalcor Energy)	N	• Will use FIFO during construction and the small numbers of operations phase workers will not be resident in western Labrador.	• None
Infrastructure or other projects at Port of Sept-Îles	N	• Will not require or draw on Fermont or western Labrador labour.	• None
Urbanization	N	• Increased urbanization is a result of Project activities.	• None

Four existing mining projects in the RSA (IOC Labrador, Wabush Mines, Mont Wright Mine, and Bloom Lake Mine) contribute to existing demands on Community Services and Infrastructure from their existing 3,790 permanent employees and each have plans for expansion that may, should expansion proceed, have incremental demands on Community Services of Infrastructure from an additional 2,100 permanent employees. Two mining projects currently under construction (Schefferville Iron Ore Mine and DSO Iron Ore Mine) will have incremental demands on Community Services and Infrastructure in the RSA from the addition of 360 permanent employees. The Project will have residual adverse effects on Community Services and Infrastructure from the demands of 800 permanent employees that may overlap with those of the other projects. Currently there are 4,150 permanent employees associated with the existing four mines and the two under construction. If all planned expansions occur, and the Project is developed, there will be a maximum of 7,050 permanent employees in the RSA (an increase of 2,900 employees, or 70%). However, various independent and collaborative initiatives, including the Western Labrador Regional Task Force, will strive to maintain or improve Community Services and Infrastructure throughout the lifespan of the Project. Therefore, the cumulative effects of the Project acting in combination with the IOC Labrador Operations and Wabush Mines and other planned projects on Community Services and Infrastructure are determined to be not significant.

Note: Environmental effects descriptors and their definitions are as used in the assessment of Project-related environmental effects

Key existing Community Services and Infrastructure constraints are limited availability of accommodations and building lots, high housing prices and rents, shortage of daycare spaces, municipal infrastructure (e.g., hydro-power and sewer) are at capacity, lack of a seniors' facility, and women's shelters are at capacity.

As presented in Table 24.14, with the exception of Changes in Housing and Accommodations in western Labrador, Project-related effects on the eleven measurable parameters for Community Services and Infrastructure (i.e., road and air transportation capacity, water/sewer capacity, power capacity, landfill capacity, health care facility and services capacity, school and training facility and services capacity, police officer/population ratio, municipal administrative capacity, existing inventory of infrastructure for both men and women in the community, recreational facility and services capacity, and accommodation and building lot availability) will be low to moderate in magnitude, mitigated through the use of well-established and proven mitigation measures, and rated not significant.

Six mining projects (IOC Labrador, Wabush Mines, Mont Wright Mine, Bloom Lake Mine, Schefferville Iron Ore Mine, and DSO Iron Ore Mine) have the potential for cumulative effects with the Project. Existing mining projects in the RSA (IOC Labrador, Wabush Mines, Mont Wright Mine, and Bloom Lake Mine) contribute to existing demands on Community Services and Infrastructure from their existing 3,790 permanent employees. Each have plans for expansion that may, should expansion proceed, have incremental demands on Community Services of Infrastructure from an additional 2,100 permanent employees. Two mining projects currently under construction (Schefferville Iron Ore Mine and DSO Iron Ore Mine) will have incremental demands on Community Services and Infrastructure in the RSA from the addition of 360 permanent employees. The Project will have residual adverse effects on Community Services and Infrastructure from the demands of 800 permanent employees that may overlap with those of the other projects. Currently, there are 4,150 permanent employees associated with the existing four mines and the two under construction. If all planned expansions occur, and the Project is developed, there will be a maximum of 7,050 permanent employees in the RSA as a result of mining projects (an increase of 2,900 employees, or 70 percent).

In the case of construction activity, all the projects will make some use of FIFO, and most will use FIFO for the great majority of their construction labour requirement. There will also be some use of FIFO for operations phase activity, but most projects will seek to use locally-resident workers, many of them necessarily in-migrants, and they and their family members will place further demands on the Community Services and Infrastructure of western Labrador and Fermont. Given the capacity constraints that already exist in western Labrador and Fermont as a result of past and current projects and activities, these cumulative demands will present challenges.

In the case of western Labrador these constraints include:

- A shortage of available and affordable housing and rental units, and limited temporary accommodation;
- Electrical consumption that exceeds the capacity of the current infrastructure;
- Labrador City's wastewater distribution system is at or near capacity;
- Despite recent improvements to child care facilities, the demand for daycare spaces continues to outstrip the supply because of population growth and the increasing number of dual-income families;
- There is no seniors' residence; and
- The only women's shelter is regularly at capacity.

In Fermont:

- Housing availability is a major issue;
- Recent regional population growth has put pressure on health care services and infrastructure;
- Rising electricity consumption has prompted Council to seek improvements to the system;
- A new water filtration plant is needed; and
- In 2011, 160 people were on the childcare waitlist.

In order to manage cumulative effects to Community Services and Infrastructure, proper planning by relevant agencies and the implementation of appropriate management strategies, particularly with respect to project-related population growth, will be required. This must involve these agencies, Alderon and other project proponents. The Western Labrador Regional Task Force and the Western Labrador Community Advisory Panel represent community-led groups that are already working collaboratively to address these challenges. Where service and infrastructure improvements are made, all projects and users generally could benefit. It is anticipated that these collaborative initiatives will be successful at maintaining or improving on current conditions in the RSA within the lifespan of the Project such that the cumulative effects of the Project in combination with other projects and activities on Community Services and Infrastructure are predicted to generally be adverse but not significant.

24.8 Assessment of Accidents and Malfunctions

Possible accidental events related to the Project are train derailment, forest fire and dyke breach. A train derailment could cause damage to municipal services and infrastructure, including the railway and nearby roads, causing them to temporarily shut-down. Such events might require emergency response and medical assistance, which would place additional demands on these services but would not exceed their capacity. The recovery initiatives would include the repair or reconstruction of a wide range of infrastructure and could last for an extended period. A train derailment could also contaminate the local water supply, which may result in interruptions to the water service. However, in the event of an accident at the Project site or in transit, appropriate emergency response procedures will be implemented. The presence of paramedic personnel at the Project site will help to control day-to-day demands on local healthcare services. In the case of the water supply becoming contaminated, an emergency supply of water would be made available to residents until the water service could be restored. Emergency clean-up crews would be called upon to clean the water supply thoroughly and efficiently to minimize effects on the community. Therefore, the residual adverse effects of a train derailment on municipal services and infrastructure in western Labrador would be not significant.

A forest fire caused by the Project could lead to the short-term closure of the highways and railway and cause disruption at the airport. Responding to a forest fire caused by the Project would place additional demands on services and infrastructure, through their use of emergency services, but these would be of relatively short duration. The effects of a forest fire caused by the Project on municipal services and infrastructure are not anticipated to exceed system capacity. The residual adverse effects of a forest fire caused by the Project on municipal services and infrastructure in western Labrador would be not significant.

Similar to a train derailment, a dyke breach could affect nearby infrastructure and may require the assistance of emergency response and medical services in western Labrador. While such an event would place additional demands on these services, the residual adverse effects of a dyke breach on municipal services and infrastructure would be not significant.

A forest fire caused by the Project is unlikely to result in damage to housing and accommodations, but could result in the short-term demands on emergency services and temporary accommodations that would be used to house firefighters.

Accidental events as a result of the Project are unlikely, as Alderon has mitigations in place to minimize their likelihood. However, should an accidental event occur, Alderon's response measures will address any negative effects of such events on Community Services and Infrastructure. Project personnel will also be trained to prevent and manage potential accidental events.

The residual environmental effects of Project-related accidents and malfunctions on Community Services and Infrastructure are summarized in Table 24.15.

Table 24.15 Summary of Residual Effects for Community Services and Infrastructure - Accidents and Malfunctions

Project Phase	Mitigation / Compensation Measures	Residual Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	
Change in municipal services and infrastructure (Western Labrador)											
Train Derailment Forest Fire Dyke Breach	• Implementation of EPP and ERP	A	L	WL	ST	U	N/A	N/A	N	H	
Change in housing and accommodations (Western Labrador)											
Train Derailment Forest Fire Dyke Breach	• Implementation of EPP and ERP	A	L	WL	ST	U	N/A	N/A	N	H	
Change in municipal services and infrastructure (Fermont)											
Train Derailment Forest Fire Dyke Breach	• Implementation of EPP and ERP	A	L	F	ST	U	N/A	N/A	N	H	
Change in housing and accommodations (Fermont)											
Train Derailment Forest Fire Dyke Breach	• Implementation of EPP and ERP	A	L	WL	ST	U	N/A	N/A	N	H	

Project Phase	Mitigation / Compensation Measures	Residual Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	

KEY

Direction:
P Positive.
A Adverse.

Magnitude:
L Low: A change experienced by less than 5% of households.
M Moderate: A change experienced by 5% to 33% of households.
H High: A change experienced by more than 33% of households.

Geographic Extent:
WL Western Labrador.
L Labrador.
F Fermont.

Duration:
ST Short-term.
MT Medium-term.
LT Long-term.
P Permanent - will not change back to original condition.

Frequency:
U Unlikely to occur.
O Occasionally, once per month or less.
S Occurs sporadically at irregular intervals.
R Occurs on a regular basis and at regular intervals.
C Continuous.

Reversibility:
R Reversible.
I Irreversible.
N/A Not Applicable.

Environmental or Socio-economic Context:
U Undisturbed: Area relatively or not adversely affected by human activity.
D Developed: Area has been substantially previously disturbed by human development or human development is still present.
N/A Not Applicable.

Significance:
S Significant.
N Not Significant.

Prediction Confidence:
Based on scientific information and statistical analysis, and effectiveness of mitigation or effects management measure.
L Low level of confidence.
M Moderate level of confidence.
H High level of confidence.

24.9 Determination of Significance of Residual Adverse Effects

24.9.1 Project-related Residual Effects

As indicated in Table 24.13, the Project is predicted to have no significant adverse residual effects on municipal services and infrastructure in western Labrador and Fermont. Effects on municipal services and infrastructure will result primarily from in-migration to western Labrador generated by operations and maintenance phase employment. Services and infrastructure that will be most affected will be municipal services, such as sewer and power, and health services since these systems are already at or nearing capacity in Labrador City and Wabush. Fermont will experience adverse effects as a result of increased demands on municipal services and infrastructure, but not to the degree that western Labrador will experience them since most operations and maintenance workers will not be relocating to Fermont.

The Project will have no significant adverse effects on housing and accommodations in western Labrador during the construction and operations and maintenance phases. Up to 800 new residents relocating to the area, accompanied by their families in the case of the operations and maintenance phase, will place additional demands on the already limited supply of affordable housing and rental units in western Labrador. However, with the implementation of the Project accommodations strategy, together with appropriate effects management / mitigation strategies, careful monitoring and implementation of normal planning procedures on the part of the relevant authorities, and liaison between Alderon and those authorities, any potential adverse effects on Community Services and Infrastructure can be mitigated.

Project construction and operations and maintenance effects on housing and accommodations in Fermont will be adverse and not significant since most employees will choose to settle in western Labrador.

24.9.2 Cumulative Effects

Four existing mining projects in the RSA (IOC Labrador, Wabush Mines, Mont-Wright Mine, and Bloom Lake Mine) contribute to existing demands on Community Services and Infrastructure from their existing 3,790 permanent employees and each have plans for expansion that may, should expansion proceed, have incremental demands on Community Services of Infrastructure from an additional 2,100 permanent employees. Two mining projects currently under construction (Schefferville Iron Ore Mine and DSO Iron Ore Mine) will have incremental demands on Community Services and Infrastructure in the RSA from the addition of 360 permanent employees. The Project will have residual adverse effects on Community Services and Infrastructure from the demands of 800 permanent employees that may overlap with those of the other projects. Currently there are 4,150 permanent employees associated with the existing four mines and the two under construction. If all planned expansions occur, and the Project is developed, there will be a maximum of 7,050 permanent employees in the RSA (an increase of 2,900 employees, or 70 percent). However, various independent and collaborative initiatives, including the Western Labrador Regional Task Force, will strive to maintain or improve Community Services and Infrastructure throughout the lifespan of the Project. Therefore, the cumulative effects of the Project acting in combination with the

IOC Labrador Operations and Wabush Mines and other planned projects on Community Services and Infrastructure are determined to be not significant.

24.9.3 Accidents and Malfunctions

The residual environmental effect of a change in capacity of both municipal services and infrastructure and housing and accommodations as a result of accidents and malfunctions during all Project phases are rated not significant. This determination has been made with a high level of confidence because Alderon will have a number of emergency and safety plans and procedures in place to minimize the likelihood and effects of accidents and malfunctions on municipal services and infrastructure and housing and accommodations. In addition, Alderon will have emergency services available to respond immediately to accidents and malfunctions.

24.9.4 Overall Residual Effects Conclusion

The overall residual effects of the Project on Community Services and Infrastructure are predicted to be adverse but not significant given the effects management / mitigation measures that Alderon and responsible agencies will have in place.

24.10 Follow-up and Monitoring

Follow-up programs to determine actual outcomes and whether any effects management / mitigation strategies implemented were effective will mostly be the responsibility government departments, public agencies and private-sector companies that deliver the Community Services and Infrastructure in question. Such follow-up would, in any event, be part of their normal planning practices. For example, before each school year the school board estimates enrolment to determine potential course demands and teacher requirements. Similarly, municipal authorities track housing demand, housing starts and residential land supply as inputs to local planning decisions. To assist in these decisions, Alderon will liaise with local authorities and provide updates on Project activities and plans on a regular basis. Alderon will also support and participate in joint initiatives to monitor the municipal effects of mining projects. Collaboration with Community Services and Infrastructure providers and other users will be an important component of the planning process to maximize local benefits and reduce social costs.

24.11 Summary

Community Services and Infrastructure was selected as a VEC because the Project has the potential to affect the ability of nearby communities, Labrador City and Wabush in western Labrador and Fermont, Québec, to deliver physical and social services and infrastructure. Consequently, Community Services and Infrastructure has been identified as an area of concern by the general public and stakeholders, and it is discussed in detail in the EIS Guidelines.

Effects on Community Services and Infrastructure during construction will primarily be a function of the level of in-migration to the area and the consequent increase of demand on infrastructure and services. However, experience suggests that construction workers do not relocate where the potential employment period is finite and short-term.

Potential effects between the Project and municipal services and infrastructure in western Labrador during construction will be associated primarily with the:

- The movement of personnel and some material and equipment through the Wabush Airport;
- The movement of personnel, materials and equipment by road through western Labrador;
- Increased demands on services and infrastructure by commute workers living in accommodations in western Labrador; and
- Increased demands on services and infrastructure arising from Project-related in-migration.

Due to their proximity and infrastructure, Labrador City and Wabush will be the primary hub for the Project, through which non-local labour will arrive and depart, and materials and equipment will be shipped. Therefore, most of the Project effects on services and infrastructure are expected to occur there. These effects are not likely to be significant as a result of regular liaison between Alderon and relevant authorities who will then have time to plan for any potential increase in demand for municipal services and infrastructure. Fermont is not expected to experience significant changes in municipal services and infrastructure as a result of Project construction.

Affordable and available housing is scarce in western Labrador and Fermont. However, changes to housing and accommodations during Project construction will not be significant in western Labrador or Fermont given the implementation of the Project accommodations strategy and the provisions of the associated MOUs with Labrador City and Wabush.

The operations and maintenance phase will see the in-migration of up to 800 Project workers, plus their families, between 2015 and 2020. This influx of people into the region will affect municipal services and infrastructure, particularly education, health care and the capacity of water, sewer and power systems, in western Labrador and Fermont. The increased population will also affect housing and accommodations, which are already in short supply. Effects on housing and accommodations will be felt predominantly in western Labrador since Project workers will not likely settle in Fermont. Effects on municipal services and infrastructure and housing and accommodations during the operations and maintenance phase will not be significant, given the Project accommodations strategy.

In addition to the Project accommodations strategy and consulting regularly with the relevant agencies and organizations to provide Project information and to identify and discuss potential Project-related implications for local infrastructure and services, Alderon will have a number of specific management initiatives in place to minimize Project effects during all phases. These include building an access road to the Project site to minimize Project-related traffic on the TLH and on roads. As part of its ongoing monitoring for management strategy, Alderon will continue to evaluate potential Project-related implications of the use of local, regional and provincial infrastructure and services. This will include direct Project requirements as well as indirect and induced increases in use of and demand for infrastructure and services by Project workers and their families.

25.0 HEALTH AND COMMUNITY HEALTH

25.1 VEC Definition and Rationale for Selection

In recent years, the general (and inter-related) themes of health and communities have become increasingly important aspects of the EAs of proposed development projects. A Health and Community Health VEC incorporates a variety of elements and issues, and is intended to reflect a broad and holistic view of the human environment and the potential socio-economic effects of proposed developments upon it.

Strong and healthy communities are influenced by, and reflected in, the physical, social, emotional and mental health of their residents, including personal wellness, family and community life, and overall perceptions of these factors. Whether and how the health and well-being of persons who live in local communities and surrounding regions may interact with, and be affected by, the proposed Project are key questions that are addressed in this Health and Community Health VEC. This includes analyses related to:

1) Physical human health and well-being; and
2) Community (social) health and quality of life.

The EIS Guidelines for the Project have outlined the need for Health and Community Health issues and potential effects to be assessed in this EA. During Alderon's Aboriginal and public consultation activities, residents have also raised questions about the possible implications of the Project for health and community health in Labrador City, Wabush and Fermont. Identified issues have included the potential effects of the Project on human health, safety, visual aesthetics and overall quality of life.

The environmental effects assessment for this VEC considers both individuals and communities that may be affected (beneficially and/or adversely) by various Project components and activities and/or their associated and resulting environmental outcomes (e.g., dust, noise, light and / or aesthetic changes; presence of Project works and personnel, employment and income).

25.1.1 Issues

Alderon has engaged and consulted with a variety of stakeholders, Aboriginal groups, and members of the public throughout the EA process, and is committed to being responsive to questions and concerns as they may arise.

Issues and questions related to this VEC that are identified in the EIS Guidelines include:

- characterization of all possible sources of contaminants / emissions, exposure pathways and consumption patterns that may generate health impacts in Labrador or Quebec (e.g., respiratory concerns for sensitive components of the population), if any;

- the potential for health impacts that may arise from changes in water quality and quantity;
- the potential for health impacts that may arise from noise or vibrations;
- the effects of the Project on the health and safety of Project workers, and those working in the areas affected by the Project, including the possible effects of any accidents or spills;
- effects of the Project on social factors such as substance abuse and crime rates; and
- implications of the Project on residents' perceptions of quality of life (e.g., from changes in recreational patterns, light, noise, changes in landscape).

An inventory of the various questions and issues that have been raised by stakeholders and the public in relation to this VEC through Alderon's consultation initiatives to date is provided in Table 25.1.

Table 25.1 Issues Raised by Aboriginal and Stakeholder Groups

Issue	Community / Organization	Summary of Comments Raised During Consultation and Engagement Activities	Response / Location in EIS
Cumulative Effects on Health and Community Health	Fermont	Cumulative effects of all the expansions in current Project, and with Alderon, potential effects on quality of life in Fermont.	The assessment and evaluation of cumulative environmental effects resulting from the Project in combination with other developments is an important and integral part of this EIS. The cumulative effects of the Project in combination with other developments on Health and Community Health are assessed and evaluated in Section 25.7.
		Assess cumulative effect of the Project and other developments on quality of life in Fermont. There are currently many different things happening in Fermont in terms of development, mining projects, housing.	
		There is a study on the current situation in Labrador regarding the impact on mining on human health. Asks the proponent to evaluate all impacts that the mine may have on the health of people of Fermont and Newfoundland.	Existing knowledge on the known effects of other past projects and activities has been reviewed and has informed the environmental effects assessment. The VEC analysis considers these issues and effects. The community of Fermont, as well as Labrador City and Wabush, are considered within the study area (LSA) that has been established for this VEC and its effects assessment. See Section 25.2.

Issue	Community / Organization	Summary of Comments Raised During Consultation and Engagement Activities	Response / Location in EIS
Visual Aesthetics	Cabin Owners	I do not want to look out my window at a plant.	The possible visibility of Project components from nearby communities, cabins and other recreational areas has been a key consideration in Project planning and the EA. Viewshed analyses and before and after photosimulations of the Project from select vantage points have been included in the EIS. These show that the Project will be minimally visible from the three municipalities. The Project will be visible from some cabin locations. See Section 23.6.4 for the viewshed analysis and photosimulations. Noise, dust and other such disturbances are modeled and assessed in Chapter 14, based on applicable standards in the relevant jurisdiction. The results of each of these VEC analyses have been integrated into and informed the assessment for Health and Community Health as presented in Chapter 25.
	CIM Conference	You're mining in Labrador, but most of the negative impacts are going to be on the Fermont side, mainly for dust, noise and visual impact from the waste stockpile. Are the requirements for dust, noise, etc… different in NL than in Quebec?	
	Fermont	What will I see from my home?	
	Fermont	Concern that the Project will create visual pollution. Desire to preserve untouched visual aesthetic in Fermont.	
	Fermont	For the visual aesthetics study, two points of view should be assessed: one from the Town of Fermont and the view from the top of the hill by the Lac d'Aviault. It is important that this point of view be assessed because a lot of people hike there and there is a beautiful viewpoint, we would not want it to be compromised by the waste rock pile.	
	Le mouvement citoyen de Fermont	Will the mine manage the site in a manner that makes it not visible from Fermont?	
	Labrador City	Concern that other lakes will become similar to Wabush Lake and have same visual impact issue.	
	Labrador City / Wabush	Will there be any visible impacts resulting from the Projects in the Duley Lake Park area, such as trucks driving around or waste rock piles?	
	Wabush	Power lines are a visual issue.	
Potential Effects on Safety	Cabin Owners	An important issue to me is safety. Safety for cabin owners using Mills Lake access road. No escorts of signage for heavy machinery. No safety officer on site.	Potential public health and safety issues are assessed throughout Chapter 25. This includes analysis and mitigation related to each of the issues raised, including road and rail traffic, presence and use of machinery, etc. Safety is a number one concern for Alderon, and all employees, contractors (including truck operators) are required to comply with Alderon's Health
	Cabin Owners	An important issue to me is that Duncread is being used and abused and I am concerned about safety with regards to speed and the number of trucks using the road.	
	Fermont	What will be the safety perimeter around the pit to ensure people safety?	

Issue	Community / Organization	Summary of Comments Raised During Consultation and Engagement Activities	Response / Location in EIS
	Wabush / Fermont / Lab City	Concerns about safety include child safety due to increased road and rail traffic, elderly people during construction.	and Safety Policy and procedures. Potential effects and mitigation related to Other Land and Resource Users are assessed in Chapter 23. Following EA approval, a Blasting Plan will be developed and implemented in compliance with all applicable laws, regulations and industry best practices, and with consideration of safety, environmental and social issues, as identified through the EA. See Section 2.6.2.
	Fermont	At the Mont Wright Arcelor Mittal mine, there is a required evacuation of all personnel for a 1,000 metre area when blasting occurs. There may be issues associated with communication regarding blasting to ensure no one is in the area.	
Human Health	Le mouvement citoyen de Fermont	Is the well-being of the people of Fermont taken into consideration?	The community of Fermont is considered within the study area (LSA) that has been established for the Health and Community Health VEC and its effects assessment. See Section 25.2.
		Potential impacts from the Kami project on human health. There are currently a number of human health issues as a result of mining in Labrador City. Blood filtration is required by many in Labrador City as a result of high concentrations of iron. Will Alderon be engaged in the future to treat people with health issues?	The potential for Project related emissions to interact with and affect the health of humans has been assessed in Chapter 25, and through the associated HHRA. This includes the potential for issues related to iron concentrations in humans. Alderon's commitments to mitigation are also outlined in Section 25.6.
	Fermont	Possible risks associated with the Project including health risks (increase in levels of iron in the blood, requiring blood filtration)	
	Lab West Status of Women	The main issues included drug use (drug testing should be done when new hire or accidents), and domestic violence and sexual abuse. They did a study on impact of mining on women's health, which is available on Mining Watch, and they found that mining had no major effect on women's health. IOC developed a code of conduct to avoid some issues associated with increased presence of men in the community.	These and other social/community health issues are assessed within the Community Health aspect of Chapter 25, including associated mitigation measures to avoid or reduce any such effects. Existing knowledge on the known effects of other past projects and activities has been reviewed and has informed the environmental effects assessment. Additional

Issue	Community / Organization	Summary of Comments Raised During Consultation and Engagement Activities	Response / Location in EIS
			information is provided in Sections 25.5; 25.6; 25.7; 25.9. Alderon will provide employee assistance and support programs for its workforce, as described in Section 25.6.2.
Potential on Quality of Life	Fermont	Will measures be taken to minimize the impacts on everyday life (e.g. dust)?	Potential effects and mitigation related to dust issues are assessed in Chapter 14 and elsewhere. This includes commitments to various dust suppression and management measures.
	Matimekush - Lac John	Deterioration of community infrastructure and housing in Matimekush - Lac John is also having a negative impact on quality of life.	The potential implications of the Project for housing and other services and infrastructure in Labrador and Quebec are assessed in Chapter 24 (Community Services and Infrastructure). The Project is not expected to have an effect on community infrastructure and housing in Matimekush - Lac John.
	Matimekush - Lac John	Drug treatment program is needed to support potential workers.	Alderon will provide employee assistance and support programs for its workforce, as described in Section 25.6.2.
	Wabush	Concern of location of transmission line (magnetic field, noise) and health issues for those who live in one mile proximity.	The potential for Project related emissions to interact with and affect the health of humans has been assessed in Chapter 25, and through the associated HHRA. The Project power requirements and the manner in which they will be addressed (options) are described in Section 2.5.6, including responsibility for permitting and constructing any new transmission line(s). The design and construction of the transmission line will be in compliance with all applicable regulatory standards. Key considerations in the design and planning of the transmission line are described in Section 2.5.6.

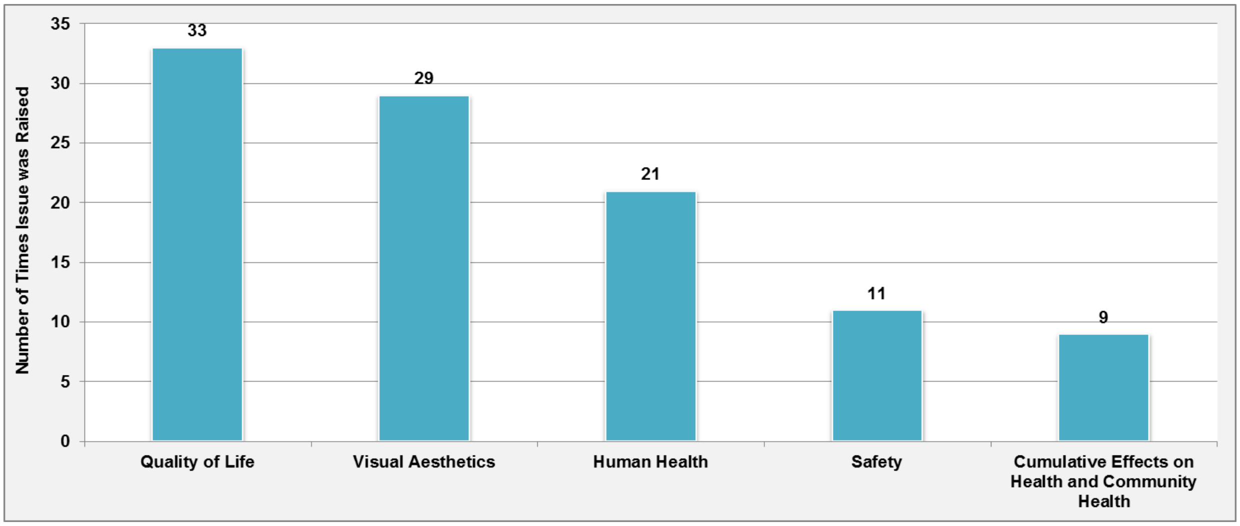
Issue	Community / Organization	Summary of Comments Raised During Consultation and Engagement Activities	Response / Location in EIS
	Wabush	Concern of social impacts for fly in-fly out operations including sexual harassment of women	Identifying and avoiding any such issues has been a key part of Project planning. These and other social / community health issues are assessed within the Community Health aspect of Chapter 25, including associated mitigation measures to avoid or reduce any such effects. This includes engaging with government agencies and municipalities to establish a Project accommodation strategy and implementing other measures such as work rotations and transportation of non-resident workers.
	Wabush / Fermont	What will be the human health impacts in Fermont resulting from location of the waste pile. Main concern is the impact to quality of life. What will be the impacts from toxic plumes associated with blasting, and contamination of the water supply? In other mining projects, seeding was done on waste rocks. Levels of iron in blood are high in the population. Their blood must be filtered.	The potential for Project related emissions to interact with and affect the health of humans has been assessed in Chapter 25, and through the associated HHRA. Visual aesthetics issues (including viewshed modeling) is addressed in detail in Chapter 23 of the EIS. Refer to Section 23.6.4. The original location of the waste rock disposal facility was changed following consultation and concerns raised by the residents of Fermont. Re-vegetation, progressive rehabilitation, and other measures will also be implemented.
	Lab City	It has been hard to preserve the quality of life, services and infrastructure in the community and we hope it is not affected by the Kami Project.	These and other social/community health issues are assessed within the Community Health aspect of Chapter 25, including associated mitigation measures to avoid or reduce any such effects. The potential implications of the Project for housing and other services and infrastructure in Labrador and Quebec are assessed in Section 24.6.
		Domestic violence and drug abuse.	

Issue	Community / Organization	Summary of Comments Raised During Consultation and Engagement Activities	Response / Location in EIS
	Fermont	Worried about the effects of blasting and associated noise on the community. Community members can hear / feel blasting from other mines (Arcelor Mittal mine, IOC) and the Rose Pit is much closer. How could it be possible not to be affected by your mine?	A Blasting Plan will be developed and implemented. See Section 2.6.2. Detailed modeling and analysis of the noise and vibration associated with Project construction and operations is provided in Chapter 14.
	CIM Conference	You're mining in Labrador, but most of the negative impacts are going to be on the Fermont side, mainly for dust, noise and visual impact from the waste stockpile. Are the requirements for dust, noise, etc… different in NL than in Quebec?	The community of Fermont is considered within the study area (LSA) that has been established for the Health and Community health is VEC and its effects assessment. See Section 25.2. Detailed modeling and analysis of the dust, noise and visual issues associated with Project construction and operations is provided in Chapters 14 and 23, including (where relevant) an evaluation of these effects against existing regulations and standards.
	Labrador City / Wabush / Lab City	Concern that dust will affect the quality of life, and use of recreation areas. Cabin owners particularly concerned with this issue. Suggestion to relocate tailings to south.	Detailed modeling and analysis of the dust, noise and visual issues associated with Project construction and operations is provided in Chapters 14 and 23, including (where relevant) an evaluation of these effects against existing regulations and standards. The proposed TMF is located west of Riordan Lake in the eastern portion of the Project area. See Figure 2.5 in Section 2.5 for an overall site plan. Key considerations in the design and planning of the TMF are described in Section 2.5.4 and 2.6.2. Various alternatives were identified and evaluated based on technical, economic and environmental factors, as described in Section 2.8.
	Cabin Owners	Cabin owners along the east side of the property are complaining about low level helicopter flying. Concern that there are too many	Detailed modeling and analysis of the dust, noise and visual issues associated with Project construction and operations is

Issue	Community / Organization	Summary of Comments Raised During Consultation and Engagement Activities	Response / Location in EIS
		helicopters and associated noise impacts, including early morning flyovers of cabin properties. Sling load loss from helicopter in area of a cabin (remote location). If I can hear / see / smell the project am I affected and how will I be treated?	provided in Chapter 14 and elsewhere in this EIS, including the potential implications of these for land and resource use in the area (Chapter 23).
		Requesting that the company take the same environmental and ethical activities towards all municipalities surrounding the project.	The communities of Wabush, Labrador City and Fermont are each included within the study area (LSA) that has been established for the Health and Community Health VEC and its effects assessment. See Section 25.2.
	Innu Nation	Suggested that Alderon should consider such a program where all community members over the age of 60 are provided with a monthly allowance of 600$. A similar program for the Voisey's Bay Project has been very helpful for the community.	Alderon will adhere to the provisions included in any benefits agreement signed in relation to the Project. Alderon's current Aboriginal engagement processes are described in Chapter 10, and its Aboriginal Relations Policy is outlined in Section 1.1.1.
		When we choose to live in Fermont, it is the tranquility and nature surrounding us that make us stay here. It is unfortunate that economic development is done to the disadvantage of the population living on the territory.	The community of Fermont is considered within the study area (LSA) that has been established for the Health and Community Health VEC and its effects assessment. See Section 25.2.
		Concerned about potential environmental and socio-economic effects in Fermont, such as recreational activities in Fermont, air quality, noise and quality of life.	

The frequency of these issues by type is summarized in Figure 25.1.

Figure 25.1 Frequency of Issues Raised Related to Health and Community Health



25.1.2 Approach to Assessment of Effects

The environmental effects analysis for the Health and Community Health VEC is based on similar approaches used in the human health and socioeconomic assessments of other recent projects. The approach differs somewhat, of necessity, between physical health and community health, as described below.

25.1.2.1 Physical Health

Relatively precise predictions and analyses of certain environmental interactions and effects arising from the Project, such as the potential for human exposure to certain Project related emissions and other disturbances and their likely health effects, were made through a human health risk assessment (HHRA). There are clear linkages between the HHRA and other VECs, including:

- Chapter 14: Atmospheric Environment;
- Chapter 15: Landforms, Soils, Snow and Ice;
- Chapter 16: Water Resources; and
- Chapter 23: Other Current Use of Lands and Resources.

The HHRA formed the basis for the physical health related assessment provided in this chapter, and relied heavily on the information and findings contained in the above noted VEC chapters and others. The VEC focuses on areas proximal to the Project site as these areas would have the highest potential to interact with any Project-related emissions. Potential issues of concern that are relevant to physical health and which have been raised by the public included:

- Air quality;
- Control of dust;

- Water quality; and
- Effects on hunting, fishing, and trapping.

Air quality is assessed in the context of potential Project-related criteria air contaminants (CACs) and their ground-level concentrations (GLCs), as well as potential emissions of non-criteria air contaminants. For the purposes of this EA, the Project-related CACs include carbon monoxide (CO), nitrogen oxides (NO_x), sulphur dioxide (SO_2), total suspended particulate matter (TSP), particulate matter less than 10 microns in diameter (PM_{10}) and particulate matter less than 2.5 microns in diameter ($PM_{2.5}$). The Newfoundland and Labrador *Air Pollution Control Regulations* (Reg. 39/04) specifies ambient air quality standards for CACs and select non-criteria contaminants. In the absence of standards from NL, criteria from other regulatory agencies are referenced including Health Canada, Ontario Ministry of the Environment (OMOE), and the United States Environmental Protection Agency (US EPA).

The potential for dust emissions to deposit in the surrounding environment and negatively affect existing environmental quality (and potentially, therefore, human health) is assessed through a comparison of predicted increases in contaminant concentrations in soil and/or vegetation in comparison to current baseline conditions. Air dispersion modeling was completed as part of this EIS (refer to Chapter 14: Atmospheric Environment for modeling details, such as emission rates). For the purposes of the assessment of physical health effects, two locations were identified from which to predict total dust fall rates at cabins on Long Lake South and on Riordan Lake, close to and down-wind of the Project boundaries. Standard risk assessment methods were used to determine the predicted change in soil and vegetation quality due to dust fall over the mine life.

During the operation and maintenance phase of the Project, potential adverse effects to surface water resources include changes to drainage patterns, changes to flow regimes, water and sediment quality. The Kami Mine process effluent is proposed to be discharged into Long Lake through a diffuser, estimated to be approximately 625 m from shore at a water depth of 14 m. This location was selected to ensure enough water column depth is available for effective dilution of effluent discharges. Treated sanitary effluent may be discharged into Long Lake. To be conservative, an effluent mixing analysis of the mine process and sanitary effluent discharges into Long Lake was conducted to identify a preliminary diffuser configuration that achieves good dilution at the boundary of an initial mixing zone in Long Lake.

Water quality is assessed in the context of potential Project-related discharges from the proposed diffuser outfall in Long Lake South. Excess water from the Tailings Management Facility (TMF) will be directed to a Polishing Pond to provide required water quality treatment to meet end of pipe water quality as per the *Metal Mining Effluent Regulations* (MMER). Typically, the actual effluent quality design criteria will be to meet a minimum effluent quality of ½ the limit and often in the range of 1/10th the limit to provide a reasonable Factor of Safety. For the assessment of physical health in this chapter, the long-term, average effluent quality is most relevant, hence it was assumed that the actual effluent quality will meet typical effluent quality design criteria and range up to half of the *MMER* and NL *Environmental Control Water and Sewerage Regulations* Schedule A limits.

For potential effects to human health from associated effects to the resources that are subject to hunting, fishing, trapping or gathering, the potential uptake of contaminants into wild game, berries, or fish is not predicted quantitatively. Rather, the nature and degree of likely effects to soil, vegetation, or water quality is assessed, and in the case of an absence of likely measurable effects to these environmental media, it is predicted that there would be no resultant effect on wild game, berries, or fish that rely on them as food sources, and therefore, on human health through the harvest and consumption of such country foods.

25.1.2.2 Community Health

The assessment of potential Project effects on this VEC includes a general approach of overlaying what is known about health and community health with the planned Project components and activities to identify and describe likely interactions and resulting effects on the VEC. The community health portion of this assessment has primarily utilized existing and available information on the existing (baseline) socioeconomic environment.

Relevant data for Labrador West were gathered from the Labrador-Grenfell Regional Health Authority, NL Community Accounts, the Newfoundland and Labrador Centre for Health Information (NLCHI), Statistics Canada, the Royal Newfoundland Constabulary and other sources. Where possible, for the Labrador West portions of the study area, data have been obtained and presented for Wabush and Labrador City only. However, from an administrative perspective (e.g., healthcare, policing, economic development), data are often only available for a larger geographic area. Information on the known and potential effects of development projects on community health was also gathered through a literature review that included academic and government publications.

Some effects may also be experienced in Fermont, Québec or the larger region. Data for the Côte-Nord region were collected from Statistics Canada and Sûreté du Québec (Ministry of Public Security) and MRC de Caniapiscau.

The Socio-Economic Baseline Study, prepared for Alderon Iron Corp. by Stassinu Stantec Limited Partnership (Appendix J) provides information on demography, income, income support, employment, health services, safety and security and recreation for Labrador City, Wabush and Fermont. This Health and Community Health VEC chapter has used information from this socio-economic study for baseline information related to key components.

25.2 Environmental Assessment Boundaries

25.2.1 Spatial Boundaries

The following geographic areas were used to understand and describe the local and regional nature of Health and Community Health and the potential effects of the Project on this VEC: the Project Development Area (PDA), a Local Study Area (LSA); and Regional Study Area (RSA), each of which is further described and defined below.

25.2.1.1 Project Development Area

The PDA is the area represented by the physical Project footprint as defined in the Project Description (Chapter 2). The PDA includes the area of physical disturbance for the Project and fully encompasses the following components: the open pit mine (Rose Pit); mineral processing infrastructure and site buildings; waste rock disposal areas (Rose North and Rose South Disposal Areas); tailings management facility; access roads; power / transmission lines; rail infrastructure; and other ancillary infrastructure and equipment.

25.2.1.2 Local Study Area

The LSA is defined as a larger area, centered on the PDA, that encompasses all planned Project components and activities, the potential "zones of influence" of any Project-related disturbances and relevant components and activities which are relevant to health-related issues and interactions. Again, the LSA has been conservatively defined so as to encompass the PDA and any adjacent communities and areas where Project-related environmental effects may reasonably be expected to occur, through both the direct "footprint" of the Project itself as well as the likely geographic extent of the various other Project-related disturbances that may occur during construction and/or operations and eventual closure (such as noise, dust, visibility and others).

For the physical health related components, the LSA is defined as per that for the Atmospheric Environment VEC (Chapter 14), specifically, the area that is 40 km (east-west) by 40 km (north-south) extending from the center of the Project-related activities and incorporating the towns of Labrador City and Wabush, Labrador, and Fermont, Québec. The LSA is analogous to the local modelling domains used for dust modelling. It also incorporates the LSA for Water Resources (Chapter 16) which includes Long Lake and Riordan Lake.

For the community health related components, the LSA includes the PDA and surrounding areas, including the adjacent communities of Wabush, Labrador City and Fermont (Figure 25.2). This LSA was chosen because these communities are closest to the proposed Kami Mine and are therefore most likely to experience any Project-related effects, and because this area corresponds with the RSA for the other related socioeconomic VECs (particularly, Community Services and Infrastructure VEC).

25.2.1.3 Regional Study Area

The RSA for physical health is likewise defined as per that for the Atmospheric Environment VEC (Chapter 14), and comprises the area within which cumulative effects for the Atmospheric Environment may occur given potential overlapping air contaminants, and includes an area that incorporates Wabush Mines, Iron Ore Company of Canada's operations, Bloom Lake Mine and Rail Spur, Schefferville Iron Ore Mine, and the DSO Iron Ore Project.

The RSA for community health includes Labrador as a whole and the Côte-Nord region of Québec (Figure 25.2) and is based on relevant health administrative regions. In Labrador, the major population centres are Labrador City, Wabush and Happy Valley-Goose Bay with a number of smaller communities which are located mainly on the coast. With 26,728 residents, Labrador has just over 5 percent of the population of Newfoundland and Labrador as a whole (Statistics Canada 2011). The Côte-Nord region of Québec covers the North Shore of the St. Lawrence River estuary and the Gulf of St. Lawrence and borders most of inland Labrador, from Blanc Sablon north to the Schefferville area. Major communities include Baie-Comeau, Port Cartier, Sept-Îles and Fermont. With a population of 94,766, the region accounts for slightly more than 1 percent of the province's population (Statistics Canada 2011).

25.2.2 Temporal Boundaries

The temporal boundaries for the assessment of the potential environmental effects of the Project on this VEC include the Project phases of construction (approximately two years), operation and maintenance (approximately 17 years), and eventual closure and decommissioning (approximately two years).

For the physical health component, potential effects would occur primarily due to Project-related air and water emissions. Effects on air and water quality would begin during construction and reach a peak during operations, diminishing again during closure and post-closure. Therefore, the temporal boundaries for physical health are based on a scenario when air quality issues would be highest throughout the life of the project (i.e, several years into operations, with both process lines and the maximum amount of mining equipment). These maximum emissions are assumed to occur throughout the operating mine life and will overestimate the long-term emissions from the Project. Water quality is assessed for both the open water and ice covered seasons.

For community health, the effects analysis recognizes and considers whether and how each phase of the Project (including similarities and differences in project activities, workforce requirements and arrangements, etc) may affect social health and well-being.

25.2.3 Administrative Boundaries

The communities (and municipal boundaries) of Wabush, Labrador City and Fermont are clearly relevant to this VEC, as are associated management areas for the various land and resource uses that are carried out in the region (Chapter 24).

The Labrador-Grenfell Regional Health Authority (Labrador-Grenfell Health) provides health care services to all of Labrador and communities north of Bartlett's Harbour on the Northern Peninsula of Newfoundland. The Royal Newfoundland Constabulary's Labrador West office serves Labrador West which includes Labrador City, Wabush and Churchill Falls. The Hyron Regional Economic Development Board (Zone 2) covers the Labrador West communities of Labrador City and Wabush, but also includes Churchill Falls. NL Community Accounts often disaggregates data, on a number of topics of interest, by community which sometimes allows for coupling of similar data for several sectors.

The Centre de santé et de services sociaux (CSSS) provides healthcare and social services throughout Québec. Fermont is located in the District de la Côte-Nord and served by the CSSS de l'Hématite. The Sûreté du Québec polices the province. Fermont is included in the District de la Côte-Nord and is served by the poste principal de la MRC de Caniapiscau which is located in the town.

Figure 25.2 Local and Regional Study Areas: Health and Community Health

25.3 Establishing Standards or Thresholds for Determining the Significance of Environmental Effects

The likely effects of the Project on Health and Community Health are described using the following descriptors, which are based on recent environmental assessment practice and the EIS Guidelines:

- **Direction:**
  - Neutral;
  - Adverse; or
  - Positive.
- **Magnitude:**
  - Low (affects a small number of persons, and may be indistinguishable from the normal condition and/or natural variability of the VEC);
  - Moderate (effect is detectable within a population, but is within normal range of variability and/or is within regulatory limits / standards and/or objectives); or
  - High (effect cause clear and sustained exceedences of regulatory limits / standards and/or objectives).
- **Geographic Extent:**
  - Site (within the PDA);
  - Within the LSA; or
  - Within the RSA.
- **Frequency:**
  - Not likely to occur;
  - Occurs once;
  - Occurs sporadically at irregular intervals;
  - Occurs on a regular basis and at regular intervals; or
  - Occurs continuously.
- **Duration:**
  - Short-term (restricted to the construction phase(s));
  - Medium-term (continues into the operations and maintenance phase);
  - Long-term (continues beyond operation and maintenance); or
  - Permanent.

- **Reversibility:**
  - Reversible: the VEC can be returned to existing conditions; or
  - Irreversible: the effect cannot be reversed.
- **Environmental or Socio-economic Context:**
  - Undisturbed: Area relatively or not adversely affected by human activity; or
  - Disturbed: Area has been substantially previously disturbed by human development and/or human development is still present.

25.3.1.1 Threshold for Determining the Significance of Residual Environmental Effects

Given the nature and diversity of the various elements which comprise this rather broad VEC, separate definitions and criteria have been developed and provided for human physical health and for community health.

A **significant adverse residual environmental effect on *Physical Health*** is defined as a Project-related environmental effect that (1) degrades the quality of the ambient air, water, or soil such that the maximum Project-related concentration being assessed repeatedly exceeds the respective environmental quality objective, guideline or standard, and (2) this results in an associated and measurable change (increase) in the incidence of human (physical) health issues within the LSA.

A **significant adverse residual environmental effect on *Community Health*** is defined as a Project-related effect that adversely affects the social health and well-being of affected individuals or communities, such that there are associated, detectable and sustained decreases in the overall quality of life of a population.

25.4 Potential Project-VEC Interactions

Each of the Project's main planned activities during its construction, operation and maintenance, and decommissioning and reclamation phases as well as possible accidental events and malfunctions, are listed in the following tables. The tables also indicate whether, and at what level, each will likely interact with the VEC (based on a rating of 0, 1, or 2, which are defined at the bottom of the table). This approach has been taken in order to frame and focus the environmental effects assessment early and on the key potential issues and interactions of concern, including those for which standard mitigations and guidelines are not necessarily defined and applicable. Again, as this VEC is quite broad and diverse, potential interactions between Project components and activities and physical health are discussed first, followed by community health.

In the following tables, a rating of zero means that no interaction is anticipated. A rating of one means that interaction is anticipated but, based on past experience, the resulting effect can be managed to acceptable levels through standard operating practices and/or through the application of best management or codified practices. No further assessment of these interactions is therefore warranted.

A rating of two means that interaction is anticipated and the resulting effects may exceed acceptable levels without the identification and implementation of additional and specific mitigation. Further assessment is therefore warranted, and Project-specific mitigations may be identified through the associated effects analyses.

25.4.1 Physical Health

A number of potential issues associated with the Health and Community Health VEC were identified in the EIS Guidelines for the Kami Iron Ore Project issued by the Governments of Newfoundland and Labrador and Canada. Alderon has also gained further information on community concerns about the Project and its potential effects through direct engagement with government regulators, Aboriginal groups and communities (including Wabush, Labrador City and Fermont) and other stakeholders. In addition, the EIS study team has knowledge about, and experience with, other mining projects in Labrador and elsewhere.

The key potential effects that are assessed for Physical Health including changes in environmental quality, including air, water, soil, and vegetation, due to Project emissions or discharges, that may result in associated and consequent effects on the physical health of humans.

Table 25.2 Potential Project Environmental Effects to Physical Health

Project Activities and Physical Works	Potential Environmental Effects			
	Changes in Physical Health, Resulting From:			
	Change in Air Quality	Change in Water Quality	Change in Soil Quality	Change in Country Foods
Construction				
Site Preparation (including clearing, excavation, material haulage, grading, removal of overburden and stockpiling)	2	1	2	1
Construction of Roads	2	1	2	1
Construction of Site Buildings and Associated Infrastructure (maintenance facilities, offices, plant, crushers, concentrator, conveyors, gatehouse, pumphouses, substation, security fencing, sanitation system)	2	1	1	1
Construction of Mine Tailings Management Facility (TMF)	2	2	2	1
Construction of Railway and Load-out Facilities (silos)	1	1	1	1
Construction of Power Line	1	0	0	0
Construction of Stream Crossings	1	1	1	1
Installation of Water Supply Infrastructure (wells, pumps, pipes)	1	1	1	1
Onsite Vehicle / Equipment Operation	2	1	1	1
Waste Management	0	0	0	0

Project Activities and Physical Works	Potential Environmental Effects Changes in Physical Health, Resulting From:			
	Change in Air Quality	Change in Water Quality	Change in Soil Quality	Change in Country Foods
Transportation of Personnel and Goods to Site	1	0	0	0
Expenditures	0	0	0	0
Employment	0	0	0	0
Operations and Maintenance				
Open Pit Mining (including drilling, blasting, ore and waste haulage, stockpiling, dewatering)	2	2	2	2
Ore Processing (including crushing, conveying, storage, grinding, screening)	2	1	2	2
Concentrator Operations (gravity and magnetic separation, tailings dewatering, tailings thickener, concentrate conveyance to load-out)	2	1	2	2
Tailings Disposal in TMF	2	2	2	2
Waste Rock Disposal on Surface	2	1	1	1
Water Treatment (including mine water and surface runoff) and Discharge	1	2	0	2
Rail Load-Out by Silo Discharge	2	1	1	1
Rail Transport	1	1	1	1
Onsite Vehicle / Equipment Operation and Maintenance	1	1	1	1
Waste Management	0	0	0	0
Transportation of Personnel and Goods to Site	1	0	0	0
Fuel Storage and Dispensing	1	1	1	0
Progressive Rehabilitation	1	1	1	1
Expenditures	0	0	0	0
Employment	0	0	0	0
Decommissioning and Reclamation				
Site Decommissioning	1	1	1	1
Site Reclamation (building demolition, grading, scarifying, hydroseeding)	1	1	1	1
Accidents and Malfunctions				
Spill / Release of Hazardous Materials	1	1	1	1
Forest Fire	2	1	1	1

KEY
0 = No interaction.
1 = Interaction occurs; however, based on past experience, the resulting effect can be managed to acceptable levels through standard operating practices and / or through the application of best management or codified practices. No further assessment is warranted.
2 = Interaction occurs, and resulting effect may exceed acceptable levels without implementation of specific mitigation. Further assessment is warranted.

The Project interactions on each environmental effect are rated as 0, 1, and 2 for a change in air quality, change in water quality, change in soil quality, and change in country foods, based on anticipated quantities of emissions and/or discharges, and project experience. Those interactions that have been rated as 0 or 1 are discussed here, but screened out of further detailed analysis because, although an interaction may occur, the resulting effect can be managed to acceptable levels through standard mitigation measures and management practices. Those that have been rated as 2 are also briefly discussed within this section, but are further analyzed in the environmental effects analysis section, because the resulting effect may exceed acceptable levels without implementation of additional and specific mitigation.

During both the construction and operation of the Project, a number of activities are not anticipated to result in an environmental effect on physical health, including waste management, expenditures, and employment In addition, the transportation of personnel and goods to the site and others have been rated as zero for all effects other than air quality. There is negligible potential for these activities to interact with water quality and soil quality, and therefore by extension, with country foods. Although some level of air emissions would result, based on past experience, these emissions are expected to be nominal and are unlikely to result in an exceedence of regulatory standards.

Major activities during the construction phase of the Project including the construction of the railway and load out facilities, construction of stream crossings, and installation of water supply do have the potential to result in air emissions and/or surface water discharges to the environment. The emissions/discharges occurring, however, will be unlikely to affect the surrounding environment and can be managed to acceptable levels using standard mitigation measures and management practices.

The following activities during Project operations have the potential to result in air emissions and/or surface water discharges and therefore interact with physical health: rail transport; on-site vehicle/equipment operation and maintenance; fuel storage and dispensing; and progressive rehabilitation. Such emissions will be intermittent and insufficient to affect the surrounding environment and can be managed to acceptable levels using standard mitigation measures and management practices.

During site decommissioning and reclamation, air emissions will result from the operation of various pieces of diesel operated equipment. Such emissions, however, will be nominal and temporary and can be managed to acceptable levels using standard mitigation measures and management practices.

Thus, in consideration of the nature of the interactions and the planned implementation of known and proven mitigation, the potential environmental effects on Physical Health of all Project activities and physical works that were rated as 0 or 1 in Table 25.2, during all phases of the Project are rated as not significant, and are not considered further in the assessment.

Various activities may result in air emissions and/or surface water discharges that have the potential to interact with physical health (e.g., air and water quality), including site preparation, construction of the TMF, open pit mining, ore processing, tailings disposal, and water treatment and discharge. These emissions/discharges may result in exceedances of acceptable levels without the implementation of Project-specific mitigation and these interactions have therefore been rated as 2 and are further assessed in the environmental effects assessment that is provided in this VEC chapter.

25.4.2 Community Health

Development projects can have both positive and negative effects on nearby communities and their residents. This can include, for example, the creation of new or enhanced employment and business opportunities, as well as an overall associated increase in the quality of life that is associated with project work. Those who earn higher incomes may, for example, experience reduced financial stress and enjoy benefits such as enhanced access to various amenities. At the same time, however, there may be adverse health issues that stem from changes to the social, economic and biophysical environments. Health effects can include those associated with safety issues, disease rates, socially-related health problems and mental health and well-being. Any such negative effects may have implications for individual or community health and residents' perceptions of their overall quality of life and well-being.

Again, project activities and components are listed below in Table 25.3, and potential interactions are rated as 0, 1, or 2 based on the anticipated effect that each will likely have on defined aspects of community health.

Table 25.3 Potential Project Environmental Effects to Community Health

Project Activities and Physical Works	Potential Environmental Effects			
	Changes In:			
	Safety (Worker and/or Public)	Substance Abuse	Crime	Perceptions of Quality of Life and Well-Being
Construction				
Site Preparation (including clearing, excavation, material haulage, grading, removal of overburden and stockpiling)	1	0	0	1
Construction of Roads	1	0	0	1
Construction of Site Buildings and Associated Infrastructure (maintenance facilities, offices, plant, crushers, concentrator, conveyors, gatehouse, pumphouses, substation, security fencing, sanitation system)	1	0	0	1
Construction of Mine Tailings Management Facility (TMF)	1	0	0	1
Construction of Railway and Load-out Facilities (silos)	1	0	0	1
Construction of Power Line	1	0	0	1
Construction of Stream Crossings	1	0	0	1

Project Activities and Physical Works	Potential Environmental Effects			
	Changes In:			
	Safety (Worker and/or Public)	Substance Abuse	Crime	Perceptions of Quality of Life and Well-Being
Installation of Water Supply Infrastructure (wells, pumps, pipes)	1	0	0	1
Onsite Vehicle / Equipment Operation	1	0	0	1
Waste Management	1	0	0	1
Transportation of Personnel and Goods to Site	2	0	0	2
Expenditures	0	1	1	1
Employment	1	2	2	2
Operations and Maintenance				
Open Pit Mining (including drilling, blasting, ore and waste haulage, stockpiling, dewatering)	1	0	0	1
Ore Processing (including crushing, conveying, storage, grinding, screening)	1	0	0	1
Concentrator Operations (gravity and magnetic separation, tailings dewatering, tailings thickener, concentrate conveyance to load-out)	1	0	0	1
Tailings Disposal in TMF	1	0	0	1
Waste Rock Disposal on Surface	1	0	0	2
Water Treatment (including mine water and surface runoff) and Discharge	1	0	0	1
Rail Load-Out by Silo Discharge	1	0	0	0
Rail Transport	1	0	0	1
Onsite Vehicle / Equipment Operation and Maintenance	1	0	0	0
Waste Management	1	0	0	0
Transportation of Personnel and Goods to Site	2	0	0	1
Fuel Storage and Dispensing	1	0	0	0
Progressive Rehabilitation	1	0	0	0
Expenditures	0	1	1	1
Employment	1	2	2	2
Decommissioning and Reclamation				
Site Decommissioning	1	0	0	1
Site Reclamation (building demolition, grading, scarifying, hydroseeding)	1	0	0	1

Project Activities and Physical Works	Potential Environmental Effects Changes In:			
	Safety (Worker and/or Public)	Substance Abuse	Crime	Perceptions of Quality of Life and Well-Being
Accidents and Malfunctions				
Spill / Release of Hazardous Materials	1	0	0	2
Forest Fire	1	0	0	2
KEY 0 = No interaction. 1 = Interaction occurs; however, based on past experience, the resulting effect can be managed to acceptable levels through standard operating practices and / or through the application of best management or codified practices. No further assessment is warranted. 2 = Interaction occurs, and resulting effect may exceed acceptable levels without implementation of specific mitigation. Further assessment is warranted.				

Project activities in any phase may interact with worker health and safety but the resulting effects can be managed to acceptable levels by following regulations and using environment, health and safety programs to prevent accidents and other health and safety issues. Worker health and safety in Newfoundland and Labrador is regulated through the Occupational Health and Safety Act and managed by industry and employer programs. The Workers Health, Safety and Compensation Commission (WHSCC) is a regulated (Workplace Health, Safety and Compensation Act) employer-funded insurance. Employers must register with WHSCC, establish and work with an internal occupational health and safety committee, facilitate workplace inspections and report incidents.

Historically, the mining industry had a relatively high risk of health hazards. However, fatalities and injuries have been greatly reduced through technological innovation, safe work policies / programs and government regulations. In 2008, the Canadian mining industry had 9.9 work related injuries per 1,000 employed workers compared to 24.5 in the construction and 24.0 in manufacturing (HRSDC 2012). Local companies set high standards for worker health and safety. For example, despite increases in employee worked hours due to mine expansion activities, IOC's injury frequency rates are lower than the national average in both mining and construction activities (IOC 2011).

The Canadian mining and construction industries therefore currently have high standards of worker health and safety. These are driven by the desire to reduce the potential for harm to employees and communities, to be employers of choice, to meet regulatory requirements and to reduce insurance costs and legal liability. As part of their safety management programs, companies monitor safety incidents and produce annual statistics.

Alderon is committed to following applicable mining industry guidelines and is required to comply with provincial government regulations and procedures for worker health and safety. Potential effects to worker health and safety are therefore not subject to additional assessment in this VEC - although, given the overall importance of this issue, additional information on worker health and safety regulations and recent experience is provided in the "existing environment" section that follows, as additional background and context.

Most individual activities related to each Project phase are not expected to, in and of themselves, cause an increase in substance abuse or crime, although individually or collectively many could affect perceptions of quality of life and well-being (e.g., cause noise, dust or limit access to recreational activities) during construction and operations.

The following anticipated interactions and their potential related effects on community health are subject to further assessment:

- Certain Project activities (e.g., transportation) may have an adverse effect on public safety and/or perceptions of quality of life and well-being due to increased traffic, or through nuisance effects (e.g., traffic delays or the visibility of Project components). Because of the concerns expressed regarding these issues and the need to develop and implement Project-specific mitigation to address these issues, these potential interactions are rated as two and are subject to further assessment.
- Increases in substance abuse and/or crime during the construction and operations of development projects may be experienced when the population suddenly increases due to in-migration of construction or mine workers and others working in support industries. Some of these workers may not have a long-term attachment to the community and / or sufficient life skills or experience with managing their incomes. They may use their increased disposable income to purchase alcohol or drugs which may be problems in their own right, but may also lead to other social issues.

25.4.3 Selection of Environmental Effects and Measurable Parameters

The environmental effects assessment for the Health and Community Health VEC is focused on the following environmental effects:

- Change in human (physical) health (due to associated changes in the quality of air, water, soil and/or country foods);
- Change in public safety (injuries / accidents);
- Change (increase) in substance abuse;
- Change (increase) in crime; and
- Change in perceptions of quality of life and well-being.

These potential effects are considered to be the primary potential outcomes which may result from the possible interaction of Project components and activities with Health and Community Health.

The environmental effects assessment for this VEC focuses primarily upon the key potential effects identified above, with a series of Measureable Parameters then being defined which represent associated aspects of the VECs to which changes could possibly be detected / measured. Although some potential Project effects may be indeed be "measured", for many potential social and cultural issues quantitative predictions are frequently neither possible nor particularly meaningful. In these cases, the identified Measureable Parameters are primarily used as key concepts upon which to focus the effects assessment, rather than to generate quantitative effects predictions.

The measurable parameters used for the assessment of the various potential environmental effects, and the rationale for their selection, are indicated in Table 25.4.

Table 25.4 Measurable Parameters for Health and Community Health

Environmental Effect	Measurable Parameter	Rationale for Selection of the Measurable Parameter
Change in human (physical) health	Emissions and ambient concentrations of criteria air contaminants (CAC) and non-criteria air contaminants (Non CAC) ($\mu g/m^3$)	• Regulatory objectives, guidelines and / or standards exist provincially and federally for the measurable parameters.
	Discharge, dilution, and surface water concentrations of contaminants (mg/L)	• Regulatory objectives, guidelines and / or standards exist provincially and federally for the measurable parameters. • Concerns expressed in community consultation.
	Emissions and deposition of contaminants in dust fall (mg/m^2/year) and change in baseline soil quality (mg/kg).	• Concerns expressed in community consultation.
	Contaminant levels in country foods due to changes in baseline soil (mg/kg), vegetation (mg/kg), and/or water quality (mg/L).	• Concerns expressed in community consultation.
Change in public safety (injuries / accidents);	Numbers of accidents / injuries / fatalities	• Concerns expressed in community consultation.
Change (increase) in substance abuse	Incidence of substance abuse	• Concerns expressed in community consultation .
Change (increase) in crime	Incidence of crime, crime rate per capita and types of crimes	• Concerns expressed in community consultation.
Change in perceptions of quality of life and well-being	Residents' self-assessed quality of life and well-being	• Concerns expressed in community consultation.

25.5 Existing Environment

Health and community health is influenced by and reflected in the physical, social, emotional and mental health of a community's residents, including personal wellness, family and community life, and overall perceptions of these factors. A variety of existing and available information sources have been used to understand and describe the existing environment for both physical health and community health, each of which are discussed below.

25.5.1 Physical Health (Air, Water, Soil Quality)

As indicated previously, the primary potential interactions between the Project and physical health are via air emissions (contaminant concentrations or dust fall) and surface water discharges (diffuser in Long Lake). The environmental effects assessments for the Atmospheric Environment and Water Resources VECs are described in detail in previous chapters of this EIS. To assess the potential effects of the project on physical health, the effects of air and water emissions on existing baseline air, soil, and water quality are examined.

Summaries of the existing air, soil, and water quality in the LSA are provided in the following sections. Note that a full description of baseline air and water quality is provided in Chapters 14 and 16. This section focuses on summarizing the results of these chapters which are particularly relevant to human health issues and effects. This is followed by an associated overview discussion of human health (incidence of diseases, self-assessed health and well-being, etc) in the various communities and regions which comprise the LSA, as further background and context related to existing human health characteristics.

25.5.1.1 Air Quality

Section 14.5 of the EIS describes ambient air quality in the LSA, and the associated Tables provide baseline data for CAC measured in Labrador City, Wabush, Fermont, and the shoreline of Long Lake.

Particulate matter has been identified as the primary air quality public concern in relation to the Project. The NL Department of Environment and Conservation compiles annual ambient air quality monitoring reports for many communities across the province, including Labrador City and Wabush. Monthly maximum values for sulfur dioxide (SO_2), nitrogen dioxide (NO_2), total particulate matter (TSP) and particulate matter less than 2.5 microns in diameter ($PM_{2.5}$) are recorded, and any exceedances to provincial standards are identified. TSP does occasionally exceed standards, however the average air quality is good, and $PM_{2.5}$, SO_2 and NO_2 ambient concentrations are below standards.

Additional air quality monitoring of $PM_{2.5}$ and particulate matter less than 10 microns in diameter (PM_{10}) was completed within Wabush, Fermont, and the northern edge of Duley Lake Provincial Park Reserve over two weeks during the summer of 2011 and winter of 2012 by Alderon. In general, there were occasional exeedances, possibly attributable to other nearby activities (e.g., ATV operation). Detailed information can be found in Chapter 14 of this EIS.

25.5.1.2 Water Quality

Surface water is used locally as the public water supply such as for the Towns of Labrador City, Wabush and Fermont as well as local cabins. The sustainability of water supply and preservation of water quality are critical to maintain and protect. Alderon has implemented a routine seasonal baseline surface water field monitoring program to continuously monitor representative location stream flow and lake level measurements within the LSA. Long Lake is the largest waterbody within the LSA and will also receive runoff from a portion of the PDA. Due to its size and large upstream watershed catchment area, Long Lake is also proposed to be the primary raw water supply source and treated effluent discharge receiving waterbody for the Project.

Baseline water quality results are presented in Chapter 16. Some exceedances of water quality criteria (Canadian Council of Ministers of the Environment (CCME) Freshwater Aquatic Life (FAL) Guidelines) were noted including several total cadmium exceedences of the hardness-adjusted CCME FAL limits in Long Lake LL2 and LL3 sample locations in April 2012 samples. A slight copper exceedance was observed at L1 with a value of 2.4 µg/L, which exceeded the CCME FAL minimum threshold of 2 µg/L. Total iron concentrations were all below the CCME FAL with the single exception of station S2 in March sampling.

25.5.1.3 Soil Quality

To assess baseline soil quality in the LSA, 14 surface soil samples were collected at the locations shown on Figure 25.3 and submitted for laboratory analysis of trace metals.

Samples were collected from 0 – 15 cm below grade with any vegetation or decaying organic matter removed and were prepared for analysis using EPA Method 3050B, in accordance with Canadian Council of Ministers of the Environment (CCME) recommended protocols.

A summary of results is provided below in Table 25.5 along with the Canadian Council of Ministers of the Environment (CCME) Soil Quality Guidelines (SQG) for residential/parkland land use. There are no exceedances of the CCME SQG, where available, in the baseline samples.

The typical range value (TR_{98}) represents the 97.5^{th} percentile of the data and approximates an upper limit of normal for the baseline conditions. These values are adopted as point estimates of baseline conditions in accordance with protocols of the Ontario Ministry of the Environment (OMOE 1993). Incremental soil concentrations due to dust emissions and deposition are compared to these baseline values in the environmental effects assessment for this VEC.

Figure 25.3 Soil Sampling Locations and Select Receptor Locations

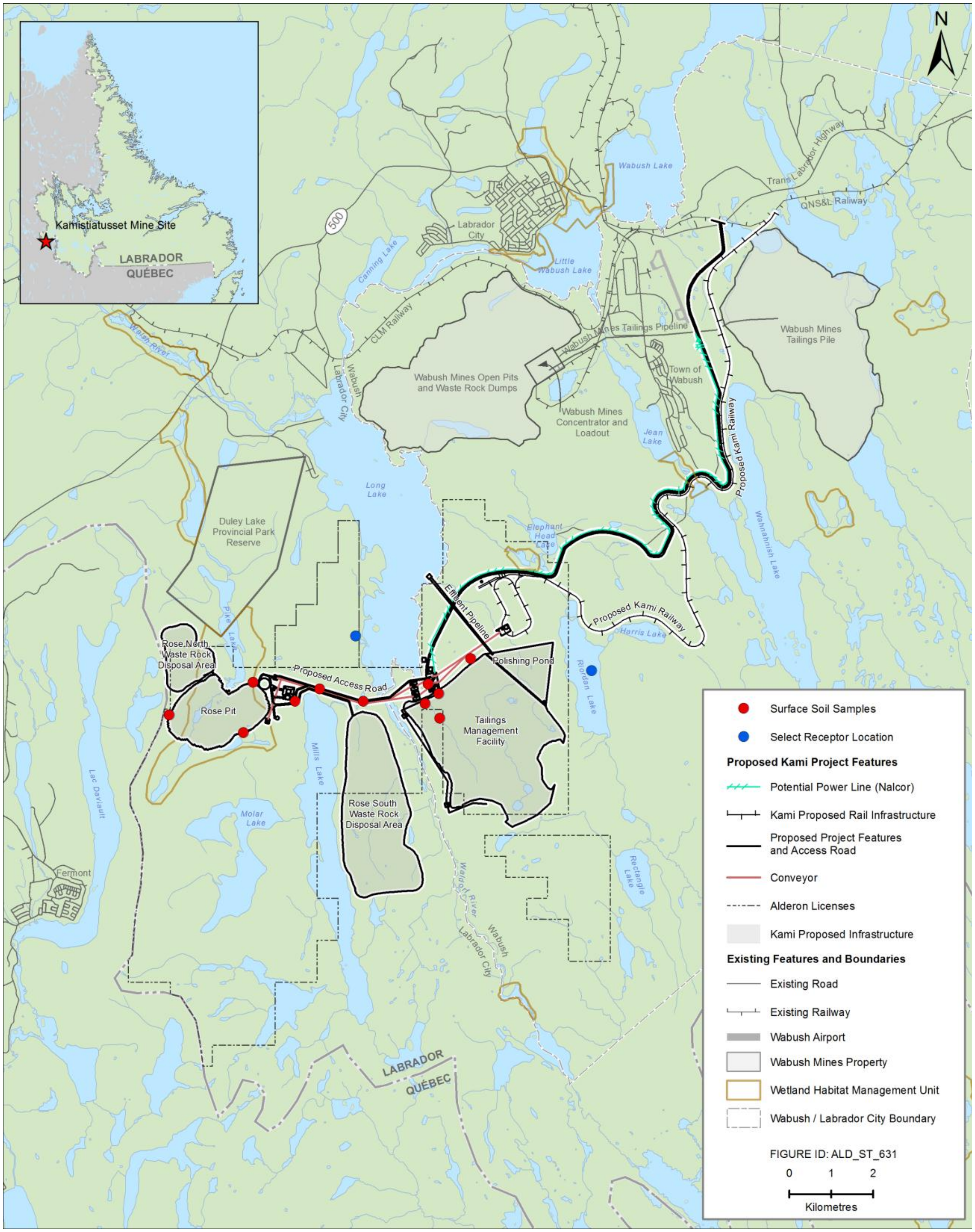


Table 25.5 Summary of Baseline Soil Metals Concentrations in the LSA

Parameter	Number of Samples (n)	CCME SQG[a]	Range (mg/kg)	Mean (mg/kg)	TR_{98} (mg/kg)
Aluminum	14	nv	432 – 10,400	5,300	9,900
Antimony	14	nv	0.05 – 0.6	0.11	0.5
Arsenic	14	12	0.5 – 1	0.57	1
Barium	14	nv	18.5 – 786	98	560
Beryllium	14	nv	0.05 – 0.3	0.12	0.26
Bismuth	14	nv	0.5 – 5	1.2	4.6
Cadmium	14	10	0.015 – 0.21	0.084	0.2
Chromium	14	64	2 – 49	23	46
Cobalt	14	nv	0.4 – 8.9	3.9	7.9
Copper	14	63	2 – 17	8.3	16
Iron	14	nv	4,345 – 41,200	16,000	37,000
Lead	14	140	1.4 – 5.9	3.6	5.5
Manganese	14	nv	32.5 – 8,640	1,000	6,300
Molybdenum	14	nv	0.2 – 29.7	5.5	29
Nickel	14	50	2 – 19	9.3	18
Selenium	14	1	0.5 – 0.5	0.5	0.5
Silver	14	nv	0.05 – 0.4	0.075	0.28
Strontium	14	nv	8 – 21	15	20
Thallium	14	1	0.05 – 0.1	0.075	0.1
Tin	14	nv	0.5 – 0.5	0.5	0.5
Uranium	14	23	0.2 – 4.8	1.1	4.2
Vanadium	14	130	1 – 41	17	37
Zinc	14	200	7 – 29	20	28

Notes:
[a] Canadian Council of Ministers of the Environment Soil Quality Guidelines (CCME SQG) for Residential Parkland land use.
nv No value.

25.5.2 Individual and Community Health

To present a comparative overview of health and well-being in the LSA (including the communities of Wabush, Labrador City and Fermont), this section presents health data from local, regional and provincial jurisdictions. Where appropriate, data are identified by area and date.

Data sets vary by jurisdiction and timeframe, are often limited at the community and / or regional level, especially as they may be suppressed due to the small population size and sampling variability (especially for rare conditions). This often limits the ability to meaningfully compare between jurisdictions. Therefore, the data have been interpreted cautiously throughout this assessment.

In many areas, physicians are employed on a fee for service basis and because reports are submitted to the provincial medical care program for compensation, these data are available to NLCHI. However, most physicians in Labrador are salaried and NLCHI does not have access to data for conditions treated by salaried physicians in clinics. Therefore, for Labrador, hospitalizations are the most complete data set available as it includes hospital admissions by both salaried and fee for service physicians. Hospitalization does not, however, capture data for illnesses that are usually treated by a family physician in an office setting.

25.5.2.1 Labrador West

The following sections describe current health status, quality of life, health and safety and crime in Labrador West. This baseline provides a basis for determining the existing state of health and community health, for the subsequent assessment and evaluation of potential Project-related changes (effects).

Labrador West's population trends (growth or decline) is tied to iron ore and steel markets. In fact, there were no communities prior to the establishment of the IOC mine in 1961. The combined population of both Labrador City and Wabush exceeded 12,000 in 1976 and since then had generally declined. Since 2006, population growth has occurred in both towns but has not returned to 1996 levels (Table 25.6). It is anticipated that with mining expansion and new development, additional workers and their families will relocate to Labrador West and the population will continue to increase.

Table 25.6 Labrador West Population

Community	1996	2001	2006	2011	% Change
Labrador City	8,455	7,744	7,240	7,367	-12.8%
Wabush	2,018	1,894	1,739	1,861	-7.7%
Labrador West	**10,473**	**9,638**	**8,979**	**9,228**	**-11.8%**
Source: Statistics Canada 1996, 2001, 2006, 2011					

The current population size means that there is capacity in some systems such as schools and the hospital. However, the ongoing lack of capacity in some areas (e.g. housing and hotel accommodations) is related to construction population workforces for mining projects, transportation infrastructure improvements (e.g., railway underpass, Trans Labrador Highway widening and paving), construction of regional infrastructure such as the new college and hospital and other residential and commercial developments.

Health Status

Various indicators, including self-assessed health status and prevalence of disease, are used to analyse community health in Labrador West (which includes Labrador City, Wabush and

Churchill Falls, Table 25.7). These indicators are from a variety of sources using various timeframes (e.g., calendar or fiscal year). Where possible, they are also compared to the same indicators for Labrador-Grenfell Regional Health Authority and the province as a whole.

Overall, the residents of Labrador West have self-reported similar health and well-being to residents of the province in general. More than 67 percent of residents rate their health status as "excellent or very good", which is higher than that reported for residents of the Labrador-Grenfell Health's total area of jurisdiction and that of the province as a whole.

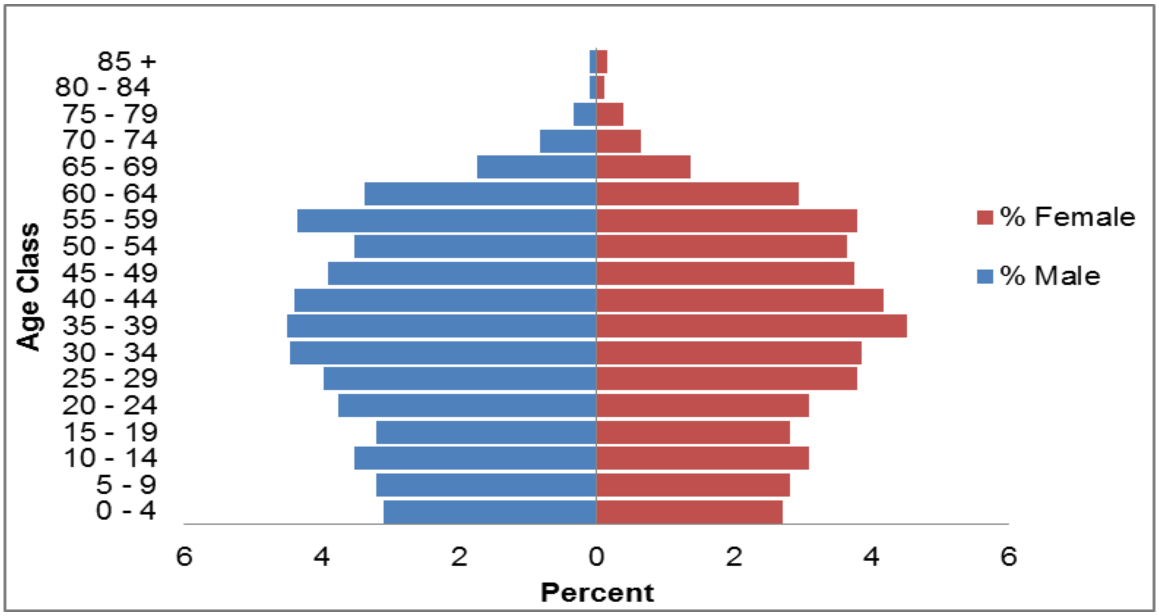
Table 25.7 Community Health Indicators

Indicator	Labrador West[1]	Labrador-Grenfell Regional Health Authority[2]	Newfoundland and Labrador
Excellent or very good self-assessed health status, age 12+ (2009-10)	67.1%	62.5%	60.1%
High blood pressure (2009-10)	15.8%[e]	17.5%	22.9%
Life expectancy at birth (2007/2009)	n/a	78.1	78.9
Smoke daily, age 12+ (2009-10)	29.1%[3]	28.4%	18.6%
Heavy drinkers (5 or more drinks on one occasion, 12 or more times a year), age 12+ (2009-10)	51.2%	42.9%	32.9%
Overweight (BMI[4] 25 or greater), age 18+ (2009-10)	63.7%	63.8%	64.7%
Physically inactive, age 12+ (2011)	n/a	48.1%	50.1%
Excellent self-assessed mental health (2007-08)	32.2%	36.6%	36.4%
Very satisfied or satisfied with life in general (2009-10)	87.6%	88.6%	87.7%
Very strong sense of belonging to community (2009-10)	80.4%	86.2%	80.3%
Life stress rated as 'quite bit', age 18+ (2009-10)	12.6%	14.8	14.0%

Notes:
[1] Labrador West includes Labrador City, Wabush and Churchill Falls unless otherwise indicated.
[2] Labrador-Grenfell Regional Health Authority includes all of Labrador and communities north of Bartlett's Harbour on the northern peninsula of Newfoundland.
[3] Labrador Rural Secretariat Region includes all of Labrador.
[4] Body Mass Index, a measure based on the ratio between an individual's weight and height.
[e] Denotes high sampling variability. Coefficient of variation is equal to or between 16.6% and 33.3%.
Source: Community Accounts 2012

Lower rates of chronic illnesses may be somewhat attributed to the area's economic characteristics. Because a large number of people moved to Labrador West in the 1960s for career opportunities in the mining industry, many have also subsequently left the area following retirement. This has resulted in a somewhat young population (relative to the rest of the province) that would naturally have lower incidence of chronic disease. The percentage of residents over 65 in the region is notably smaller than the provincial situation (Figures 25.4 and 25.5).

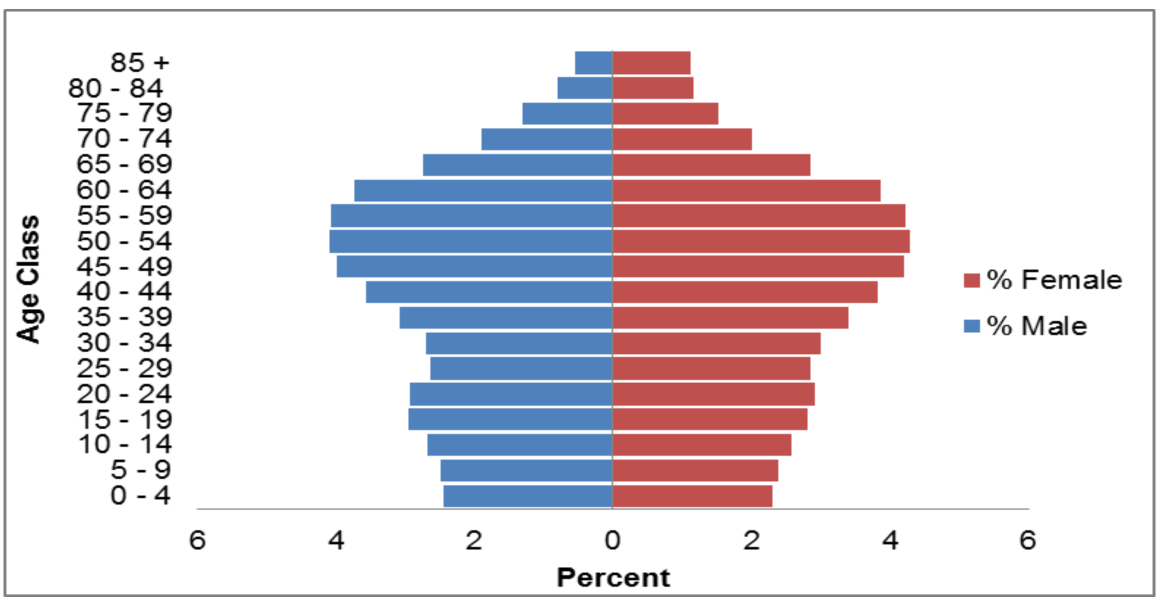
Figure 25.4 Age / Sex Structure Labrador West (2011)



Source: Statistics Canada 2011

The provincial population has a higher proportion of people over the age of 65 years.

Figure 25.5 Age / Sex Structure Newfoundland and Labrador (2011)



Source: Statistics Canada 2011

Data on the incidence of specific diseases is not available for Labrador West (and often not for Labrador itself). Hospitalization rates for selected conditions are provided and compared below for Labrador West, Labrador-Grenfell Health and the province. These data have been segregated for Labrador City and Wabush (without Churchill Falls). Note that the data are not age-standardized and may be affected by the underlying effect of differing age distributions in various jurisdictions.

Specific illnesses have been selected for this analysis and are based on the key issues identified through Project-related consultation or in the EIS Guidelines (e.g., respiratory diseases). Cancers were also chosen because the population of Labrador West has relatively high cancer mortality compared to the province as a whole. Heart disease and diabetes are also common throughout the province and may be the result of age or poor health practices in general.

In Labrador West, hospitalizations for respiratory illnesses have decreased since 2006, and appear to now be lower than Labrador-Grenfell Health and the province (Table 25.8). Due to the small number of cases, hospitalizations for asthma have been suppressed in the data, but hospitalizations for this illness appear to have been declining across the jurisdictions. Lung cancer hospitalization rates also appear to have declined across all jurisdictions.

Table 25.8 Hospitalization Rates for Selected Conditions

Condition (per 10,000 persons)	Labrador West[1]		Labrador-Grenfell Regional Health Authority[2]		Newfoundland and Labrador	
	2006/07	2010/11	2006/07	2010/11	2006/07	2010/11
Respiratory illness	159.2	98.6	148.4	129.3	135.0	136.0
Asthma	14.5	**	9.7	4.7	7.8	5.4
Lung cancer	10.0	6.5	7.3	5.8	11.4	11.3
Ischemic heart disease[3]	56.8	39.0	63.8	57.2	82.0	75.6
Diabetes	98.0	80.2	107.2	148.0	131.8	166.0
Mental Illness	83.5	67.2	91.3	85.8	71.8	82.0
Substance Abuse	20.0	18.4	18.8	14.0	13.2	14.7

Notes:

1 Labrador West includes Labrador City and Wabush

2 Labrador-Grenfell Regional Health Authority includes all of Labrador and communities north of Bartlett's Harbour on the northern peninsula of Newfoundland.

3 Ischemic heart disease is characterized by ischaemia (reduced blood supply) of the heart muscle, usually due to coronary artery disease. Its risk increases with age, smoking, high cholesterol levels, diabetes and high blood pressure.

** Data suppressed due to small cells counts (less than 5)

Note: Rates are crude rates and may be affected by the differing age distributions in various areas of the province.

Source: NLCHI 2012

Hospitalization for diabetes appears to be lower in Labrador West than Labrador-Grenfell Health and half the provincial average. The difference may be somewhat attributed to lack of age-standardization of data.

Hospitalizations for mental illness and substance abuse have decreased in Labrador West and Labrador-Grenfell Health in recent years but have increased throughout the province. Mental illness, substance abuse, and their management and treatment, are complex issues. Therefore, reduced or increased hospitalizations may be an indication of the quality care by physicians, counselors and other professionals outside of hospital and / or other support programs.

Currently, a new 14-bed acute care and 14-bed long-term care health care centre is being constructed on Route 500 in Labrador City with an anticipated opening date of late 2013. This facility will have similar capacity to the existing Captain William Jackman Memorial Hospital. Activity at the current hospital is presented in Table 25.9. Acute care occupancy has decreased slightly in recent years and births have increased slightly.

Table 25.9 Hospital Statistics, Captain William Jackman Memorial Hospital

Indicator	2007	2008	2009	2010
Occupancy – acute care	56.4%	63.8%	54.6%	50.1%
Occupancy – long-term care	96.8%	85.7%	89.2%	84.3%
Number of births	85	85	86	90
Emergency room visits	23,559	22,364	22,879	22,477
Source: LGH 2010				

Although Captain Jackman Memorial Hospital has acute care capacity, Labrador West lacks adequate health care providers including mental health professionals. Labrador-Grenfell Health has vacancies that result in wait times of up to four to six weeks for mental health counselling in Labrador West. Due to lack of success in recruiting a full-time practitioner, a psychiatrist visits Labrador West only twice each year (Chapter 24).

It must be remembered, however, that hospitalization is not a complete indicator of the occurrence or prevalence of disease. For example, reduced hospitalization for illnesses such as asthma or diabetes may be due to improved health education and disease management. Lower hospitalization for chronic illnesses and cancer may also be a result of having a younger population or other factors.

Among other programs, Child, Youth and Family Services (CYFS) provides mental health and addictions treatment and support through Labrador-Grenfell Health. Between 2007 and 2010, Labrador-Grenfell Health experienced a 30 percent increase in the number of patients receiving mental health services throughout its entire service area which includes all of Labrador and a portion of Newfoundland's Northern Peninsula.

Table 25.10 Labrador-Grenfell Health, Mental Health and Addictions Services

Service	2007-08	2008-09	2009-10	% change
Mental Health and Addictions Treatment	8,178	9,228	10,616	29.8%
Source: LGH 2010				

Due to the small number of patients and privacy issues, Labrador-Grenfell Health does not publish information specific to Labrador West. Abuse of prescription drugs has, however, reportedly increased in Labrador West (A. Parsons, pers. comm. 2011).

Nearly $200,000 was committed in the 2011 Provincial Budget to oversee and manage mental health and addictions referrals in Labrador West and Happy Valley-Goose Bay. Provided that recruitment and retention efforts are successful, the level of care should improve in the coming years.

Concerns have also been expressed through Alderon's community consultation initiatives about existing and proposed mining developments possibly resulting in relatively high blood iron levels in local residents. This may be referring to a condition called hemochromatosis, which causes a person to absorb two to three times the normal amount of iron from their food. Hemochromatosis is an inherited condition for which the recessive gene is estimated to be carried by one-in-nine people of Northern European descent. A person must inherit two recessive genes to be at risk of iron overload, and not all who have two genes develop the disorder (Canadian Hemochromatosis Society 2012). Along with having two recessive genes (which is the greatest factor), other risk factors include having a parent or sibling with the disease, being of Northern European descent and being male (Mayo Clinic 2012).

Hemochromatosis is often overlooked as it is may be an underlying causative factor in other illnesses. Its symptoms include chronic fatigue, depression, abdominal pain and aching joints. When the condition is advanced, symptoms are more serious and include diabetes, hypothyroidism and liver disorders. Once diagnosed, hemochromatosis can be treated in physician's office by phlebotomy, or removal of blood to reduce iron (similar to the process used for blood donation) until blood iron is within the normal range (Mayo Clinic 2012; Canadian Hemochromatosis Society 2012).

The best available information on the occurrence of hemochromatosis comes from NLCHI (Table 25.11). The data covers hospitalization for treatment of this illness in Labrador West, Labrador-Grenfell Health and Newfoundland and Labrador. While the data are variable, it appears that only a small proportion of the population in any jurisdiction has been hospitalized for treatment.

Table 25.11 Hospitalization for Hemochromatosis

Year	Hospitalization Rates (per 100,000 population)		
	Labrador West	Labrador-Grenfell Regional Health Authority[1]	Newfoundland and Labrador
2006	61.080	16.213	20.870
2007	**	**	20.674
2008	0.000	0.000	13.585
2009	0.000	0.000	6.694
2010	**	**	10.632

Notes:
[1] Labrador West includes Labrador City and Wabush
[2] Labrador-Grenfell Regional Health Authority includes all of Labrador and communities north of Bartlett's Harbour on the Northern Peninsula of Newfoundland.
** Data suppressed (less than 5)
Note: Rates are crude rates and may be affected by the differing age distributions in populations.
Source: NLCHI 2012

The data on hemochromatosis are not robust for several reasons. As discussed above the illness is rare and / or often misdiagnosed. Due to the small numbers of incidents, data may be suppressed. Also, as this condition is mainly treated in physicians' offices it may not be fully represented in these data, particularly for Labrador.

Causes of Mortality

The main causes of mortality for Labrador and for the province are shown in Table 25.12. Similar data are not available for Labrador West. The Labrador-Grenfell Health Regional Health Authority region shows higher rates of death due to cancers, circulatory disease and unintentional injuries. Residents of this relatively large area also have a higher rate of premature mortality that the population of the province as a whole.

Table 25.12 Rates of Death (2011)

Cause of Death (per 100,000 population, age-standardized)	Labrador-Grenfell Regional Health Authority[1]	Newfoundland and Labrador
Total, all causes of death	781.1	687.6
All cancers	212.4	195.4
Circulatory disease	269.9	232.4
Respiratory disease	50.8	51.0
Unintentional injuries	37.0	21.9
Premature mortality	342.9	306.7

Notes:
Labrador-Grenfell Regional Health Authority includes all of Labrador and communities north of Bartlett's Harbour on the Northern Peninsula of Newfoundland.
Source: Statistics Canada 2012c

These data are age-standardized, which makes the information reliably comparable across jurisdictions.

Health Practices

Health practices, such as lifestyle choices, are important indicators of health and well-being as they can be beneficial or detrimental to an individual's health. Based on the available data, health practices in Labrador West appear to be similar to Labrador-Grenfell Health and the province.

Both Labrador West and Labrador-Grenfell Health's area of jurisdiction have a higher self-reported percentage of smokers (both more than 50 percent higher) than the province in general. The number of self-reported heavy drinkers is also higher. Hospitalization for substance abuse in Labrador West appears to be higher than for Labrador-Grenfell Health and the province. The likelihood of being overweight (BMI of 25 or higher) and / or physically inactive is greater than 50 percent in all three jurisdictions (Community Accounts 2012).

Quality of Life

Life satisfaction is appears to be high in Labrador West, Labrador-Grenfell Health's jurisdiction and the province of Newfoundland and Labrador as a whole (rated 87 percent and higher), and the perceived sense of community is also high. Labrador West residents report lower levels of life stress compared to the other jurisdictions. Hospitalizations for mental illness appear to be lower in Labrador West than within Labrador-Grenfell Health and the province. However, the number of individuals seeking help for mental health and addictions issues throughout Labrador-Grenfell Health's jurisdiction is increasing.

Labrador West's relatively high quality of life levels can likely be attributed to several factors including high average employment rate and income. In Economic Zone 2 (Labrador City, Wabush and Churchill Falls), 2006 employment participation rates and average annual income were higher than that of Labrador and the province. Between 2005 and 2009, the number of individuals in Labrador City and Wabush who accessed income support decreased by 40 percent (Appendix J). Therefore, current employment and income figures may be even more favourable (income data from the 2011 Census is not yet available).

Worker Health and Safety

Worker health and safety in Newfoundland and Labrador is regulated through legislation and managed by industry and employer programs. The provincial *Occupational Health and Safety Act* and *Regulations* impose certain minimum conditions on all workplaces which ensure that workers are provided with an environment that does not jeopardize their health and / or safety. The *Act* includes direction on employer's duties, worker's duties, stop work orders, accident reporting and right to refuse work (Service NL 2012).

The Workers Health, Safety and Compensation Commission (WHSCC) is a regulated (*Workplace Health, Safety and Compensation Act*) employer-funded insurance system that helps to ensure safe and healthy workplaces. All employers must register with WHSCC, establish and work with an internal occupational health and safety committee, facilitate workplace inspections and report incidents. WHSCC provides services such as return-to-work programs and compensation to injured workers and dependants (WHSCC 2012).

Some industry sectors establish their own safety training and recognition programs. For example, the Newfoundland and Labrador Construction Safety Association (NLCSA), an industry-driven not-for-profit corporation, provides safety training and related services to the province's construction industry. The NLCSA offers a Certificate of Recognition (COR) program which trains company representatives to develop and maintain a company-wide health and safety management program (NLCSA 2012).

The Canadian mining and construction industries have relatively high standards of worker health and safety. These are driven by the desire to reduce harm to employees and communities, to be desirable employers, to meet regulatory requirements and to reduce insurance costs and legal liability. Both existing Labrador West mining companies, Iron Ore Company of Canada (IOC) and Cliffs Natural Resources (Cliffs), have good overall safety records. As part of their safety management programs, these companies monitor safety incidents and produce annual statistics.

Even with increased production, a higher number of employees, more total working hours and ongoing construction projects, IOC has a good overall safety record (Table 25.13). Compared to Canadian safety benchmarks, IOC's injury frequency rate for both mining and construction falls below the national average, indicating effective health and safety programs.

Table 25.13 Canadian Safety Benchmarks (2008)

Sector	Canadian Injury Rate (Lost time injuries per 1000 employed workers)	Canadian Injury Rate (Equivalent per 200,000 hours worked)	IOC All Injury Frequency Rate (Injuries per 200,000 hours worked)
Mining and quarrying	9.9	0.99	0.91
Construction	24.5	2.45	0.91
Source: IOC 2011			

In addition to ongoing company health and safety programs, since 2010 IOC has required all contractors to adhere to its Substance Abuse Policy. Currently, both employees and contractors are required to participate in drug and alcohol screening prior to performing particular types of work at the mine site. Testing may also occur at other times, especially following an incident (IOC 2010). Residents reportedly feel that this policy and practice has had a positive impact on attitudes about substance abuse.

Cliffs Natural Resources reports safety statistics for all of its mine sites collectively rather than specifically for the Wabush Mines or Bloom Lake sites. Cliffs mine sites reportable incidents are below the average of Canadian injury rates (Table 25.14). The company also requires employees to be tested for drugs and alcohol as a condition of employment at the site.

Table 25.14 Incident Statistics, Cliffs Natural Resources

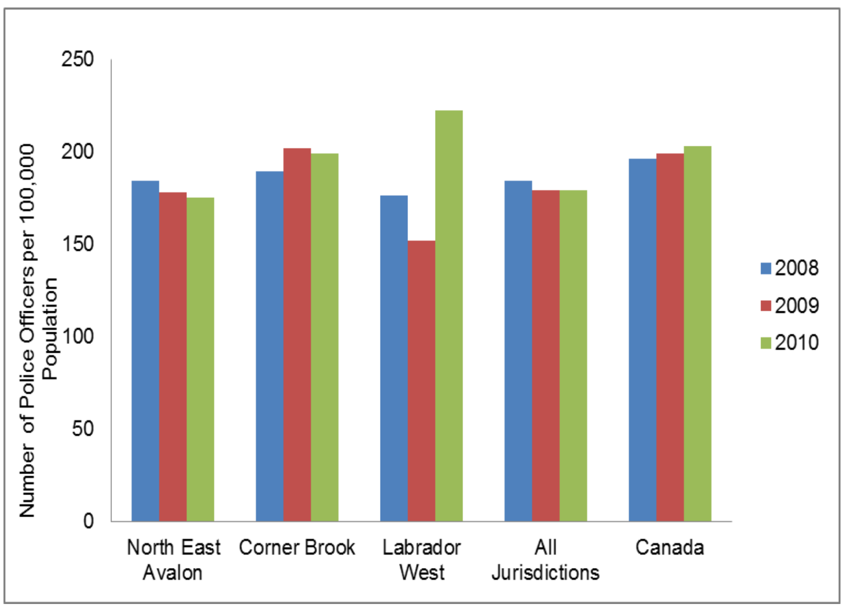
Type of Incident[1]	2006	2007	2008	2009	2010
Total Reportable Incident Rate	2.26	1.93	3.7	2.99	2.93
Lost Days Severity Rate	28.3	25.9	57.8	58.6	52

Notes:
[1] Per 200,000 hours worked.
Source: CNR 2010

Crime and Accidents

The Royal Newfoundland Constabulary (RNC) provides policing services for Labrador West (Labrador City, Wabush and Churchill Falls) and for the Corner Brook and the North East Avalon regions of the Island of Newfoundland. The RNC has increased the number of police officers at its Labrador West detachment in 2010 (Figure 25.6), and the police to population ratio of 222:100,000 is now higher than any of the other RNC jurisdictions in Newfoundland and Labrador and the Canadian average.

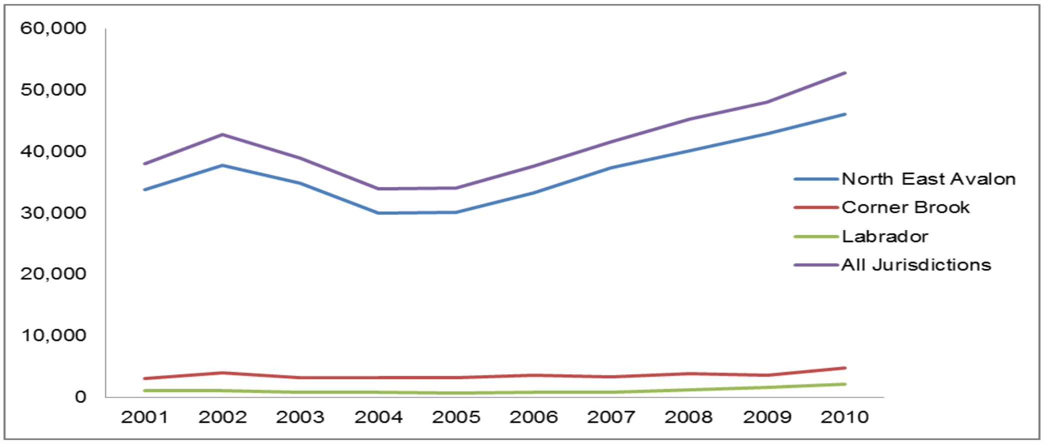
Figure 25.6 Police Population Ratio, All RNC Jurisdictions



Source: RNC 2009, 2010

Recently, an additional inspector has also been assigned to Labrador West. The detachment has also received a new unmarked vehicle and is obtaining four new patrol cars (P. Walsh, pers.comm. 2012). These measures may affect the prevention and detection of crime in Labrador West. In each of the areas policed by the RNC, violations have been increasing (Figure 25.7) in proportion to the size of the population and also in relation to population growth (i.e., more people often equals more incidents).

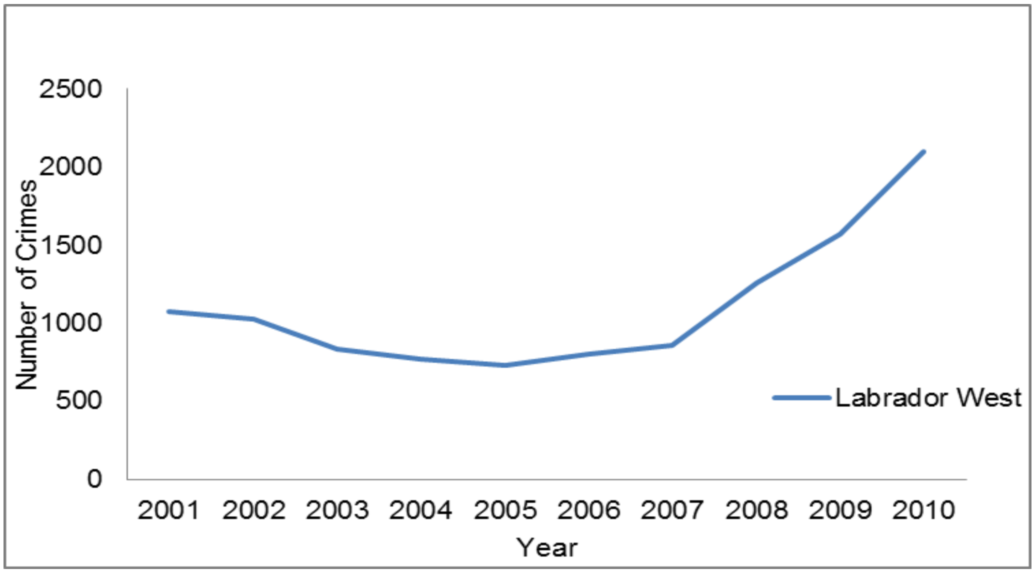
Figure 25.7 All Violations, All RNC Jurisdictions (2001-2010)



Source: RNC 2009, 2010

The number of violations in Labrador West has been increasing most noticeably since 2007 (Figure 25.8)

Figure 25.8 All Violations, Labrador West



Source: RNC 2009, 2010, 2011

Crime, which also has been presented as a concern in the EIS Guidelines, can be an indicator of social change in a community and may be precipitated by population increase - which is anticipated to occur in Labrador West. The total number of criminal violations in Labrador West increased by 95 percent between 2001 and 2010 (Table 25.15) at a time when the permanent population declined, and recently only increased slightly.

It is, however, also important to identify and understand the types of violations that have increased, and to note the increase in surveillance and the number of police vehicles in Labrador West. The RNC in Labrador West is experiencing an increase in activity related to drugs and alcohol which is possibly due to higher disposable income (Walsh. P., pers. comm. 2012).

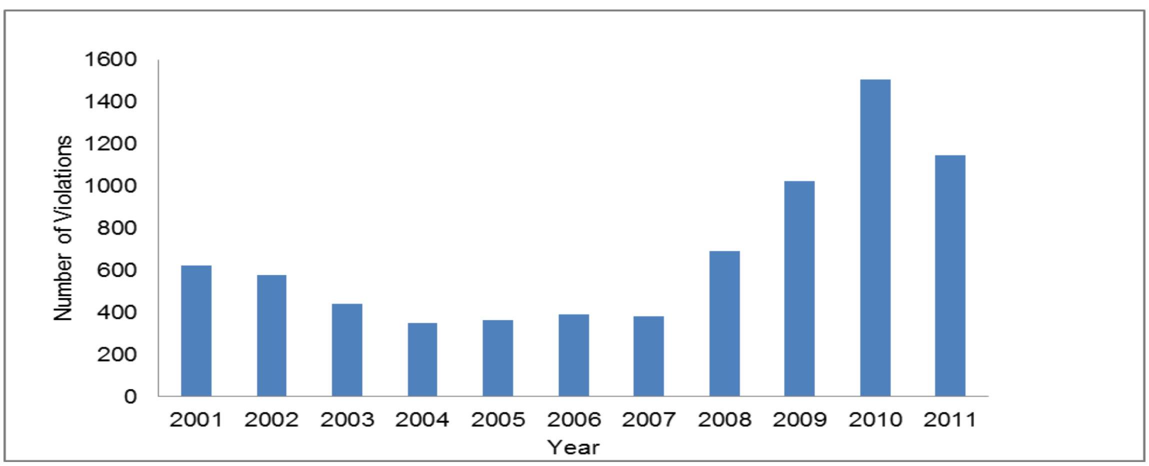
Table 25.15 Types of Violations, Labrador West

Offence Classification	2001	2003	2005	2007	2010	Change[1]
Controlled Drugs and Substances	8	25	11	15	32	300%
Provincial Traffic Offences	422	218	126	133	1,258	198%
Violent Crimes Against a Person	106	59	70	118	148	40%
Traffic Violations / Impaired Operations	39	36	57	49	51	31%
Crimes Against Property	221	247	220	235	281	27%
Motor Vehicle Accidents	164	189	182	198	197	20%
Other Criminal Code Violations	115	54	57	102	132	15%
Other Federal Statutes	0	4	5	7	1	-
Total	**1,075**	**832**	**728**	**857**	**2,100**	**95%**

[1] Change between 2001 and 2010.
Source: RNC 2009, 2010

The increase in violations in Labrador West is influenced mostly by motorists' activities (Figure 25.9). Traffic related incidents (including traffic violations and impaired operations, provincial traffic offences and motor vehicle accidents) together increased by 141 percent between 2001 and 2010. This may be the result of increased police presence. However, these violations also subsequently decreased by 24 percent between 2010 and 2011, which may mean that the increased surveillance is having an effect.

Figure 25.9 Traffic Related Incidents, Labrador West



Source: RNC 2009, 2010

The increase in total provincial traffic offences is largely attributed to moving violations (Table 25.16) and the total number of provincial traffic offences in 2011 had increased by 88 percent over 2001. Motor vehicle accidents have also increased, including non-fatal injury collisions and property damage collisions.

Table 25.16 Traffic Related Incidents, Labrador West

Offence Classification	2001	2006	2011
Traffic Violations			
Total Traffic Violations and Impaired Operations	**39**	**57**	**50**
Impaired Operation of a Motor Vehicle or Over 80mg[1]	32	26	45
Failing/Refusing to Provide a Breath Sample	5	26	4
Provincial Traffic Offences			
Total Provincial Traffic Offences	**422**	**146**	**795**
Failure to Stop or Remain	20	34	50
Other Moving Traffic Violations	321	57	623
Roadside Suspension	36	31	21
Motor Vehicle Accidents			
Total Motor Vehicle Accidents	**164**	**187**	**300**
Non-Fatal Injury Collisions	8	20	24
Property Damage Collisions	155	164	185

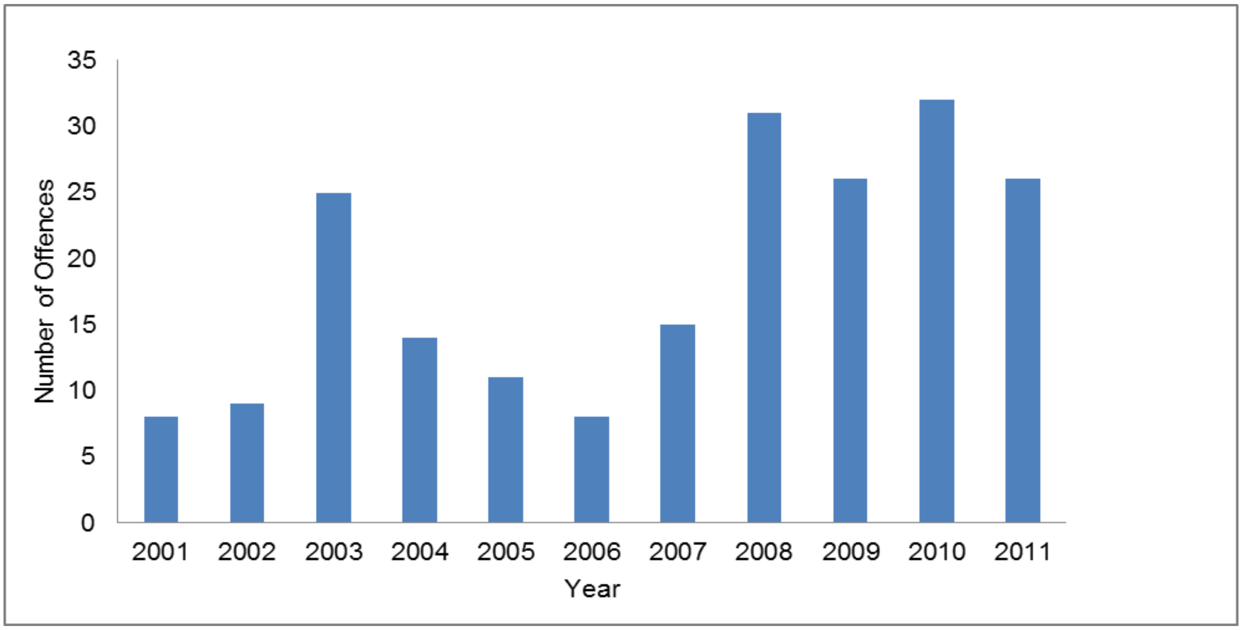
[1] 80mg of alcohol in 100ml of blood is the legal limit of alcohol in Canada.
Source: RNC 2011

Other factors can also influence data trends. Authorities have, for example, suggested that the increasing rate of vehicle ownership in Newfoundland and Labrador is a contributing factor to the increase in motor vehicle accidents. Currently, the province has more registered cars and trucks than it has residents (almost 633,000 in 2010 for a 2011 population of 514,536), with the number of registered vehicles having increased by 20 percent since 2004 (CBC 2012). This may contribute to the traffic problem in Labrador West where employment rates and average income are relatively high. Due to the current level of construction, mining and business activity, Labrador City and Wabush also have a number of individuals who are temporary workers from other areas, some of which would have vehicles.

The number of motor vehicle accidents has increased in Labrador West in recent years, with the total number of accidents increasing by 83 percent (from 164 to 300) between 2001 and 2011. Most incidents were property damage collisions which increased by just under 20percent (from 155 to 185) during the same time period. Non-fatal injury collisions, a relatively small portion of the total, increased by 200 percent (from 8 to 24) between 2001 and 2011 (RNC 2011).

Although far less common than traffic related incidents, the total number of controlled drugs and substances violations has also increased (Figure 25.10). The number of drug violations varied in the years between 2001 and 2011, but overall since 2008 the number has increased and remained higher than in previous years.

Figure 25.10 Drug Violations, Labrador West



Source: RNC 2009, 2010, 2011

Possession of cannabis, the most commonly occurring violation, decreased between 2010 and 2011 (Table 25.17). While there are fewer incidents, trafficking and possession of cocaine are also evident in Labrador West and trafficking offenses increased between 2010 and 2011.

Table 25.17 Drug Violations, Labrador West

Offence Classification	2010	2011
Total Controlled Drugs and Substances Offences	32	26
Possession		
Cocaine	2	2
Cannabis	27	18
Trafficking		
Cocaine	0	3
Cannabis	1	0
Source: RNC 2011		

Criminal Code offences include violent crimes, property crimes, impaired driving and drug violations. In Labrador West, per capita criminal code offences (independent of population size) decreased slightly in 2009 and increased in 2010 (Table 25.18).

Table 25.18 Criminal Code Violation Rate, Labrador West

Indicator (per 100,000 population)	2008	2009	2010
Total Criminal Code Violations	522	506	561
Population (RNC estimate)	9,660	9,844	9,912
Crime Rate	5,403	5,140	5,659
Source: RNC 2009, 2010			

25.5.2.2 Fermont

Various health indicators, including self-assessed health status, prevalence of disease and life expectancy are used to describe and understand community health characteristics in the Côte-Nord Region (Table 25.19). Similar, individual data are not available for the community of Fermont itself.

Table 25.19 Community Health Indicators

Indicator	Région de la Côte-Nord	Québec
Excellent or Very Good Self-assessed Health Status, Age 12+ (2012)	60.1%	60.2%
Prevalence of Diabetes, Age 12+ (2012)	6.2%	5.6%
High Blood Pressure (2012)	16.4%	17.1%
Life Expectancy at Birth (2012)	79.3	81.2
Smoke Daily, Age 12+ (2012)	27.5%	17.3%
Heavy Drinkers (5 or more drinks on one occasion, 12 or more times a year), Age 12+ (2009-10)	25.3%	18.2%
Overweight (BMI 25 or greater), Age 18+ (2012)	57.6%	50.5%
Physically Inactive, Age 12+ (2012)	66.6%	51.1
Excellent Self-assessed Mental Health (2012)	80.1%	76.3%
Very Satisfied or Satisfied with Life in General (2012)	96.5%	94.1%
Very Strong Sense of Belonging to Community (2012)	80.5%	56.7%
Life Stress Rated as 'quite a bit', age 18+ (2012)	20.7%	26.4%
Source: Statistics Canada 2012c		

Health Status

Residents of the Côte-Nord region appear to have similar health and well-being characteristics to the population of Québec as a whole. Over 60 percent of the region's population rate their health status as "excellent or very good", slightly under the provincial figure. The prevalence of diabetes is slightly greater in the Côte-Nord region compared to the province, while high blood pressure is slightly less common. The Côte-Nord's life expectancy is 79.3 years, almost two years lower than the provincial value.

Causes of Mortality

The main causes of mortality are shown for Côte-Nord and for Québec in Table 25.20 (individual data are not available for Fermont). Residents of the Côte-Nord region have higher rates of death due to cancers, respiratory disease and unintentional injuries compared to Québec. As Côte-Nord is a large region overall, the reasons for these trends may be widely varied.

Table 25.20 Rates of Death (2011)

Cause of Death (per 100,000 population, age-standardized)	Cote-Nord	Québec
Total, All Causes of Death	610.3	549.9
All Cancers	213.5	183.4
Circulatory Disease	143.9	142.9
Respiratory Disease	63.2	47.2
Unintentional Injuries	34.4	23.4
Premature Mortality	308.9	257.2
Source: Statistics Canada 2012c		

Health Practices

The self-reported percentage of daily smokers in the Côte-Nord region is almost 10 percent higher than in the province overall. The number of self-reported heavy drinkers is also higher, as is the percentage of people who are overweight. About 1 percent of the residents of the Côte-Nord region are reportedly physically inactive as compared to the population of the province as a whole.

Quality of Life

Self-reported mental health is relatively high in the Côte-Nord, with over 80 percent of the population rating their mental health as “excellent”, with a high percentage of residents being very satisfied with life in general in both the Côte-Nord and the province. Sense of community belonging is markedly stronger among Côte-Nord residents than the province (more than 20 percent higher), and comparatively, life stress is lower than that for the province.

Crime and Accidents

The Québec Ministère de la sécurité publique (Ministry of Public Security) maintains records of the number of criminal code violations such as violations against persons, property and other crimes. The Ministry also maintains statistics on violations against federal and provincial laws, such as drug and narcotic violations and vehicle infractions.

The Côte-Nord region sees an above average number of criminal violations, as compared to other regions of Québec. The region ranks the second highest in the Province for criminal violations, behind Montreal (MSP 2007). For crimes against persons, the Côte-Nord ranks the highest of all regions in Québec. The Côte-Nord also ranks the highest for other violations against the criminal code, 50 percent higher than the Montreal region which ranked second (Table 25.21). This rate is twice that of Labrador West.

Table 25.21 Per Capital Criminal Code Violations, Côte-Nord (2007)

Offence Classification (per 100,000 population)	Région de la Côte-Nord	Québec
Violations against persons	1,721	1,004
Violations against property	3,193	3,254
Other violations (except vehicle incidents)	1,227	357
Total	**6,142**	**5,026**
Source: MSP 2007		

The Côte-Nord region also sees a relatively high number of drug and narcotic violations, violations against federal and provincial laws, and motor vehicle infractions (Table 25.22).

Table 25.22 Total Other Crime, Côte-Nord (2007)

Offence Classification (per 100,000)	Région de la Côte-Nord	Québec
Drug and narcotic violations	315	257
Violations against federal laws	34	12
Violations against provincial laws	100	80
Vehicle infractions	997	692
Total	**1,446**	**1,041**
Source: MSP 2007		

Sûreté du Québec in Fermont indicates that drug and narcotic violations are relatively high (pers. comm. 2012). In addition, since December 2011, six people in Sept-Îles have been arrested (in three instances) for trafficking cocaine, ecstasy, methamphetamine, hashish and cannabis (RCMP 2011, 2012a; 2012b).

25.5.3 Traditional and Local Knowledge

Tables 25.23 and 25.24 provides an overview of Aboriginal Traditional Knowledge and Local Knowledge that is relevant to this VEC, and which has been considered integrally throughout the environmental effects assessment.

Table 25.23 Local Knowledge – Health and Community Health

Date	Stakeholder	Community	Comment
October 5, 2011	Town of Fermont	Fermont	For the Mont Wright Arcelor Mittal mine (where they work), there is a required evacuation of all personnel for a 1,000 metre area when blasting occurs.
October 5, 2011	Town of Fermont	Fermont	People hear the blasting from Mont Wright mine, so they are very concerned about the Project since it is much closer to the community.
November 15, 2011	Town of Fermont	Fermont	We can hear the blast from IOC.
March 15, 2012	Individual	Fermont	Concern that Bloom Lake project has contaminated two adjacent lakes.
March 15, 2012	Individual	Fermont	In other mining projects, seeding was done on waste rocks. Levels of iron in blood are high in the population. Their blood must be filtered.
March 15, 2012	Individual	Fermont	I can feel blasting [vibration] from the Arcelor Mittal mine.
March 15, 2012	Individual	Fermont	Workforce in Fermont is fully employed. Workforce for your project will have to come from the outside and we will suffer the effects.
March 16, 2012	Individual	Fermont	Vibrations from the Arcelor Mittal mine, located 17 km from Fermont, can be felt by residents.
March 16, 2012	Individual	Fermont	Town of Fermont is already exposed to dust from operating mining sites further away from the proposed Alderon location. Labrador City has had “red snow” resulting from mining activity residue.
March 17, 2012	Individual	Fermont	Labrador City is polluted as result of mining activities in the area (e.g. 'black snow').
March 14, 2012	Individual	Labrador City	Cabin owner indicated that he heard a blasting event last year that "shook the building".
March 17, 2012	Individual	Labrador City	Current health issues as a result of mining in Labrador City. Blood filtration is required by many in Labrador City as a result of high concentrations of iron.
October 12, 2011	Individual (Cabin Owner)	Wabush	Railway too close to the Town of Wabush. Tailings affecting Ouananiche (our water supply).
April 25, 2012	Labrador West Status of Women		Completed a study on the impact of mining on women's health, which is available on Mining Watch, and they found that mining had no major effect on women's health.
April 25, 2012	Labrador West Status of Women		IOC developed a code of conduct to avoid some issues associated with increased presence of men in the community.

Table 25.24 Aboriginal Traditional Knowledge- Health and Community Health

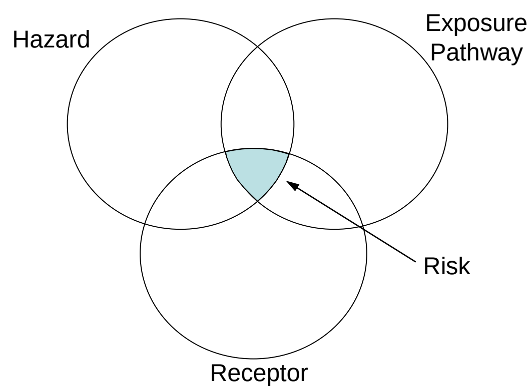
Group	Source	Page or Date Reference	Comment or Excerpt
Naskapi	Lower Churchill Project, Consultation Assessment Report CEAR Doc#501	p. 4-7	The informal trading of food for goods and services is still a common practice (Martin 2009). The Labrador Métis prefer to eat traditional foods rather than store bought foods, since it is believed that foods harvested from the land prevents and cure illnesses and nutritional-deficiencies (Martin 2009).
Naskapi	Lower Churchill Project, Consultation Assessment Report CEAR Doc#501	p.13-9	The Naskapi Nation of Kawawachikamach harvest plants for food and medicinal purposes (Weiler 1992). Labrador tea and berries are commonly harvested near Kawawachikamach (Weiler 1992). A reference was made to using spruce buds and rock tripe in a broth during times of starvation (Henriksen 1978). The Naskapi use medicinal plants. Of deep significance for Naskapi is the tight link between their health and wellness and the medicinal properties of plants and animals, including caribou, moose, bear and beaver.

25.6 Assessment of Project-Related Environmental Effects

This section assesses the potential effects of the Project on health and community health in Labrador West and Fermont during each of the three Project phases: construction, operation and maintenance and decommissioning and reclamation. Existing knowledge regarding the effects of previous similar projects in Labrador West, Canada and elsewhere is also provided (where available and relevant) to help inform the effects predictions. The identification of the potential effects of the Project is followed by a description of Alderon's planned mitigation and management strategies, and finally, the likely residual effects of the various components of this VEC once these measures are applied.

25.6.1 Physical Health

The following sections discuss the potential effects and appropriate mitigations for physical health. The purpose of the associated HHRA has been to quantitatively assess the potential risks associated with exposure to chemicals of potential concern (COPC) to individuals living in proximity to the Project and who undertake land and resource use activities in the region.



Three components must be present to establish a risk to physical health. As indicated in the diagram to the right, these are:

- An elevated chemical concentration (hazard);
- A receptor to come in contact with the chemical; and
- An exposure pathway to facilitate contact between the receptor and the chemical.

The HHRA and associated assessment of potential effects to physical health are based on this paradigm, and evaluate changes in COPC concentrations (hazards) due to Project emissions and/or discharges (exposure pathways) at specific locations (receptors).

For air quality, incremental concentrations due to the Project are compared to regulatory standards or toxicity reference values (TRVs). If predicted COPC concentrations are below regulatory criteria or appropriate TRVs, adverse effects to human (physical) health would not be expected to occur.

For soil quality, incremental concentrations due to the Project are added to existing baseline conditions. In the absence of measurable changes to existing baseline soil concentrations, adverse effects to human (physical) health would not be expected to occur.

For water quality, an evaluation is made of the size of the mixing zone required to meet applicable water quality criteria at the point of effluent discharge in Long Lake South (e.g., drinking water criteria). If applicable criteria are rapidly achieved, adverse effects to human (physical) health would not be expected to occur.

25.6.1.1 Construction

For the assessment of potential effects to physical health, temporal boundaries encompass project activities during construction, operations, and the closure / post-closure phases. Physical health is primarily affected by air emissions and water discharges, and although effects on air and water quality will begin during construction, they are expected to be greatest during operations, diminishing again at closure and post-closure.

The assessment of potential effects on physical health is therefore based on a scenario when possible air quality effects would be highest throughout the life of the Project. This is predicted to occur several years into mine operations during the maximum ore processing rate (i.e., with both processing lines active 24 hours/day). Therefore, a separate and specific assessment of physical health effects during construction is not required as the assessment conducted for the operations phase (below) is considered to be a "worst case scenario" that addresses and encompasses the potential effects of all Project phases.

25.6.1.2 Operations

Change in Air Quality

Potential changes in air quality during operation and maintenance are discussed in detail in Chapter 14, Atmospheric Resources. This section summarizes those aspects that are relevant to effects on physical health.

Potential Environmental Effects

The operation and maintenance phase of the Project will involve the following activities:

- Open pit mining;
- Ore and waste rock haulage;
- Processing of the extracted ore;
- Concentrator operations;
- Tailings disposal in the TMF; and
- Rail load out and rail transport.

The main sources of air emissions from the above activities are: (1) the combustion of fuel in the equipment, which produces emissions of particulate matter (TPM, PM_{10}, $PM_{2.5}$), combustion gases (SO_2, CO, NO_x), volatile organic compounds (VOCs), polycyclic aromatic hydrocarbons (PAHs), and metals; (2) burning of No. 2 light fuel oil in boilers; and (3) the fugitive releases of dust from material handling and haul truck and vehicle travel on unpaved roads.

The selection of COPC for air quality is based on an understanding of those chemicals expected to be emitted from Project activities as a result of the equipment being used (e.g., heavy equipment) or the activities being performed (e.g., earthworks). The Master List of Compounds Emitted by Mobile Sources provided by the US EPA Mobile Source Air Toxics was consulted (US EPA, 2006), which identifies chemicals that are present in diesel exhaust. Based on these sources, the contaminants of potential concern (COPC) identified for air quality are as follows:

Criteria Air Contaminants TPM PM_{10} $PM_{2.5}$ SO_2 NO_x CO	**VOCs** Acrolein Acetaldehyde Benzene 1,3-Butadiene Formaldehyde
Metals Antimony Arsenic Cadmium Chromium VI Manganese Mercury Nickel	**PAHs** Benzo(a)pyrene Naphthalene

The quantities of the equipment in use in any given year of operation will differ depending on the production rates and activities. It is expected that during the initial years of operation only one processing line will be in operation, with the second potentially commencing several years into the operations phase. During the operation of the Project some activities will occur 24 hours a day seven days a week. Detailed emission inventories of the above COPC were prepared and dispersion modeling was carried out using CALPUFF (Version 6.4) in order to predict the ground level concentrations of COPC during Project operations. The results of these analyses are presented in the Atmospheric VEC chapter of this EIS.

Concerns have also been raised related to potential iron exposure. Specific modeling has not been completed, however, as iron is an element of low inherent toxicity and is an essential nutrient that is typically regulated by the body. For these reasons, government agencies have not developed regulatory criteria for iron (and other typically innocuous substances). It is not anticipated that the Project will result in adverse effects on health in terms of elevated levels of blood iron. While this condition (hemochromatosis) exists in Labrador West (as it does in the rest of the province), this is not related to mining activity.

Mitigation of Potential Environmental Effects

Chapter 14, Section 14.6, details measures for mitigating air contaminant emissions during the operation and maintenance of the Project.

As the majority of the air emissions related to Project operation will consist of fugitive releases of dust due to material handling and haul truck and vehicle travel on unpaved roads, provisions to control this (as detailed in Section 14.6) will be included in the Environmental Protection Plan (EPP). A dust suppression program will be implemented.

Characterization of Residual Project Environmental Effects

Detailed emission inventories of Project-related COPC emissions were prepared to assess the residual Project environmental effects on a change in air quality during Project operation and maintenance. The emission inventories were based on full production rate of 16 million tonnes of concentrate per year, when the greatest amount of mining equipment are in operation at one time. Further, the simulations assume that operation occurred 24 hours a day, seven days a week. In order to predict the ground level concentrations of COPC during Project operations, dispersion modeling was carried out using CALPUFF (Version 6.4).

The dispersion modeling was completed (refer to Chapter 14: Atmospheric Environment) for two discrete receptor locations representing cabins located within the LSA, which were selected based on information contained in Chapter 23: Other Current Use of Lands and Resources. A key component of this VEC was interviews with 15 residents of Labrador City-Wabush and 5 residents of Fermont, Québec, who use the region for recreational, subsistence and, to a lesser extent, commercial purposes. The 20 informant interviews were supplemented through discussions with government personnel, including fisheries and wildlife conservation officers familiar with western Labrador. Interviews were conducted to gather detailed information on a broad range of subsistence, recreational and commercial land and resource use activities currently being carried out in the region. Information related to hunting, fishing, trapping, boating / water navigation, snowmobile and all-terrain vehicle (ATV) use, wood harvesting (for firewood and saw-logs), berry picking, cabin use, outfitting, and birding and geo-caching was collected.

Based on this information, the selected receptor locations were (Figure 25.3):

- Receptor Location 1: E: 635960; N: 5857470. Southwest shore of Long Lake South, proximal to the Project conveyors, process plant, and load out facilities; and
- Receptor Location 2: E: 641590; N: 5856650. Riordan Lake, proximal to and downwind of the TMF.

The maximum incremental predicted ground level concentrations of COPC due to Project operation at these receptor locations are presented in Table 25.25. Relevant health based standards and guidelines have also been included for comparison.

Table 25.25 Project-Related Ground Level Air Concentrations of COPC (µg/m^3)

COPC	Air Quality Results						Air Quality Standards		
	Averaging Time						Averaging Time		
	1 hour		24 hour		Annual Average		1 hour	24 hour	Annual Average
	Location 1	Location 2	Location 1	Location 2	Location 1	Location 2			
NO_x	62.61	115.15	17.75	31.78	2.36	1.41	400 [a]	200 [a]	100 [a]
SO_2	41.59	43.07	6.45	8.58	0.41	0.41	900 [a]	300 [a]	60 [a]
CO	33.03	56.93					35,000 [a]		
TSP			41	32	4	3		120 [a]	60 [a]
PM_{10}			34	26				50 [a]	
$PM_{2.5}$			**27**	15				25 [a]	
Antimony					5.55E-06	3.31E-06			4.79 [e]
Arsenic					5.55E-06	3.31E-06			0.0016 [b]
Cadmium					5.55E-05	3.31E-05			0.001 [b]
Chromium VI					1.89E-06	1.13E-06			0.00013 [b]
Manganese					1.11E-05	6.63E-06			0.05 [d]
Mercury					1.39E-05	8.29E-06			0.3 [d]
Nickel					8.87E-06	5.30E-06			0.0077 [b]
Benzo(a)pyrene					5.55E-06	3.31E-06			0.32 [b]
Naphthalene					5.19E-03	3.10E-03			3 [b]
Acrolein					7.69E-04	4.60E-04			0.02 [d]
Acetaldehyde					4.81E-03	2.88E-03			4.5 [d]
Formaldehyde					1.04E-02	6.22E-03			0.77 [d]

COPC	Air Quality Results						Air Quality Standards		
	Averaging Time						Averaging Time		
	1 hour		24 hour		Annual Average		1 hour	24 hour	Annual Average
	Location 1	Location 2	Location 1	Location 2	Location 1	Location 2			
Benzene					5.57E-03	3.33E-03			3 [b]
1,3-Butadiene					5.00E-04	2.99E-04			2 [c]

Notes:

a. Newfoundland and Labrador Regulation 39/04, Schedule A.

b. Federal Contaminated Site Risk Assessment in Canada Part II: Health Canada Toxicological Reference Values (TRVs) and Chemical-Specific Factors, Version 2.0, May 2009.

c. Summary of Standards and Guidelines to support Ontario Regulation 419/05, Ontario Ministry of the Environment, April 2012.

d. United States Environmental Protection Agency, Integrated Risk Information System, accessed on-line, July 2012.

e. Value converted from original averaging time according to methods in Air Dispersion Modeling Guideline for Ontario, Version 2, March 2009.

Bold Indicates air concentrations exceeds standard.

Location 1 = Long Lake South

Location 2 = Riordan Lake

Although the operation and maintenance of the Project will result in fugitive emissions of COPC, based on the current planned mitigation theses emissions will not result in any exceedances of the air quality standards at the representative receptor locations, except for a slight exceedance of $PM_{2.5}$ for the 24 hour averaging time at Receptor Location 1 on Long Lake South. This is consistent with the dispersion modeling presented in the Atmospheric Environment VEC (Chapter 14, Figure 14.8) which indicates that maximum 24-hour $PM_{2.5}$ concentrations exceed the applicable air quality standard generally over the southern end of Long Lake South. It should be noted that the maximum 24-hour concentration can potentially overstate risks and that further analysis of the dispersion modeling results indicates that there is only a single 24 hour exceedance in one year at Receptor Location 1. While there are other cabins in the same area as Receptor Location 1, some closer to the Project, similar air quality results would be expected including the low frequency of exceedances.

Dispersion model results for the more distant communities of Fermont, Wabush, and Labrador City (Chapter 14) show that, based on the current planned mitigation, Project emissions will not result in any exceedances of the provincial *Air Pollution Control Regulations*, the National Ambient Air Quality Objectives (NAAQ) maximum acceptable levels or the Canada Wide Standards within these communities.

No associated adverse effects upon the physical health of humans within the LSA is therefore expected to occur.

Change in Water Quality

Potential changes in water quality during operation and maintenance are discussed in detail in Chapter 16: Water Resources. During the operation and maintenance phase, potential adverse effects to surface water resources include changes to drainage patterns, changes to flow regimes, water and sediment quality. This section summarizes those aspects that are relevant to potential effects on physical health.

Potential Environmental Effects

Long Lake is proposed to be the primary raw water supply source and treated effluent discharge receiving waterbody for the Project. Therefore, potential effects on physical health have been assessed in the context of COPC discharges into Long Lake and resultant changes in water quality. The main potential effects to surface water in Long Lake influencing physical health include:

- Net changes to flow out of Long Lake as well as changes in Long Lake water quality arising from Project effects on hydrology, water takings and effluent discharges in the LSA; and
- Changes to water quality in Long Lake, to be determined via effluent receiving water assessment.

The hazard-pathway-receptor combinations relevant to an assessment of physical health effects are:

- COPC discharge into Long Lake and consumption of surface water from the lake as a drinking water supply for cabin owners; and
- COPC discharge into Long Lake, uptake of contaminants into fish, and consumption of fish from the lake by cabin owners.

Mitigation of Potential Environmental Effects

Chapter 16 details Alderon's planned and proposed measures for mitigating discharges to surface water during the operation and maintenance of the Project.

Characterization of Residual Project Environmental Effects

Chapter 16 of the EIS presents the methodology and results of a preliminary diffuser design for the proposed Kami Mine process effluent discharges into Long Lake. This section summarizes the methods and results and assesses the potential effects to physical health through drinking water and/or fish consumption.

An effluent mixing analysis of the mine process and possible sanitary effluent discharges into Long Lake was conducted to identify a preliminary diffuser configuration that achieves good dilution at the boundary of an initial mixing zone in Long Lake. The proposed location of the diffuser is estimated to be 625 m from shore with a local water depth of 14 m. This location was selected to help ensure enough water column depth is available for effective dilution of effluent discharges and to minimize the length and cost of an outfall pipe.

The Cornell Mixing (CORMIX™) Model was used to simulate the mixing zone of combined mine process and possible sanitary effluent discharges into Long Lake. This model is one of the most extensively used for predicting mixing behaviour in surface water bodies. The predicted mixing zone boundaries corresponding to various average dilution factors are presented in Chapter 16 (Tables 16.49 and 16.50 for open-water and ice-cover conditions, respectively). The predicted mixing zone boundary for the open-water condition is smaller than that of ice-cover season. During open-water conditions, the dilution factors are expected to be much greater than those predicted for the ice-cover period due to generally stronger currents produced by winds, which induce more mixing than what would occur during ice-cover conditions. Mixing zone boundaries are shown as dilution factor isopleths on in Chapter 16, for the selected diffuser design under open-water and ice-cover conditions for a discharge of 50,000 m^3/d.

It should be noted that the concentrations achieved at the mixing zone boundaries incorporate existing baseline and represent final mixed water quality in the lake. Therefore, these concentrations are not additive to baseline but include baseline conditions in the mixing model. The water quality criteria to be satisfied at the mixing zone boundary are selected as:

- Guidelines for Canadian Drinking Water Quality (GCDWQ) (http://www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/2010-sum_guide-res_recom/index-eng.php); and

- Surface water concentrations protective of uptake of COPC into fish (calculated in the analysis).

The above water quality criteria for Long Lake are presented in Table 25.26 below, which also shows the combined process mine water and sanitary effluent concentration assumed at end of pipe and the required dilution of effluent to achieve the water quality criteria. The required dilution factor varies between <1 up to a maximum of 56 depending on constituents (and so the mixing zone boundary also varies) As a result, the mixing zone boundary was defined as a boundary where the dilution factor is 56. At the mixing zone boundary, effluent water quality will meet both the GCDWQ and surface water criteria protective of fish consumption.

Table 25.26 Long Lake Water Quality Criteria and Required Effluent Dilution

COPC[a]	Effluent Water Quality at End of Pipe[b] (mg/L)	GCDWQ (mg/L)	Water Quality Criteria for Fish Tissue (mg/L)[c]	Required Dilution for GCDWQ at Mixing Zone Boundary	Required Dilution for Fish Consumption at Mixing Zone Boundary
Arsenic	0.25	0.01	0.031	25	8.1
Barium	2.25	1	0.051	2.25	44
Cadmium	0.0021	0.005	0.0005	<1	4.6
Chromium VI	0.025	0.05	0.13	<1	<1
Chromium III	0.5	0.05	0.022	10	23
Copper	0.15	≤1	0.052	<1	2.9
Lead	0.1	0.01	5.56	10	<1
Mercury	0.0025	0.001	0.000045	2.5	55.8
Nickel	0.25	0.3[d]	0.0069	<1	36.4
Selenium	0.005	0.01	0.02	<1	<1
Silver	0.015	0.071[d]	0.024	<1	<1
Zinc	0.25	≤5	0.1	<1	2.5

Notes:

a. COPC selected by reference to suite of parameters analyzed for the baseline water quality monitoring and identifying substances with GCDWQ and with the potential to accumulate in fish tissue.

b. Metals effluent objectives assumed to achieve ½ MMER limits. All sanitary effluent will be treated to regulatory effluent criteria before discharge to the receiving environment.

c. Criteria protective of fish tissue calculated in the HHRA based on assumptions regarding fish consumption rates from Long Lake South and by relating fish tissue concentrations to corresponding surface water concentrations using bioconcentration factors (BCFs).

d. US EPA Regional Screening Level (RSL)

As indicated in Chapter 16, the required dilution to protect both potential physical health effects (drinking water and fish consumption) is achieved within a few meters (<10 m) of the diffuser outfall.

No associated adverse effects upon the physical health of humans within the LSA are therefore expected to occur.

The water uses and requirements for the Project were described in Chapter 2, and will include, for example, process water for the mine operations that will be extracted from Long Lake, as well as a number of groundwater wells or pumps at nearby lakes that will be installed for the supply of potable and wash water. These required water quantities will clearly not affect the availability of freshwater within the LSA in such a way that could have negative implications for human health in the region.

Change in Soil Quality

Potential changes in soil quality during operation and maintenance may result from dust emissions from the Project and subsequent deposition and accumulation in the surrounding environment. Atmospheric Environment are discussed in detail in Chapter 14 and this section summarizes those aspects that are relevant to effects on physical health due to changes in soil quality.

Potential Environmental Effects

The main sources of dust emissions are from open pit mining, ore and waste rock haulage, processing of the extracted ore, concentrator operations, tailings disposal in the TMF, and rail load out and rail transport. With respect to effects on physical health, the primary concerns are those COPC that have the potential to persist and accumulate in the soil, once deposited. Based on this, the COPC identified for soil quality are metals that would be associated with the Kami ore.

Twelve samples from the Kami ore body were analysed for a range of trace metals to determine the trace metal content of the ore and to permit the calculation of metal-specific deposition rates. Similar to air quality, dust fall modeling is based on both ore processing lines operating 24 hours a day seven days a week. The maximum expected deposition rates are assumed to occur throughout the operating mine life (2016 – 2033). This will over-estimate long-term dust fall due to the Project but provides a conservative estimate of potential soil quality changes for the purposes of assessing any physical health effects.

Mitigation of Potential Environmental Effects

Chapter 14, Section 14.6 details measures for mitigating air emissions during the operation and maintenance of the Project.

Characterization of Residual Project Environmental Effects

As discussed above for air quality, detailed emission inventories of Project-related COPC emissions were prepared to assess the residual project environmental effects on a change in soil quality during Project operation and maintenance. Deposition modeling was carried out using CALPUFF (Version 6.4), for the same two discrete receptor locations used or the air quality assessment:

- Receptor Location 1: E: 635960; N: 5857470. Southwest shore of Long Lake South, proximal to the Project conveyors, process plant, and load out facilities; and
- Receptor Location 2: E: 641590; N: 5856650. Riordan Lake, proximal to and downwind of the TMF.

The total dust fall rates at these locations were calculated to be 1.62 g/m^2/year and 1.30 g/m^2/year for receptor location 1 and receptor location 2, respectively. Based on the metal content of the Kami ore and assumptions related to mixing of dust deposited in the surface soil layers, the incremental increases in soil metals concentrations due to dust fall from the Project are presented in Table 25.27. The baseline soil TR_{98} values presented in Section 25.5.1cor are also included in the Table, along with the predicted percent change in baseline soil quality.

Table 25.27 Predicted Changes in Soil Quality at Selected Receptor Locations

COPC	Baseline TR_{98} Values (mg/kg)	Incremental Soil COPC Concentration (mg/kg)		% Change in COPC Concentration	
		Location 1	Location 2	Location 1	Location 2
Antimony	0.5	0.000257	0.000206	0.051	0.041
Arsenic	1	0.00135	0.00109	0.135	0.109
Barium	560	0.0509	0.0408	0.009	0.007
Cadmium	0.2	0.0000245	0.0000196	0.012	0.01
Chromium	46	0.0255	0.0205	0.055	0.044
Cobalt	7.9	0.00207	0.00166	0.026	0.021
Copper	16	0.0018	0.00145	0.011	0.009
Iron	37,000	53.2	42.7	0.144	0.115
Lead	5.5	0.000432	0.000346	0.008	0.006
Manganese	6,300	2.5	2.01	0.04	0.032
Molybdenum	29	0.000907	0.000728	0.003	0.003
Nickel	18	0.0014	0.00112	0.008	0.006
Selenium	0.5	0.000248	0.000199	0.05	0.04
Silver	0.28	0.0000242	0.0000194	0.009	0.007
Strontium	20	0.0056	0.00449	0.028	0.022
Thallium	0.1	0.000051	0.000041	0.051	0.041
Tin	0.5	0.000162	0.00013	0.032	0.026
Uranium	4.2	0.000308	0.000247	0.007	0.006
Vanadium	37	0.0115	0.00923	0.031	0.025
Zinc	28	0.00209	0.00168	0.007	0.006

While the operation of the Project will result in fugitive dust emissions, based on the current planned mitigation these emissions will not result in any measurable change in baseline soil quality at the representative receptor locations. The maximum predicted change in soil metals concentrations is <0.2 percent.

In addition to direct effects on soil quality, dust deposition also has the potential to affect vegetation with subsequent physical health effects via ingestion of the vegetation (e.g., berries) and/or wild game that feed on the vegetation. The degree of exposure will be dependent on the extent of deposition during the growing season, the types of plants harvested, consumption rates within a family, and preparation methods (e.g., washing and cooking).

Plant concentrations may be affected by uptake from soil and/or by direct dust deposition on above-ground plant surfaces. Table 25.27 shows that soil concentrations are not expected to measurably change due to the Project, and therefore, soil-to-plant uptake would also not be changed by the Project. However, changes to plant tissue concentrations may arise due to dust fall on plant surfaces.

To estimate concentrations within plant tissue the total dust fall rates (1.62 g/m^2/year and 1.30 g/m^2/year for Receptor Location 1 and Receptor Location 2, respectively) were assumed to be constant during the growing season. These rates were used as the input parameter for a standard equation (US EPA, 2005) that accounts for the surface area of the plant exposed to deposition and the loss of deposited material due to mechanisms such wind and water erosion. The incremental increases in plant metals concentrations due to dust fall from the Project are presented in Table 25.28.

Table 25.28 Predicted Changes in Vegetation Quality at Selected Receptor Locations

COPC	Incremental Plant COPC Concentration (mg/kg-ww)	
	Location 1	Location 2
Antimony	3.11E-06	2.49E-06
Arsenic	1.64E-05	1.31E-05
Barium	6.15E-04	4.93E-04
Cadmium	2.96E-07	2.37E-07
Chromium	3.08E-04	2.47E-04
Cobalt	2.50E-05	2.01E-05
Copper	2.18E-05	1.75E-05
Iron	6.43E-01	5.16E-01
Lead	5.22E-06	4.19E-06
Manganese	3.02E-02	2.42E-02
Molybdenum	1.10E-05	8.80E-06
Nickel	1.69E-05	1.35E-05
Selenium	2.99E-06	2.40E-06
Silver	2.92E-07	2.35E-07
Strontium	6.76E-05	5.43E-05
Thallium	6.17E-07	4.95E-07

COPC	Incremental Plant COPC Concentration (mg/kg-ww)	
	Location 1	Location 2
Tin	1.95E-06	1.57E-06
Uranium	3.72E-06	2.99E-06
Vanadium	1.39E-04	1.12E-04
Zinc	2.53E-05	2.03E-05

The predicted dust fall will not result in any measurable accumulation of metals in vegetation at the representative receptor locations. The maximum predicted metals concentration in vegetation is <1 mg/kg with most concentrations <1 µg/kg.

No associated adverse effects upon the physical health of humans within the LSA are therefore expected to occur.

Other Potential Project-Related Emissions and Effects

The EIS Guidelines also require the consideration of the potential for health effects that may arise from noise or vibrations associated with the Project.

As indicated through the modeling and effects analyses presented elsewhere in this EIS, during construction there will be a temporary increase in noise levels in the region due to the use of heavy equipment, which may at time be discernable at the cabins on Long Lake or the residential area of Wabush as an industrial “hum”, but which is not likely to have implications for human health. Similarly, the modeling has indicated that with implementation of the identified mitigation measures during Project operations, any increased sound pressure levels at the nearest cabins on Long Lake would not exceed the Health Canada criteria.

Vibration issues could also arise during either phase of the Project, particularly through the use of heavy machinery, blasting and the operations of the rail line. The Blasting Plan for the Project that will be developed will address this issue. Vibration modeling for various Project activities has indicated that these emissions would also be within established criteria and thresholds (Chapter 14).

No associated adverse effects upon the physical health of humans within the LSA are therefore expected to occur as a result of noise or vibrations that may be associated with the Project.

It is again also not anticipated that the Project will result in adverse effects on health in terms of elevated levels of blood iron. While this condition (hemochromatosis) exists in Labrador West (as it does in the rest of the province), this is not related to mining developments.

25.6.1.3 Decommissioning and Reclamation

Once operations activities cease at the end of the mine life, the decommissioning and reclamation phase of the Project will commence, as described in detail in Section 2.6 Progressive rehabilitation involves rehabilitation that is completed, where possible or practical, throughout the mine operation stage and prior to closure (as described above). Closure rehabilitation involves measures undertaken after mining operations, in order to restore or reclaim the property as close as reasonably possible to its pre-mining condition, including those activities detailed in the required Rehabilitation and Closure Plan. Upon completion of the closure rehabilitation activities, a period of “post-closure monitoring” is then required to ensure that the rehabilitation activities have been successful in achieving the prescribed goals.

For the assessment of effects to physical health, temporal boundaries encompass Project activities during construction, operations, closure and post-closure phases. Physical health is primarily affected by air emissions and water discharges and although effects on air quality and water quality will begin during construction, they are expected to reach a peak during operations, diminishing again during closure and post-closure. Therefore, the assessment of effects on physical health is based on a scenario when emissions would be highest throughout the life of the Project (again, predicted to be several years into operations).

A specific and separate assessment of physical health during decommissioning is therefore not required as the assessment conducted for the operations phase (above) is considered to be a “worst case scenario” that encompasses the possible effects of all Project phases.

Again, it is likely that Project related permitting will require a program of environmental monitoring at the site to assess and confirm compliance with regulatory guidelines and standards.

25.6.2 Community Health

As indicated previously, development projects can have both positive and negative effects on communities, including the health and overall quality of life of their residents. This can include, for example, the creation of new or enhanced employment and business opportunities, as well as an overall increase in the quality of life that is associated with project-related work and associated incomes. Those who earn higher incomes may experience reduced financial stress, and have the ability to continue or increase their participation in a variety of community activities. Project related activity and work can also, both directly and indirectly, serve to increase the availability and/or quality of community services, infrastructure and other components (Chapter 24), leading to an enhancement in the well-being and quality of life of local residents.

At the same time, however, there may be concerns about public safety due to the presence and movement of equipment and materials to and through a community. In addition, the potential influx of new persons to an area during construction or operations may have associated social interactions and issues, as well as leading to a possible increase in crime rates, substance abuse and/or other societal problems resulting from Project-related work, incomes and other interactions. Any such negative effects may have implications for the perceptions of residents regarding their overall quality of life and well-being.

The environmental effects assessment for the community health portion of this VEC is therefore focused on the following potential environmental effects:

- Change in public safety (injuries / accidents);
- Change (increase) in substance abuse;
- Change (increase) in crime; and
- Change in perceptions of quality of life and well-being.

Clearly there is a long history of development projects (mining and others) in northern areas of Canada and elsewhere. Although there is, unfortunately, a somewhat limited amount of published “existing knowledge” which has evaluated and measured the actual and known effects of similar projects and activities on communities, a number of examples do provide some relevant, general insights.

Most of the current available research into the community health effects of mining is focused on northern Canadian Aboriginal communities and on the effects of fly in-fly out (FIFO) in remote regions (e.g., Wood Buffalo, Alberta and the Pilbara in Australia). The Government of the Northwest Territories (NWT) does, however, produce an annual report to evaluate the actual socio-economic effects of mining developments following the development of BHP Billington’s Ekati Mine, the Diavik Diamond Mine and the De Beers Snap Lake Mine. While this analysis focuses on the effects of mining projects on small Aboriginal communities, it also discusses effects on the City of Yellowknife, which is somewhat more comparable to the Towns of Labrador City, Wabush and Fermont (at least collectively).

In these studies, various parameters of health and well-being in Yellowknife are compared to the pre-mining situation. Potential years of life lost (PYLL) seems to follow a natural long-term pattern which is not related to mining. The rate of injuries to residents as a whole was decreasing prior to mine development and has been decreasing at a faster rate since the mines began due to improved safety practices and programs, which is somewhat attributed to mining activities. Yellowknife’s suicide rate has been increasing since 1996 / 1998 but the available data are insufficient and too variable to determine if it is related to mining (GNWT 2012). In Yellowknife, the rate of teen births has been decreasing, and the rate of single-parent families has been increasing, at the same rate as the rest of Canada (GWNT 2012). In general, Yellowknife follows many of the socio-economic trends (e.g., increase in STIs, decrease in teen births, increase in single parent families) as the rest of the NWT and throughout Canada, and therefore these trends cannot be definitively attributed to mining developments.

A study in British Columbia found that life in rural mining communities was stressful due to isolation, the harsh climate, uncertain employment in resourced-based economies and limited access to resources, each of which were stresses on health, particularly for women. Mental illness was also found to be more prevalent than in urban areas. A study of a remote Norwegian coal mining community showed that over a 20-year period, the prevalence of non-occupational accidents and deaths was higher than on the Norwegian mainland. In this community, alcohol consumption was high and a factor in 25 percent of fatalities (Mining Watch 2004).

Cigarette smoking and alcohol consumption can also be relatively high in mining communities. A number of studies have shown that this alcohol use has resulted in family violence. In northern British Columbia mining communities, the transient worker population contributed to increased violence against women and a high rate of single parent homes. Various studies cite violence against, and isolation of, women throughout northern Canadian mining communities. The Yukon, which has a highly transient workforce, has the highest per capita incidence of alcohol and drug consumption in Canada and the statistics are similar in northern British Columbia mining communities (Mining Watch 2004).

The health of mining communities in Canada is therefore becoming a priority for the mining industry, governments and researchers. In northern British Columbia, the influx of transient resource-based workers with high disposable incomes has had a negative effect on the health of already vulnerable residents in communities where health care services are often lacking (Shandro et al. 2011). Concerns are also often expressed about sexually transmitted infections (STIs) in natural resource development areas with transient workforces. The literature is somewhat mixed on this topic and is often centered around natural resource development and sexual exploitation, HIV / AIDS and other infections in emerging economies. Some data are available for other areas such as the African countries such as Guinea and Guyana, Indonesia, India and the Amazon, but far less information is available on western countries (Mining Watch 2004).

In northeastern British Columbia's oil and gas industry, workers (mostly young men) work in isolated conditions and spend brief holidays in adjacent towns where they often binge on alcohol and/or drugs. This has resulted in disproportionately high and rising rates of STIs among young people aged 15-24 (Goldenberg et al 2008). In Tumbler Ridge, for example, STIs have also increased during mine boom times (Shandro et al. 2011). Higher rates of STIs have also been experienced in Yellowknife since the development of the diamond mines, although these rates have increased throughout the NWT and more quickly in other parts of the NWT and throughout Canada.

25.6.2.1 Construction

Construction activities for the Labrador components of the Project will initially occur over an approximately two year period (with further construction in Phase 2 as required), and will include the following:

- Movement of equipment, materials and personnel to, within and from the site;
- Mobilization and installation of required construction infrastructure;
- Site preparation (including vegetation clearing, grubbing and excavation as required);
- Establishing site buildings and other components and facilities such as access roads, the rail line, transmission lines, associated watercourse crossings, the TMF, etc);
- Installation of associated systems, equipment and utilities, and
- Project commissioning.

Phase one of construction involves engaging a workforce of between fewer than five persons at construction mobilization and start-up in 2013 to approximately 800 on-site construction personnel by 2015 (which will include temporary workers from other locations). The second phase of construction (2018 to 2019), if required, will employ a similar workforce. As discussed in Chapter 24, Alderon will engage with government agencies and communities to establish a Project accommodations strategy, which will address housing concerns.

Worker shift lengths and duration / rotation arrangements will be defined at a later stage of Project planning and development, and will likely vary somewhat between occupations and employers. In general, however, it is expected that most on- site construction workers will work 10 to 12 hours per day, six days per week, with the possibility of having two shifts (covering a 24 hour period) for some work activities and periods. Work rotations will also be defined and finalized later, but it is expected that most construction employees will be employed on a four weeks on two weeks off schedule, similar to other recent mining developments in the region and elsewhere. This will again likely vary between individuals and contractors, as required.

Change in Public Safety (Injuries / Accidents)

Construction activities will include the clearing of vegetation, stripping and grubbing, excavation, filling, infrastructure and equipment installation, and other activities (Chapter 2). Access restrictions will be implemented progressively throughout the PDA as required, including for the eventual footprint of the open pit, TMF, waste rock disposal areas, and buildings and associated infrastructure (including the conveyor). These restricted-access zones are necessary for public safety and practical reasons, and once established, many will remain in place throughout the life of the Project.

A security office and gate will be installed on the access road near the location of the site buildings, which will restrict access to the Project site, and signs will be installed at select locations to help ensure public safety. In other areas, such as those associated with the construction of the site access roads and rail line, temporary access restrictions will be implemented during active construction periods. These will serve to reduce the potential for interactions with, and negative implications for, public safety within the immediate the Project area.

Concern has also been raised about possible public safety issues due to the presence and movement of equipment and materials to and through a community. The construction phase of the Project will see the transportation and movement of fairly large volumes of materials and heavy equipment to and from the PDA, particularly in the initial and then later stages of construction. Existing highways, ports and other local and regional transportation infrastructure and systems in Labrador and Quebec will be used to receive and transport these materials as required. Alderon and its contractors will coordinate and schedule the transportation of significant equipment and materials to Labrador West in consultation with relevant authorities and agencies to attempt to avoid issues and interactions.

A related issue of concern for local residents and municipalities has been the potential movement of equipment through the Town of Wabush, and the possible public safety issues that may be associated with this. This issue has been a key consideration by Alderon in the early planning and design of the Project.

Road access to the property will be by means of a new gravel surface access road that will extend south from the Trans Labrador Highway to the Project area, to the east of the Town of Wabush (Chapter 2). This is intended to avoid (or at least, minimize) the requirement to transport construction equipment and materials through the Town of Wabush, so that Project traffic avoids the already busy existing thoroughfares such as Grenfell Avenue.

Again, Alderon will consult and communicate regularly with local municipalities and other parties to provide information and regular updates on planned Project activities throughout construction, and to identify and seek to proactively address any issues or concerns.

Changes in Substance Abuse and Crime Rates

The following section examines the potential effects of the Project on both substance abuse levels in particular and crime rates in general, given that potential issues and interactions are quite similar between these. Any important differences are also highlighted as relevant.

Researchers have studied the prevalence of drug and alcohol abuse in fast growing remote natural resource-based regions (e.g., Australia, Alberta, and Saskatchewan). Although the results of such research are somewhat applicable to Labrador West, these should be viewed with caution due to the differences in the nature and scale of development. The Labrador West / Québec mining region currently has four operating mines, which are all expanding or planning to expand, and two developing mines in nearby Schefferville. By comparison, the Pilbara region has 21 operating mines with approximately 14,600 workers living in accommodations camps (Rio Tinto 2012a; BHP Billiton 2012; PICC 2010). The Regional Municipality of Wood Buffalo (RMWB) in Alberta has 13 operating oil sands projects and eight under construction, and in 2010, 23,325 workers were housed in camps (RMWB 2010).

In Australia, relatively high levels of alcohol consumption have been associated with particular industries, occupations and population groups, including in the mining sector. A sudden rise in disposable income can lead to higher rates of alcohol and drug abuse, gambling and other forms of conspicuous consumption and indebtedness (Carrington, et al. 2011).

As Alberta's petroleum industry moves through a period of unprecedented growth, northern communities are increasingly affected by alcohol and drug abuse (National Post 2009). The Alberta Alcohol and Drug Abuse Commission attributes the problem to a "wild west frontier mentality" in which people embrace a "work hard, play harder" outlook. Other authorities state that substance abuse is related primarily to temporary, non-resident workers (National Post 2006).

Alberta residents are increasingly seeking assistance for alcohol issues. Between 2006 and 2008, incidence of accessing employee assistance programs (EAP) for alcohol abuse increased by 481 percent. In 2006, employees in the oil and gas industry requested assistance at a 34 percent higher rate than the Canadian norm, and 40 percent higher than the norm in 2007 and

2008. Spouses of oil and gas industry workers accessed EAP at a 33 percent higher rate than the national norm in 2006, 56 percent higher in 2007 and 75 percent higher in 2008 (National Post 2009).

Oil and mining industry workers are often required to pass a pre-employment drug test. In addition, occupational health consultants are sometimes engaged to conduct random tests at oil industry work sites. A Saskatchewan testing company indicates that skilled and older workers usually pass screening tests, but drug use among young, new workers is increasing (Starphoenix 2008).

Most of the research on substance abuse and crime in natural resource regions is focussed on areas where high numbers of temporary workers (relative to local population size) are engaged for construction or operations for mining and oil and gas developments. It is typical to use temporary workers and house them in camps for construction projects, especially in remote areas where local populations are insufficient or already gainfully employed.

Similar to substance abuse, increased criminal violations are also at times evident in such regions. In many instances, the two may be closely related. Alcohol abuse may result in criminal activities such as assaults or driving while impaired. The use of illegal substances is inexorably linked to drug possession and trafficking. Australian researchers conclude that conditions where large numbers of young men are concentrated in relatively isolated conditions, and free from close supervision, produce high levels of interpersonal violence. Such situations are exacerbated by excessive consumption of alcohol which is an accelerant to anti-social and violent behaviour (Carrington et al.2011). Official crime statistics may provide a conservative estimate of the reality of violence in worker camps. Camp accommodated workers generally do not report or press charges for incidents such as assaults, as acknowledged involvement may lead to dismissal from employment or expulsion from camps (Carrington, et al. 2011).

In Alberta's Regional Municipality of Wood Buffalo (RMWB), which includes Fort McMurray, recent reductions in violations (2008-2010) have been attributed to the work of two dedicated RCMP crime reduction teams. Police also report that calls for service correspond to population increases and decreases, and during this period the population had decreased (Crewe 2010; RMWB 2011). Therefore, increases in crime can often be anticipated when the population of a community suddenly and significantly increases.

It is recognized that the Labrador West and adjacent areas have seen increases in the nature and degree of substance abuse issues and other violations in the communities, which is likely driven at least in part by on-going and increased economic (mining) activity in these areas. Labrador West had been experiencing an increase in violations related to driving, drugs and alcohol since 2001 prior to the beginning of the six construction projects that have been ongoing since 2010. The more recent increases in charges may be somewhat related to the increase in the number of police officers in Labrador West since 2010.

The Project will generate employment activity and associated incomes throughout its various phases, which could conceivably contribute to these trends.

Potential Environmental Effects and Their Mitigation

The construction workforce for the Project will comprise a mixture of resident and non-resident workers, with resident workers living at their homes and commuting to and from the work site each day. Transportation arrangements will be made for workers Alderon is engaged with government agencies and municipalities to establish a Project accommodation strategy.

Project employment may therefore result in a somewhat rapid increase in the number of people residing in, but without an attachment to, the community and also with additional disposable income which may be spent on alcohol and / or drugs. This trend has been seen in other remote regions with rapid growth based on natural resource industries. The effect has been most evident in areas such as RMWB and the Pilbara with large numbers of temporary workforces for construction and / or operations. Employment activity can also lead to an increase in other sorts of crime and violations, particularly of the types that are currently being experienced in Labrador West (i.e., speeding and impaired driving, and to a much lesser extent drug possession and trafficking).

A number of measures have been incorporated into Project planning and design and/or will be implemented during construction, that will help to avoid or reduce any associated increase in substance abuse and general crime rates in the LSA communities. These include:

- The use of a resident workforce wherever possible (with possible preference given to local residents during the hiring process). Again, the local communities have a high employment rate and relatively high incomes at present, through extensive previous experience with mining and other large scale developments. As a result, for many resident Project workers the construction phase of the Project will essentially represent an extension and continuation of their existing lifestyles, rather than a significant change and associated increase in their propensity for drug and alcohol abuse.
- Similarly, many of the non-resident workers who will be involved in Project construction are skilled and experienced workers who will have been involved in similar projects (with comparable incomes and work arrangements) as those that will be associated with the Kami Project. An accommodations strategy is being developed for the workforce.
- The nature of construction work, including extended work-days, the rotational work system (with non-resident workers returning to their home communities at the end of their rotations), will also help to minimize worker-community interactions, and will help to further isolate non-resident Project workers from the community. This will help further minimize any potential adverse community effects of the Project.
- Project construction workers will also, as part of their initial and regular site and safety orientations, receive community and cultural information and training related to both “respectful workplaces”, as well as being a respectful visitor to the communities within and near which they will be working.

- Alderon and/or its contractors will also offer a comprehensive employee assistance and support program, to provide assistance to its workers with respect to any emotional or other issues that may contribute to substance abuse problems (e.g., income management, coping with temporary separation from family, etc).
- Pre-employment drug and alcohol testing may also be conducted, as required and permissible by law.
- As most members of the temporary construction workforce will not have vehicles onsite, they will not be a significant source of additional traffic (and possible violations) related to operating motor vehicles.

Alderon will also work with local and regional community health agencies and service providers to identify and plan for any associated issues, including through the provision of up-to-date project information and schedules. Alderon is an active participant in the Labrador West Community Advisory Panel. This group represents mining companies and social / community service agencies (e.g., health care, police, relevant provincial agencies and social service groups) that work together to share information, address issues and monitor the effects of mining projects on the communities of Labrador West. Alderon is also a member of the recently formed (2012) Labrador West Regional Task Force (includes municipal and provincial governments and mining companies) which addresses regional concerns about the growing mining industry and its effects on regional infrastructure both in Labrador West and in Québec.

Characterization of Residual Project Environmental Effects

Given the nature of the Project and its associated timelines and durations – including the relatively short duration(s) of construction, and the various mitigative measures outlined above - the construction phase of the Project is not likely to measurably and materially increase the type or level of substance abuse or general criminal activity within the various communities that comprise the LSA.

Changes in Perceptions of Quality of Life and Well-Being

In addition to specific concerns around public safety, an influx of transient personnel, increased criminal activity and other such issues, the construction of major development projects may also result in a range of possible “nuisance effects” within a community, which may have implications for the overall (real or perceived) quality of life and well-being of its residents.

Increased local and regional traffic, especially the movement of heavy equipment, materials and personnel, can cause delays in traffic and associated frustrations. Residents already experience a degree of frustration due to increased traffic, trucks and heavy equipment as a result of current mining exploration, development and expansion in Labrador and Québec. Traffic has also increased since the completion and upgrading of various segments of the TLH. The number of business people participating in mining support and service sectors has also increased, and many of these either drive to the area or fly in and use rental vehicles. In addition, since 2010, the region has had several large scale construction projects, including IOC expansion, college, railroad underpass, health care centre and TLH upgrades, each of which has contributed to the increased construction traffic.

A number of the measures will help to avoid or reduce any interactions with the local communities, and associated quality of life issues, including:

- The use of a resident workforce wherever possible (with possible preference given to local residents during the hiring process);
- An accommodations strategy is being developed for the workforce;
- The nature of construction work, including extended work-days and the rotational work system (with non-resident workers returning to their home communities at the end of their rotations) will also help to minimize worker-community interactions, and will help to isolate non-resident Project workers from the community and to thereby minimize any potential adverse community effects of the Project; and
- Project construction workers will also, as part of their initial and regular site and safety orientations, receive community and cultural information and training related to both "respectful workplaces" as well as being a respectful visitor to the communities within and near which they will be working.

In addition to potential direct interactions between Project components and activities and the local communities, the construction phase of the Project will result in other types of disturbances, such as those associated with air emissions (including dust and construction equipment exhausts), noise, light, vibrations, the visibility of Project equipment and physical works, and other potential emissions and related disturbances.

Detailed modeling and analysis of the nature, magnitude and spatial and temporal distribution of the potential air and water emissions, noise, vibration and light that may be associated with the Project has been presented in Chapters 14 and 16, and a viewshed analysis is presented in Chapter 23. These analyses have indicated that these construction-related disturbances will occur intermittently and/or over a relatively short time period (2 years of initial construction, with a possible Phase 2 overlapping with Project operations), and will have a limited geographic zone of influence – which in most cases will not extend to the adjacent communities themselves. The various environmental effects mitigation measures outlined in these other VEC chapters will further serve to avoid or reduce any Project-related disturbances or effects that could potentially have implications for community health and well-being in the region.

The potential effects of any such Project-related disturbances on land and resource use activities in the general region (including cabin use, hunting and fishing etc) have also been assessed in Chapters 22 and 23.

Although the construction phase of the Project will see a high degree of activity within the Project site (PDA), as well as a degree of interaction with the local communities themselves, the nature, location and duration of this phase of the Project and its associated activities – in combination with the design features and other mitigation measures outlined earlier - will likely mean that the construction phase of the Project is not likely to measurably and materially decrease the overall quality of life or well-being (real or perceived) of the residents of the various communities that comprise the LSA.

25.6.2.2 Operations and Maintenance

Once the construction phase of the Project is completed and its various components have been commissioned, the operations phase of the Project will commence. The current Project schedule indicates that this phase of the Project will commence in late 2015 (pre-production), and extend to approximately 2033. Project operations and maintenance activities will entail open pit mining (drilling and blasting, mineral loading and transportation, waste rock disposal), mineral processing and associated support activities (tailings management, water management, equipment use, railway operations, fuel handling, inspection and maintenance work).

Worker shift lengths and duration / rotation arrangements will be defined at a later stage of Project planning and development, and will likely vary somewhat between occupations and employers. In general, however, it is expected that most on-site operations workers will work 10-12 hours per day, and five to six days per week, with the possibility of having multiple shifts (covering a 24 hour period) for some work activities and periods. This will again vary between individuals and contractors as required.

It is Alderon's preference to have a resident workforce during the operations phase, and the proponent is developing, in consultation with local municipalities and government, a workforce accommodations strategy.

Potential Environmental Effects and Their Mitigation

Upon completion of Project construction and the commencement of the operations phase, the level of new and "non-resident" activity within the local communities (e.g., transient workforce, traffic) will decrease considerably, and it is expected the operational aspects of the Project will eventually become an integral part of the structure and functioning of the communities themselves (similar to the existing mining operations). The permanent Project site access road will be in place throughout this phase of the Project.

A larger population may experience an increase in overall crime levels, but not necessarily an increase in per capita crime levels or in the type and degree of criminal activity. As discussed, the most common and increasing types of violations in Labrador West are those relating to driving (speeding and impaired driving) and drugs (possession and trafficking). The former far exceeds the latter and the increase in incidents may again be somewhat related to increased policing.

As indicated previously, Alderon is seeking to establish and maintain a resident workforce during the Project's operations phase. It is therefore anticipated and intended that the workforce will be comprised of Project employees and their families, who will move to the Labrador West area, make it their home, and become members of the community. It is expected that this will help contribute to a degree of stability and cohesiveness as compared to a highly mobile (and unattached) workforce, which should, in turn, help to address any associated potential for increases in social issues such crime, substance abuse or other possible negative social interactions.

An increase in the population of a community (particularly where these occur in association with resource development “booms”) can, however, create potential quality of life issues within a community related to the use, availability, affordability and quality of services and infrastructure and other issues. These have been assessed in detail in Chapter 24 (Community Services and Infrastructure VEC).

Managing and mitigating general community and regional health issues, and in particular the provision of associated services and facilities, is for the most part beyond the ability and responsibility of Alderon or any other individual project proponent, and involves municipal, provincial and federal agencies and other organizations. In this regard, the purpose of the environmental assessment is – as a planning tool for all parties - to help identify potential issues and requirements well in advance of their occurrence, so that appropriate measures can be identified and implemented by these agencies in an effective and timely manner. Again, Alderon will continue to work with local and regional communities and other service providers to identify and plan for any associated issues, including through the provision of up-to-date project information and schedules. This will include continued participation in the Labrador West Community Advisory Panel and the Labrador West Regional Task Force.

Although the operations phase of the Project will not result in significant additional works or disturbance over those which were implemented and completed during construction, Project operations and maintenance activities will entail open pit mining (drilling and blasting, mineral loading and transportation, waste rock disposal), mineral processing and associated support activities (tailings management, water management, equipment use, railway operations, fuel handling, inspection and maintenance work). It will also result in other types of disturbances, such as those associated with air emissions (dust, engine exhausts) noise, light, vibrations, the visibility of Project infrastructure and activities, other potential emissions and related disturbances, for which detailed modeling and analysis have been presented in other sections of this EIS (Chapters 14, 16, 23).

Some of the key findings of this modeling and analysis (for construction and operations) which are particularly relevant to community health (quality of life and well-being) include:

- As indicated through the modelling and effects analyses presented in Chapter 14 of this EIS, during construction there will be a temporary increase in noise levels in the region due to the use of heavy equipment, which may at time be discernable at the cabins on Long Lake or the residential area of Wabush as an industrial “hum”, but which is not likely to have implications for human health. Similarly, the modeling has indicated that with the implementation of identified mitigation measures during Project operations, any increased sound pressure levels at the nearest cabins on Long Lake would not exceed the Health Canada criteria.

- Vibration issues could also arise during either phase of the Project, particularly during the use of heavy machinery, blasting and the operations of the rail line. The Blasting Plan that will be developed for the Project will address this issue. Vibration modelling for various Project activities indicates that this would be within established criteria and thresholds (Chapter 14).
- Although Project components and activities will be visible from some locations within the PDA and LSA, they will not be visible from most residential locations. The Project will be developed in a region that has been subject to significant mining activity for several decades, and any such issues will be fully reversible upon the closure and decommissioning.

Moreover, Alderon has considered and attempted to proactively address community and viewshed issues in Project planning and design. The Rose South Waste Rock Disposal Area was, for example, relocated following consultation with the Town of Fermont and other stakeholders, during which concerns were raised by the community related to noise, dust, and visual issues at the previously proposed location. A detailed viewscape and visual aesthetics assessment is provided in Chapter 23.

These analyses have therefore indicated that these Project-related emissions and associated disturbances will have a limited geographic zone of influence – which in most cases will not extend to the adjacent communities themselves. The various environmental effects mitigation measures outlined in these other VEC chapters will further serve to avoid or reduce any Project-related disturbances or effects that could potentially have implications for community health in the region.

The potential effects of any such Project-related disturbances on land and resource use activities in the general region (including cabin use, hunting and fishing etc) have been assessed in Chapters 22 and 23.

Characterizaion of Residual Project Environmental Effects

The operations phase of the Project is not likely to measurably or materially decrease community health in the various communities that comprise the LSA.

25.6.2.3 Decommissioning and Reclamation

Once operations activities cease at the end of the mine life, the decommissioning and reclamation phase of the Project will commence, as described in detail in Section 2.6. Detailed information and estimates regarding the activities, processes and labour force requirements and arrangements that may be associated with eventual Project closure cannot be known or provided at this time, given that these activities are in the distant future (2033 and beyond), and because detailed plans for these activities will be developed later.

Closure of the mine will mean loss of employment which may result in reduction of income and loss of company sponsored health care benefits. Any reduction of income will also affect financial security which could increase family stress and substance abuse. Any population decrease may result in loss of public health care services that are based on population size.

For the most part, however, this phase of the Project will see the progressive closure and cessation of Project-related work, and therefore, the removal of any associated disturbances or issues that may have contributed to any community health effects (of whatever degree) that may have been experienced during construction and/or operations.

25.6.3 Summary of Project Residual Environmental Effects

25.6.3.1 Physical Health

The assessment of potential effects to physical health is based on evaluating changes in COPC concentrations due to Project emissions and/or discharges at specific receptor locations. In the absence of measurable changes in COPC concentrations in environmental media (e.g., air, soil, water quality) and/or if predicted concentrations are within regulatory criteria, adverse effects to physical health would not be expected.

Although the operation and maintenance of the Project will result in fugitive air emissions of COPC, based on the current planned mitigation these emissions will not result in any exceedances of the air quality standards at the representative receptor locations, except for a slight exceedance of $PM_{2.5}$ at the southern end of Long Lake. This phase of the Project will also result in fugitive dust emissions, however, based on the current planned mitigation these emissions will not result in any measurable change in baseline soil quality at the representative receptor locations nor will the predicted dust fall result in any measurable accumulation of metals in vegetation at the representative receptor locations. The Project will also include discharge of process mine water and possible sanitary effluent into Long Lake via a diffuser. The required dilution of this effluent to protect against potential physical health effects (i.e., drinking water and fish consumption) is achieved within a mixing zone of a few meters (< 10m) at the diffuser outfall.

It should be noted that these physical health analyses and effects assessments have been based (rather conservatively) upon the assumed potential for humans to come into contact with Project-related emissions to the air, water and soils in the LSA. While this may be realistic for cabin locations proximal to the Project, people living in the communities of Wabush, Labrador City and Fermont have a very low potential of coming into contact with any Project emissions. Even for locations close to the Project, however, Project emissions are not expected to result in changes to these media that would likely pose a threat to human health. This is likely to be even further reduced by the fact that people may somewhat adjust their activities (and especially, consumption patterns) in and around the immediate area due to the known presence of an operating mine.

No associated adverse effects upon the physical health of humans within the LSA are therefore expected to occur during any phase of the Project.

25.6.3.2 Community Health

The Project will result in employment opportunities and associated income benefits which should have an overall beneficial effect on the quality of life in Labrador West. Public safety will be protected through Project site access restrictions throughout construction and operations, transportation and access systems which avoid the use of existing local roadways (especially within the communities), and on-going consultation and communication forums.

Increased drug and alcohol abuse, criminal activity and other social issues and interactions may at times be associated with major development projects, and the region has been seeing increases in various such issues in recent years. Alderon's desire and planned measures to attract and maintain a resident workforce, as well as its work rotations and transportation systems during construction, will help to minimize any negative social issues and interactions with the local communities.

Effects analysis and modeling for possible Project-related emissions and disturbances (such as noise, air emissions, vibrations, visual intrusions) have indicated that these will have a limited geographic zone of influence, which in most cases will not extend to the adjacent communities themselves. The various environmental effects mitigation measures outlined in this and other VEC chapters will further serve to avoid or reduce any Project-related disturbances that could potentially have implications for community health in the region.

Table 25.29 Summary of Project Residual Environmental Effects: Health and Community Health

Project Phase	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	
Changes in Air Quality (Which Could Affect Human Health)											
Operation and Maintenance (Representative of all Project phases)	• Refer to Chapter 14: Atmospheric Resources	A	L	L	M	C	R	D	N	M	Air quality monitoring program.
Changes in Water Quality (Which Could Affect Human Health)											
Operation and Maintenance (Representative of all Project phases)	• Refer to Chapter 16: Water Resources	A	L	S	M	C	R	D	N	M	Surface water monitoring programs.
Changes in Soil Quality (Which Could Affect Human Health)											
Operation and Maintenance (Representative of all Project phases)	• Refer to Chapter 14: Atmospheric Resources	A	L	L	P	C	R	D	N	M	Air quality monitoring program.
Changes in Vegetation Quality (Which Could Affect Human Health)											
Operation and Maintenance (Representative of all Project phases)	• Refer to Chapter 14: Atmospheric Resources	A	L	L	M	C	R	D	N	M	Air quality monitoring program.

Project Phase	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	
Change in Public Safety (Injuries / Accidents)											
Construction	• Project site access restrictions. • Transportation systems, new access roads. • Planning and communication.	A (N)	L	L	S	S	R	D	N	H	Continued cooperation and communication with local and regional communities and agencies and service providers. Provision of Project information as required and requested.
Operation and Maintenance		A (N)	L	L	M	S	R	D	N	H	
Decommissioning and Reclamation		N	-	-	-	-	-	-	-	-	
Change in Substance Abuse											
Construction	• Use of a resident workforce wherever possible. • Workforce accommodations plan. • Community and cultural information and training for workers. • Employee assistance program. • Drug and alcohol testing, as legally allowed. • Continued cooperation with local and regional communities and agencies and service providers.	A	L	L	S	S	R	D	N	H	Continued cooperation and communication with local and regional communities and agencies and service providers. Provision of Project information as required and requested.
Operation and Maintenance		A	L	L	M	S	R	D	N	H	
Decommissioning and Reclamation		N	-	-	-	-	-	-	-	-	

Project Phase	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	
Changes in Crime											
Construction	• As above.	A	L	L	S	S	R	D	N	H	Continued cooperation and communication with local and regional communities and agencies and service providers. Provision of Project information as required and requested.
Operation and Maintenance		A	L	L	M	S	R	D	N	H	
Decommissioning and Reclamation		N	-	-	-	-	-	-	-	-	
Changes in Perceptions of Quality of Life and Well-Being											
Construction	• As above.	A / P	L	L	M	S	R	D	N	H	Continued cooperation and communication with local and regional communities and agencies and service providers. Provision of Project information as required and requested.
Operation and Maintenance		A / P	L	L	M	S	R	D	N	H	
Decommissioning and Reclamation		N	-	-	-	-	-	-	-	-	

Project Phase	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	

KEY

Direction:
- P Positive.
- A Adverse.
- N Neutral (or No Effect).

Magnitude:
- L Low: affects a small number of persons, and may be indistinguishable from the normal condition and/or natural variability of the VEC;).
- M Moderate: effect is detectable within a population, but is within normal range of variability and/or is within regulatory limits / standards and/or objectives.
- H High: effect cause clear and sustained exceedences of regulatory limits / standards and/or objectives).

Geographic Extent:
- S Site: includes PDA and 200 m beyond.
- L Local: LSA.
- R Regional: RSA.

Frequency:
- N Not likely to occur.
- O Once: Occurs once.
- S Sporadic: occurs sporadically.
- R Regular: occurs on a regular basis.
- C Continuous.

Duration:
- S Short-term: construction phase only .
- M Medium-term: continues through operation and maintenance phase.
- L Long-term: continues beyond operation and maintenance.
- P Permanent .

Reversibility
- R Reversible.
- I Irreversible.

Reversibility:
- R Reversible.
- I Irreversible.

Environmental or Socio-economic Context:
- U Undisturbed: Area relatively or not adversely affected by human activity.
- D Developed: Area has been substantially previously disturbed by human development or human development is still present.

Significance:
- S Significant.
- N Not Significant.

Prediction Confidence:
Based on scientific information and statistical analysis, past experience, and effectiveness of mitigation or effects management measure
- L Low level of confidence.
- M Moderate level of confidence.
- H High level of confidence.

N/A Not Applicable.

25.7 Assessment of Cumulative Effects

This section provides an assessment of potential cumulative effects resulting from the Kami Iron Ore Project in combination with other projects and activities during a similar time period and within the same geographic region. These include new developments, current operations, ongoing expansions, developing mines and potential expansions of the following projects:

- IOC Labrador Operations;
- Cliffs Natural Resources' Wabush Mines;
- ArcelorMittal's Mont Wright Mine;
- Cliffs Natural Resources' Bloom Lake Mine;
- Labrador Iron Mines' Schefferville Iron Ore Mine;
- Tata Steel Minerals Canada's DSO Iron Ore Project;
- Nalcor Energy's Lower Churchill Generation Project; and
- Infrastructure or other projects at the Port of Sept-Îles.

25.7.1 Physical Health

The assessment of possible effects on human (physical) health has focussed on a number of physical environmental components – air, water, soil and vegetation – which may be affected by developments and their associated emissions and discharges, and which may, in turn, have implications for human health.

The existing (baseline) condition of these environmental components within the LSA is the result of other past and on-going human activities. Regional ambient air quality monitoring shows that the average air quality in the region is good overall, with SO_2 and NO_2 ambient concentrations being below applicable standards and with TSP occasionally exceeding guidelines. Baseline water quality monitoring data similarly shows that existing surface water quality is good, with cadmium, copper, and iron occasionally and slightly exceeding ecological water quality guidelines. Baseline soil quality information also indicates that local soil quality meets the Canadian Soil Quality Guidelines. The Project is not predicted to have significant adverse effects on air, water or soil quality within the LSA, particularly of the type or degree of effect that would have resulting adverse effects on human health.

Chapter 14, Section 14.7, discusses potential cumulative effects on air quality and concludes that cumulative effects on air quality will not be significant. Historical monitoring indicates limited adverse effects from existing developments near Labrador City, Wabush, Fermont, and surrounding rural dwellings. Baseline air quality monitoring has established that while there are sporadic exceedances in TPM, the annual and average concentrations of contaminants and particulates are well below provincial standards and federal guidelines.

Given the proposed mitigation and monitoring associated with this Project and that of IOC and Wabush Mines, ambient air quality from all projects are predicted to remain within the provincial *Air Pollution Control Regulations*, the National Ambient Air Quality Objectives and Canada Wide Standards, with the exception of short and infrequent exceedances of ambient particulate emissions guidelines during meteorological-driven events consistent with those that occur at present.

Particulate emissions have been identified through air dispersion modeling as the major contributor to adverse air quality from the Kami mine. Incorporating mitigation measures such as reduced hauling truck speed, dust suppression programs for roads and stockpiles, and covered conveyors will ensure no significant adverse residual effects to air quality occur. It is also noted that the emissions from each site are not strictly additive, but are highly dependent on meteorological conditions. Existing mine sites are oriented in such a way that surrounding dwellings cannot be affected by more than two mines simultaneously, and then only in the case of Labrador City due to a SSE wind. As presented in Chapter 14, winds typically blow from the south towards Labrador City approximately 11 percent of the time.

Chapter 16, Section 16.7 discusses potential cumulative effects on water quality. Surface water quality residual effects relate to the net consumption of water by the Project under worst case conditions, with this residual effect is determined to be not significant. Other projects and activities will not overlap the physical footprint of the Kami Project or interfere with water supply and discharge potential. Therefore there will be no cumulative effects to surface water resulting from other projects and activities in combination with the Kami Project, particularly that will have implications for human health.

The Project will therefore not likely result in significant adverse cumulative effects on physical health in combination with other projects and activities that have been or will be carried out.

Table 25.30 Potential Cumulative Effects on Physical Health

VEC Existing Condition (Past & On-Going Activities)	• Air quality in the region is generally good, with rare short-term exceedances of air quality standards. Long-term and average ambient concentrations are well below standards and guidelines for contaminants and particulates. • Baseline soil quality is below environmental guidelines. • Surface water quality is generally good, with occasional and minor exceedances of CWQG.		
Kami Project Residual Effects	• Heavy machinery, equipment, and facilities operating at the Kami mine site and rail infrastructure will be sources of air contaminants (CO, NO_x, SO_2, TPM, PM_{10}, $PM_{2.5}$, metals, and VOCs). • With mitigation measures in place, air emissions all comply with provincial and federal standards and guidelines. • Dust fall associated with the Project is not predicted to result in measurable degradation in soil or vegetation quality. • The primary effluent discharge from the Project will be via a diffuser outfall in Long Lake. Dilution required to achieve acceptable water quality for protection of physical health is predicted to be achieved within 10 m of the diffuser.		
Other Projects / Activities	**Likely Effect Interaction (Y/N)**	**Rationale**	**Cumulative Effects**
IOC Labrador Operations	Y	• Direct overlap in air emissions. • Discharge of effluent into Long Lake.	• Air dispersion modeling shows IOC and Kami could not affect residential areas simultaneously due to geographic orientation. • Effects of Long Lake mixing zone contained within LSA.
Wabush Mines (Cliffs Resources)	Y	• Direct overlap in air emissions.	• Air dispersion modeling shows Wabush Mines and Kami could not affect residential areas simultaneously due to geographic orientation. • A SSE wind could bring emissions from both sites to Labrador City, however the majority of emissions would be due to Wabush mine site. • As Wabush mines site complies with air quality standards and guidelines, no significant effect is expected from interaction with Kami mine.

Mont Wright Mine (ArcelorMittal)	N	• Sites too distant to interact in a significant way.	• No cumulative physical health effect expected with the Project.
Bloom Lake Mine and Rail Spur (Cliffs Resources)	N	• Sites too distant to interact in a significant way.	• No cumulative physical health effect expected with the Project.
Schefferville Iron Ore Mine (Labrador Iron Mines)	N	• Sites too distant to interact in a significant way.	• No cumulative physical health effect expected with the Project.
DSO Iron Ore Project (Tata Steel Minerals Canada)	N	• Sites too distant to interact in a significant way.	• No cumulative physical health effect expected with the Project.
Lower Churchill Generation Project (Nalcor Energy)	N	• Sites too distant to interact in a significant way.	• No cumulative physical health effect expected with the Project.
Infrastructure or other projects at Port of Sept-Îles	N	• Sites too distant to interact in a significant way.	• No cumulative physical health effect expected with the Project.

Cumulative Effects Summary (Kami Project + All Relevant Projects / Effects)	**Direction**	**Magnitude**	**Geographic Extent**	**Duration**	**Frequency**	**Reversibility**	**Significance**	**Confidence**
	A	L	L	M	C	R	N	M

- The potential residual environmental effects of the Kami Project may have measurable interactions with other existing and planned projects on ambient air quality (particulate matter).
- The cumulative effects of the Kami Project combined with Wabush Mines and IOC Labrador Operations may exceed guidelines for ambient particulate matter in localized areas for short periods during certain meteorological events. All other air quality predictions are below standards and guidelines.
- Residual environmental effects on soil and vegetation quality are predicted to be not measurable and therefore would have no measurable effect above existing baseline.
- Residual effects on water quality are localized to within a few meters of the diffuser outfall in Long Lake and would not interact with any other projects.
- Therefore, the cumulative effects of the Project acting in combination with other past, present, and planned projects and activities on physical health are determined to be not significant.

Note: Environmental effects descriptors and their definitions are as used in the assessment of Project-related environmental effects.

25.7.2 Community Health

Projects in Schefferville, Central Labrador and Sept-Îles will not likely result in or contribute to cumulative effects on health and community health because of their distance from the Kami Project. This discussion of cumulative effects therefore focuses on the four nearby existing and expanding mining projects in Labrador West and Fermont: IOC's Labrador Operations, Wabush Mines, Mont Wright Mine and Bloom Lake Mine.

Labrador City, Wabush and Fermont are modern, vibrant communities, whose residents have high levels of health and overall well-being. This is due, at least in part, to the high standards of living and employment and income levels in the region that have resulted from the mining developments and associated activities that have characterized the economies of the region over the past several decades. While it is recognized that recent years have seen a degree of increase in various social issues related to substance abuse, crime, the availability and affordability of housing and other services and infrastructure due to the expansion and growth of the mining sector, the overall satisfaction with quality of life of residents of Labrador West and Cote-Nord regions remain similar to Newfoundland and Labrador in general and somewhat higher than the province of Quebec as a whole.

The Project will result in some associated issues and interactions with the local communities, both positive and negative. It will generate employment opportunities and associated income benefits which should have an overall beneficial effect on the quality of life in the LSA, particularly for current and new residents who become employed in the mine. Although there have been concerns around public safety (especially due to Project related traffic in and around the communities), possible increases in substance abuse and crime, and others, as indicated in the preceding analysis the Project is not likely to have significant adverse effects on community health within the LSA.

In addition to the proposed Project, the four existing Labrador West and Fermont mines are in various stages of expansion. This has and will increase the temporary construction workforce though the number of workers is difficult to define (some projects have begun but the timing of others is unknown). Neither Labrador nor northeastern Québec will have enough workers to supply these projects and non-resident workers will likely be used for construction. For example, IOC has approximately 1,000 construction workers who are engaged in expansion related projects and housed in an accommodation camp in Labrador City. Also, it is estimated that Fermont had approximately 3,000 FIFO construction workers (for mine expansion and housing development) in November 2011 that were accommodated in temporary housing (CBC 2011). Due to existing housing shortages and the fact that it is not necessary to build permanent communities for temporary workers, additional construction workers for mining projects may be housed in camps in Labrador West and/or Fermont. Therefore, in addition to current temporary workforces, further construction will result in a larger number of temporary workers and potential issues related to drug and alcohol abuse and criminal violations. Temporary of transient workforces can result in associated health and social issues.

Current operations for the four Labrador West and Fermont mines (IOC's Labrador Operations, Wabush Mines, Bloom Lake Mine and Mont Wright Mine) collectively employ approximately several thousand permanent employees. These mines are expanding and some may use FIFO workers for operations, but most proponents try to recruit and retain permanent residents wherever possible. If the various expansion projects proceed, they will increase the permanent worker population in Labrador City, Wabush and Fermont to some degree. The projects would also indirectly increase the general population through in-migration of permanent employees' families and workers required for other sectors. This increase in population could have a cumulative effect on drug and alcohol abuse and criminal violations though to a lesser extent than in the construction phase as many workers will be residents with families living in the communities. A rapid increase in population, employment and disposable income can result in a higher number of incidents of drug and alcohol abuse and criminal violations (e.g. impaired driving and / or drug trafficking) in both construction and operations. Although these will not necessarily increase proportionally by a per capita rate, they will result from an increase in employment with the Kami Project along with other projects.

Current construction projects operating simultaneously are likely to be already causing increased traffic. This will also be true for future projects including the Kami project and those previously listed. Local roads and the TLH have additional capacity but residents are not accustomed to even higher traffic levels that may be experienced as a result of several large projects occurring simultaneously, thereby causing a nuisance effect at an increased level and higher potential of increased accidents and injuries. Visual landscape disturbances will also result from additional industrial development. Alderon has taken measures to reduce both of these effects from the Kami Project but cumulative traffic effects will result from an overall increase in population from the Kami Project along with other developments in the region.

To manage cumulative effects on health and community health, relevant agencies will engage in and implement appropriate management strategies, particularly with respect to drug and alcohol abuse and criminal violations. Government agencies (e.g., policing and healthcare), Alderon and other project development and expansion proponents will be involved. The Labrador West Regional Task Force includes Alderon, IOC, Cliffs, ArcelorMittal, Labrador Iron Mines, Tata Steel, Town of Labrador City, Town of Wabush, Town of Fermont, Memorial University's Harris Centre, Atlantic Canada Opportunities Agency and Provincial Government agencies such as the Department of Municipal Affairs, Department of Natural Resources and Executive Council (Intergovernmental & Aboriginal Affairs Secretariat and Labrador Affairs Office). This group and the Community Advisory Panel are currently working collectively to address cumulative effects and associated management challenges.

Table 25.31 Potential Cumulative Effects on Community Health

VEC Existing Condition (Past & On-Going Activities)	• Residents of Labrador City, Wabush and Fermont enjoy a high employment rate and above average incomes which improve quality of life • Residents of Labrador West are already experiencing increased traffic due to current activities • Substance abuse is already evidenced by hospital admissions, impaired driving charges and the fact that drug trafficking exists in Labrador West and Fermont • Per capita crime (mostly traffic incidents with a small number of controlled substances violations) has been increasing in Labrador West (but also may be a result of more policing)		
Kami Project Residual Effects	• Quality of life will be enhanced through increased employment and income. Residual effects include increased employment, income and population which may lead to increases in drug and alcohol abuse and crime. Increased traffic will also result from transport of personnel, equipment and materials to the project site.		
Other Projects / Activities	**Likely Effect Interaction (Y/N)**	**Rationale**	**Cumulative Effects**
IOC Labrador Operations	Y	• Existing operations, current construction and planned expansions occur within Labrador West.	• Each of these on-going and potential (expansion) projects will likely have similar interactions with the Towns of Wabush and Labrador City as the Project (workforces, accommodations, transportation, income etc), and will overlap in time.
Wabush Mines (Cliffs Resources)	Y	• Existing operations and expansion occur within Labrador West.	
Mont Wright Mine (ArcelorMittal)	Y	• Existing operations and expansion occur in Fermont.	• Although the Project will see less direct interaction with Fermont as compared to Labrador West, there may be some interactions (visual, etc).
Bloom Lake Mine and Rail Spur (Cliffs Resources)	Y	• Existing operations and expansion occur in Fermont.	
Schefferville Iron Ore Mine (Labrador Iron Mines)	N	• Existing operations and expansion occur in the Schefferville area.	• The Project will not likely interact with or have direct effects on the communities or populations which are adjacent to these developments.
Schefferville Iron Ore Mine (Labrador Iron Mines)	N	• Existing operations and expansion occur in the Schefferville area.	
DSO Iron Ore Project (Tata Steel Minerals Canada)	N	• Existing operations and expansion occur in the Schefferville area.	
Lower Churchill Generation Project (Nalcor Energy)	N	• Construction and operations will occur in Central Labrador.	
Infrastructure or other projects at Port of Sept-Îles	N	• Activities will occur in Sept-Îles.	
Summary: The proposed Kami Project will interact with residents and communities in Labrador West and to a much lesser extent in Fermont. The existing four mining projects are all undergoing or planning expansions. The Kami Project would increase construction and permanent workforces which would be housed in Labrador West. Various projects' constructions and operations will also bring new workers and may result in increases in drug and alcohol abuse, criminal violations and traffic. However, responsible agencies using initiatives such the Labrador West Regional Task Force and the Community Advisory Panel, will address these issues individually and collectively. Therefore, the Kami Project in combination with other existing or future projects and activities will not likely result in significant adverse environmental effects. Note: Environmental effects descriptors and their definitions are as used in the assessment of Project-related environmental effects.			

25.8 Assessment of Accidents and Malfunctions

In the construction, operation and maintenance, and decommissioning and closure of a large scale development project, an accidental or other unplanned event is an unlikely, but unfortunately possible, outcome.

Some of the potential accidental events or malfunctions that may be associated with the Project and which are particularly relevant for EA purposes and specifically this VEC include:

- A fire at the Project site, potentially extending into adjacent areas; and
- An accidental release of fuels, chemicals or other substances into the terrestrial and/or aquatic environments (such as through an accidental spill, breach of the tailings management facility, train derailment, etc).

Either of these events could potentially occur during the Project's construction, operations and/or decommissioning and closure phases, the potential environmental effects of which would clearly depend upon the nature, magnitude, location and duration of the event.

25.8.1 Physical Health

Possible physical health effects related to the Kami mine are associated with emissions of COPC into the surrounding environment causing changes to air, water, or soil quality. Therefore, possible accidental events that may affect physical health are those that may affect air quality (and by extension soil quality) and water quality. An assessment of accidents and malfunctions on air and water quality is fully discussed in Chapter 14, Section 14.8, and Chapter 16, Section 16.8, respectively. A brief summary is provided below.

A fire at or near the Project site could have implications for air quality, which would occur throughout the region for the period until the fire was extinguished. A derailment involving fuel trains could expose fuel to the open air, releasing VOCs. Clean-up of the site would employ hauling trucks and earth moving equipment which would release particulate matter and combustion gases through fuel consumption, and dust emissions from the clean-up activities. If derailment were to occur near the mine, air quality affects would be at least partially offset by reduced mining activities until the rail was returned to full operations. Mitigation measures during clean-up include the use of dust suppressants and adherence to a comprehensive equipment preventative maintenance program to maintain the vehicles, and to maximize fuel efficiency and vehicle performance.

Changes in the air quality due to a train derailment will be local in geographic extent, affecting only the immediate vicinity of the derailment. Pollutant emissions from the clean-up will be sporadic in frequency and short in duration. The likelihood of a derailment is extremely low, and the effects on air quality will cease once the clean-up is complete. Contaminant emissions are expected to be within all pertinent standards and guidelines.

The main accidents and malfunctions scenarios that could affect surface water quality include:

- Forest fire;
- Breach of the polishing pond or tailings dykes/berms, and
- Train derailment or fuel storage tank failure and consequent spill of hydrocarbon or contaminants.

In the unlikely event of any of these scenarios, the quality of local water surface water resources in the immediate and down-gradient areas could be affected. Alderon has developed and will implement associated mitigation and management measures including:

- Rail traffic management and Environmental Protection Plan (EPP);
- EPP includes storage containment, redundancy and contingency planning for spills;
- Emergency Response Plan; and
- Annual review of dam integrity.

In the context of physical health, in the event of a water supply becoming contaminated, an emergency supply of water would be made available to residents until the water service could be restored. Emergency clean-up crews would be called upon to clean the water supply thoroughly and efficiently to minimize effects on the community. Should water bodies used for fishing become contaminated, fish consumption advisories or bans could be put in place until clean up is completed.

Again, given the typically “mobile” nature of many of the land and resource use activities involved (e.g., hunting, fishing etc), residents may choose to avoid an area for a period if there is a (real or perceived) effect due to an accidental event. No associated effects to human health are therefore anticipated.

25.8.2 Community Health

Identified potential accidental events related to the Kami Mine include potential unplanned releases of materials into the environment (spills, dyke breaches, train derailment) or fires. For the most part these events would occur on the mine site property. Such events could occur in any Project phase, and whether and how they affect the surrounding areas and communities would depend on the nature, scale, time and location of the incident. Accidental events as a result of the Project are unlikely, as Alderon has prevention programs to minimize their likelihood. However, should an event occur, Alderon’s response measures will address adverse effects on health and community health. Project personnel will be trained to manage any accidental events that may occur.

A forest fire resulting from an incident caused by the Project's activities could lead to the short-term health and safety risks for Project workers, fire fighters or others exposed to or engaged in controlling such a fire. A forest fire could result in a loss of or disturbance to property or other infrastructure in the region. A fire would likely be contained and extinguished within a short time, but would be nonetheless stressful for the community. These effects would be short-term and planned for within Alderon's Environmental Protection and Emergency Response Plans and Labrador West's new regional emergency response plan which is being prepared by the Towns' fire departments, the RNC, LGH, Wabush Airport and other industries and agencies.

Human health and safety and environmental protection have been important considerations by Alderon in the planning and design of the Project, and these will continue to be key priorities during the construction, operation and eventual closure of the Project. As referenced previously and described in some detail elsewhere in this EIS, Alderon has and will develop and implement comprehensive Environmental Protection and Emergency Response Plans for the various phases of the Project. These are being designed to avoid such events and their associated environmental outcomes, or as required, to effectively and efficiently respond to such an accidental event or malfunction should one occur.

The potential residual environmental effects of Project-related accidents and malfunctions on Health and Community Health are summarized in Table 25.32.

Table 25.32 Summary of Residual Environmental Effects for Health and Community Health – Accidents and Malfunctions

Project Phase	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	
Changes in Physical Health											
Fire	• Development and implementation of the Project EPP(s) and ERP.	A	L	S-L	S-M	N	R	D	N	M	Liaise with other mine operators through the Regional Task Force. Liaise with Towns and emergency response agencies.
Spill / Release of Hazardous Materials		A	L	S-L	S-M	N	R	D	N	M	
Changes in Community Health											
Fire	• Development and implementation of the Project EPP(s) and ERP.	A	L	S-L	S-M	N	R	D	N	M	Liaise with other mine operators through the Regional Task Force. Liaise with Towns and emergency response agencies.
Spill / Release of Hazardous Materials		A	L	S-L	S-M	N	R	D	N	M	

Project Phase	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	

KEY

Direction:
P Positive.
A Adverse.
N Neutral (or No Effect).

Magnitude:
L Low: affects a small number of persons, and may be indistinguishable from the normal condition and/or natural variability of the VEC;).
M Moderate: effect is detectable within a population, but is within normal range of variability and/or is within regulatory limits / standards and/or objectives.
H High: effect cause clear and sustained exceedences of regulatory limits / standards and/or objectives).

Geographic Extent:
S Site: includes PDA and 200 m beyond.
L Local: LSA.
R Regional: RSA.

Frequency:
N Not likely to occur.
O Once: Occurs once.
S Sporadic: occurs sporadically.
R Regular: occurs on a regular basis.
C Continuous.

Duration:
S Short-term: construction phase only .
M Medium-term: continues through operation and maintenance phase.
L Long-term: continues beyond operation and maintenance.
P Permanent .

Reversibility
R Reversible.
I Irreversible.

Reversibility:
R Reversible.
I Irreversible.

Environmental or Socio-economic Context:
U Undisturbed: Area relatively or not adversely affected by human activity.
D Developed: Area has been substantially previously disturbed by human development or human development is still present.

Significance:
S Significant.
N Not Significant.

Prediction Confidence:
Based on scientific information and statistical analysis, past experience, and effectiveness of mitigation or effects management measure
L Low level of confidence.
M Moderate level of confidence.
H High level of confidence.

N/A Not Applicable.

25.9 Determination of Significance of Residual Adverse Environmental Effects

This section evaluates the significance of predicted residual adverse environmental effects on Health and Community Health, including Project-specific effects, cumulative effects and the potential effects of any accidents and malfunctions.

25.9.1 Project-related Residual Environmental Effects

The Project is predicted to have no significant adverse residual effects on human (physical) health in the communities of Western Labrador, Fermont or elsewhere. Possible effects on physical health would result primarily from emissions of COPC into the surrounding environment causing changes to air, water, or soil quality. Ground level air concentrations due to Project-related air emissions are predicted to be below standards and guidelines. Project related dust fall is predicted to result in no measurable change in soil and/or vegetation quality. Effluent discharge into Long Lake will be diluted to below acceptable surface water concentrations for the protection of physical health within 10 m of the diffuser. No associated adverse effects upon the physical health of humans within the LSA or elsewhere are therefore expected to occur during any phase of the Project.

In terms of community health, the Project will result in employment opportunities and associated income benefits which should have an overall beneficial effect on the quality of life in Labrador West. Public safety will be protected through Project site access restrictions throughout construction and operations, transportation and access systems which seek to avoid the use of existing local roadways (especially within the communities), and on-going consultation and communication forums. Increased drug and alcohol abuse and criminal activity may at times be associated with development projects and new or increased economic activity, and the region has been seeing increases in these and other issues in recent years. Alderon's desire and planned measures to attract and maintain a resident workforce, as well as its work rotations and transportation systems during construction will help to minimize any negative social issues and interactions with the local community.

Effects analysis and modelling for possible Project-related emissions and disturbances (such as noise, air emissions, vibrations, visual intrusions) have indicated that these will have a limited geographic zone of influence, which in most cases will not extend to the adjacent communities themselves. The various environmental effects mitigation measures outlined in this and other VEC chapters will further serve to avoid or reduce any Project-related disturbances that could potentially have implications for community health in the region.

By implementing appropriate effects management strategies, careful monitoring by relevant authorities and liaison between Alderon, authorities and others engaged in the Labrador West Regional Task Force and the Community Advisory Panel, potential adverse effects on health and community health can be addressed.

25.9.2 Cumulative Effects

The cumulative effects of the Kami Project in combination with Wabush Mines and IOC Labrador operations may exceed guidelines for ambient particulate matter in localized areas for short periods during certain meteorological events. All other air quality predictions are below standards and guidelines. Residual environmental effects on soil and vegetation quality are predicted to be not measurable and therefore would have no measurable effect above existing baseline. Residual effects on water quality are localized to within a few meters of the diffuser outfall in Long Lake and would not interact with any other projects. Therefore, any cumulative effects of the Project acting in combination with other past, present, and planned projects and activities are determined to be not significant.

The proposed Kami Project will contribute to some degree to cumulative effects on health and community health in the overall region. The construction and operations of the various existing and proposed projects will likely result in increases in employment and population levels, which may in turn result in increases in substance abuse and criminal violations. Various on-going initiatives, including the Labrador West Regional Task Force and the Community Advisory Panel, will help to avoid or address any such issues. Therefore, any cumulative effects of the Project acting in combination with other existing and planned projects will not likely be significant.

25.9.3 Accidents and Malfunctions

Possible accidental events or malfunctions that may result in effects on this VEC include a fire or the accidental release of fuels, chemicals or other substances into the environment (such as through an accidental spill, breach of the tailings management facility, train derailment, etc). Either of these events could potentially occur during the Project’s construction, operations and/or decommissioning and closure phases, the potential effects of which would clearly depend upon the nature, magnitude, location and duration of the event. Alderon has and will develop and implement comprehensive Environmental Protection and Emergency Response Plans for the various phases of the Project. In addition, Labrador West’s regional emergency response team will respond to incidents that might affect communities. Therefore, the residual environmental effect of a change in health and community health as a result of accidents and malfunctions during all Project phases are anticipated to be not significant.

25.9.4 Overall Residual Effects Conclusion

The Project is not likely to result in significant adverse effects on health and community health given current and future effects management measures that Alderon and responsible agencies will establish and execute. This determination is made with a high degree of confidence based on literature review, past experience, and anticipated effectiveness of management measures.

25.10 Follow-up and Monitoring

Identified monitoring and follow-up programs related to the atmospheric, aquatic and terrestrial environments (Chapters 14 to 20) also apply indirectly to physical health. No health-specific monitoring programs are required or proposed for this VEC.

Monitoring the characteristics of, and any changes and trends in, health and community health (and in the use and availability of adequate local programs and services), is the responsibility of various organizations and agencies, including provincial and federal government departments. Alderon will cooperate by providing Project-related information as required and requested (including labour force employment statistics), as well as by continuing to participate in the regional forums described previously. Monitoring and planning on the part of these agencies and others will help ensure that overall health and community health issues can be identified and addressed in an effective and timely manner.

25.11 Next Steps

Alderon will continue to consult with relevant organizations, directly and through the Labrador West Regional Task Force and the Community Advisory Panel, to provide Project information and updates on on-going and planned activities, as well as to facilitate discussion of any issues and potential means of addressing them during Project design, construction, operations and/or closure.

25.12 Summary

The Project is not likely to result in significant adverse effects on Health and Community Health, either in and of itself or in combination with other projects and activities.

26.0 ECONOMY, EMPLOYMENT AND BUSINESS

The Project effects, including accidents and malfunctions, and cumulative effects are assessed for Economy, Employment and Business. Proposed effects management, including mitigation, measures, an evaluation of residual and cumulative effects, determination of significance and suggestions for follow-up work and monitoring are also presented.

26.1 VEC Definition and Rationale for Selection

Economy, Employment and Business represent the primary opportunities for the Project to deliver economic benefits to adjacent communities and to the region and jurisdiction within which it is located. This includes direct effects of Project expenditures, primarily on labour, supplies and services, and their multiplier effects through the economy, as well as taxes and royalties. The effects on Economy, Employment and Business can also be adverse and can have linkage to other VECs. Effects may also include benefits to economically disadvantaged groups such as women, Aboriginal people, and persons with disabilities. All of the above are matters of concern to a wide range of stakeholders and a topic discussed in detail in the assessment Guidelines. The concern with economic benefits is also reflected in the Guidelines requirement that a Benefits Plan and Diversity Plan be submitted with the EIS.

Economy, Employment and Business is defined as:

- Economy of Labrador and the rest of the Province;
- Taxes and royalties;
- Gross domestic product (GDP);
- Employment in Labrador and the rest of the Province;
- Skilled and unskilled labour supply in Labrador and the rest of the Province;
- Expenditures in Labrador and the rest of the Province;
- Employment equity and diversity including under-represented groups (e.g., women, persons with disabilities, Aboriginal groups);
- Business capacity: goods and services; and
- Economic activities related to tourism.

26.1.1 Approach to Assessment of Effects

Three meetings were held with provincial government officials to review the proposed assessment approach and data sources:

- A gender-focused meeting was held with officials of the Department of Natural Resources and the Women's Policy Office on December 14th 2011. It saw agreement that it would be valuable to consult with women's groups and training institutions to investigate issues and appropriate responses related to employment and business opportunities for women and women-led companies. Interviews were subsequently conducted with such groups as the Women in Resource Development Corporation, the Provincial Advisory Committee on the Status of Women, the Newfoundland and Labrador Organization of Women Entrepreneurs and the Labrador West Status of Women Council.

- The Economy, Employment and Business and Community Services and Infrastructure VECs were the subject of a regulator meeting on April 2nd 2012. The participants included officials from the Department of Environment and Conservation, the Department of Advanced Education and Skills, the Department of Tourism, Culture and Recreation and the Department of Municipal Affairs. The meeting saw agreement that the geographic scopes for the Economy, Employment and Business VEC would include Economic Zone 2 (Hyron Regional Economic Development Corporation (REDC)), Labrador and the Province as a whole, and that the main information sources would be Statistics Canada, the Newfoundland and Labrador Statistics Agency (and especially Community Accounts), municipal governments, training institutions, regional economic development boards and other public agencies. (The Guidelines subsequently extended the geographic scope to include Fermont, Québec, thus additionally requiring the use of a range of sources in that community and Province.) The meeting also discussed the planned approach to the assessment, which included:
    - Recognizing the current and expected labour force challenges in the Province as a whole and Western Labrador in particular;
    - Emphasizing effects management, especially through the Benefits Plan and Diversity Plan and including measures that have been designed into the Project; and
    - Using follow-up and adaptive management to adjust effects management initiatives in those cases where the outcomes are less satisfactory than had been predicted.
- On Friday April 20th 2012, benefits issues were discussed with Department of Natural Resources officials. The meeting reemphasized the Government of Newfoundland and Labrador concern to maximize local, regional and provincial economic benefits, including employment and business. The topics discussed included the location of design engineering, procurement and rail operations personnel, and of component and module fabrication and any pelletization activity. It was confirmed that the Benefits Plan would be the main tool for benefits maximization and the basis for a contractual Benefits Agreement between Alderon and the Government of Newfoundland and Labrador.

The preparation of the Economy, Employment and Business VEC also saw meetings and interviews with representatives of training institutions (e.g. College of the North Atlantic) and economic development agencies (e.g., Hyron REDC).

A wide range of the most recently available data on baseline economic, employment and business conditions and, where appropriate and available, trends, are presented in the Existing Environment (Section 26.5) section of this chapter and also in the Socio-economic Baseline Study (Appendix J). Information was drawn from secondary sources, organization websites, and telephone discussions with representatives of government and local associations. The assessment also makes extensive use of economic modeling and business and employment capacity reports completed for the Project by Strategic Concepts Inc.

The information available through these sources provides a reliable description of the existing environment for the purpose of the environmental assessment.

26.1.2 Issues

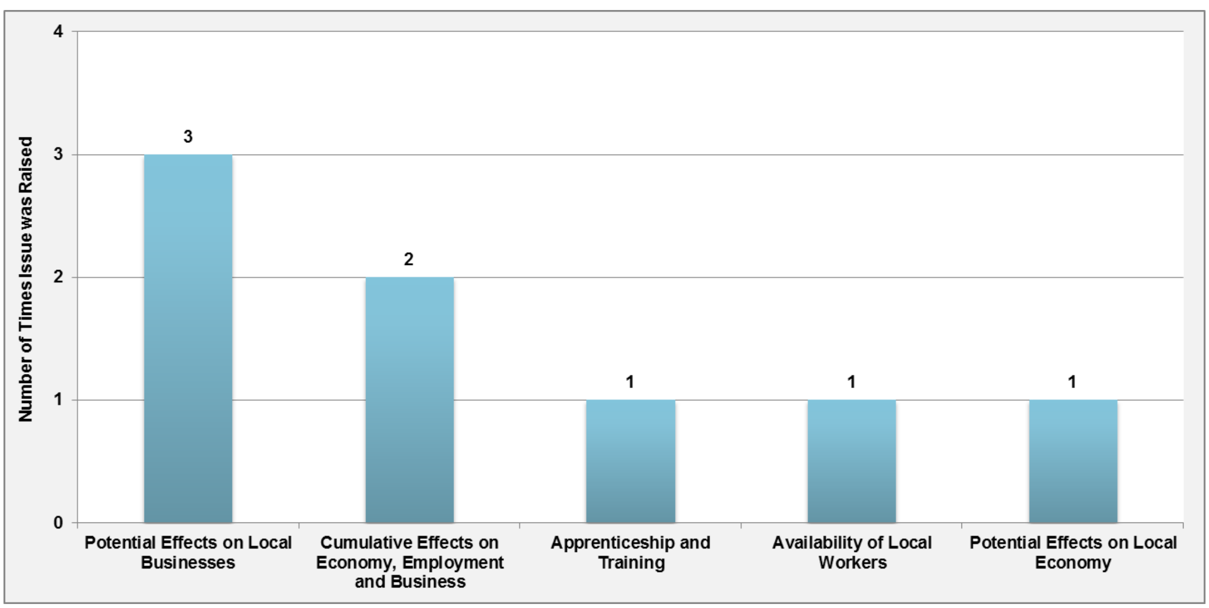
Alderon has consulted, and engaged with, a variety of stakeholders, Aboriginal groups, and members of the public prior to and throughout the EA process, and is committed to being responsive to questions and concerns that arise. Potential issues of concern related to Economy, Employment and Business include:

- Aboriginal employment and business opportunities;
- Apprenticeship and training;
- Availability of local workers;
- Diversity in the workplace;
- Potential effects on local businesses;
- Potential effects on local economy; and
- Secondary processing of iron ore.

Accordingly, these issues are included in the assessment of the VEC. Details on the issues raised by stakeholders are provided in Table 26.1.

The frequency of issue type is summarized in Figure 26.1.

Figure 26.1 Frequency of Issue Type Related to Economy, Employment and Business



26.2 Environmental Assessment Boundaries

26.2.1 Spatial Boundaries

The Regional Study Area (RSA) is the spatial area within which the significance of an environmental effect, including a cumulative effect, is determined. It is based on the geographic extent of the interactions with the Project, the assessment Guidelines, the availability of appropriate data, and the administrative boundaries described below.

The RSA for Economy is Labrador, because this is the main area affected by the Project activity and expenditures and of concern to the public and in the draft Guidelines. The assessment also examines the effects on the Province because it is the administrative unit for which such measures of economic activity as the GDP are available, and for which assessment is required by the Guidelines.

The RSA for both Employment and Business is Economic Zone 2. This is the area within which most Project activity interactions will occur, where most Project employees and many supply and service companies will be located, where most related multiplier effects will occur, and for which related baseline data are available. The assessment also examines the effects on Labrador as a whole, because both it and Economic Zone 2 are identified as being of concern in the assessment Guidelines.

The potential effects of the Project on Economy, Employment and Business in Fermont, Québec are also assessed, as required by the Guidelines.

Table 26.1 Project-Related Issues Raised by Stakeholders

Issue	Community / Organization	Summary of Comments Raised During Consultation and Engagement Activities	Response / Location in the EIS
Aboriginal Employment and Business Opportunities	Innu Nation	Alderon should organize a site tour for elders and a few students from local schools to promote employment.	Alderon is committed to building mutually beneficial and respectful relationships with all Aboriginal groups. Alderon's current Aboriginal engagement processes are described in Chapter 10, and its Aboriginal Relations Policy is outlined in Section 1.1.1.
	Innu Nation	Do not like when agreements are in place and people forget about implementation. For example, training was not done for Voisey's Bay as detailed in the agreements. Contracts were only awarded to big companies and not evenly shared with smaller companies.	Alderon is committed to building mutually beneficial and respectful relationships with all Aboriginal groups. Alderon's current Aboriginal engagement processes are described in Chapter 10, and its Aboriginal Relations Policy is outlined in Section 1.1.1. The Project Benefits Plan, Diversity Plan and any Benefits Agreements will address these issues. Alderon is currently negotiating a benefits agreement with Innu Nation. Additional information is available in Chapter 26.

Issue	Community / Organization	Summary of Comments Raised During Consultation and Engagement Activities	Response / Location in the EIS
	Innu Nation	Request for breakdown of employment and business opportunities for the winter 2012 drilling program.	Alderon provided Innu Nation with this information in November 2011 (Section 10.3).
	Innu Nation	Request for environmental monitors on the Project.	A Project-specific Environmental Protection Plan (EPP) will be developed prior to start of the construction phase. Alderon will have an on-site Environmental Monitor whose duties will include inspection of worksites and activities for conformance with the EPP, application of mitigation measures required by design, and compliance with government regulations and permits. See Chapter 8 for more information
	Innu of Matimekush-Lac John	A drug treatment program is needed to support potential workers.	Alderon will provide employee assistance and support programs for its workforce, as described in Section 25.6.2.
	NNK	Want to be kept informed of business and contracting opportunities. Interested in economic opportunities, and have a mining exploration training group and an environmental assessment training group. Have also started vocational training for trades, and by the construction phase should have people in training. Have a waste management company and could pick up the waste produced by mine dispose of it (e.g. tires). Also looking to open a contaminated soil treatment centre in Schefferville, which would be closer and cheaper than the current one in Baie Comeau.	Alderon will develop a Project Benefits Plan and Diversity Plan that includes a wide range of effects management mechanisms and initiatives designed to enhance the benefits to the Province of Newfoundland and Labrador, and especially Labrador and Economic Zone 2, and to women, Aboriginal people and persons with disabilities resident in the Province. Additional information is found in Section 26.6.
	Innu of Uashat mak Mani-Utenam	Has agreements with many partners and want members of the community to benefit from these projects. Also have many companies in the community and want them to benefit from projects.	

Issue	Community / Organization	Summary of Comments Raised During Consultation and Engagement Activities	Response / Location in the EIS
	NCC	Are there opportunities available for NCC to get involved in baseline study work? Interested in business opportunities associated with the Project, for example they could potentially support drilling activities.	
	Innu Business Development Centre	Inquiry about employment opportunities for two Aboriginal community members who recently completed their online drilling training programs.	
	NNK	What benefits will the Naskapi receive from this Project?	
Apprenticeship and Training	College of the North Atlantic	Wants to advance the Aboriginal file and provide training opportunities.	Meetings have been held with CNA and other training institutions to discuss Project training requirements. Alderon is committed to the encouragement and assistance of residents of the Province, and in particular of Labrador, to receive the education and training necessary to maximize their opportunities for employment on and related to the Project. Alderon will develop a Project Benefits Plan and Diversity Plan that includes a wide range of effects management mechanisms and initiatives designed to enhance the benefits to the Province of Newfoundland and Labrador, and especially Labrador and Economic Zone 2. This is discussed in Section 26.6 and Chapter 24.
	Labrador City	Alderon should actively participate in journeyman / apprenticeship programs.	
	Hyron Regional Economic Development Board	Apprenticeship and training: there should be industry-led initiatives. Industry needs to be involved to solve these issues.	
	Provincial Advisory Council on the Status of Women (PACSW)	It is important to set targets. The numbers presented by Alderon are great at this stage because it may help women decide in which line of work they can train to get employment in the Province. Issue with women in trades, apprenticeships. There is also an issue with women in technology programs where there are no apprenticeships, it is hard to find work. Need to communicate with industry.	
	College of the North Atlantic	CNA would like to know Alderon's diversity targets. 1:4 ratio of apprentices for journeypersons. Scarce journeypersons and challenge to grow apprentices to journeypersons. IOC and Hebron have peak employment at similar point in time as Alderon so it will be a challenge for the Province to have local workforce. Alderon should start recruitment and training of workers by Fall 2012. Should meet again to continue discussion.	

Issue	Community / Organization	Summary of Comments Raised During Consultation and Engagement Activities	Response / Location in the EIS
	Innu Nation	Alderon could contribute in the community by providing training opportunities. Suggested that a mentorship / training program in place for environmental monitors. There was a Guardian program in Innu Nation in the past, that was very useful in training people as it is not within the regular school system.	
	Lab West Status of Women	Main issues include apprentices.	
	Innu Nation	Alderon should organize a site tour in the new year for Innu Nation elders and a few students from local schools to promote employment. Also suggested that Alderon provide scholarships for students.	Alderon is committed to building mutually beneficial and respectful relationships with all Aboriginal groups. Alderon's current Aboriginal engagement processes are described in Chapter 10, and its Aboriginal Relations Policy is outlined in Section 1.1.1.
	Labrador City / Wabush / Fermont	How many people will be needed for the mine? How many permanent workers will there be and what is the plan to attract workers? Will preference be given to local workers? Will workers from Quebec be recruited? Do you need any surveyors?	Alderon will develop a Project Benefits Plan and Diversity Plan that includes a wide range of effects management mechanisms and initiatives designed to enhance the benefits to the Province of Newfoundland and Labrador, and especially Labrador and Economic Zone 2, and to women, Aboriginal people and persons with disabilities resident in the Province. Additional information is found in Section 26.6.
Availability of Local Workers	Labrador City	Complaints from trades people who cannot obtain employment from local companies. Resentment of workers brought in for jobs that can be done by local population. How many permanent workers will there be and how will you get them?	Alderon will focus on increasing opportunities for residents of western Labrador, Labrador as a whole, and the rest of the Province. Employment-related and business-related actions include advertising opportunities locally through print media, websites and Project website and working with Labrador stakeholders to identify how best to involve Labrador businesses in the Project. Additional information is found in Section 26.6.
	CIM Conference	Are you going to use local workers for operations or go FIFO?	Alderon is engaging with government agencies and municipalities to establish a Project accommodation strategy. Alderon will consider employing a Fly-in / Fly-out workforce during the construction phase of the Project. During operations and maintenance, Alderon aims to hire a residential workforce. Additional information is found in Sections 24.5; 24.6 26.5, and 26.6.

Issue	Community / Organization	Summary of Comments Raised During Consultation and Engagement Activities	Response / Location in the EIS
	Labrador City	Will Alderon have administration and human resources in Lab West or in Montreal?	Alderon will have administration and human resources staff in western Labrador. A list of occupations by NOC code is found in Chapter 2.
	Wabush	When will Alderon be hiring someone local for community relations?	Alderon will focus on increasing opportunities for residents of western Labrador, Labrador as a whole, and the rest of the Province. Employment-related actions include advertising opportunities locally through print media, websites and Project website and working with Labrador stakeholders to identify how best to involve Labrador residents in the Project. Additional information is found in Section 26.6.
	Provincial Advisory Council on the Status of Women (PACSW)	IOC and Hebron have peak employment at similar point in time as Alderon so it will be a challenge for the Province to have local workforce. Alderon should start recruitment and training of workers by Fall 2012. Should meet again to continue discussion.	Alderon will work with the provincial Skills Task Force and other industry and professional groups, trades unions, training institutions and other mining companies to address current and future labour shortages. Alderon will also work with these groups to facilitate the delivery of training to Labradorians and Newfoundlanders, including members of the designated groups. Additional information is available in Section 26.6.
Business Access	Newfoundland and Labrador Organization of Women Entrepreneurs	Alderon should educate business owners through supplier development sessions to ensure development of local suppliers. Develop business access strategy, especially for women-owned businesses. They mentioned that women in business could have a great positive community impact. Supplier diversity and set targets for women owned businesses.	Alderon will develop a Project Benefits Plan and Diversity Plan that includes a wide range of effects management mechanisms and initiatives designed to enhance the benefits to the Province of Newfoundland and Labrador, and especially Labrador and Economic Zone 2, and to women, Aboriginal people and persons with disabilities resident in the Province. Additional information is available in Section 26.6.
Diversity in the Workplace	Fermont	Concern that job opportunities will only be for Anglophones. Can equality program also include opportunities for female Francophones?	
	Lab West Status of Women	The main issues include women in trades, and adapting to women in the workplace and having policies for respectful workplace.	
	College of North Atlantic	What are Alderon's diversity targets in the workplace?	
	Provincial Advisory Council on the Status of Women (PACSW)	Diversity in the workplace is an important issue	

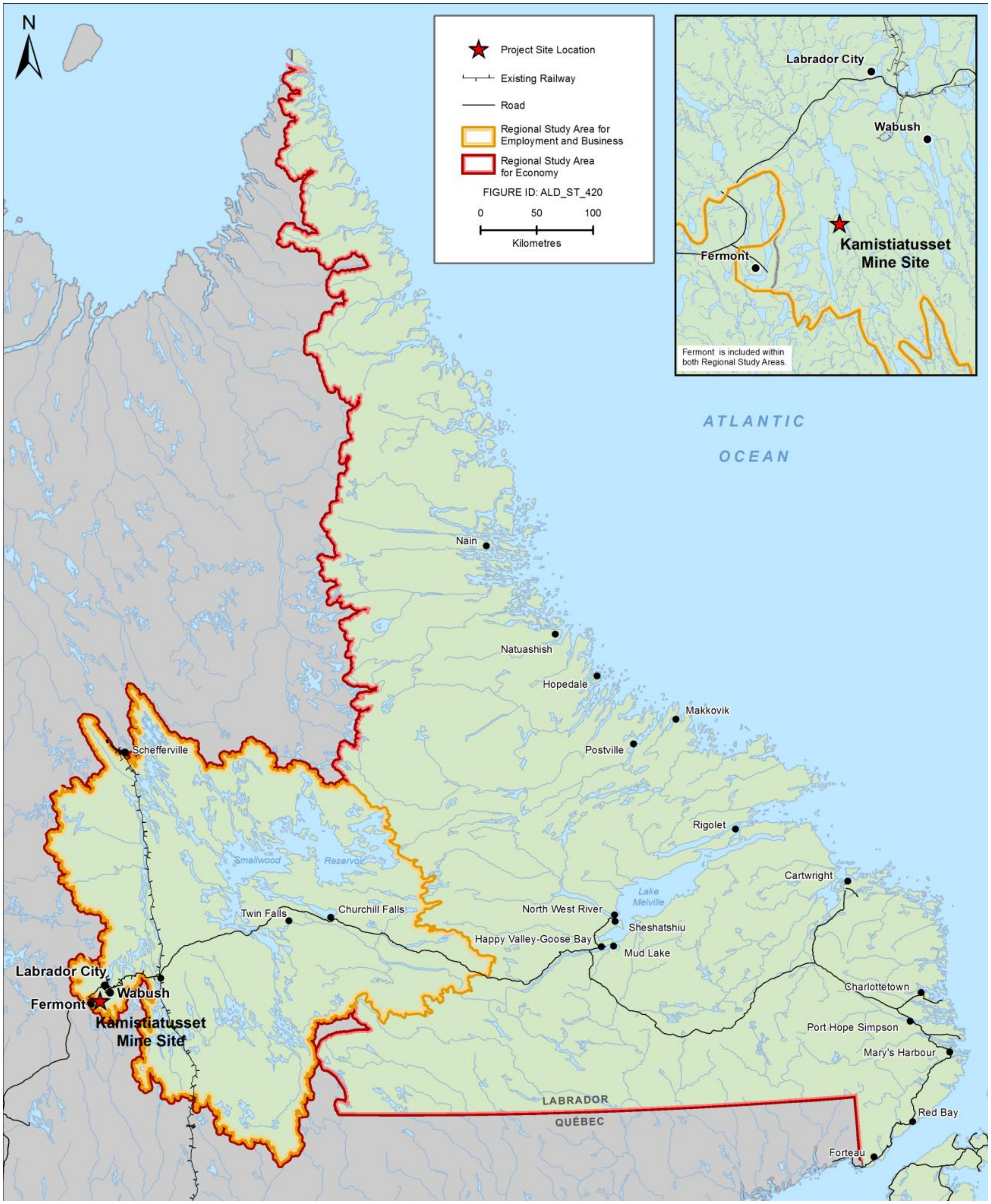
Issue	Community / Organization	Summary of Comments Raised During Consultation and Engagement Activities	Response / Location in the EIS
	NLOWE	Alderon should educate business owners through supplier development sessions to ensure development of local suppliers. Develop business access strategy, especially for women-owned businesses. Women in business could have a great positive community impact. Supplier diversity and set targets for women owned businesses.	
Financial Benefit for Municipality	Wabush	Comment that Bloom Lake project has not lived up to commitments in Lab West.	The follow-up and monitoring policies and practices for all Project phases will be as specified in the Benefits and Diversity Plan. They provide a description of Alderon's process for monitoring and reporting benefits and diversity performance, including success in meeting quantitative and other targets, based on its own performance and that of its contractors and sub-contractors. Additional information is found in Section 26.11
	Wabush	Work with stakeholders to give something back to the community.	Alderon is committed to working with community stakeholders throughout the EA and the life of the Project to maximize benefits for the community. The Benefits and Diversity Plan will outline Alderon's commitment to optimize local benefits. Additional information is found in 26.6, as well as in Chapter 24: Community Services and Infrastructure.
	Wabush	Do not want to pit ourselves against Labrador City or others, but if we (Wabush) are to be impacted more, we expect more of the benefits.	The Project Benefits and Diversity Plan will outline Alderon's commitment to working with local business. Alderon will hold information sessions for suppliers, packaging bids so local companies are contenders. More information is found in Section 26.6.
Potential Effects on Local Businesses	CIM Conference	Many indications of interest by regional suppliers and contractors. In this regards, I believe we should hold information forums in St. John's and Sept-Îles when our contracting strategy is firmed up.	The Project Benefits Plan will outline Alderon's commitment to working with local business. Alderon will hold information sessions for suppliers, packaging bids so local companies are contenders. More information is found in Section 26.6.
	Sept-Îles	Involvement of the local communities and businesses in the procurement process for the construction and operation of the mine. State the company's intentions concerning local procurement.	

Issue	Community / Organization	Summary of Comments Raised During Consultation and Engagement Activities	Response / Location in the EIS
	Fermont	Commercial camp owner on Lake Daviault is concerned about dust, visual, noise, money invested on developing site.	The potential Project effects on cabin use are included in the assessment of the Project on Other Use of Lands and Resources. Alderon has been engaging with cabin owners in the Project area and has developed a strategy to mitigate adverse effects on cabin owners. Alderon will continue its engagement with cabin owners to determine appropriate mitigation for individual cabin owners, as applicable. See Sections 23.5.2.1 and 23.6.3
	Fermont	What will be the economic spin-offs for Fermont? Will it be Fly-in / Fly-out? Will you build houses?	The effects of the Project on Economy, Employment and Business in Fermont are assessed in Chapter 26.. Alderon will consider employing a Fly-in / Fly-out workforce during the construction phase of the Project. During operations and maintenance, Alderon aims to hire a residential workforce. Additional information is found in Section 26.6.
	Wabush	Owners of the Duley Lake park will probably not want the Project to impact their business	Potential effects on Duley Lake Provincial Park from the Project have been assessed and mitigation measures identified. More details about the results of this assessment are provided in Section 24.6.
Potential Effects on Local Economy	Cabin Owners	An important issue is the impact on the local economy. Please use local people no "fly in, fly out" stuff.	Alderon will consider employing a Fly-in / Fly-out workforce during the construction phase of the Project. During operations and maintenance, Alderon aims to hire a residential workforce. Alderon will develop a Project Benefits Plan and Diversity Plan that includes a wide range of effects management mechanisms and initiatives designed to enhance the benefits to the Province of Newfoundland and Labrador, and especially Labrador and Economic Zone 2, and to women, Aboriginal people and persons with disabilities resident in the Province. Additional information is found in Section 26.6.
	Wabush	Is Alderon going to build a new town site or leave the requirement for 600-700 employees up to the economy to provide - local contractors, etc.?	
	Labrador City	Will Alderon be hiring locals as a priority?	
	Labrador City	Will Alderon be promoting that workers live in Lab West?	
	Sept-Îles	At the end of the predicted mine life, what are you going to do with your employees?	The work force will be kept informed of Project plans and, as with any other project, will be down-sized as the Project plans warrant.
	Wabush	Concern about economic impacts on cities.	An assessment of the economic effects of the Project on Labrador City, Wabush and Fermont is presented in Chapter 26.

Issue	Community / Organization	Summary of Comments Raised During Consultation and Engagement Activities	Response / Location in the EIS
	Fermont	Concern about economic impacts to local camp sites, cabins and parks.	The potential Project effects on cabin use, and recreational sites are included in the EIS as part of the assessment of the effects on Other Use of Lands and Resources. Economic effects of the Project on the tourism industry are also assessed. Alderon has been engaging with cabin owners in the Project area and has developed a strategy to mitigate adverse effects on cabin owners. Alderon will continue its engagement with cabin owners to determine appropriate mitigation for individual cabin owners, as applicable. See Section 23.5.2.1 and 23.6.3 for additional information.
	Fermont	When we choose to live in Fermont, it is the tranquility and nature surrounding us that make us stay here. It is unfortunate that economic development is done to the disadvantage of the population living on the territory. Concerned that Alderon is presenting the project as a positive for the community.	The purpose of the EA process is to identify mitigation measures to avoid or reduce environmental issues and effects. These are described throughout this EIS, and summarized in Chapter 27. Alderon has presented information about the Project and potential effects to the community, and responded to public concerns and questions throughout the EA process, and will continue to do so throughout the life of the Project. Information about Alderon's consultation and engagement activities completed to date are include in Chapter 10.
	Le mouvement citoyen de Fermont	What impact will the mine have on tourism given the importance to the local economy?	Potential effects of the Project on the local economy, including the tourism sector are assessed and mitigation identified in Section Section 26.6.

The spatial boundaries are illustrated in Figure 26.2.

Figure 26.2 Spatial Boundaries for Economy, Employment and Business



26.2.2 Temporal Boundaries

The temporal boundaries for the assessment of the potential effects of the Project on Economy, Employment and Business include the periods of construction (approximately two years), operation and maintenance (approximately 17 years), and decommissioning and reclamation (approximately two years). During all seasons and phases there will be public and government interest in the scale and distribution of the economic, employment and business effects of the Project.

26.2.3 Administrative Boundaries

The basic building units for the Economy, Employment and Business are geographic data regions used by Statistics Canada and the Newfoundland and Labrador Statistics Agency. The effects on the Economy, Employment and Business will be felt throughout the Province. Although qualified labour in Labrador will have priority for employment, and Alderon will focus attention on building business opportunities in Labrador, and especially Economic Zone 2, the scale of the Project is such that a substantial portion of the required labour and business capacity will be drawn from the Island of Newfoundland.

With respect to Fermont, baseline economic conditions were studied for Fermont and the regional municipal county of Caniapiscau (MRC de Caniapiscau), which includes Schefferville and Fermont. Employment and business research was conducted for the Town of Fermont. To provide socio-economic context, additional information was collected at the provincial level.

26.3 Establishing Standards or Thresholds for Determining the Significance of Effects

The effects of the Project on Economy, Employment and Business cannot be characterized using the standard descriptors for biological and physical VECs. Therefore the following set of descriptors is used for each of the Economy, Employment and Business components.

- **Direction:**
  - Adverse;
  - Positive;
  - Neutral.
- **Magnitude:**
  - Low: A change experienced by less than 5 percent of households;
  - Moderate: A change experienced by 5 percent to 33 percent of households; and
  - High: A change experienced by more than 33 percent of households.
- **Geographic Extent:**
  - Economic Zone 2;
  - Labrador;

  - Province; and
  - Fermont.
- **Frequency:**
  - Not likely to occur;
  - Occurs once;
  - Occurs sporadically at irregular intervals;
  - Occurs on a regular basis and at regular intervals; and
  - Continuous.
- **Duration:**
  - Short-term;
  - Medium-term;
  - Long-term; and
  - Permanent – will not change back to original condition.

The significance criteria described below are based on changes in measurable parameters which are described in Section 26.4.

A significant adverse residual socio-economic effect of the Project on Economy, Employment and Business will result if the Project causes substantial decreases in the measurable parameters over the life of the Project.

A significant positive socio-economic effect of the Project on Economy, Employment and Business will result if Project expenditures cause substantial increases in the measurable parameters over the life of the Project.

26.4 Potential Project-VEC Interactions

Each Project activity and physical work for the Project is listed in Table 26.2, and each interaction is ranked as 0, 1, or 2 based on the potential level of interaction each activity or physical work will have with Economy, Employment and Business. The effects of the Project on Economy, Employment and Business associated with employee recruitment during Construction and Operations, are grouped as Employment in the table. Project expenditures, including the procurement of goods and services and generation of revenue during Operation are grouped as Expenditures.

Table 26.2 Potential Project Effects to Economy, Employment and Business, Economic Zone 2, Labrador and Fermont

Project Activities and Physical Works	Potential Effects					
	Economic Zone 2 and Labrador			Fermont		
	Economy	Employment	Business	Economy	Employment	Business
Construction						
Site Preparation (including clearing, excavation, material haulage, grading, removal of overburden and stockpiling)	0	0	0	0	0	0
Construction of Roads	0	0	0	0	0	0
Construction of Site Buildings and Associated Infrastructure (maintenance facilities, offices, plant, crushers, concentrator, conveyors, gatehouse, pumphouses, substation, security fencing, sanitation system)	0	0	0	0	0	0
Construction of Mine Tailings Management Facility (TMF)	0	0	0	0	0	0
Construction of Railway and Load-out Facilities (silos)	0	0	0	0	0	0
Construction of Power Line	0	0	0	0	0	0
Construction of Stream Crossings	0	0	0	0	0	0
Installation of Water Supply Infrastructure (wells, pumps, pipes)	0	0	0	0	0	0
Onsite Vehicle / Equipment Operation	0	0	0	0	0	0
Waste Management	0	0	0	0	0	0
Transportation of Personnel and Goods to Site	0	0	0	0	0	0
Expenditures	2	2	2	1	1	1
Employment	2	2	2	1	1	1
Operations and Maintenance						
Open Pit Mining (including drilling, blasting, ore and waste haulage, stockpiling, dewatering)	0	0	0	0	0	0
Ore Processing (including crushing, conveying, storage, grinding, screening)	0	0	0	0	0	0
Concentrator Operations (gravity and magnetic separation, tailings dewatering, tailings thickener, concentrate	0	0	0	0	0	0

Project Activities and Physical Works	Potential Effects					
	Economic Zone 2 and Labrador			Fermont		
	Economy	Employment	Business	Economy	Employment	Business
conveyance to load-out)						
Tailings Disposal in TMF	0	0	0	0	0	0
Waste Rock Disposal on Surface	0	0	0	0	0	0
Water Treatment (including mine water and surface runoff) and Discharge	0	0	0	0	0	0
Rail Load-Out by Silo Discharge	0	0	0	0	0	0
Rail Transport	0	0	0	0	0	0
Onsite Vehicle / Equipment Operation and Maintenance	0	0	0	0	0	0
Waste Management	0	0	0	0	0	0
Transportation of Personnel and Goods to Site	0	0	0	0	0	0
Fuel Storage and Dispensing	0	0	0	0	0	0
Progressive Rehabilitation	0	0	0	0	0	0
Expenditures	2	2	2	1	1	1
Employment	2	2	2	1	1	1
Decommissioning and Reclamation						
Site Decommissioning	0	0	0	0	0	0
Site Reclamation (building demolition, grading, scarifying, hydroseeding)	0	0	0	0	0	0
Accidents and Malfunctions						
Change in Economy	2	2	2	2	2	2
Change in Employment	2	2	2	2	2	2
Change in Business	2	2	2	2	2	2

KEY

0 No measurable interaction will occur. Assessment of effects is not required.

1 Identified interactions that are well understood, are subject to prescribed environmental protection measures or normal regulatory processes, and/or which can be managed through the application of standard management measures and practices. Based on past experience, the potential effects resulting from these interactions are rated not significant.

2 Identified interactions that may result in more substantive effects and/or public or regulatory concern. These interactions require more detailed analysis and consideration in the environmental assessment, in order to predict, manage and evaluate potential effects.

None of the Project activities or physical works will directly cause effects on Economy, Employment and Business. All of them are accordingly ranked as 0. Thus, in consideration of the nature of the interactions and the planned implementation of known and proven effects management, the potential effects of all Project activities and physical works that were ranked as 0 in Table 26.2 on the Economy, Employment and Business during any phase of the Project are rated not significant, and are not considered further in the assessment.

The Project instead causes effects on Economy, Employment and Business through the expenditures on supplies and services and the employment that are involved in all of the Project activities and works. The direct, indirect and induced effects of Project expenditures, together with proponent and other Project-related business taxes and royalties, will also contribute to provincial and municipal revenues in the Province and especially in Labrador and Economic Zone 2. These expenditures and this employment are expected to have substantive effects and are of public and regulatory concern. As such, these interactions require more detailed analysis and consideration in the environmental assessment, in order to predict, manage and evaluate the potential effects, and are accordingly ranked as 2.

The direct and indirect effects of Project expenditures and employment are predicted to be not significant for Fermont. Given the location of the Project and Newfoundland and Labrador benefits initiatives, Project expenditures will not be directed towards the Fermont business community, and it is not expected that a substantial number of employees will be drawn from the Fermont workforce. As such, Project expenditures and employment are ranked as 1 (Table 26.2) and are not considered further in the assessment.

26.4.1 Selection of Effects and Measurable Parameters

The assessment of the effects of the Project on Economy, Employment and Business is focused on each of these effects:

- Change in Economy;
- Change in Employment; and
- Change in Business.

The measurable parameters used for the assessment of these effects, and the rationale for their selection, are provided in Table 26.3.

Table 26.3 Measurable Parameters for Economy, Employment and Business

Environmental Effect	Measurable Parameter	Rationale for Selection of the Measurable Parameter
Change in Economy	GDP	• GDP provides a standard overall measure of the Project's economic effects.
	Income and taxes	• The direct, indirect and induced effects of Project expenditures, together with proponent business taxes and royalties, will contribute to provincial and municipal revenues
Change in Employment	Employment in Province, Labrador and western Labrador	• The direct, indirect and induced effects of Project employment will contribute to the local and regional economies
	Employment of women and persons of Aboriginal status	• The effects of the Project on the employment of women and aboriginals will contribute to the well-being of these economically disadvantaged groups and address the diversity concerns of the Government of Newfoundland and Labrador and Aboriginal groups related to the Project.
Change in Business	Labrador business capacity	• Project work by Labrador businesses will enhance their capacity and that of the regional economy.
	Women-led and Aboriginal business capacity	• Project work by women-led and Aboriginal businesses will enhance their capacity and contribute to the well-being of these economically disadvantaged groups.

26.5 Existing Environment

This section provides baseline information to allow the effects of the Project on the Economy, Employment and Business to be assessed. For Economy, the main focus is on Labrador, while for Employment and Business, the primary focus is on Economic Zone 2. Information is provided on existing employment and income conditions, labour force and business characteristics. Provincial baseline data on the labour force, employment, GDP and other relevant measures are included as appropriate. Economy, employment and business baseline information is also provided for Fermont.

26.5.1 Economy

26.5.1.1 Province

Newfoundland and Labrador has experienced strong economic growth during the past decade, during which the primary economic drivers have been offshore oil production and mining. The Newfoundland and Labrador Department of Finance (NLDF) reports that the provincial real Gross Domestic Product (GDP) increased 58.8 percent between 1997 and 2010, with approximately half of this growth attributed to oil and gas production (NLDF 2011a). After enduring the global recession in 2009, real GDP grew by an estimated 6.1 percent in 2010, fuelled by investment growth and a rebound in exports. Real GDP growth and employment growth in Newfoundland and Labrador were the highest among Canada's provinces for 2010. Economic conditions remained robust in the Province in 2011, with a forecast real GDP increase of 4.9 percent (NLDF 2011a). In 2011, the provincial unemployment stood at 12.7 percent, having decreased each year since the 2009 recession (NL Statistics Agency 2012). Economic expansion is expected to continue as a result of investment in major projects, including Vale Newfoundland and Labrador Limited's commercial nickel processing facility in Long Harbour, the IOC mining expansion in Labrador City, the Muskrat Falls development, the Hebron offshore oil project and planned expansion projects for the Hibernia and White Rose oil fields.

Investment related to further project development in Newfoundland and Labrador has continued to drive economic expansion, and the economy is now one of the fastest growing in Canada. Capital investment was estimated to be nearly $8 billion for 2011 (Table 26.4), reflecting the development of projects such as the Long Harbour, IOC mining expansion, Hebron, Hibernia expansion and White Rose expansion projects.

However, the development of major projects involving mineral production and offshore oil production is highly capital-intensive. As a result, the growth in employment, while substantial, has not kept pace with the growth in GDP and the unemployment rate in Newfoundland and Labrador still remains the highest in Canada. Unemployment in Newfoundland and Labrador has considerable regional characteristics. For instance, in 2006, the St. John’s Census Metropolitan Area unemployment rate (7.4 percent) was comparable to that in the rest of Canada (6.3 percent) while on the south coast of Newfoundland and Labrador it was much higher (25.8 percent). This indicates a changing structure in the provincial economy away from rural, labour-intense, resource-based activities to highly capital-intensive, concentrated, resource-based activities (JWL 2006).

The current state of the provincial economy is robust, and the Department of Finance has predicted solid economic conditions for the medium-term outlook (NLDF 2011a). As shown in Table 26.4, most economic indicators posted gains for 2010, and 2011 estimates indicate continued growth.

Table 26.4 Selected Economic Indicators, Newfoundland and Labrador, 2001-2011

Economic Indicators	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Population as of July 1 (000's)	522	519.5	518.5	517.4	514.4	510.3	506.4	506.4	508.9	511.3	510.6
% Change	**-1.1**	**-0.5**	**-0.2**	**-0.2**	**-0.6**	**-0.8**	**-0.8**	**0**	**0.5**	**0.5**	**-0.1**
GDP at Market Prices ($000)	14,179	16,457	18,119	19,407	21,960	24,111	28,267	30,785	24,762	28,192	33,170
% Change	**1.8**	**16**	**10.2**	**7.1**	**13.2**	**9.8**	**17.2**	**8.9**	**-19.6**	**13.9**	**17.7**
Personal Income ($000)	11,576	11,927	12,436	12,855	13,249	13,952	14,808	15,659	16,728	17,372	NA
% Change	**4.1**	**3.0**	**4.3**	**3.4**	**3.1**	**5.3**	**6.1**	**5.7**	**6.8**	**3.8**	**NA**
Per Capita Personal Income ($)	22,176	22,958	23,985	24,845	25,756	27,341	29,242	30,922	32,871	33,976	NA
% Change	**5.3**	**3.5**	**4.5**	**3.6**	**3.7**	**6.2**	**7**	**5.7**	**6.3**	**3.4**	**NA**
Labour Force, Annual Average (000s)	243.4	248.6	253.3	253.3	251.0	251.8	250.3	252	251.3	256.3	258
% Change	**2.1**	**2.1**	**1.9**	**0**	**-1**	**0.3**	**-0.6**	**0.7**	**-0.3**	**2**	**0.7**
Employment, Annual Average (000s)	204.9	207.5	211.8	213.7	213.0	214.8	216.5	218.7	212.3	219.4	225.4
% Change	**3**	**1.3**	**2.1**	**0.9**	**-0.3**	**0.8**	**0.8**	**1**	**-2.9**	**3.3**	**2.7**
Unemployment Rate, Annual Average (%)	15.8	16.5	16.4	15.6	15.1	14.7	13.5	13.2	15.5	14.4	12.7
% Change	**-4.8**	**4.4**	**-0.6**	**-4.9**	**-3.2**	**-2.6**	**-8.2**	**-2.2**	**17.4**	**-7.1**	**-11.8**
Consumer Price Index (2002 = 100)	97.7	100	102.9	104.8	107.6	109.5	111.1	114.3	114.6	117.4	NA
% Change	**1.1**	**2.4**	**2.9**	**1.8**	**2.7**	**1.8**	**1.5**	**2.9**	**0.3**	**2.4**	**NA**
Newsprint Shipments (thousands of metric tonnes)	745.8	740.3	780.9	731.7	761.8	594.8	549.4	525.4	264.5	259.1	NA
% Change	**-7.7**	**-0.7**	**5.5**	**-6.3**	**4.1**	**-21.9**	**-7.6**	**-4.4**	**-49.7**	**-2**	**NA**
Value of Fish Landings ($Millions)	487.2	505.4	575.6	606.1	497.3	441.6	514.3	519.2	423.3	439.1	NA
% Change	**-14.6**	**3.7**	**13.9**	**5.3**	**-18**	**-11.2**	**16.5**	**1**	**-18.5**	**3.7**	**NA**

Economic Indicators	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Value of Mineral Shipments ($Millions)	754.1	795.6	776.4	693.9	1,550.4	2,604.4	3,913.5	3,796.5	1,987.9	3,730[e]	4,544.2[f]
% Change	**-22.5**	**5.5**	**--2.4**	**-10.6**	**123.4**	**68**	**50.3**	**-3**	**-48**	**87.6[e]**	**21.8[f]**
Value of Iron Ore Shipments ($000)	691,626	728,909	720,427	653,923	1,286,771	1,346,989	1,157,858	2,390,811	1,159,627	2,595,288[e]	2,832,441[f]
% Change	**-23.3**	**5.4**	**-1.2**	**-9.2**	**96.8**	**4.7**	**-14**	**106.5**	**-51.5**	**123.8[e]**	**9.1[f]**
Value of Manufacturing Shipments ($000)	2,467.8	2,537.3	2,583.8	2,513.2	2,780.6	4,292.9	5,113.6	6,574.3	4,377	5,167.3	NA
% Change	**-1.4**	**2.8**	**1.8**	**-2.7**	**10.6**	**54.4**	**19.1**	**28.6**	**-33.4**	**18.1**	**NA**
Oil Production (Millions of Barrels)*	54.3	104.3	123	114.8	111.3	110.8	134.5	125.2	97.7	100.7	NA
% Change	**2.8**	**92.1**	**17.9**	**-6.7**	**-3**	**-0.4**	**21.4**	**-7**	**-22**	**3.1**	**NA**
Public and Private Capital Investment ($Millions)	3,371	3,361	3,712	4,243	4,576	4,359	4,217	5,037	4,949	6,549	7,982[e]
% Change	**-0.8**	**-0.3**	**10.4**	**14.3**	**7.8**	**-4.7**	**-3.2**	**19.4**	**-1.7**	**32.3**	**21.9[e]**
Housing Starts (Number)	1,788	2,419	2,692	2,870	2,498	2,234	2,649	3,261	3,057	3,606	NA
% Change	**22.5**	**35.3**	**11.3**	**6.6**	**-13**	**-10.6**	**18.6**	**23.1**	**-6.3**	**18**	**NA**
Retail Trade NAICS ($Millions)	5,201	5,407	5,736	5,761	5,824	6,012	6,528	7,009	7,120	7,449	NA
% Change	**9.3**	**4**	**6.1**	**0.3**	**1.1**	**3.2**	**8.6**	**7.4**	**1.6**	**4.6**	**NA**
New Motor Vehicle Sales (Number)	24,649	25,790	25,428	22,898	24,899	24,188	28,260	31,448	28,755	31,667	NA
% Change	**3.3**	**4.6**	**-1.4**	**-9.9**	**8.7**	**-2.9**	**16.9**	**11.3**	**-8.6**	**10.1**	**NA**

Source: Newfoundland and Labrador Statistics Agency 2012 (Compiled from various tables)

e = estimate, f = forecast

* = Hibernia began production in November 1997, Terra Nova began in January 2002, White Rose began in November 2005 and Voisey's Bay began in September 2005.

In 2011, Newfoundland and Labrador continued to post strong economic growth with private sector estimates forecasting an average real GDP growth of 4.9 percent, down from a 6.1 percent increase in 2010 (NLDF 2011a). The oil industry remains the leading contributor to this growth in the provincial economy; in 2010, oil production contributed approximately 30 percent of the Province's nominal GDP and 19.2 percent of investment (NLDF 2011a). Strong economic growth, coupled with increasing employment, higher wages, low interest rates and strengthened consumer confidence led to a 2.4 percent increase in retail sales, totaling $7.4 billion (NLDF 2011a).

After a recession-related decrease in 2009, employment rose 3.3 percent to 219,400 in 2010. Employment was expected to reach a record high of 225,600 in 2011. Wages also increased in 2010 with average weekly earnings increasing by 4.5 percent. This resulted in a 4.9 percent increase in labour income, bringing the total to $10.6 billion. Total personal income increased by an estimated 3.8 percent to $17.3 billion and the unemployment rate declined by 1.1 percentage points, to 14.4 percent. A further decrease in the unemployment rate was forecast for 2011, with the rate expected to fall a further 0.7 percentage points to 12.5 percent. There were job gains in natural resources industries, goods and services industries, construction, tourism, and transportation industries (NLDF 2011a).

Recent economic conditions for several major industries in Newfoundland and Labrador are discussed below.

Mining

The mining industry contributes substantially to the provincial economy. In 2010, the contribution of mining to the provincial GDP was $2.25 billion, representing 8.6 percent. This contribution was second only to oil extraction and support activities (30.4 percent) (NLDF 2011a). Mining activity has increased substantially in recent years. After a downturn in 2009 resulting from the global recession, market conditions have improved and the provincial mining industry grew substantially in 2010 and 2011. The total value of mineral shipments in 2012 was forecast to reach $5.7 billion, representing a 25 percent increase since 2011 and the highest value on record. The expected increase in mineral shipments is based on the first-year production of Labrador Iron Mines and production increases at Iron Ore Company of Canada (IOC) (NLDNR 2012a).

Direct employment in mining was expected to be over 6,000 person-years in 2011, an increase of 900 over the 2010 estimate and the highest level in over three decades (NLDF 2011a). Further employment increases are projected for 2012. Direct employment is expected to rise to 7,684 person-years (NLDNR 2012a). Mineral exploration activities are also on the rise; expenditures in 2011 were estimated to increase by almost 50 percent from 2010, rising to $158 million (NLDF 2011a).

Oil and Gas

As noted above, production from the offshore oil industry has become an increasingly important contributor to the provincial economy over the last decade (NLDF 2011a). Revenue from oil extraction and support activities contributed 30.4 per cent of the provincial GDP in 2010 (NLDF 2011a). Oil production totaled 100.7 million barrels in 2010. Production in 2011 was expected to decrease by 3.2 percent to 98.9 million barrels. Production decreases reflect natural declines, as the Hibernia, Terra Nova and White Rose projects are now beyond peak production. However, in 2011 the total value of oil production was expected to increase by 31.4 percent to $10.8 billion as a result of higher crude oil prices.

Forestry

The provincial forestry industry has struggled with a decrease in demand for newsprint, which has remained a trend over the past decade. With the closure of the AbitibiBowater mills in Stephenville and Grand Falls in 2005 and 2009, respectively, the Corner Brook Pulp and Paper Ltd. mill is the only newsprint operation in the Province. In 2010, provincial newsprint shipments totaled 259,100 tonnes, down 2.0 percent from 2009 (NLDF 2011b). Newsprint shipments during the first nine months of 2011 had decreased by 4.2 percent compared to the same period in 2010 (NLDF 2011a). The value of newsprint shipped out of Newfoundland and Labrador decreased by about 5 percent in 2010 and was expected to decline by a further 2 to 3 percent during 2011 (NLDF 2011a, 2011b).

Fisheries and Aquaculture

The provincial seafood industry posted a solid economic performance in 2011. Total production value, including aquaculture, grew from $948 million in 2010 to $1.0 billion in 2011, representing growth of 7.3 percent. Industry employment totaled 21,289, down 0.6 percent since 2010 (NLDFA 2012).

For commercial capture fisheries, the total landed volume dropped to 267,910 tonnes, down 12.1 percent from 2010. However, due to higher prices for raw materials, particularly crab and shrimp, the total landed value for 2011 rose by 21.3 percent to $568 million (NLDFA 2012).

Aquaculture production and market value grew in 2011. Between 2010 and 2011, total production rose 12.4 percent to approximately 17,000 tonnes. The total market value increased from $118 million in 2010 to $120 million, an increase of 1.8 percent. Growth in production and market value is attributed to higher production in the salmonid and mussel sectors (NLDFA 2012).

Tourism

The economic performance of the provincial tourism industry has continued to grow in recent years. The 2010 statistics indicate that tourism spending reached $879 million, with resident expenditures representing about 53 percent of the total (NLDTCR 2011). In 2010, the number of non-resident visitors grew by 7 percent to a record high of 518,500. Associated spending in the same year reached $410.6 million. For 2011, the number of non-resident visitors was expected to remain near 2010 levels, while related expenditures were expected to increase by about 4 percent to around $425 million.

Other performance indicators reflect the growth of tourism and travel in Newfoundland and Labrador. Occupancy rates indicated a strong year for the accommodation industry, with an increase of 0.9 percentage points to a 53.1 percent occupancy rate in 2011. Air travel to the Province by non-resident passengers was also projected to rise in 2011. However, decreases were recorded in 2011 for cruise ship passenger visits and non-resident automobile visits. The number of port calls booked for the Province in 2011 was down to 83 from 133 in 2010 Automobile visitation was reduced to 107,300, down 7.7 percent from 2010 (NLDF 2011a).

26.5.1.2 Labrador

Labrador's economy is traditionally based on raw material extraction and the service industry. Major industries include mines and energy, aerospace and defence, fish harvesting and processing, forest resources and tourism (NLDTW 2006).

Mining

The mining industry in Labrador is centered on iron ore production in western Labrador and nickel ore production at Voisey's Bay. These are the dominant contributors of GDP for the provincial mining industry. In 2011, the forecast value of mineral shipments was expected to total over $4.5 billion, of which approximately $2.8 billion was attributed to iron ore production and approximately $1 billion was attributed to nickel production (NLDF 2011a).

Smaller mining operations also generate considerable economic benefits for the people of Labrador (NLDLAA 2006). Continued mineral exploration offers potential for further economic development. In 2012, there were 16,410 mineral claims staked in Labrador, compared to 12,124 for the Island of Newfoundland (NLDNR 2012b).

Oil and Gas

Major natural gas reserves have been identified in the Labrador offshore region. There are currently five significant offshore discovery licenses and four exploration licenses for the Labrador Shelf (CNLOPB 2012a). A 2007 call for bids by the Canada-Newfoundland and Labrador Offshore Petroleum Board produced $186 million in expenditure commitments in return for the four exploration licenses offshore Labrador (CNLOPB 2012b).

Forestry

Labrador has 18 million ha of forested land. With 5.5 million ha of productive forest, the total gross merchantable timber is estimated at 180,000,000 m³. The provincial government commissioned a Labrador Value Added Forestry Study to evaluate the potential of developing sawmills and value-added wood products. The study identified potential business plans for secondary processing of wood products with the objective of increasing economic development in the area (NLDLAA 2006).

As of 2007, Forestry Management District (FMD) 19A in central Labrador had eleven commercially licensed sawmills with annual output ranging from a few thousand board feet to over one million board feet. Average production since 1990 is about 1.4 million foot-board-measures (fbm) (3,304 m^3).

Fisheries and Aquaculture

There are ten fish plants in Labrador that process rockcod, Arctic char, snow crab, turbot, scallops, shrimp and other species. Fisheries continue to be the largest employer for coastal communities despite the shortage of some species such as snow crab and turbot. This shortage, combined with an aging labour force and the challenge of labour recruitment, are major issues for the fishing industry. Increased fuel prices and the high cost of transporting materials and products also add to the uncertainty of the industry (NLDLAA 2006).

Tourism

Tourism is a growing focus of economic development in Labrador (NLDAA 2006). Nature tourism and adventure tourism are the region’s main draws, with attractions such as the Torngat National Park Reserve, the proposed Mealy Mountain National Park and the Battle Harbour Historic Trust.

Tourism in Labrador was once limited to a short summer season with approximately 50 fishing and hunting outfitter businesses. However, with the construction of the groomed winter trail network, as well as other transportation links, the industry is evolving into a year-round opportunity. Other winter tourism products include the Cain’s Quest Snowmobile Endurance Race, the Labrador Winter Games, and regional winter festivals (NLDAA 2006).

Tourism statistics indicate increasing number of visitors to the Labrador region. Between 2009 and 2010, roofed accommodation occupancy levels in Labrador increased by almost 10 points, partly as a result of increased activity in the mining sector and improved access via the Trans Labrador Highway (NLDTCR 2011).

Agriculture

Agriculture has been identified as a potential growth industry in Labrador (NLDAA 2006). In 2004, the Government of Newfoundland and Labrador issued a Northern Agrifoods Development Strategy to examine the viable economic potential of agrifoods development in Labrador (NLDNR and NLDLAA 2004).

26.5.1.3 Economic Zone 2

The major employers in western Labrador include IOC, which employs about 1,900 individuals in Labrador City, Wabush Mines, with approximately 900 employees, and the provincial government, including healthcare workers and education employees (Cliffs Natural Resources 2011; IOC 2009).

Mining

Mining has provided a valuable foundation and cornerstone for economic development and growth in western Labrador, with a primary focus on iron ore. Large scale mining development projects are generally long term and capital intensive and often result in major economic and employment benefits similar to operations already existing in western Labrador (NLDLAA 2008).

Production mining is the main activity in western Labrador. IOC operates its Carol Lake Mine out of Labrador City, and Wabush Mines operates its Scully Mines from Wabush. The situation has not changed substantially since 1993 in terms of both mines being dependent on the fluctuations in the international market for steel and subsequently iron ore.

The IOC began production from the Carol Lake Mine in 1962. The company is Canada's largest iron ore pellet producer and operates a mine, concentrator, and pellet plant at Carol Lake, port facilities in Sept-Iles, Québec and a 420-km rail line that links the mine and the port. Total resources at Carol Lake are estimated to be 5.5 billion tonnes. Proven and probable reserves are 1.4 billion tonnes; indicated and referred reserves are 4.1 billion tonnes. Annual mine production at the open pit operation is in the 35 to 38 million tonne range at an average grade of approximately 40 percent total iron. The annual production capacity is 18 million tonnes of concentrate of which 12.5 million tonnes can be pelletized (NLDF 2011b).

In 2010, IOC resumed its proposed three-phase expansion plan with the goal of increasing total concentrate capacity to 26 million tonnes per year. Phase I began in May 2010 and is expected to increase capacity to 22 million tonnes. Phase II construction is underway, and it is expected to bring total concentrate capacity to 23.3 million tonnes. Phase III is currently under consideration. The company is also considering further site expansion to increase concentrate production to 50 million tonnes or more annually (NLDNR 2012a).

Since 1996, IOC has also mined dolomite in western Labrador for making fluxed pellets. In 2011, production was 135,000 tonnes. Forecast production for 2012 is 160,000 tonnes (NLDNR 2012a).

Wabush Mines began mining iron ore from the Scully Mine in Labrador in 1965 and now operates a mine and concentrating plant at Wabush and a pellet plant and shipping facilities in Point Noire, Québec. All ore is mined by open pit and sent through the Scully Mine concentrator. The final concentrate is transported 443 km by rail to the port at Pointe Noire for pelletizing and shipment. The majority of ore is loaded onto ships bound for the Canadian and US Great Lakes region while the remainder is loaded for the US East Coast, Europe and more recently China. In 2011, Wabush Mines shipped approximately 3.2 million tonnes of concentrate. Production is expected to increase over the next four to five years to 5 million tonnes annually (NLDNR 2012a).

There is also one inactive mine in the western Labrador area. From 1999 to 2008, Shabogamo Mining and Exploration supplied quartzite to Bécancour Silicum Inc. of Québec which used the material to manufacture silicon metal. Shabogamo's contract ended in 2008, and the company is exploring alternative arrangements (NLDNR 2012a).

Mining activity has been increasing regionally, as well. Near Schefferville, Québec, Labrador Iron Mines Ltd. (LIM) began operations in 2011. LIM is expected to mine 2.5 to 3 million tonnes of ore in 2012, which is expected to yield 2 million tonnes of iron ore (NLDNR 2012a). Expansion plans are currently under environmental assessment review.

Developing properties in the region include Tata Steel Minerals Canada Ltd.'s (TSMC) Elross Lake Project. TSMC is a partnership between Tata Steel of India and New Millennium Iron Corp. The company expects to begin commissioning and ramp-up of the plant in Q3, 2012 with full processing capacity expected between November, 2012 and January 2013. Five and a half million tonnes of ore per year will be processed to produce about 4 million tonnes of iron concentrate. Eighty percent of the product will be sinter fines and 20 percent will be pellet fines. The project will operate year round and employ about 188 people (NLDNR 2012a).

New Millennium Iron Corp. is also the primary interest holder in Labmag tactonite iron ore deposit, a 5-6 billion tonne deposit near Schefferville. An economic assessment has been completed for this project, but it has not been registered with regulators. Mining and production capacities are estimated at approximately 51 million tonnes of ore mined per year, with 15 million tonnes per year pellet capacity. Operations employment is estimated at 810 positions (NLDNR 2012a).

Tourism

Tourism development in western Labrador is pursued by the Hyron REDC in partnership with Destination Labrador, the marketing agency for Labrador tourism. Gateway Labrador Inc. operates a tourism information complex in Labrador City.

Tourism is promoted by the Hyron REDC to add profitable diversification to the economy of western Labrador. Reflecting western Labrador's intention to expand tourism, the 2011-2014 strategic plan economic plan for Zone 2 details three goals for developing the industry. Development goals have been planned or implemented to expand and capitalize on the burgeoning winter tourism industry, to develop competitive summer tourism products and to increase the number of francophone visitors by developing bilingual promotional tools (Hyron 2011).

Adventure tourism, specifically winter tourism, has been identified as a sector with particular growth potential (Hyron 2008). Winter tourism products in the area include the annual Cain's Quest Snowmobile Race, local snowmobile clubs and trails, cross-country and downhill skiing, and winter festivals. The Hyron REDC also considers the development of cultural tourism, educational tourism and eco-tourism as suitable sectors for the area.

In 2008, several requirements were identified to support a year-long tourism industry, including infrastructure investment, service training and marketing collateral (Hyron 2008). Increasing accessibility through improved transportation infrastructure was discussed as a key factor for expanding the western Labrador winter tourism draw into a year-long industry.

According to the Hyron REDC (2008), potential summer tourism products include activities such as visitor tours of the Churchill Falls hydro-electric plant and the iron ore mines in western

Labrador. Other initiatives to develop summer tourism potential include expanding marketing for local outfitting operations, encouraging the establishment of more adventure tourism operations, and increasing promotion of local festivals and events. In 2011, the Hyron REDC planned to partner with Destination Labrador to develop the Bowdoin Canyon area, near Churchill Falls, as a summer attraction (Hyron 2011).

Destination Labrador marketing promotes four distinct regions for Labrador tourism: Labrador North, Labrador West, Central Labrador and Labrador Coastal Drive (Destination Labrador 2012). Table 26.5 contains the western Labrador tourism attractions listed on the Destination Labrador website.

Table 26.5 Tourism Attractions in Economic Zone 2

Tourism Attraction	Amenities	Location
Cross-Country Skiing	Menihek Nordic Ski Club	Labrador City
Downhill Skiing	Smokey Mountain Ski Club	Labrador City
Hiking / Walking Trails	Menihek Interpretive Trail	Labrador City
	Tanya Lake Walking Trail	Labrador City
	Jean Lake Walking Trail	Wabush
Parks and Campgrounds	Wabush Playground	Wabush
	Peace Park	Labrador City
	Centennial Park	Labrador City
Snowmobile Trails	Electric Link Snowmobile Trail	Churchill Falls
	White Wolf Snowmobile Trail	Labrador City
Visitor Information Centres	Gateway Labrador	Labrador City
Golf Courses	Tamarack Golf Club	Labrador City
Industrial Site Tours	Churchill Falls Hydro Station	Churchill Falls
	Iron Ore Company of Canada	Labrador City

26.5.1.4 Fermont

In 2011, the Québec government released the Plan Nord, a 25-year plan to develop energy resources, mineral resources, forest resources, wildlife resources, tourism, and bio-food production potential in regions of the Province situated above the 49th parallel. The plan also calls for the preservation of 50 percent of lands north of the 49th parallel for environmental protection.

The context for local economic development is also shaped by the strategies of the MRC de Caniapiscau, which seeks to increase access to the region to promote mining and tourism. At the same time, the MRC calls for maintaining public access to the lands in the territory for the purposes of recreation. This represents an important amenity for the local population. The MRC has also taken a strong position towards protecting environmental resources to maintain the health, security and quality of life and local residents, as well as to promote local fish and wildlife populations for fishing and hunting.

Mining

The main mining operations near Fermont are two large open-pit mines which are operated by ArcelorMittal Mines Canada: one in Mont-Wright, the largest of its kind in North America, and one in Fire Lake. Also at Mont-Wright, the ArcelorMittal Mines Canada mining complex includes a concentrator, massive workshops and an automated concentrate train loading system. The site is linked by rail to the Port-Cartier industrial complex, which comprises the pellet plant, storage areas and port facilities for shipping. ArcelorMittal Mines Canada produces some 15 million tonnes of iron ore concentrate and over nine million tonnes of iron oxide pellets annually (ArcelorMittal 2012). In addition, Cliffs Natural Resources currently operates the Bloom Lake Mine near Fermont, which has an annual rated capacity of 8 million tonnes of iron ore (Cliffs Natural Resources 2011).

Mining activity around Fermont is increasing with the expansion of existing mines and the planning and development of new mining projects. Cliff Resources is currently expanding existing operations and ArcelorMittal Canada is planning to raise annual capacity at its Mt. Wright mine from 14 million tonnes to 24 million tonnes (Gibbens 2012). Plans to double the annual capacity of its Port Cartier pelletizing plant to 18.5 million tonnes are also in place (Gibbens 2012). The proposed Champion Minerals projects at Fire Lake, Harvey Tuttle, and North Bellechasse have a combined potential of 1.5 billion tonnes of iron ore (Pelletier 2011).

Several projects are also expanding and opening near Schefferville. New Millennium Iron Corp. is increasing output and has partnered with Tata Steel of India to build a $1 billion pelletizing plant in Sept Îles. New Millennium's $4.4 billion Taconite project along the Québec-Labrador border some 25 to 50 km north of Schefferville may begin transporting taconite slurry to Sept-Îles by way of a planned slurry pipeline. The pipeline represents a possible alternative to the railway proposed by the Province to provide extra capacity to the existing railroad. Adriana Resources also plans to open a mine at Lac Otelnuk, 170 km north of Schefferville that would produce 50 million tonnes of iron ore annually. That project is still awaiting investment (Gibbens 2012).

Various opportunities have been identified in an attempt to diversify the local economy. These include other types of mineral extraction and the development of wind power and hydro-electric production (Rouleau 2010).

Tourism

Since the late 1980s, the Centre local de développement (CLD) de Caniapiscau has been working to develop the local tourism industry. The Town of Fermont operates a tourist information office, which promotes local attractions including local hiking, snowmobiling and cross-country skiing trails, tours of the Mont Wright mine, boating on Daviault Lake, camping and guided tours of the Town's iconic windscreen building and interpretative centers.

The most important tourist draws outside Fermont are hunting and fishing, with several outfitters operating in the area. La Pourvoirie du Lac Justone inc., located on Rivière-Mouchalagane, runs fly-in fishing and hunting expeditions, including caribou hunting expeditions in the Fermont region in winter (Gouvernement du Québec 2012). Recently, the outfitter has partnered with

Nord-Expé to provide snowmobile expeditions throughout the region. Nord-Pourvoirie du lac Kerbodot also organizes caribou hunting (MRC de Caniapiscau 2012). Other outfitting operations are located in the vicinity of Schefferville.

Other tourist attractions in the greater region include the ghost town of Gagnon in the MRC of Caniapiscau and the Manicouagan-Uapishka World Biosphere Reserve, the Groulx Mountains, the Daniel-Johnson Dam and Manic-5 Generating Station in the MRC of Manicouagan.

As part of Plan Nord, the Ministère du Tourisme released a strategy to develop the tourism industry north of the 49th parallel. In this strategy, the Côte-Nord Region was identified as a region with a great deal of potential, but little existing infrastructure. The strategy includes providing funding to initiatives that offer tourist activities and contribute to expanding the necessary infrastructures, such as accommodations and campgrounds. Given the relative isolation of the region and natural resources present, development of high quality adventure and eco-tourism were identified as appropriate (Ministère du Tourisme 2011).

Several tourism projects are currently underway or planned for Fermont. These include the development of new ATV trails and mountain-biking trails on Mount Daviault. Additionally, the CLD de Caniapiscau is working towards further developing the Taïga Carnaval, a festival combining winter sports and entertainment. A new multi-functional center planned for this year will house the interpretive center and a new auditorium. Several hotel projects are being studied as is the expansion of the cross-country ski network (Tremblay 2012b).

A campground has been proposed for the shores of Daviault Lake. Once completed, it will offer 100 campsites each fully serviced with water, sewer and electrical connections (St-Pierre 2012a). The campground will principally serve seasonal tenants with a few sites being reserved for tourists. The campground will operate from the end of May to the end of October.

26.5.2 Employment

26.5.2.1 Province

Employment conditions in the Province have been improving. The labour force has increased steadily since the mid-1990s (Table 26.6). Between 2006 and 2011, average annual employment increased from 251,800 to 258,000. The annual average unemployment rate for this period dropped 2 percentage points, from 14.7 percent to 12.7 percent. In 2011, the total population aged 15 years and older was approximately 428,800. With a participation rate of 60.2 per cent, the provincial labour force in 2011 was approximately 258,000. Employment conditions are expected to remain strong for 2012 (NLDF 2011a).

Table 26.6 Labour Force Characteristics, Newfoundland and Labrador, 1991-2011, Annual Averages

	1991	1996	2001	2006	2011
Total Population, 15 years and older (000s)	444.4	443.7	427.3	425.8	428.8
Labour Force (000s)	249.7	232.9	243.9	251.8	258.0
Employment (000s)	204.7	232.9	204.9	214.8	225.4
Participation Rate (%)	56.2	52.5	57.0	59.1	60.2
Employment Rate (%)	46.1	42.6	48.0	50.4	52.6
Unemployment Rate (%)	18.0	18.9	15.8	14.7	12.7
Source: Newfoundland and Labrador Statistics Agency 2012					

The number of individuals receiving Employment Insurance benefits has decreased steadily since the 1990s, reflecting a long period of economic recovery after the fisheries moratorium in 1992 (Table 26.7). In 2009, this number stood at 97,135, a difference of over 50,000 people since 1992, when Employment Insurance beneficiaries accounted for 53.4 percent of the labour force (Community Accounts, no date).

Table 26.7 Employment Insurance Beneficiaries, Newfoundland and Labrador, 1992 and 2009

	1992	2009	% Change
EI Beneficiaries (Individuals)	154,555	97,135	-37.1%
EI Incidence (% of labour force)	53.4	33.4	-20.0
Source: Community Accounts, no date			

In 2011, the provincial labour force was comprised of 52 percent males and 48 percent females (Table 26.8). The participation rate for males stood at 64.5 percent, while for females this figure was 56.1 percent. At 19.7 percent, the male unemployment rate was substantially higher than the unemployment rate for females, which stood at 10.5 percent (NLDF 2012).

Table 26.8 Labour Force Characteristics by Gender, Newfoundland and Labrador, 2011

	Males	Females	Total
Labour Force (000s)	134.6	123.4	258.0
Employment (000s)	114.9	110.4	225.4
Participation Rate (%)	64.5	56.1	60.2
Employment Rate (%)	55.1	50.2	52.6
Unemployment Rate (%)	19.7	10.5	12.7
Source: Newfoundland and Labrador Statistics Agency 2012			

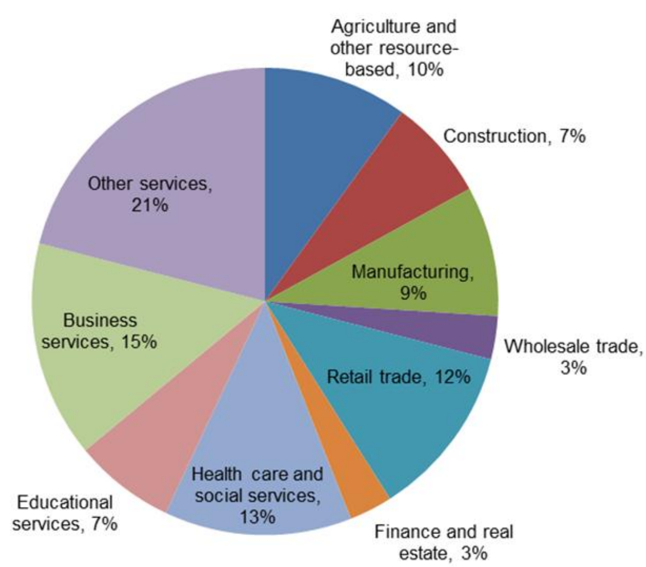
In 2006, there were 10,975 Aboriginal people in the labour force (Table 26.9). The Aboriginal labour force was 51 percent male and 49 percent female. The unemployment rate for the total Aboriginal population was 30.1 percent. The unemployment rate was higher for males (41.8 percent) than for females (43.1 percent).

Table 26.9 Labour Force Characteristics, Aboriginal Population, Province, 2006

Labour Force Characteristic	Total	Males	Females
Total Aboriginal identity population 15 years and over	18,050	8,765	9,285
In the labour force	10,975	5,605	5,375
Employed	7,675	3,665	4,005
Unemployed	3,300	1,940	1,365
Not in the labour force	7,075	3,160	3,915
Participation rate (%)	60.8	63.9	57.9
Employment rate (%)	42.5	41.8	43.1
Unemployment rate (%)	30.1	34.6	25.4
Source: Statistics Canada 2007			

In 2006, the main sources of employment by industry were business services, which employed 35,390 people, retail trade (30,580), health care and social services (30,360) and other services (50,040) (Figure 26.3). Industries that employed the fewest people were finance and real estate (7,895) and wholesale trade (6,630). Agriculture and other resources, which include mining, supported 10 percent of total provincial employment, employing 24,500 people (Statistics Canada 2007).

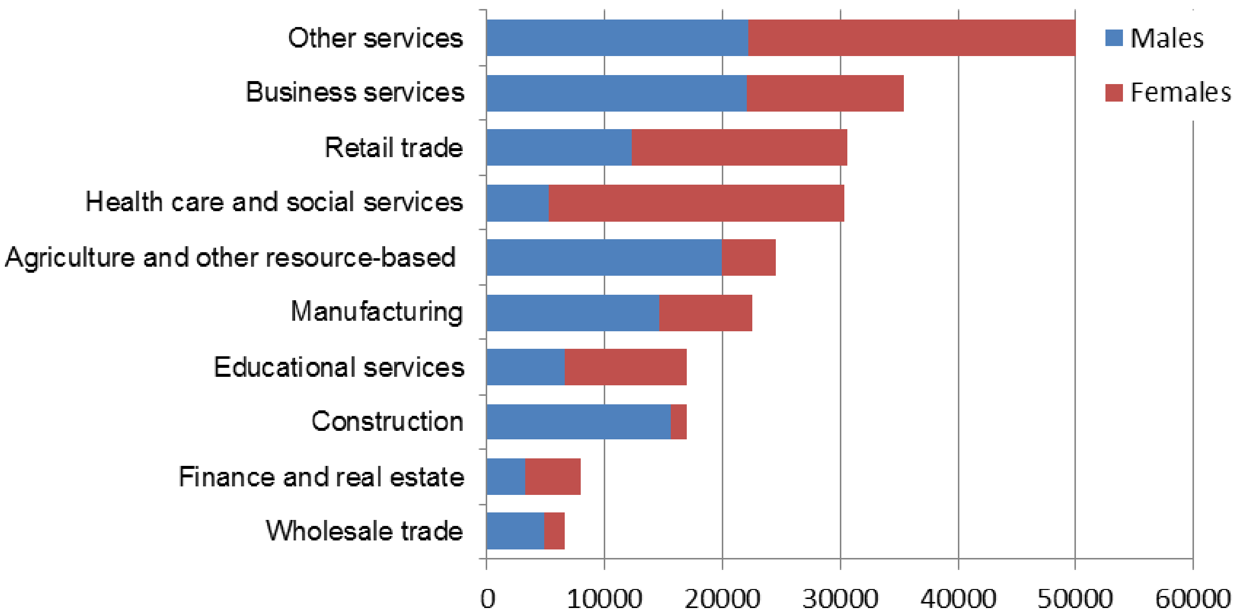
Figure 26.3 Labour Force by Industry, Newfoundland and Labrador, 2006



Source: Statistics Canada 2007

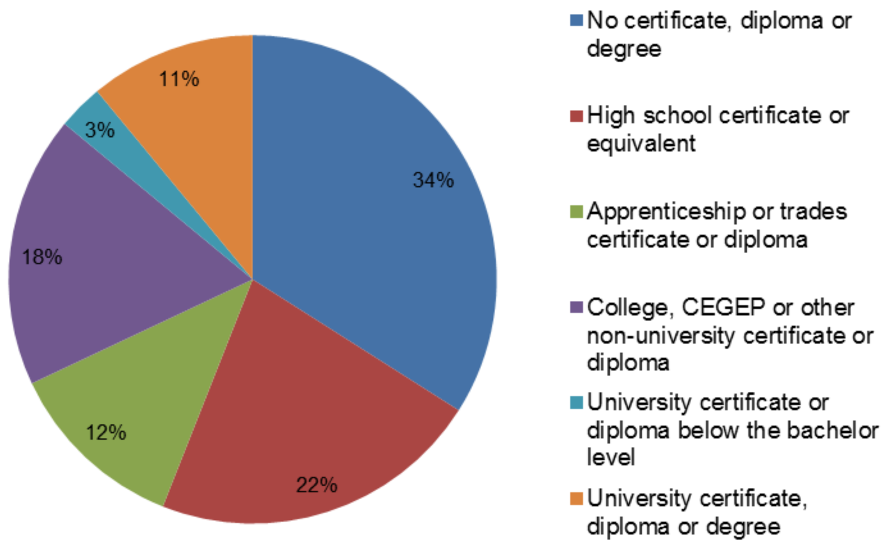
There were gender differences in employment by industry in 2006 (Figure 26.4). For males, the industries supporting the most employment were other services (22,185), business services (22,050) and agriculture and other resource based industries (19, 885). A high number of female employees also worked in other services (27,850), while the next highest levels of female employment were in health care and social services (25,180) and retail trade (18,380). The greatest gender difference in employment was seen in health care and social services, in which female employees represented 83 percent of total employment. For agriculture and other resource-based industries, employment was 81 percent male and 19 percent female. An imbalance was also seen in the construction industry, in which 79 percent of employees were male and 21 percent were female.

Figure 26.4 Labour Force by Industry and Gender, Newfoundland and Labrador, 2006



In 2006, 34 percent of the provincial population aged 15 years and over had no certificate, diploma or degree (Figure 26.5), whereas 11 percent had a university certificate, diploma or degree (Statistics Canada 2007). There were 2,395 people with an apprenticeship or trades certificate or diploma in the Province (Table 26.10). Among those with apprenticeship or trades credentials, 1,665 were male and 730 were female.

Figure 26.5 Education Level, Newfoundland and Labrador, 2006



Source: Statistics Canada 2007

Table 26.10 Education Level by Gender, Newfoundland and Labrador, 2006

Education Level	Total	Males	Females
No certificate, diploma or degree	28,820	15,745	13,075
High school certificate or equivalent	24,470	12,010	12,455
Apprenticeship or trades certificate or diploma	2,395	1,665	730
College, CEGEP or other non-university certificate or diploma	4,855	2,230	2,625
University certificate or diploma below the bachelor level	1,015	420	600
University certificate, diploma or degree	3,800	1,150	2,655
Source: Statistics Canada 2007			

For the Aboriginal population aged 15 years and over, there were 7,580 people (42 percent) who did not have a certificate, diploma, or degree in 2006 (Table 26.11). There were 3,415 people for whom the highest level of education was high school or equivalent and 3,180 people who had attained a college or other non-university certificate or diploma. Aboriginal people with an apprenticeship or trades certificate or diploma numbered 2,300 in 2006; 66 percent of these people were male and 44 percent were female (Statistics Canada 2007).

Table 26.11 Education Level, Aboriginal Population, Newfoundland and Labrador, 2006

Education Level	Total	Males	Females
No certificate, diploma or degree	7,580	3,705	3,870
High school certificate or equivalent	3,415	1,550	1,860
Apprenticeship or trades certificate or diploma	2,300	1,525	775

Education Level	Total	Males	Females
College, CEGEP or other non-university certificate or diploma	3,180	1,355	1,825
University certificate or diploma below the bachelor level	430	170	260
University certificate, diploma or degree	1,145	460	685
Source: Statistics Canada 2007			

26.5.2.2 Labrador

In 2006, the labour force in Labrador was 14,360 (Table 26.12). The participation rate was 68.8 percent, while the unemployment rate was 18.5 percent. The participation rate was over 10 percentage points higher for males than for females in 2006. There was also a higher unemployment rate for males in Labrador: 20.1 percent compared to 16.7 percent for females (Community Accounts, no date; Statistics Canada 2002; 2007).

Table 26.12 Labour Force Characteristics, Labrador, 2006

	Total	Males	Females
Labour Force	14,360	7,790	6,570
Participation Rate (%)	68.8	73.9	63.6
Employment Rate (%)	56.1	59.1	53.0
Unemployment Rate (%)	18.5	20.1	16.7
Source: Community Accounts, no date			

Similar to the Province as a whole, Employment Insurance use in Labrador has decreased substantially since the 1990s (Table 26.13). A smaller percentage of the labour force in Labrador receives Employment Insurance benefits compared to the Province: in 2009, Labrador had an Employment Insurance incidence of 29.3 percent, while 33.4 percent of the provincial labour force received Employment Insurance benefits (Community Accounts, no date).

Table 26.13 Employment Insurance Beneficiaries, Labrador, 1992 and 2009

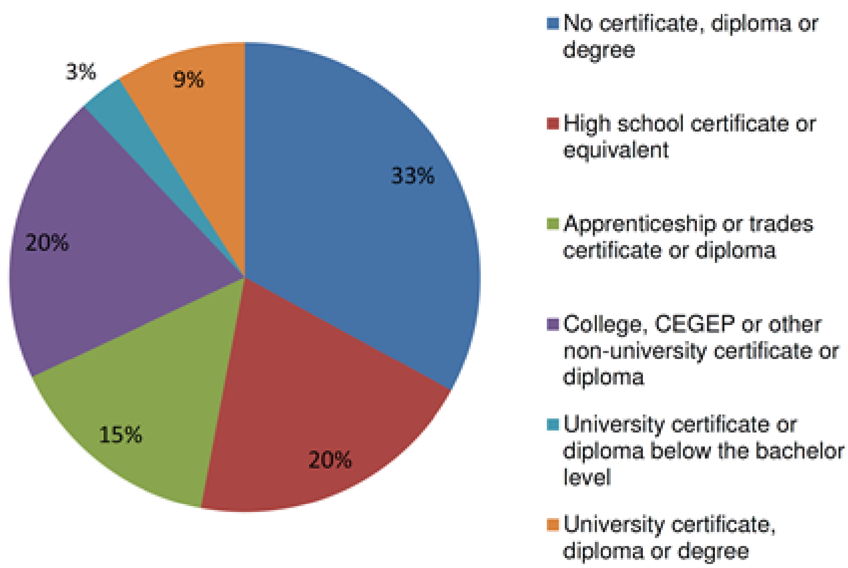
	1992	2009	% Change
EI Beneficiaries (Individuals)	6,910	4,805	-30.5
EI Incidence (% of labour force)	41.6	29.3	-12.3
Source: Community Accounts, no date			

Population decline in Labrador has had an effect on labour supply. The 15 to 64 age-group was estimated at 19,813 in 2006, a decline of 5.1 percent from 2001; this decline is expected to continue. The difference between overall population trends and those of the 15 to 64 age group can be attributed to out-migration. Within the 15 to 64 age group, 14.6 percent in the 55 to 64 year age cohort. This means that approximately 15 in every 100 individuals will exit the labour force over the next decade, creating replacement demand for labour in the region for younger workers (Labrador Regional Council of the Rural Secretariat 2006).

A number of issues concerning employment in Labrador have been identified. For example, many people living in Labrador, especially those in rural areas, lack the skills to fill non-resource-based jobs, and training that is provided does not always match the skills required in the marketplace. In addition, generally low education levels in rural areas can prevent people from pursuing the higher education that is required to take advantage of many employment opportunities (The Institute for the Advancement of Public Policy 2004).

In 2006, 35 percent of the population of Labrador had a non-university or trades certificate or diploma; this compares to 32.6 percent for Canada as a whole. However, 33 percent of the population had not completed high school (Figure 26.6), and only 8.6 percent had a university certificate, diploma or degree (Statistics Canada 2007). If local residents are to qualify for local employment, education and skills training are a priority. Residents of isolated coastal areas and Aboriginal communities in particular, experience higher levels of unemployment (The Institute for the Advancement of Public Policy 2004).

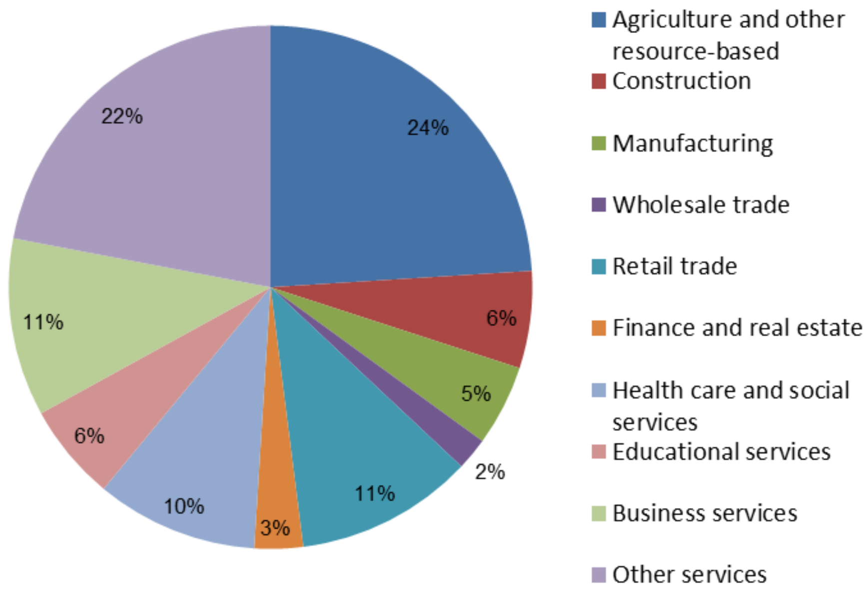
Figure 26.6 Education Level, Labrador, 2006



Source: Statistics Canada 2007

In 2006, 14,340 people aged 15 and over were in the labour force in Labrador. The main sources of employment by industry in Labrador (Figure 26.7) were agriculture and resource-based, which employed 3,395 people, retail trade (1,560), business services (1,525) and other services (3,145). Industries that employed the fewest people were finance and real estate (380) and wholesale trade (350) (Statistics Canada 2007).

Figure 26.7 Employment by Industry, Labrador, 2006



Source: Statistics Canada 2007

26.5.2.3 Economic Zone 2

Employment conditions were also strong in Economic Zone 2, where participation rates were higher, unemployment rates were lower, and the average annual income was higher than figures for Labrador and for the entire Province in 2006 (Table 26.14).

Table 26.14 Labour Force Characteristics, Economic Zone 2, 2006

	Labrador City	Wabush	Churchill Falls	Economic Zone 2
Total Population, 15 years and older	5,935	1,460	525	7,395
Labour Force	4,325	1,045	380	5,745
Participation Rate (%)	72.9	71.6	72.4	72.5
Unemployment Rate (%)	8.9	8.1	5.3	8.6
Median Income, 2005	$30,884	$36,091	$51, 732	NA
Source: Statistics Canada 2007, Community Accounts, no date.				

In 2006, the labour force of Economic Zone 2 consisted of 5,745 individuals (Table 26.15). The participation rate is much higher in Economic Zone 2 (72.5 percent in 2006) than in the Province (59.1 percent) and Labrador (68.8 percent). Unemployment rates in Labrador City, Wabush and Churchill Falls are also well below those for the Province and for Labrador.

Table 26.15 Labour Force Characteristics by Gender, Economic Zone 2, 2006

	Total	Males	Females
Labour Force	5,745	3,350	2,395
Participation Rate (%)	72.5	82.2	62.2
Unemployment Rate (%)	8.6	5.8	12.7
Employment Rate (%)	66.3	77.5	54.4
Source: Statistics Canada 2007, Community Accounts, no date			

The labour force of Economic Zone 2 was comprised of 3,350 males (58 percent) and 2,395 females (42 percent) in 2006 (Table 26.15). As was the case for Labrador, in Economic Zone 2 the male participation rate was substantially higher than that for females. The unemployment rate for males was low at 5.8 percent, while for females the unemployment rate was 12.7 percent (Statistics Canada 2007; Community Accounts, no date).

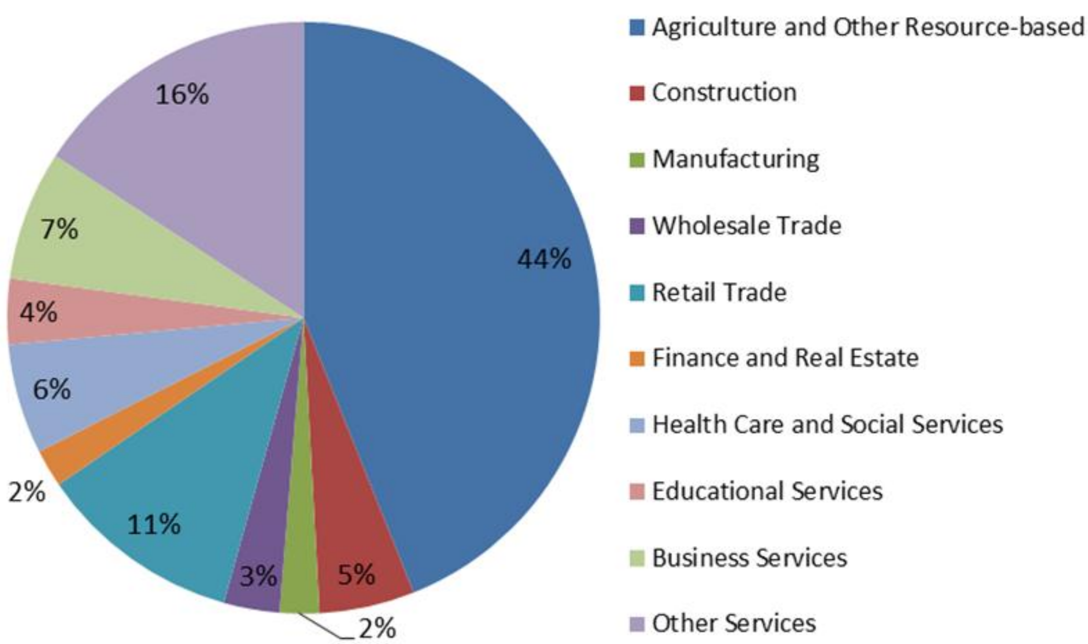
A smaller percentage of the labour force (19.8 percent) received Employment Insurance payments than recorded for both the Province (33.4 percent) and Labrador (29.3 percent) in 2009 (Community Accounts, no date). Similar to the Province and Labrador, the proportion of the labour force receiving these benefits has decreased since the 1990s. Between 1992 and 2009 the number of individuals in Economic Zone 2 receiving Employment Insurance payments decreased by 21.5 percent (Table 26.16).

Table 26.16 Employment Insurance Beneficiaries, Economic Zone 2, 2002-2006

	1992	2009	% Change
EI Beneficiaries (Individuals)	1,675	1,315	-21.5
EI Incidence (% of labour force)	25.9	19.8	-23.5
Source: Newfoundland and Labrador Statistics Agency 2012			

The occupational structure of Economic Zone 2 is weighted toward goods-producing and seasonal industries. The highest percentage of employment (44 percent) was supported by sectors in the agriculture and other natural resources category, which includes mining (Figure 26.8). Other services and retail trade employed 16 percent and 11 percent of the population, respectively. Business services accounted for seven percent of regional employment, while health care and construction accounted for six percent and five percent of employment, respectively. Few Economic Zone 2 residents worked in wholesale trade (three percent), manufacturing (two percent) or finance and real estate (two percent) (Statistics Canada 2007).

Figure 26.8 Employment by Industry, Economic Zone 2, 2006



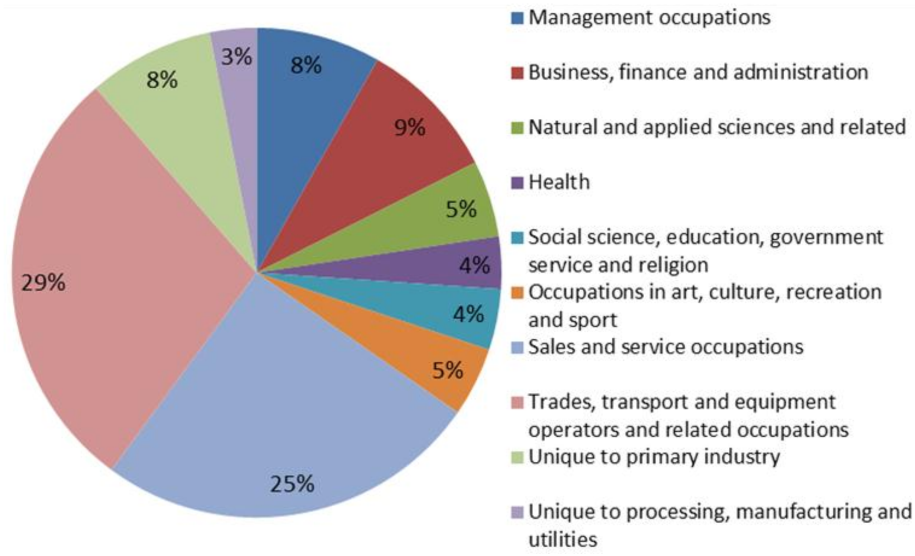
Source: Statistics 2007

The main occupations of residents of Economic Zone 2 are trades, transport and equipment operation (29 percent) and sales and service (25 percent) (Figure 26.9). Occupations unique to primary industry accounted for eight percent of positions, while nine percent of occupations were classified under business, finance and administration (Statistics Canada 2007).

26.5.2.4 Fermont

Table 26.17 presents a summary of labour force activity for Fermont and Québec in 2006. The total labour force was 1,725 people in 2006 and total employment was 1,655 people (Statistics Canada 2007). The total labour force participation rate was 80.0 percent of the population. This was considerably higher than the participation rate for Québec, which stood at 60.9 percent (Statistics Canada 2007). In 2006, the unemployment rate for Fermont was 4.1 percent, which was considerably lower than the Québec average of 7.0 percent (Statistics Canada 2007).

Figure 26.9 Employment by Occupation, Economic Zone 2, 2006



Source: Statistics 2006

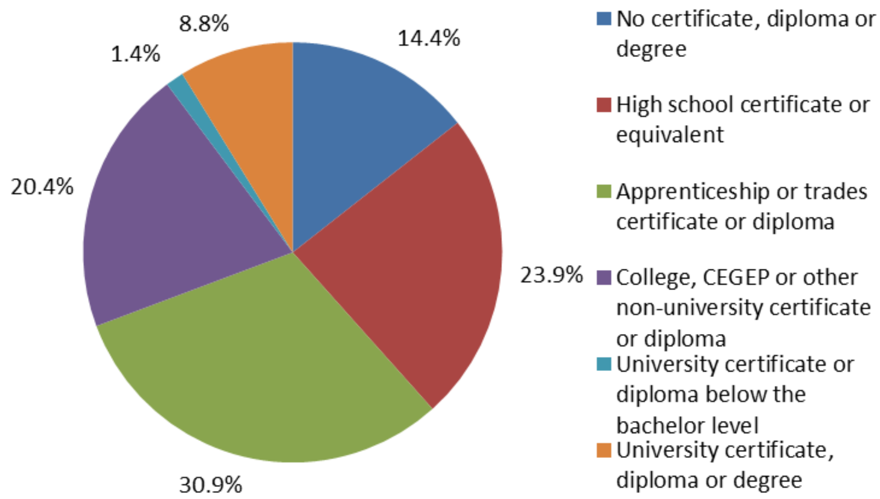
Table 26.17 Labour Force Activity, Fermont and Province of Québec, 2006

	Fermont	Québec
Labour Force	1,725	4,015,200
Employed	1,655	3,735,505
Unemployed	70	279,695
Participation Rate (%)	80.0	64.9
Employment Rate (%)	76.8	60.4
Unemployment Rate (%)	4.1	7.0
Source: Statistics Canada 2007		

The high participation rate and low unemployment rate reflect the tendencies for people to secure employment before moving to Fermont and to move away once they are no longer employed (Rouleau 2010). However, this situation is shifting as the first and second generations of people who grew up in Fermont are now choosing to stay in their hometown and enter the workforce (Rouleau 2010).

The labour pool of Fermont is characterized by a high level of technical specialization. Figure 26.10 shows the breakdown of the labour force by education level. In 2006, 61.7 percent of the population had attained a certificate, diploma or degree above the high school level. The distribution of the types of diplomas, degrees and certificates reflects the demands of the major employers in Fermont, with the greatest demand being for trades and skilled technical labour (Rouleau 2010). In 2006, 30.9 percent of the labour force had attained an apprenticeship or trades certificate or diploma and 20.4 percent held a college, CEGEP or other non-university certificate. In comparison, 8.85 percent of the Fermont population aged fifteen years and older had attained a university certificate, degree or diploma. This was substantially lower than the provincial figure, which stood at 16.5 (Statistics Canada 2007).

Figure 26.10 Educational Level, Fermont, 2006



Source: Statistics Canada, 2007

The most common type of occupation in Fermont consists of trades, transport and equipment operators, which provided 685 positions in 2006, representing 39.8 percent of total employment (Statistics Canada 2007). Sales and service occupations supported the next highest number of positions, followed by occupations in the primary industry. Table 26.18 lists the number of positions for each category of occupation, as well as the number of jobs as a percentage of the total.

Table 26.18 Experienced Labour Force by Occupation, Fermont, 2006

Industry	Fermont	
	Jobs	Percentage
Management occupations	50	2.9
Business, finance and administration	175	10.2
Natural and applied sciences	145	8.4
Health occupations	30	1.7
Social science, education, government service	60	3.5
Art, culture, recreation and sport	25	1.5
Sales and service occupations	315	18.3
Trades, transport and equipment operators	685	39.8
Primary industry	195	11.3
Processing, manufacturing and utilities	45	2.6
Source: Statistics Canada 2007		

Fermont had the highest average income of any municipality in Québec in 2006, reflecting the high wages paid by the main industries: mining and the public service. Residents of Fermont also receive tax advantages for working in remote regions. In 2005, the median personal income before taxes was $58,871 (Statistics Canada 2007).

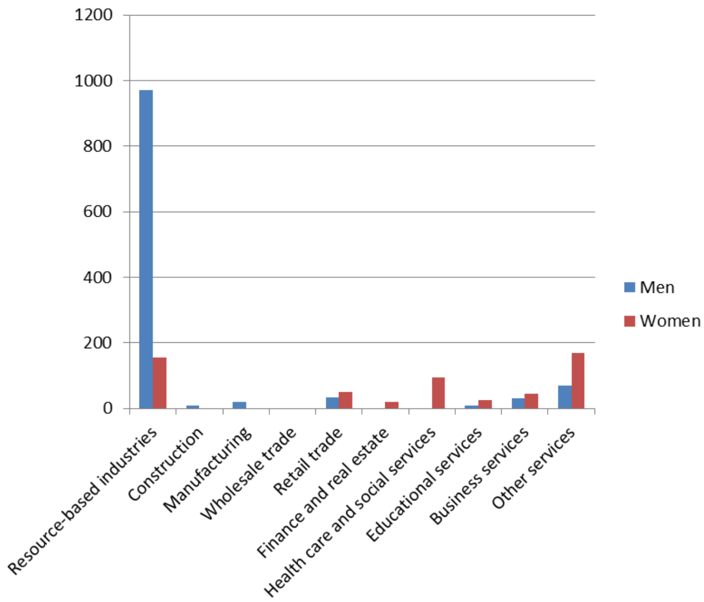
In 2006, women represented 44 percent of the total population aged 15 years and over, but only 33.3 percent of the total labour force (Statistics Canada 2007). There was a marked difference between the rates for women and men in Fermont. As shown in Table 26.19, the participation rate for men was 95.0 percent while that for women was 60.5 percent. In 2006, the unemployment rate for men was 0.9 percent while that for women was 10.4 percent (Statistics Canada 2007).

Table 26.19 Labour Force Activity Statistics, By Gender, Fermont, 2006

	Men	Women
Labour Force	1,145	575
Employed	1,135	520
Unemployed	10	60
Participation Rate (%)	95.0	60.5
Employment Rate (%)	94.2	54.7
Unemployment rate (%)	0.9	10.4
Source: Statistics Canada 2007		

The 2006 census indicates that the large majority of mining employees in Fermont were male. Figure 26.11 shows the employment of men and women in diverse industries in Fermont in 2006. While mining has represented an important employment industry for women, women were relatively underrepresented compared to men (Tremblay 2012). Women on the other hand dominated other services, health care and social services, and to a lesser extent retail trade. The high incomes provided by the mining sector and low representation of women in this industry help to explain why women in Fermont earn substantially less than men. In 2006, the median income before taxes for women aged 15 years and over was $15,870 while that for men was $75,531(Statistics Canada 2007).

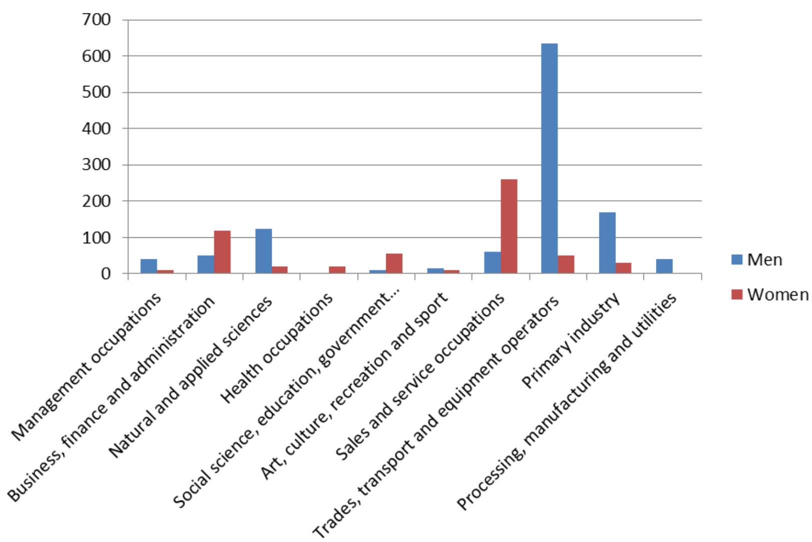
Figure 26.11 Employment by Industry and Gender, Fermont, 2006



Source: Statistics Canada 2007

The 2006 census data on occupation show marked gender differences in Fermont. Men tended to occupy jobs in trades, transport and equipment and related occupations. Out of a total of 685 people holding these occupations, 635 were men. Among women, the most common occupations were related to sales and services where 260 jobs out of 315 were held by women (Figure 26.12).

Figure 26.12 Employment by Occupation and Gender, Fermont, 2006



Source: Statistics Canada 2007

26.5.3 Business

26.5.3.1 Province

In 2011, there were 16,948 businesses in Newfoundland and Labrador. Small businesses formed the majority, with 54.4 percent of businesses in the Province employing one to four persons (Table 26.20). A further 5,792 businesses (34.2 percent) employed 5 to 19 employees, 1,610 (9.5 percent) employed 20 to 99 people and 274 (1.6 percent) had between 20 and 99 employees. Businesses that employ over 500 people are relatively rare; in 2011 there were 46 businesses in this category, representing 0.3 percent of all businesses (Newfoundland and Labrador Statistics Agency 2012).

Table 26.20 Number of Businesses by Employment Size Range, Newfoundland and Labrador, 2011

Employment Size Range	Number of Businesses	Percent
1 to 4	9,226	54.4
5 to 19	5,792	34.2
20 to 99	1,610	9.5
100 to 499	274	1.6
500 +	46	0.3
Total	**16,948**	**100.0**
Source: Newfoundland & Labrador Statistics Agency 2012		

As indicated in Table 26.21, the top five North American Industrial Classification System (NAICS) industry code categories of business in the Province, based on the number of operations are: other services, retail trade, construction, health care, and accommodation and food services.

Table 26.21 Number of Businesses by Industry, Newfoundland and Labrador, 2011

Industry	Number of Businesses
Agriculture, Forestry, Fishing and Hunting	545
Mining and Oil and Gas Extraction	78
Utilities	26
Construction	2,067
Manufacturing	454
Wholesale Trade	696
Retail Trade	2,637
Transportation and Warehousing	676
Information and Cultural Industries	129
Finance and Insurance	375
Real Estate, Rental and Leasing	592

Industry	Number of Businesses
Professional, Scientific and Technical	1,054
Management of Companies and Enterprises	145
Administrative and Support, Waste Management and Remediation	578
Educational Services	149
Health Care and Social Assistance	1,917
Arts, Entertainment and Recreation	341
Accommodation and Food Services	1,279
Other Services	2,765
Public Administration	445
Total	**16,948**
Source: Newfoundland & Labrador Statistics Agency 2012	

26.5.3.2 Labrador

In 2011, there were 799 businesses in Labrador, representing 4.7 percent of the total for the Province. Of these, 348 (43.6 percent) employed one to four persons, 336 (42.0 percent) had five to 19 employees and 96 (12.0 percent) had between 20 and 99 employees (Table 26.22) (Newfoundland and Labrador Statistics Agency 2012).

As indicated by Table 26.23, the top five categories of business in Labrador, based on the number of operations, are similar to that for the Province.

Table 26.22 Number of Businesses by Employment Size Range, Labrador, 2011

Number of Employees	Number of Businesses
1-4	348
5-19	336
20-99	96
100-499	X
500+	X
Total	**799**
Note: "X" indicates data suppressed by Statistics Canada for confidentiality purposes Source: Newfoundland & Labrador Statistics Agency 2012	

Table 26.23 Number of Businesses by Industry, Labrador, 2011

Industry	Labrador
Agriculture, Forestry, Fishing and Hunting	21
Mining and Oil and Gas Extraction	x
Utilities	x
Construction	71

Industry	Labrador
Manufacturing	18
Wholesale Trade	42
Retail Trade	167
Transportation and Warehousing	25
Information and Cultural Industries	10
Finance and Insurance	12
Real Estate, Rental and Leasing	35
Professional, Scientific and Technical	33
Management of Companies and Enterprises	13
Administrative and Support, Waste Management and Remediation	27
Educational Services	7
Health Care and Social Assistance	84
Arts, Entertainment and Recreation	20
Accommodation and Food Services	62
Other Services	119
Public Administration	24
Total	**799**
Note: X = data not available Source: Newfoundland and Labrador Statistics Agency 2012	

These Labrador businesses include a number of Aboriginal joint ventures. In the case of the Innu Nation, a recent list of Aboriginal companies and joint ventures identifies a total of 112 companies (SCI 2012). In respect to women-led businesses, the Newfoundland and Labrador Organization of Women Entrepreneurs identifies 17 members in Labrador. While most of these members are from women's and economic development groups, there are also representatives of four businesses, including a metal fabrication company (NLOWE 2012).

26.5.3.3 Economic Zone 2

The business community of Economic Zone 2 includes 293 companies, representing 1.7 percent of all businesses in the Province (Statistics Canada Business Register). Most of them have one to four employees (Table 26.24). The types of business are presented in Table 26.25.

Table 26.24 Number of Businesses by Employment Size, Economic Zone 2, 2011

Number of Employees	Number of Businesses
1-4	123
5-19	127
20-99	37
Total	**293**
Source: Statistics Canada Business Register	

Table 26.25 Number of Businesses by Industry, Economic Zone 2, 2011

Industry Code	Number of Businesses
Agriculture, Forestry, Fishing and Hunting	x
Mining and Oil and Gas Extraction	4
Utilities	x
Construction	23
Manufacturing	6
Wholesale Trade	26
Retail Trade	60
Transportation and Warehousing	9
Information and Cultural Industries	x
Finance and Insurance	7
Real Estate and Rental Leasing	19
Professional, Scientific and Technical Services	11
Management of Companies and Enterprises	5
Administrative and Support, Waste Management, and Remediation Services	11
Educational Services	x
Health Care and Social Assistance	19
Arts, Entertainment and Recreation	7
Accommodation and Food Services	20
Other Services (Except Public Administration)	56
Public Administration	x
Total	**293**

Note: X = data not available
Source: Newfoundland and Labrador Statistics Agency 2006

26.5.3.4 Fermont

The Fermont economy is based largely around the mining industry, which is dominated by two companies: ArcelorMittal and Cliff Resources. Other businesses exist in Fermont to service the mining industry and local population.

There are approximately 124 enterprises in Fermont. Businesses include a grocery store, clothing shops, beauty salons, daycares, construction companies, snow removal companies, post office, liquor store, grocery store, gift shops, explosives, drilling, automotive repair, financial services, graphic design and media communications firms, restaurants, bars, hotels and inns, and outfitters, among others (CLD de la MRC de Caniapiscau 2012a). When classified by industrial sector under the North American Industry Classification System (NAICS) Canada of 2007, the most common type of business is other services with 27 businesses, followed by retail trade with 14 and educational services with 13 businesses (Table 26.26).

Table 26.26 Number of Businesses, by Industry, Fermont, 2012

Industrial Sector	Number of Businesses
Agriculture, Forestry, Fishing and Hunting	1
Mining and Oil and Gas Extraction	6
Utilities	2
Construction	5
Manufacturing	1
Wholesale Trade	0
Retail Trade	14
Transportation and Warehousing	8
Information and Cultural Industries	4
Finance and Insurance	4
Real Estate and Rental and Leasing	3
Professional, Scientific and Technical Services	4
Management of Companies and Enterprises	0
Administrative and Support, Waste Management and Remediation Services	2
Educational Services	13
Health Care and Social Assistance	9
Arts, Entertainment and Recreation	4
Accommodation and Food Services	7
Other Services - except Public Administration	27
Public Administration	10
Total Number of Businesses	**124**
Source: CLD de la MRC de Caniapiscau 2012	

The largest employers in Fermont are AcelorMittal and Cliff Resources, followed by the Centre de santé et services sociaux de l'Hématite (CSSSH) and the Town of Fermont. Small businesses employing fewer than seven people represent the majority of enterprises in Fermont (Table 26.27).

Table 26.27 Number of Businesses, by Employment Size, Fermont, 2012

Number of Employees	Number of Businesses
0 to 6	96
7 to 15	8
16 to 30	6
31 to 60	5
61 to 120	2
120 to 500	1
500 or more	1
Unknown	5
Total Number of Businesses	**124**
Source: Gosselin 2012	

The importance of the mining industry is reflected in the number of jobs it provides locally (Table 26.28). In 2006, 1,125 people were employed in resource-based industries. This is equivalent to 65.6 percent of the experienced labour force over the age of 15 (Statistics Canada 2007). The second largest industry as represented by the number of jobs was other services, with 240 jobs, followed by health care and social services, with 100 jobs (Statistics Canada 2007).

Table 26.28 Industrial Structure, Based on Jobs in Workplace, Fermont, 2006

Industries	Fermont	
	Jobs	Percent
Agriculture and other resource-based industries	1125	65.6
Construction	10	0.6
Manufacturing	30	1.7
Wholesale trade	0	0.0
Retail trade	85	5.0
Finance and real estate	20	1.2
Health care and social services	100	5.8
Educational services	30	1.7
Business services	75	4.4
Other services	240	14.0
Source: Statistics Canada, 2006 Census of Population		

There are no Aboriginal businesses registered in the town of Fermont. However, such businesses are operating in the region and have won contracts related to local mining projects (Tremblay 2012). These enterprises tend to be registered in other communities elsewhere in the region, for instance near Schefferville or Sept-Îles (Tremblay, pers. comm.).

26.6 Assessment of Project-Related Environmental Effects

This section assesses project-related effects on Economy, Employment and Business. It discusses, first, the effects of construction. This is followed by an assessment of the operations and maintenance phase and then those of decommissioning and reclamation.

26.6.1 Construction

The following sections discuss the potential effects, effects management and residual effects of the Project during the construction phase. First, the potential effects of Project construction on economy, employment and business are addressed, followed by a discussion of effects management for each effect and then a characterization of residual project effects. While this section makes particular reference to the construction phase, much of the discussion is also relevant for the operations and maintenance and decommissioning and reclamation phases.

26.6.1.1 Potential Effects

Economy

Mining projects can have a wide range of positive effects on local, regional, provincial and national economies. Many of these economic effects are consequent of the effects on employment and business, and of proponent company industrial benefits initiatives such as may be found in benefits and diversity plans. The nature of the effects, and ways in which they can be beneficially managed, are largely common to construction, operations and maintenance, and decommissioning and reclamation activity. Accordingly, the following discussion of potential effects has general application to all three Project phases. Additional discussion is provided, where relevant, in sections describing potential effects specific to each of the three phases.

Existing knowledge about the effects of mining projects on Economy, Employment and Business is presented below. Other types of large construction projects have also been considered. The construction phase of mining projects is similar to that for other types of large-scale projects that require site clearing, the development of access infrastructure, and the supply and use of large amounts of supplies, services and labour. Other considerations include labour market shifts and competing demands from other projects that will affect the availability and cost of labour, goods and services. This review also considers the industry's previous experience managing the effects of other projects in Canada.

Major construction projects in Newfoundland and Labrador have created economic, employment and business benefits for local residents and businesses and for the Province as a whole (Community Resource Services Ltd. (CRS) 1996, 2003; Voisey's Bay Nickel Company (VBNC 2006). For example, construction of the integrated mine and concentrator at Voisey's Bay from 2002 to 2005 employed more than 4,500 individuals, of whom more than 1,100 were Labradorians of Aboriginal descent. At one point in the construction phase, more than 500 Aboriginal persons were employed (VBNC 2006, Internet site). In 2005, in the final phase of construction, 1,920 persons were involved, 87 percent of whom were residents of the Province and 25 percent were of Aboriginal descent (VBNC 2007). Aboriginal companies also benefitted from construction contracts. In 2004, contracts totalling $4.9 million were awarded to Aboriginal companies.

Information on the effects of the construction of the TLH Phase II indicates that some Innu felt that local businesses benefited economically from the project and that work on highway construction was available if they wanted it (Russo and Stanley 2002). Others disagreed, saying that construction companies brought in too many of their own workers to do jobs that could have been filled by local residents.

Construction of the offshore platform for the Hibernia Project also generated considerable expenditure and employment benefits within the Province. Approximately $34 million was spent in the 50-km radius local impact area for that project (Community Resource Services (CRS) 1996). Of the total 63 million person-hours of work on the project, 78 percent were undertaken by Canadians, including 65 percent by residents of Newfoundland and Labrador (CNOPB 1998).

The construction of infrastructure for major projects can also provide considerable direct and indirect employment and business opportunities for the local construction industry, in turn generating demands for other products and services. The presence of related construction, transportation and other infrastructure created for major construction projects has also provided a stimulus for other mining and oil and gas projects in the Province (Stantec 2009a). New education and training facilities and courses may also be established that facilitate the development of a highly skilled workforce.

Projects of this type offer the potential of large numbers of relatively highly-paid jobs and business opportunities, notwithstanding the potential for benefits leakage. These economic benefits can also result in substantial social effects on individuals, families and businesses in communities near the Project.

Employment

Most construction projects use specialist commute labour, drawn from multiple skilled trades, who work for differing (and in some cases quite short) durations. This section provides additional discussion specific to the employment effects of the Fly-in / Fly-out (FIFO) work arrangements. Many mining and other construction projects use FIFO, which sees workers spending set periods at the worksite and offsite. Travel to and from the worksite and accommodations at the work site are paid for by the employer.

Hourly wages and benefits at FIFO construction worksites may be similar to those at conventional ones. However, employees often earn higher take-home pay because of long hours and overtime. In addition, their living costs are reduced during the period they live at the work site, adding to their disposable income. From a household economy perspective, the rosters associated with many FIFO projects are also attractive to some workers because they allow them time to engage in, for example, subsistence activities, and in some cases even to hold second jobs or run small businesses.

Business

Construction activity requires a wide range of goods and services. Some are highly specialized, including for example the manufacture of milling process equipment, and is only undertaken by a few global specialist companies. At the other extreme, there are some activities (for example site clearing or providing food services to the project workforce) that can be done by smaller local companies.

The effects of large resource development projects on business, including through company case studies, have been documented in studies of Newfoundland and Labrador's offshore petroleum industry (CRS 2003; Jacques Whitford 2005; Stantec 2009a and 2012). This research is particularly relevant to the present Project because the petroleum industry is subject to the same types of benefits and diversity planning, as a result of provincial and federal / provincial regulatory and contractual initiatives. These studies demonstrated that bidding on and performing construction and operations activity has dramatically increased the capacity, capabilities and competitiveness of Newfoundland and Labrador companies.

This has included increased expertise (through training or hiring), additional and improved equipment, better business practices (including re health, safety, environment and quality) and associated increased productivity. As a consequence, many of these companies have subsequently been able to successfully undertake work in other jurisdictions and industries (including the mining industry, in the case of East Coast Catering, GJ Cahill and Strategic Concepts (Stantec 2012)), increasing their and the Province's economic sustainability.

26.6.1.2 Management of Project Effects

The primary objective of effects management for issues relating to Economy, Employment and Business is to generate or enhance potential economic benefits and, where necessary, mitigate or prevent adverse effects. Successful effects management can be measured, for example, by the number of people from particular targeted subsets of a population who are employed on a project. Changes in employment / unemployment participation rates, skill levels and incomes are indicators of success. Similarly, the number of contracts awarded to local businesses and capacity development reflect the effectiveness of local business participation strategies. However, a consequence of the demand that large projects make on the labour market is the potential for wage inflation. This can affect local businesses that compete for workers in the higher-cost environment.

Many potential Economy, Employment and Business effects can be anticipated and managed through Project design and proponent policies and practices established and implemented at the outset of the project rather than subsequently mitigated. Such designed-in management tools are now standard and have been applied to all major construction projects developed in Newfoundland and Labrador over the past 25 years.

Project proponents can optimize local effects using benefits plans, which are comprehensive documents that set out in detail the proponent's approach, policies and procedures with respect to local industrial benefits. They commonly address matters such as supplier development, procurement, education, training, hiring and succession planning, and technology transfer and research and development (R&D).

For example, as part of the 1985 federal-provincial Atlantic Accord, a regulatory framework for offshore petroleum activity was put in place that sought to deliver employment and business benefits to Newfoundland and Labrador (Canada-Newfoundland 1987). This framework has since resulted in benefits to the Province including employment, education and training, development of business and supplier capabilities, infrastructure provision and R&D capacity (CRS 2003; Jacques Whitford 2005; Stantec 2009a; Stantec 2012). In recent years, the Government of Newfoundland and Labrador has increasingly required that the proponents of projects include a benefits plan as a supporting document to the environmental assessment EIS. In the case of major offshore projects, there is an increasingly common requirement that the benefits plan be supported by a contractual benefits agreement.

The Impact and Benefits Agreement (IBA) is a broader tool, in the form of contractual arrangements between the proponent and particular Aboriginal groups. They are typically confidential documents and may contain provisions for: hiring and training commitments;

procurement processes; support of local businesses; direct payments to the affected group or groups; measures designed to protect the environment; and valued social and cultural components. In 2002, VBNC and the Inuit and Innu of Labrador, signed IBAs that preceded the development of the Voisey's Bay Mine / Mill in northern Labrador. These agreements emphasized maximization of project benefits to Aboriginal people and Aboriginal businesses. VBNC also developed an Adjacency Principle to address hiring and procurement preferences among local interests and parties.

Diversity plans and women's employment plans are other tools related to the provision of employment and business benefits to groups that often are economically and socially disadvantaged. These plans address such topics as hiring policies, mentoring, workplace harassment and the culture of the workplace. Diversity plans were required and are in place for White Rose and subsequent offshore oil projects in Newfoundland and Labrador. The Vancouver Island Highway Project and Vale's Nickel Processing Plant in Long Harbour are examples of project agreements that include a number of provisions designed to facilitate involvement of women and, in the former case, Aboriginal workers (VBNC 2008; Cohen and Braid 2003).

Effects management for Economy, Employment and Business for the Project, and especially discussion of the Project Benefits Plan and Diversity Plan and their provisions, is provided below.

Economy

Alderon understands the importance of the Project to the people of Newfoundland and Labrador and is committed to the delivery of associated employment, business and other benefits to Labrador and the Province as a whole. Project benefits will increase when residents and businesses within the region and Province can take advantage of the job and business opportunities that arise from the Project. The more people and companies involved in these opportunities, the greater the revenues to government from personal, business and other types of tax.To enhance these potential benefits, Alderon will undertake the wide range of initiatives described in the Project Benefits Plan and Diversity Plan, and will be a party to other benefits mechanisms required by any benefits agreement.

In particular, Alderon is committed to the following:

- The delivery of Project-associated benefits, including employment, education, training and business and economic development, to the Province and in particular to Labrador;
- The timely provision of Project-related information to encourage the participation of provincial and in particular Labrador employees and businesses in the economic opportunities of the Project;
- The encouragement and assistance of residents of the Province, and in particular of Labrador, to receive the education and training necessary to maximize their opportunities for employment on and related to the Project;
- The procurement of goods and services from within the Province, and in particular from

- Labrador, with provincial suppliers having full and fair opportunity and first consideration on a competitive basis;
- Where feasible and where there are long-term opportunities, the transfer of expertise from non-local specialist personnel and companies to local employees and businesses; and
- The implementation of procurement policies and practices for Project goods and services that enhance economic and business opportunities in the Province, and in particular of Labrador, including the identification and support of opportunities that will generate sustainable economic benefits.

The Project's Benefits Plan describes the ways in which Alderon will deliver on these commitments. In particular, it:

- Describes the Project and its employment and goods and services requirements, based on the Project description and other materials;
- Provides ambitious but realistic quantitative targets for the provincial, regional and local share of Project employment and business during the construction and the operations and maintenance phases; and
- Describes the actions that Alderon will take to fully satisfy its benefits commitments and achieve the established Benefits Plan targets, drawing on Alderon's relevant human resources, contracting and other policies and initiatives.

These actions include plans and initiatives related to: benefits management; employment and training; procurement, contracting and supplier development; R&D; and monitoring and reporting. The Plan also describes the means by which Alderon will confirm comparable benefits actions are taken by its Project contractors and sub-contractors.

In addition, Alderon has developed, and will rigorously implement the provisions of, the Project's Diversity Plan. This provides an employment plan and business access strategy for women and other under-represented groups, including members of Aboriginal groups and persons with disabilities. It includes a description of Alderon's approach to diversity, quantitative targets with respect to Project employment, actions that Alderon will take to fully satisfy its diversity commitments and achieve the established targets, and details of the company's plans for monitoring and reporting its success in delivering diversity on and through the Project. The Plan also describes how Alderon will confirm comparable diversity actions are taken by its Project contractors and sub-contractors.

Benefits and diversity initiatives that are specific to employment and business, as described in the Benefits Plan and Diversity Plan, are discussed further in the relevant sections below.

Employment

In order to enhance the potential employment benefits, Alderon will undertake a wide range of actions as described in the Project Benefits Plan and Diversity Plan, and will be a party to other benefits mechanisms required as part of any benefits agreement. Strategies to optimize the socio-economic effects of Project employment will focus on increasing opportunities for residents of western Labrador, Labrador as a whole, and the rest of the Province, and women, Aboriginal people and persons with disabilities, to gain employment and improve their skill sets and experience levels. Long-term benefits from this include increasing residents' income earning opportunities and, by extension, their economic and social well-being.

The Project's Benefits Plan includes the following examples of employment-related actions:

- Advertise Alderon positions externally through local print media, regional websites and a Project website;
- Communicate projected human resource requirements to post-secondary institutions, education groups and other interested parties in a timely manner to encourage further dissemination of skills requirements information and to increase awareness of opportunities;
- Participate in career fairs to promote careers in technical, engineering and trade / operational roles;
- Work with the provincial Skills Task Force, the national Mining Industry Human Resources Council, other industry and professional groups, trades unions, training institutions and other mining companies to address current and future labour shortages;
- Where a specific provincial shortage of skilled trades, engineering or other Project personnel is identified, work with educational institutions, other companies, industry groups, women's and Aboriginal groups and other stakeholders to facilitate the delivery of training to Labradorians and Newfoundlanders, including members of the designated groups;
- Have, and require major operations and maintenance phase contractors to have, processes for recruitment and selection of candidates that provide first consideration for employment to residents of Labrador and Newfoundland and reflect the principles of equitable employment; and
- During operations and maintenance, define career development plans for key positions including skills training, health and safety and regulatory training, on-the-job training and mine-specific training.

The Project's Diversity Plan additionally presents planned actions designed to facilitate employment opportunities for women, members of Aboriginal groups, and persons with disabilities. These include actions in the areas of management, recruitment and selection, employee development, work environment and equipment, work / family balance, information and communications, community outreach, and monitoring and reporting.

Business

The construction phase business opportunities will also be enhanced through the application of the Project Benefits Plan and Diversity Plan. Actions will be undertaken to assist in the procurement of goods and services from businesses on the local, regional and provincial level and from Aboriginal and women-owned or led companies, including through increasing business capacity. This will include the use of benefits management, procurement, contracting, supplier development, monitoring and reporting initiatives.

Example business-related actions listed in the Benefits Plan are:

- Maintain a Project office, including contracts and procurement personnel, in the Province, and disseminate contact information for all Project procurement personnel as soon as it becomes available;
- Provide early and detailed notification of Project requirements, including through the use a Project website to disseminate requirements and provide contracting process and supplier development information;
- Hold supplier information sessions and workshops, and participate in industry trade shows, conferences and workshops, including Expo Labrador;
- Ensure companies are aware of any specific standards, practices, qualifications or certifications required by Alderon, and provide them with information on how to meet these requirements;
- Provide feedback to unsuccessful bidders, when so requested;
- Encourage the establishment of joint ventures, licensing arrangements and education and training activities in support of identified business opportunities; and
- Stipulate in contracts that contractors and suppliers must impose similar requirements on sub-contractors and suppliers.

Diversity Plan initiatives include actions to facilitate the success of women-owned or led and Aboriginal businesses in pursuing opportunities to supply of Project goods and services. Example actions include:

- Support diverse business development initiatives of the Newfoundland and Labrador Organization of Women Entrepreneurs and other relevant business networks and community organizations;
- Ensure diverse companies are aware of any specific standards, practices, qualifications or certifications required by Alderon, and provide them with information on how to meet these requirements; and
- Provide diverse companies with detailed procurement-related information, including requests for proposals.

26.6.1.3 Residual Project Effects

The residual economic effects associated with the Project were assessed by Strategic Concepts Inc. (SCI), using an economic model designed specifically for resource projects. This model has been applied by SCI to a number of iron ore projects being proposed or in operation in Newfoundland and Labrador, as well as mining and other resource development projects elsewhere in Canada. The economic impact of the Project was modeled based on forecast construction phase expenditures (CAPEX) and operating costs (OPEX) provided by Alderon. Using this information, the economic model was applied to determine the direct, indirect and induced effects of the Project on employment, incomes, GDP and tax revenues. Table 26.29 provides definitions for these three types of economic effect and for other key terms used in the analysis.

Table 26.29 Economic Effects Model Terms and Definitions

Term	Definition
CAPEX	Total capital expenditures during the construction phase
OPEX	Annual Project expenditures during the operation and maintenance phase
Direct Effects	Stem from the direct hire of persons and include employment and labour income effects
Indirect Effects	Result from the supply of goods and services and are measured on employment, labour income and profits
Induced Effects	Refer to effects from the expenditure of money in the economy by those employed directly and indirectly on the Project. They are calculated using income multipliers and are based on the total direct and indirect effects
Income Multipliers	Measure the effect of an initial expenditure into an economy on incomes in the economy. The size of the income multiplier is determined by three factors: • how much of the income that people receive is actually spent • how much of the income is allocated to government through taxation • how much of the income spent in the community is on imported goods and services

Economy

The Project will have a wide range of positive effects on the economy of Labrador and the Province, as well as for Canada, throughout its life. The residual Project effects on economy will result from Project-generated GDP, taxes and income. The SCI economic model determined GDP and taxes for the life of the Project (including both the construction and operations and maintenance phases). These results are presented below, followed by projected construction-phase income, as determined by the SCI model.

GDP

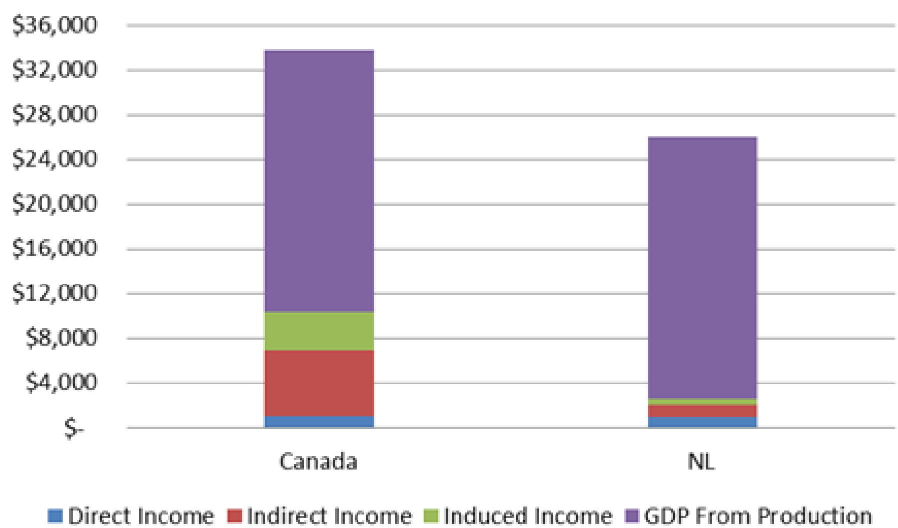
The Project will contribute to GDP through the value of mine production, as well as through direct and multiplier (i.e., indirect and induced) employment and incomes. A summary of expected GDP for Canada and Newfoundland and Labrador for the life of the Project is provided in Table 26.30 and displayed in Figure 26.13.

The total GDP from all Project phases is estimated to be $33.8 billion for Canada, including $23.4 billion from production and $10.4 billion from labour incomes. Newfoundland and Labrador will receive an approximate GDP of $26.1 billion (77.2 percent of the total), including approximately $23.4 billion net GDP from production and an additional $2.7 billion in labour incomes.

Table 26.30 GDP from Capital and Operating Expenditures (2011$, Millions), Canada and Newfoundland and Labrador

GDP	Canada	Newfoundland and Labrador
Direct Income	$1,091	$916
Indirect Income	$5,830	$1,204
Induced Income	$3,460	$551
Total GDP from Income	$10,381	$2,671
Net GDP from Production	$23,407	$23,407
Total GDP	**$33,788**	**$26,078**

Figure 26.13 Project-generated GDP, Canada and Newfoundland and Labrador (2011$ Millions)



Taxes

Government revenue generated over the life of the Project will result from direct income taxes paid by Project employees, indirect taxes paid by the owners of companies supplying goods and services to the Project, and induced taxes resulting from Project effects on income in the broader economy. The SCI analysis estimated the total taxes over the life of the Project.

The Government of Newfoundland and Labrador can expect to receive an estimated $4.3 billion in direct, indirect and induced taxes. The Government of Canada will receive approximately $3.5 billion in Project-generated taxes. Table 26.31 summarizes the direct, indirect and induced taxes that will be generated by the Project for Canada and for Newfoundland and Labrador.

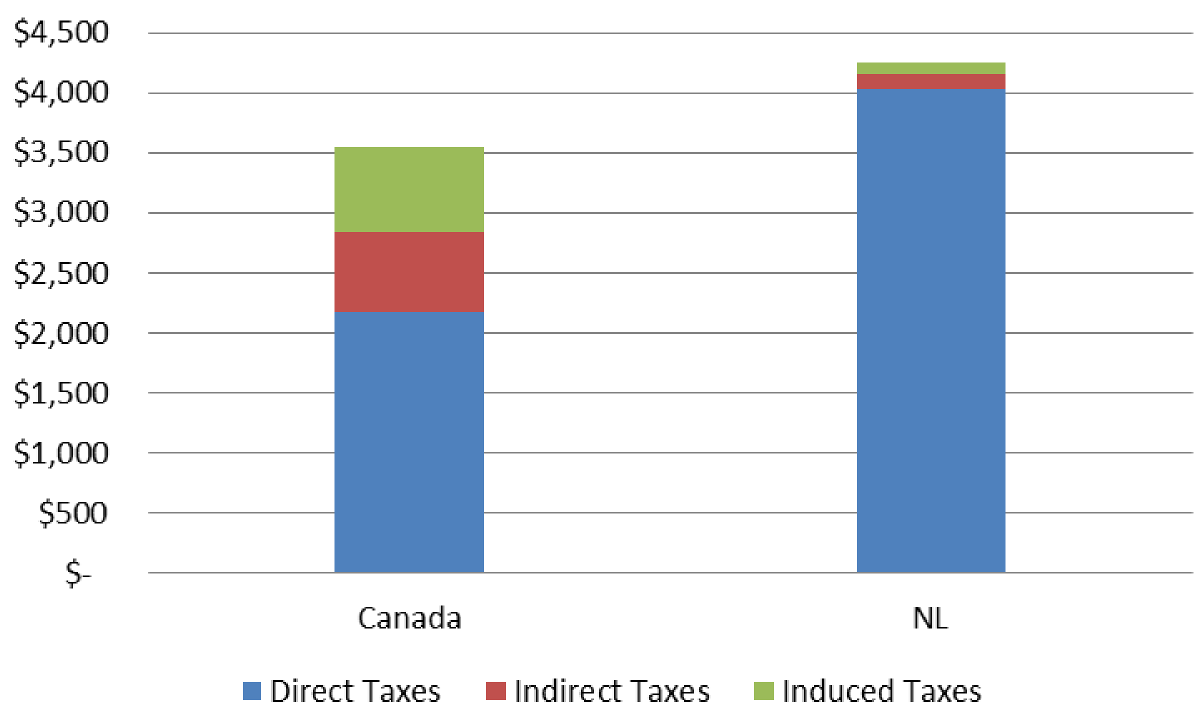
Table 26.31 Project-generated Taxes, Canada and Newfoundland and Labrador (2011$ Millions)

Taxes	Canada	Newfoundland and Labrador
Direct Taxes	$2,178	$4,035
Indirect Taxes	$660	$122
Induced Taxes	$711	$98
Total Taxes	**$3,549**	**$4,255**

Expenditures

It is anticipated that the Project will have an expected annual expenditure of approximately $350 million over the life of the Project. It is estimated that $60 million of this will be spent on direct labour annually, while the remaining $290 million will be for non-labour expenditures. In total, the Project will require expenditures at an estimated cost of $12.5 billion for construction and operations. This comprises $1.6 billion of expenditures incurred during construction, $0.5 billion in sustaining capital and another $10.4 billion expended during operations and maintenance. A proportional breakdown of the expected total expenditures for the Project is illustrated in Figure 26.14.

Figure 26.14 Project CAPEX and OPEX Expenditure Profile



Income

Project-generated incomes were determined by the SCI economic analysis for both Project construction and operations and maintenance. During construction, the provincial income associated with capital expenditures is estimated to total $336 million. Of this, Labrador can expect to receive $92 million (27.4 percent) and Economic Zone 2 $66 million (19.6 percent) (Table 26.32).

Table 26.32 Direct, Indirect and Induced Income Summary, Construction Phase (2011$, Millions)

	Newfoundland and Labrador	Labrador	Economic Zone 2
Direct	$143	$57	$46
Indirect	$124	$20	$12
Induced	$69	$15	$9
Total Capital Expenditures	**$336**	**$92**	**$66**

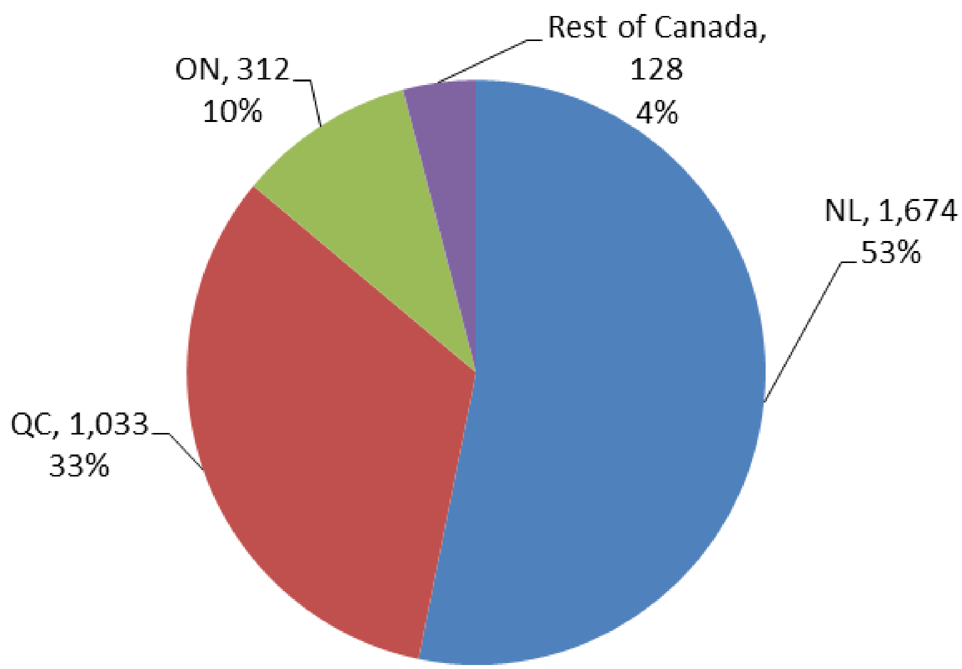
Employment

Over the life of the Project, combined capital and operating expenditures are projected to create approximately 138,410 person-years of employment, including 14,490 person-years of direct employment. The following discussion provides details on construction-phase total, direct, indirect and induced employment and related income for the construction phase. The number of construction-phase hires for Newfoundland and Labrador, Labrador and Economic Zone 2, based on economic modelling including consideration of benefits planning initiatives, is also indicated.

Capital expenditures during the construction phase are expected to generate approximately 3,147 person-years of direct employment and $268 million in direct labour incomes. During construction, approximately 53 percent of the direct employment (1,556 person-years) and 53 percent of the direct labour income ($132 million) is expected to accrue to workers in Newfoundland and Labrador. Figure 26.15 displays the geographic distribution of construction phase employment after benefits planning initiatives are taken into account.

The SCI economic analysis provides a separate examination of the effects of the two construction phases associated with building the initial 8 Mt facility (Phase 1, from 2013 to 2015) and then expanding the capacity to 16 Mt (Phase 2, from 2018 to 2019). In the environmental assessment context, the latter Phase occurs simultaneously with operations and maintenance activities and within that phase.

Figure 26.15 Construction Phase Direct Employment by Region (Person-Years)



The annual average direct employment for the Province during Phase 1 construction is 460 person-years and the annual average total employment (i.e., including indirect and induced) is estimated to be 1,080 person-years. During Phase 2, the annual average for direct employment will be 350 person-years, while the average annual total employment will be 890 person-years.

Peak direct employment in the Province is expected to occur during Phase 1 construction, in 2014. Peak employment during Phase 1 is estimated at 640 direct person-years, which increases to 1,320 person-years when indirect and induced employment is included. For construction Phase 2, peak direct employment is estimated to occur in 2018 at 370 person-years, which increases to 950 person-years when indirect and induced employment is considered. (Table 26.33)

Table 26.33 Construction Phase Peak and Annual Average Direct Employment, Newfoundland and Labrador

Phase	Employment (Person-Years)	
	Average	Peak
Construction Phase 1	460	640
Construction Phase 2	350	370

During construction, Labrador is expected to receive 1,253 person-years of total employment. For Labrador, 670 person-years will be direct employment, representing approximately 21 percent of all construction phase direct employment. An estimated 267 person-years will be indirect and 316 induced person-years will accrue to the service sector. In Economic Zone 2, total construction employment is estimated at 869 person-years, with the direct, indirect and induced employment estimated to be 536, 157 and 177 person-years respectively. Direct employment during construction in Economic Zone 2 represents 17 percent of all construction phase direct employment. Table 26.34 summarizes the number and percentage of construction phase person-years for Canada, the Province, Labrador and Economic Zone 2.

Table 26.34 Construction Phase Direct, Indirect and Induced Employment by Region

	Canada	Newfoundland and Labrador		Labrador		Economic Zone 2	
	Person-years	Person-Years	Percent	Person-Years	Percent	Person-Years	Percent
Direct Employment	3,147	1,674	53%	670	21%	536	17%
Indirect Employment	8,582	1,656	19%	267	3%	157	2%
Induced Employment	8,892	1,423	16%	316	4%	177	2%
Total Employment	**20,621**	**4,752**	**23%**	**1,253**	**6%**	**869**	**4%**
Note: Percentages may not sum to 100 due to rounding							

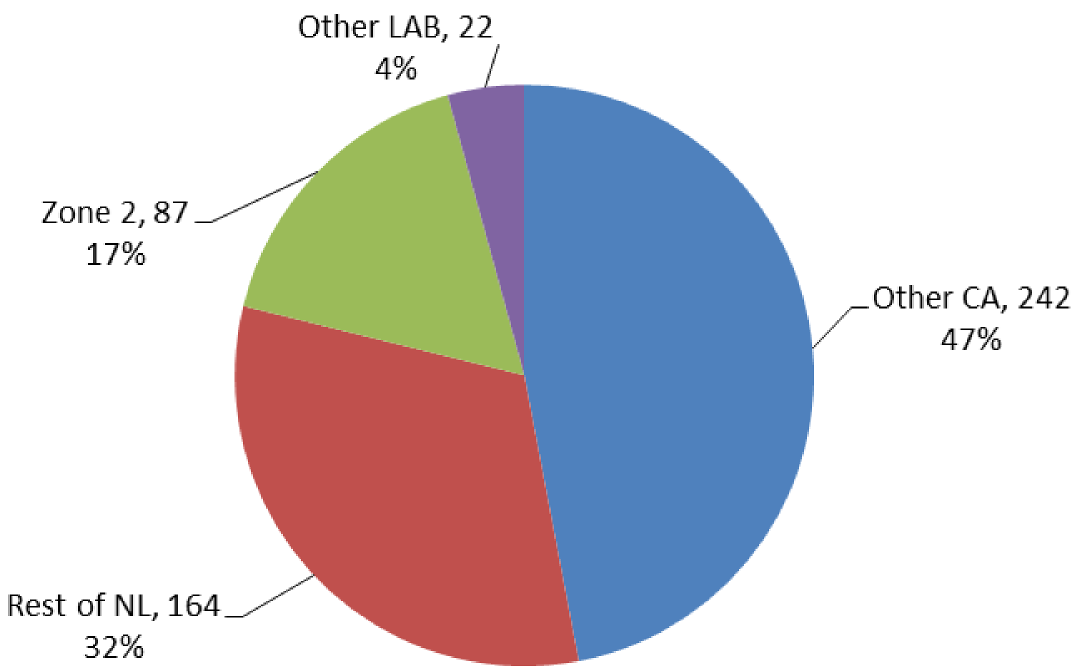
The SCI analysis also calculates the annual average number of positions that will be filled from each region of interest during the construction phase, taking into account the available labour force in each region and the effects of benefits planning initiatives. Given the labour force distribution in the Province, Labrador and Economic Zone 2, it is estimated that during construction there will be an annual average of 273 directly-employed workers from Newfoundland and Labrador. An annual average of 109 people will be hired from Labrador and an estimated 87 being hired from Economic Zone 2.

Including indirect and induced employment, the annual average for total employment is estimated to be 712 workers from the Province during the construction phase. Total employment for Labrador during the construction phase will be an annual average of 195 workers. There will be an annual average of approximately 136 workers hired from Economic Zone 2 (Table 26.35 and Figure 26.16).

Table 26.35 Average Annual Employment, Construction Phase

	Canada	Newfoundland and Labrador	Labrador	Economic Zone 2
Direct Employment	515	273	109	87
Indirect Employment	1,215	225	36	21
Induced Employment	1,310	214	49	28
Total Employment	**3,040**	**712**	**195**	**136**

Figure 26.16 Average Annual Employment for Construction Phase by Region

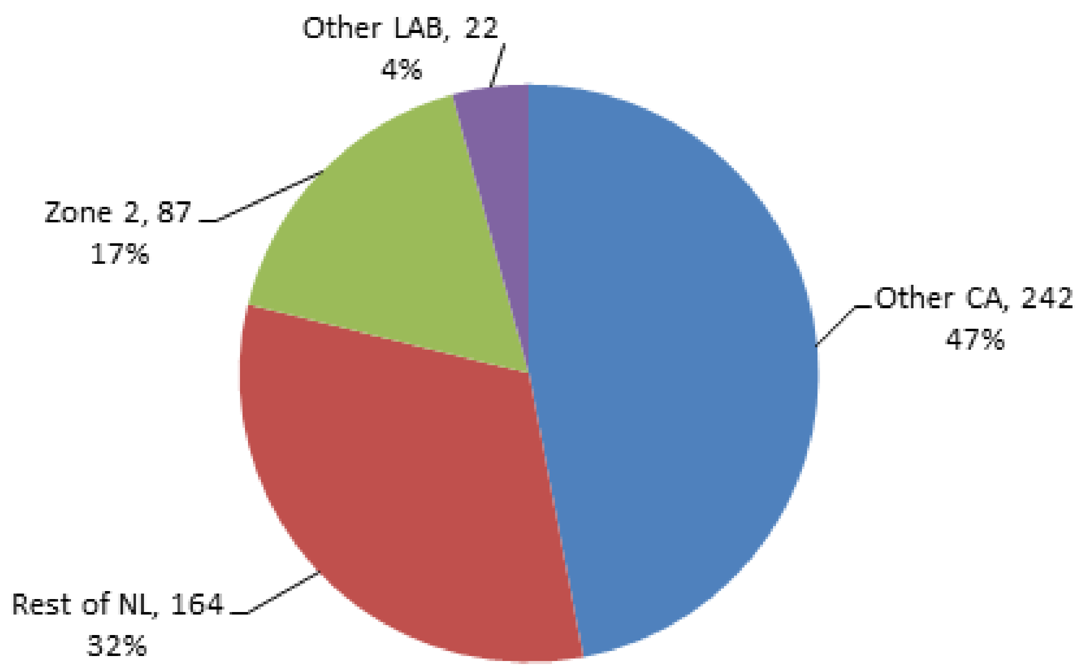


The SCI economic model does not provide forecasts of Aboriginal or women's employment. In the former case, Alderon discussions with the Innu Nation do not indicate a specific interest in Project employment, not least given the location of the Project distant from Innu communities. Accordingly, it is anticipated that Aboriginal employment on Project construction will approximate the Aboriginal share of the labour force as a whole: approximately 37 percent in Labrador as a whole and about five percent in Economic Zone 2. Aboriginal employment targets, which are the levels of Aboriginal employment that Alderon expects to achieve, are presented in the Project Diversity Plan.

Women's construction phase employment targets, which are the levels of women's employment that Alderon expects to achieve, are presented in the Project Diversity Plan. They are based on Statistics Canada data on women's share of the required construction occupations, information on graduations from relevant training programs, the experience of other projects, and Plan initiatives to facilitate women being attracted to and retained in Project employment.

The construction phase employment (i.e. Phase 1 and Phase 2) for the Province is expected to generate approximately $4.8 billion in labour incomes. Of this total, $1.7 billion, $1.7 billion and $1.4 billion respectively will result from direct, indirect and induced employment.

Figure 26.17 Average Annual Employment for Construction Phase by Region



Business

The Project will have a range of positive effects on business during the construction phase. The ability of businesses in Economic Zone 2, Labrador and the Province as a whole, and Aboriginal and women-led companies, to provide goods and services to the Project will affect the level and nature of the economic benefits derived from it.

A large number of Newfoundland and Labrador companies or branches of companies, of a wide range of sizes and capabilities, have already worked on the Project. They include, for example, Stassinu Stantec, AMEC, Strategic Concepts Inc., N.E. Parrott Surveys, Martin Surveys and Land Services, the Copy Shop and the Two Seasons Hotel. The degree to which these and other businesses in the Province, Labrador and Economic Zone 2, and Aboriginal and women-owned or led companies, continue to secure contracts to supply the Project with materials, equipment, labour and services will determine the magnitude of positive socio-economic effects on Business. This will itself be largely dependent on the existing business capacity, but facilitated by the initiatives set out in the Benefits Plan and Diversity Plan.

According to the SCI analysis, capital expenditures including construction, plus sustaining and closing costs, will total approximately $2.1 billion. Approximately 82.1 percent ($1.8 billion) of this will be spent on materials, services and equipment, with the remaining 17.9 percent ($383 million) being directed towards labour costs. The major cost items for the construction phase are labour, fabrication, construction and mining equipment, mobile fleets, pipes and valves, concrete and drilling supplies. Total annual mining costs will vary depending on the stage of the mine plan, however, it is estimated that the capital costs will average approximately $400 million per year during construction in Phase 1(2013/2015) and Phase 2 (2018/2019). Direct Project capital expenditures are summarized by cost type in Table 26.36

Table 26.36 Direct Capital Expenditures by Cost Type (2011$ Millions)

Functional Category	Total	Labour	Materials	Services and Other	Equipment
Mining	$661	$27	$21	$14	$599
Concentrator and Site Infrastructure	$1,086	$274	$239	$184	$389
Environmental and Tailings Management	$83	$10	$25	$34	$14
Rail Transportation	$45	$3	$5	$26	$10
Port Facilities	$203	$69	$43	$20	$71
Rehabilitation and Closure Costs	$63	$0	$0	$63	$0
Capital – Total	**$2,141**	**$383**	**$333**	**$341**	**$1,084**
Capital %		17.9	15.5	15.9	50.6

A preliminary list of the equipment requirements is provided in Table 26.37. This list will become more certain and detailed as the Project is further defined. Preliminary estimates indicate that the value of goods requirements for each of the two production lines will be approximately $274 million. Some of the listed items are not manufactured in Newfoundland and Labrador or even Canada. For example, it is likely that the following materials and services requirements will need to be sourced from outside the Province:

- Crusher and beneficiation plant unit supply;
- Mine engineering consulting services;
- Rails, rail ties and other track materials; and
- Rail cars and power units.

However, in such cases, there will still be benefits to the Province through local companies that act as agents, distributors or stockists for the manufacturers, and from transportation, installation and commissioning activity related to these commodities.

Furthermore, the capabilities and capacities of Newfoundland and Labrador construction and supplies companies have increased in recent years, largely as a result of work on large mining and offshore petroleum projects. A review of industrial capacity in Labrador (SCI 2012) indicates there is already considerable local capacity to assist in construction activity. For example, with regard to fabrication / mechanical capacity, there are at least two established companies currently providing these services in Labrador: Carol Lake Metal Works, in Labrador City, and Pressure Pipe Steel Fabrication Ltd., in Happy Valley - Goose Bay. Local companies have also been successful in providing such commodities as fuel, packaging, scaffolding, lumber, accommodations and electrical supplies for such projects. The anticipated equipment requirements during operation are provided in Table 2.8 of Chapter 2.

Construction phase capital expenditures will also go toward the procurement of a wide range of services, the majority of which are available in the Province. They include:

- Earthworks;
- Site construction;
- Buildings construction;
- Plant construction;
- Mine preliminary works and overburden stripping;
- Fuel and refueling services;
- Welding and machining goods and services;
- Land surveying;
- Taxi and car rental;
- Hotel accommodations;
- Blasting;
- Pipe-laying;
- Road construction;
- Electrical and mechanical contracting;
- Miscellaneous tools and small equipment;
- Heavy equipment rental (cranes, excavators, loaders); and
- Environmental monitoring.

Provincial companies, including women-led and Aboriginal companies, can put their past experience in providing goods and services to use in bidding work on the Project, and those that are successful will likely see Project work increasing their capabilities and capacities yet further. This may include increased expertise (through training or hiring), additional and improved equipment, better business practices (including health, safety, environment and quality) and associated increased productivity.

As is specified in the Diversity Plan, Alderon will also work with Aboriginal business communities to assist such companies in identifying and bidding successfully on construction phase contracts. Many goods and services are already available through Aboriginal-owned companies.

For example, a review of Innu Nation industrial capacity identified approximately 175 Innu-owned businesses that provide goods and services in the following relevant areas of expertise:

- Accommodation and food services (3 companies);
- Administrative and support services (2 companies);
- Explosives and blasting (2 companies);
- Construction - building and maintenance (18 companies);
- Construction – concrete work (7 companies);
- Construction – cranes (3 companies);
- Construction – electrical (9 companies);
- Construction – heavy equipment and roads (10 companies);
- Construction – mechanical / metal fabrication (10 companies);
- Construction – surveying (3 companies);
- Management companies and enterprises (10 companies);
- Mining, oil and gas extraction and services (8 companies);
- Professional, scientific and technical services (12 companies);
- Security (5 companies);
- Transportation and warehousing (14 companies);
- Waste management and environmental remediation (6 companies); and
- Wholesale trade (20 companies). (SCI 2012)

Success in bidding on Project work will not only help sustain these and other Aboriginal companies, but in many cases it will enable them to acquire new experience, expertise, equipment and capabilities. Similarly, Alderon will use the initiatives specified in the Diversity Plan to assist women-led companies in identifying and successfully bidding on construction phase contracts, allowing them to increase their expertise and capabilities and hence their ability to compete in the mining and other industries.

Specific concern has been expressed about the effects of the Project on businesses engaged in the tourism industry. During construction, there is a potential for in-migration to affect the capacity of the local service industry to meet demands related to tourism. Project-related activities may lead to decreased vacancy rates and increased prices at hotels and other accommodations in Labrador City, Wabush and Fermont. Other service-based businesses, such as restaurants, may also experience increased demand as a result of the Project, potentially reducing capacity to service the tourism sector.

There is also potential for Project construction to increase demand on transportation infrastructure and services used by tourists. During the construction phase, all non-local construction workers will arrive and leave through Wabush by air, increasing demand on services and infrastructure at the Wabush Airport. However, as reported in Chapter 24: Community Services and Infrastructure, Transport Canada has been developing a new plan for Wabush Airport, which may include upgrades to increase capacity (Cayouette 2012, pers. comm.). It is anticipated that such planning procedures will accommodate increased demand resulting from the Project, as well as for tourism-related travel.

While it is likely that Project construction will have some local aesthetic effects, these will be limited to the Project Development Area and are not likely to affect areas important for tourism in Wabush, Labrador City or Fermont.

26.6.2 Operations and Maintenance

This section reviews the potential effects, effects management and residual effects of the Project for the operations and maintenance phase. First, the potential effects of the Project on economy, employment and business are addressed, followed by a discussion of effects management for each effect and then a characterization of residual project effects.

26.6.3 Potential Effects

Mining projects can have a wide range of positive effects on local, regional, provincial and national economies. Many of these are consequent of the effects on employment and business, and of proponent company industrial benefits initiatives such as may be found in benefits plans, diversity plans and women's employment plans. The nature of these effects, and ways in which they can be beneficially managed, are mostly common to all phases.

26.6.3.1 Management of Project Effects

Economy

During the operations and maintenance phase, socio-economic benefits to the economy of Labrador and the Province as a whole will increase as residents and businesses within the region and Province take advantage of the employment and business opportunities that arise from the Project. The larger the number of people and companies involved in these opportunities, the greater the revenues to government from personal, corporate and other types of tax. To enhance Project benefits during operations and maintenance, Alderon will undertake the wide range of initiatives specified in the Project Benefits Plan and Diversity Plan, as outlined in Section 26.6.1, and will be a party to other benefits mechanisms required by any benefits agreement.

Employment

As was discussed earlier, the strategies to optimize the effects of Project employment will focus on increasing opportunities for residents of western Labrador, Labrador as a whole, and the rest of the Province, and women and Aboriginal people, to gain employment and improve their skill sets and experience levels. Operation and maintenance phase employment opportunities will be enhanced through the application of initiatives described in the Project Benefits Plan and Diversity Plan, as outlined in Section 26.6.1. Long-term benefits include increasing residents' income earning opportunities and, by extension, their economic and social well-being.

Business

Operation and maintenance phase business opportunities will be enhanced through the application of initiatives described in the Project Benefits Plan and Diversity Plan, as outlined in Section 26.6.1, including those related to supplier development, procurement, contracting and business access. These will serve to increase the capacity of the supply community and increase its success in capturing Project opportunities.

26.6.3.2 Residual Project Effects

Economy

The Project will have a wide range of positive effects on the economy of Labrador, the Province as a whole and Canada during operations and maintenance. As with construction, the extent to which the Project generates positive effects for the economy of Labrador and the Province will depend on the scale of the Project-generated GDP, income and tax effects, including the ability of workers and businesses, aided by Benefits Plan and Diversity Plan initiatives, to benefit from employment and expenditures. The SCI economic model calculated the GDP, tax effects and expenditures for the life of the Project, which are presented in Section 26.6.1.

Income

For Newfoundland and Labrador, total income associated with operations and maintenance expenditures is estimated to be approximately $2,335 million, of which direct, indirect and induced incomes account for approximately $773 million (33.1 percent), $1,080 million (46.3 percent) and $482 million (20.6 percent), respectively. Total incomes during the operations and maintenance are estimated at $1,433 million for Labrador, $1,162 million (81.1 percent) of which will occur in Economic Zone 2. Direct, indirect and induced incomes for the Province, Labrador and Economic Zone 2 are summarized in Table 26.37.

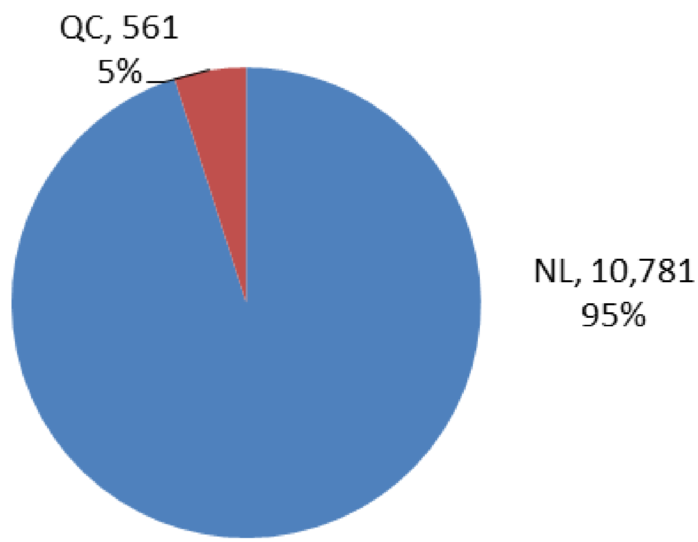
Table 26.37 Operations and Maintenance Phase Direct, Indirect and Induced Income Summary (2011$ Millions)

	Newfoundland and Labrador	Labrador	Economic Zone 2
Direct	$773	$773	$773
Indirect	$1,080	$421	$237
Induced	$482	$239	$152
Total	$2,335	$1,433	$1,162

Employment

Of the three Project phases, operations and maintenance will generate the largest effects on direct employment. An estimated 11,342 person-years of direct employment and $822 million of direct labour income are expected to be generated during operations and maintenance between 2016 and 2033, with approximately 95 percent of employment taking place in Newfoundland and Labrador (Figure 26.18).

Figure 26.18 Operations and Maintenance Phase Direct Employment by Region (Person Years)



During operations and maintenance, Newfoundland and Labrador direct employment will peak in 2021 at 820 person-years. Total employment for operations and maintenance will peak at 2,745 person-years in 2020. This corresponds to an annual average of 605 person-years of direct employment during operations and an average of 1,978 person-years of total employment. Operations and maintenance phase employment for Labrador is projected to be 21,295 person-years, of which 17,047 person-years (80.1 percent) will occur in Economic Zone 2. Employment is summarized by type for each region in Table 26.38.

Table 26.38 Operations Phase Direct, Indirect and Induced Employment by Region

	Canada	Newfoundland and Labrador		Labrador		Economic Zone 2	
	Person-Years	Person-Years	Percent	Person-Years	Percent	Person-Years	Percent
Direct Employment	11,342	10,781	95%	10,781	95%	10,781	95%
Indirect Employment	56,194	14,394	26%	5,614	10%	3,158	6%
Induced Employment	50,256	9,882	20%	4,900	10%	3,108	6%
Total Employment	**117,792**	**35,057**	**30%**	**21,295**	**2%**	**17,047**	**15%**

Including construction and operations, the Project is expected to create approximately 14,490 person-years of direct employment, yielding an estimated $1,090 million in incomes to direct labour. Approximately 87 percent (12,689 person-years) of the direct employment and 85 percent of the direct labour income ($916 million) generated by expenditures is expected to accrue to Newfoundlanders and Labradorians. Approximately 80 percent of direct employment over the life of the Project will accrue to Labrador.

As was noted in the Project Description, for the most part, the nature and composition of the Project's workforce, including with regard to the associated entry requirements, skill levels and compositions, and the ratio of journeypersons and apprentices, will likely be very similar to other similar, recent development projects in Newfoundland and Labrador. Information on the general duties and training and experience requirements for each of the occupations as listed in the Project Description can be found at HRSDC (2011).

As was discussed, the SCI economic model does not provide forecasts of Aboriginal or women's employment. However, it is anticipated that Aboriginal employment during the Project operations and maintenance phase will approximate the Aboriginal share of the labour force as a whole: initially N percent in Labrador as a whole and about five percent in Economic Zone 2, although it is expected that these percentages will increase over the life of the Project.

The Project Diversity Plan contains both Aboriginal and women's operations and maintenance phase employment targets. These are the levels of employment that Alderon expects to achieve. They are based on Statistics Canada data on women's share of the required construction occupations, information on graduations from relevant training programs, projections of future labour force change, the experience of other projects, and Plan initiatives to facilitate women being attracted to and retained in Project employment, which will result in continuous improvement in both actions and outcomes.

Business

The Project will continue to generate positive effects on business during the operations and maintenance phase. As with construction, the capability and capacity of businesses in Economic Zone 2, Labrador and the Province as a whole, and Aboriginal and women-led companies, to provide goods and services to the Project will affect the magnitude of positive socio-economic effects on Business during operations and maintenance.

The total expenditures during the operations and maintenance phase are estimated to be approximately $10.4 billion. Labour accounts for approximately 11 percent of expenditures, with materials representing 47 percent and the remaining 42 percent going to services (38 percent) and equipment (4 percent). The direct costs during operations and maintenance are summarized by cost type in Table 26.39.

Table 26.39 Direct Operating Expenditures by Cost Type (2011$ Millions)

Functional Category	Total	Labour	Materials	Services and Other	Equipment
Mining	$4,467	$793	$3,188	$486	$0
Concentrator	$1,507	$241	$1,010	$0	$257
General Site	$130	$0	$130	$0	$0
General Administration	$417	$82	$214	$104	$17
Environmental & Tailings Management	$75	$30	$37	$0	$8
Rail Transportation	$3,267	$0	$42	$3,189	$36
Port Facilities	$506	$29	$202	$174	$101
Operating – Total	**$10,370**	**$1,175**	**$4,824**	**$3,953**	**$418**
Operating %		**11.3**	**46.5**	**38.1**	**4.0**

Specific business opportunities for supplying goods and services to the Project during operations are in the following areas:

- Mining;
- Concentrator;
- General and Administrative;
- General Site;
- Owner's Costs;
- Transportation;
- Sustaining Capital;
- Operations and Maintenance; and
- Consumables.

An outline of each of these is provided below.

Mining

The major cost items for the mining operations and maintenance phase are labour, fuel, mobile equipment and maintenance, explosives and drilling supplies. The total mining costs over the life of the Project are $5.0 billion, $650 million in capital and $4.5 billion in operating costs. Total annual operations and maintenance phase mining costs will vary depending on the stage of the mine plan; however, it is estimated that they will average approximately $250 million per year.

Concentrator

It is expected that the annual operating and maintenance phase cost for the concentrator will average approximately $80 million range over the life of the Project, $50 million during Phase 1 and $100 million after Phase 2. The main cost items for the concentrator operations include labour, reagents (chemicals), steel used in grinding and crushing, electrical power and maintenance materials.

General and Administrative

General and administrative costs, which include those related to support services, represent the highest level of costs in the operation and maintenance of the mine and mill at approximately $22 million per year over the life of the Project, $13 million during Phase 1 and $26 million after Phase 2.

General Site

General site OPEX represents approximately $22 million per year over the life of the Project, $13 million during Phase 1 and $26 million after Phase 2.

Owner's Costs

Owner's costs typically include costs such as insurance, the operation of offices in Labrador and on the island, business travel, environmental monitoring and compliance and other similar costs.

Transportation

Transportation costs include those related to shipping the concentrate to port via QNS&L, and moving personnel and supplies to site. Opportunities may be available for the complete supply of transportation services. The shipment of goods and employees to the site may be handled by one or more airline contractors. Total rail transportation costs over the life of the Project are estimated to be about $185 million annually.

Sustaining Capital

Sustaining capital is a necessary ongoing expenditure for upgrades and improvements, such as the replacement of equipment including mobile fleets that will provide opportunities for Newfoundland and Labrador businesses.

Operations and Maintenance

After a specified number of operating hours, process equipment and components will be removed and restored to original specification and then put back in operation. This will be required for items such as conveyors and pumps.

Consumables

The operation and maintenance of the mine / concentrator will require many consumables including steel, chemicals, janitorial supplies, office supplies and others included in the generic list below. These goods and services are typically used in an open pit mine and concentrator, and are for reference purposes only; they may or may not be required for the Project.

- Abrasives
- Adhesives, Coatings and Sealants
- Aggregates
- Agricultural Equipment and Supplies
- Automotive Electrics
- Automotive Powertrain and Brakes
- Batteries and Chargers
- Building and Building Materials
- Castings
- Cement and Concrete Products
- Chemicals
- Industrial Cleaning Agents
- Cleaning Contracts
- Cleaning Machines
- Computer Equipment and Supplies
- Electrical Instrumentation
- Electrical Insulation and Lighting
- Electrical Powered Devices
- Electrical Transfer and Interrupt Devices
- Electrical Wire Cable and Service Entrance
- Engineering, Geological and Environmental
- Small Engines
- Explosives
- Fasteners - Rock Bolts
- Powered Fastening Systems
- Filters and Media
- Finished Product Handling
- Foodstuffs and Confectionery
- Fuels, Gases and Lubrication
- Hardware
- Heating Equipment (Building)
- Janitorial Supplies
- Laboratory Supplies
- Lubricating Equipment
- Lumber, Timber and Wood Products
- Material Handling
- Medical Supplies
- Metal Fabrication and Forgings
- Metals
- Office Equipment Supplies and Services
- Off-Road Vehicles
- On-Road Vehicles
- Personal Hygenics and Sanitation
- Pipe and Fittings
- Plastics
- Plumbing
- Power Transmission Industrial
- Process Equipment
- Promotional Supplies
- Pumps
- Rock Drilling
- Rubber, Industrial
- Safety and Fire Protection
- Shop Equipment
- Textiles and Hides
- Tools
- Valves and Flow Controls
- Ventilation Equipment
- Welding Equipment
- Wire Rope Chain and Fittings

Source: Voisey's Bay Nickel Project: Mine / Concentrator Operations Opportunities Study, July 2004.

There may also be contracted-out opportunities for support activities during the operations and maintenance phase, including, for example, haulage operations, freight handling and logistics, maintenance and repair of equipment, explosives, contract mining and security.

A large number of these required operations and maintenance goods and services will be available locally. For example, a review of local business capacity indicates that the following are available on a commercial basis from within Western Labrador:

- Fuel and refueling services;
- Welding and machining goods and services;
- Catering services;
- Vehicle rental, rail passenger and air transportation services;
- Maintenance operations;
- Hardware stores miscellaneous tools and small equipment;
- Heavy equipment rental (e.g. cranes, excavators and loaders);
- Local contracting services (e.g. construction, electrical and mechanical);
- Mine contractors;
- Beneficiation equipment operation; and
- Power supply.

A number of others of the required goods and services will be available from elsewhere in the Province.

As with the construction phase, Benefits Plan and Diversity Plan initiatives will facilitate the success of Newfoundland and Labrador companies, and especially Labrador, Aboriginal and women-led firms, in bidding Project operations and maintenance contracts. In some cases, this will include companies that will already have enhanced capabilities based on construction phase work; if successful, they will increase their capabilities and capacities yet further. In all cases, successful bidders will likely see their capabilities enhanced by increased expertise (through training or hiring), additional and improved equipment, better business practices (including re health, safety, environment and quality) and associated increased productivity, which will increase their ability to compete on other mining projects and in other industries.

As was noted above, there have been concerns about the effects of the Project on businesses involved in tourism. It is not likely that the Project will have any adverse effects during the operations and maintenance phase. While there may be some minor increase in demand for transportation, accommodations and other services as a result of Project employment, it is not anticipated that such increases will adversely affect tourism. Furthermore, increased local employment and incomes, and the increase in the population of western Labrador associated with Project operations and maintenance will generate year round demand for entertainment and recreational facilities and businesses used by tourists, increasing their economic viability.

In terms of aesthetics, viewshed analysis has been conducted to determine the impact of Project features on local viewscapes (see Chapter 23: Other Current Use of Lands and Resources). It was concluded that Project features will not significantly alter viewscapes from several key areas for tourism, including Labrador City, Wabush, and Fermont, as well as camping areas at Duley Lake and the shorelines of Lac Daviault.

The three towns in Economic Zone 2, as well as Fermont, have also worked to develop a growing tourism sector while maintaining their traditional position as a centre of industrial activity. In addition to local outdoor and adventure tourism products, Western Labrador and Fermont have also recognized the potential of industrial tourism. The industrial infrastructure of the area has been promoted by western Labrador and Fermont as a tourism attraction. Specific industrial attractions include site tours of the IOC mine in Labrador City and ArcelorMittal's Mont-Wright mine near Fermont; the Hyron REDC has also promoted tours of the Churchill Falls hydro-electric plant. Given the existing relationship between tourism and industrial activity in western Labrador, it is not anticipated that Project activity during the operations and maintenance phase will adversely affect economic activities related to tourism.

26.6.4 Decommissioning and Reclamation

This section discusses the potential effects on employment, economy and business, effects management and residual Project effects for the operations and maintenance phase.

26.6.4.1 Potential Effects

Decommissioning and reclamation are currently scheduled to commence in 2033. The methods used will be those that are best practice at that time. As such, the nature and duration of decommissioning and reclamation activity are unknown, but it will involve Alderon expenditures and associated direct, indirect and induced economic effects. This will have positive but likely relatively short-term and minor effects on western Labrador, Labrador as a whole and the rest of the Province.

Alderon expenditures during decommissioning and reclamation will have direct, indirect and induced employment and business effects. This will include likely relatively short-term opportunities for people and businesses in western Labrador, Labrador as a whole and the rest of the Province, and for Aboriginal people and women and the businesses they operate.

26.6.4.2 Management of Project Effects

Decommissioning and reclamation activity will be subject to the same Benefits Plan and Diversity Plan provisions as the other Project phases. Project effects on economy, business and employment during decommissioning and reclamation will be managed according to the provisions detailed in these documents.

26.6.4.3 Residual Project Effects

The economic effects associated with decommissioning and reclamation will depend on the specific techniques employed, but will likely involve grading, material transportation, monitoring and other activities that Labrador and Newfoundland companies and workers are already well qualified to undertake. This work will also provide opportunities for women, Aboriginal people and companies they operate. This activity will likely have minor effects on the provincial GDP, incomes, taxes, employment and business but their actual size will only be clear closer to decommissioning.

26.6.5 Summary of Project Residual Environmental Effects

A summary of the effects assessment and prediction of residual effects resulting from interactions ranked as 2 on the Economy, Employment and Business is provided in Table 26.40. Only the interactions ranked as 2 were considered further in the assessment of Project-related effects. All other interactions previously ranked as 0 or 1 were rated as not significant.

Positive socio-economic effects are predicted with a high level of certainty for Economy, Employment and Business. This has been determined using baseline information and the Project description to assess interactions and residual effects, while considering the effects management strategies Alderon will take to optimize positive socio-economic effects.

The Project will contribute significant positive effects for Economy, Employment and Business in the Province, particularly in Labrador and Economic Zone 2. The Project will generate these effects by providing the following:

- Income, taxes and GDP for the Province and Canada;
- Local employment and incomes during construction and operations;
- Contracts with local businesses during construction and operations;
- Employment for women and contracts with women-owned businesses;
- Employment for Aboriginal workers and contracts with Aboriginal-owned businesses;
- Increased skills and capacity of the local labour force and businesses; and
- Opportunity for workers and businesses in Economic Zone 2 to further demonstrate their skills and capacity relating to mining developments, strengthening the region's position for future economic development.

Table 26.40 Summary of Project Residual Effects: Economy, Employment and Business

Project Phase	Effects Management Measures	Residual Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	
Economy											
Construction	• Benefits Plan and Diversity Plan provisions.	P	H	LW L NL	MT	C	N/A	N/A	S	H	As per Benefits Plan and Diversity Plan.
Operation and Maintenance		P	H	LW L NL	LT	C	N/A	N/A	S	H	
Decommissioning and Reclamation		P	L	LW L NL	ST	C	N/A	N/A	S	H	
Employment											
Construction	• Benefits Plan and Diversity Plan provisions.	P	H	LW L NL	MT	C	N/A	N/A	S	H	As per Benefits Plan and Diversity Plan.
Operation and Maintenance		P	H	LW L NL	LT	C	N/A	N/A	S	H	
Decommissioning and Reclamation		P	L	LW L NL	ST	C	N/A	N/A	S	H	

Project Phase	Effects Management Measures	Residual Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	
Business											
Construction	• Benefits Plan and Diversity Plan provisions.	P	H	LW L NL	MT	C	N/A	N/A	S	H	As per Benefits Plan and Diversity Plan.
Operation and Maintenance		P	H	LW L NL	LT	C	N/A	N/A	S	H	
Decommissioning and Reclamation		P	L	LW L NL	ST	C	N/A	N/A	S	H	

Project Phase	Effects Management Measures	Residual Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	

KEY

Direction:
- P Positive.
- A Adverse.

Magnitude:
- L Low: A change experienced by less than 5 percent of households.
- M Moderate: A change experienced by 5 percent to 33 percent of households.
- H High: A change experienced by more than 33 percent of households.

Geographic Extent:
- LW Economic Zone 2.
- L Labrador.
- NL Province.

Duration:
- ST Short-term.
- MT Medium-term.
- LT Long-term.
- P Permanent – will not change back to original condition.

Frequency:
- O Occasionally, once per month or less.
- S Occurs sporadically at irregular intervals.
- R Occurs on a regular basis and at regular intervals.
- C Continuous.

Reversibility:
- R Reversible.
- I Irreversible.
- N/A Not Applicable.

Environmental or Socio-economic Context:
- U Undisturbed: Area relatively or not adversely affected by human activity.
- D Developed: Area has been substantially previously disturbed by human development or human development is still present.
- N/A Not Applicable.

Significance:
- S Significant.
- N Not Significant.

Prediction Confidence:
Based on scientific information and statistical analysis, and effectiveness of mitigation or effects management measure
- L Low level of confidence.
- M Moderate level of confidence.
- H High level of confidence.

26.7 Assessment of Cumulative Effects

In association with the Project environmental effects discussed previously, an assessment was conducted of the potential cumulative effects of the Project in combination with those of other projects and activities. Potential cumulative effects to Economy, Employment and Business relate to Changes in Economy, Changes in Employment, and Changes in Business as a result of Project activities in combination with those of other past, present, and future projects and activities in the RSA. A summary of results of the cumulative effects assessment is provided in Table 26.41.

The environmental effects of past and present projects and activities on Economy, Employment and Business in the RSA are reflected in characterization of baseline conditions. As has been described in Section 26.5, Newfoundland and Labrador has undergone strong economic growth during the past decade, during which the primary economic drivers have been offshore oil production and mining, as well as other projects in Labrador. This is reflected in the state of the Economy, Employment and Business in the Province, Labrador, and especially Economic Zone 2.

The Project will further contribute to economic growth at the provincial, regional and local levels, by delivering taxes, royalties, employment and business opportunities. The Project Benefits Plan and Diversity Plan include a wide range of effects management mechanisms and initiatives designed to enhance the benefits to the Province, and especially Labrador and Economic Zone 2, and to women, Aboriginal people, and persons with disabilities resident in the Province.

All identified other projects and activities in the Province have the potential for cumulative effects with the Project. Other ongoing or reasonably foreseeable projects within Labrador will be subject to similar provincial benefits planning pressures and requirements. Given this, and their location, the following projects will draw on, and benefit, the same jurisdictions, labour force and businesses as the Project:

- Labrador Operation (Iron Ore Company of Canada);
- Wabush Mines (Cliffs Resources);
- Bloom Lake Rail Spur (only) (Cliffs Resources);
- Schefferville Iron Ore Mine (Labrador Iron Mines);
- DSO Iron Ore Project (Tata Steel Minerals Canada (formerly New Millennium)); and
- Lower Churchill Generation Project (Nalcor Energy).

The projects in Québec will place only limited demands on the labour force and businesses in Labrador, for historic and language reasons, while the Project provincial benefits planning requirements will concentrate its labour force, supply and services demand in Newfoundland and Labrador, further reducing overlap. Given this, these Québec projects will have nominal overlap with the residual effects of the Project and are not considered further.

In assessing the cumulative effects of the Project with other Labrador projects, the taxes and royalties they pay, and their direct requirements for labour, goods and services and the multiplier effects of same, will vary from project to project and, for each project, over time and between the construction and operations phases. Furthermore, forecasts of the timing and size of the construction phase effects of large projects are notoriously inaccurate, and the size of operations phase effects fluctuate over the life of mines in response to resource prices. This means that, while the cumulative effects of the different Labrador projects on the Province, Labrador and Economic Zone 2 Economy, Employment and Business will be substantial, it is impractical to forecast with any accuracy the aggregate values over time for the different Economy, Employment and Business effects considered in this chapter.

However, as for the Project, the effect of the creation of new taxes, royalties, employment and business by these other projects will be largely positive. While it is recognized that the cumulative effects could be inflationary, as a result of aggregate demand exceeding the labour supply or business capacity, this is being addressed by the operators and proponents of all the projects, both individually and collaboratively. The latter includes cooperation with the provincial government's Skills Task Force and participation in the Labrador West Regional Task Force. The latter is a social development group comprised of local mining companies, municipalities and governments. The group works to identify ways in which collaboration between stakeholders may manage impacts upon the communities of Labrador City and Wabush arising from the rapid growth of the local mining industry. Given such effects management initiatives by the proponents and operators of the different projects, it is concluded that the Project and other ongoing and reasonably foreseeable projects will have significant positive cumulative effects on Economy, Employment and Business.

Table 26.41 Potential Cumulative Effects to Economy, Employment and Business

VEC Existing Condition (Past & On-Going Activities)	• Thriving provincial, Labrador and western Labrador economies • Declining unemployment in Province, Labrador and especially western Labrador • Labrador, and especially western Labrador, companies experiencing growth		
Kami Iron Ore Mine and Rail Infrastructure Project Residual Effects	• The Project will have significant positive residual effects on Economy, including raising the provincial GDP and increasing provincial and regional incomes and taxes • The Project will have significant positive residual effects on Employment, including creating large amounts of employment in Province, Labrador and western Labrador, and for women and Aboriginal persons • The Project will have significant positive residual effects on Business, including through the award of Project contracts to Labrador, women-led and Aboriginal companies • Project benefits planning takes into account the likely labour and business capacity to meet Project requirements, and hence the likely demands of other projects on both		
Other Projects / Activities	**Likely Effect Interaction (Y/N)**	**Rationale**	**Cumulative Effects**
IOC Labrador Operations	Y	Draws on, and benefits, same jurisdictions, labour force and businesses	• Economy: Incremental positive effects on economy • Employment: Incremental positive effects on employment, perhaps accompanied by adverse labour shortages • Business: Incremental positive effects on business, perhaps accompanied by adverse labour shortages and wage inflation
Wabush Mines (Cliffs Resources)	Y	Draws on, and benefits, same jurisdictions, labour force and businesses	• Economy: Incremental positive effects on economy • Employment: Incremental positive effects on employment, perhaps accompanied by adverse labour shortages • Business: Incremental positive effects on business, perhaps accompanied by adverse labour shortages and wage inflation
Mont Wright Mine (Arcelor Mital)	N	Mostly uses, and benefits, Québec jurisdictions, labour force and businesses	• None

Bloom Lake Mine and Rail Spur (Cliffs Resources)	N	Mostly uses, and benefits, Québec jurisdictions, labour force and businesses	• None
Schefferville Iron Ore Mine (Labrador Iron Mines)	Y	Draws on, and benefits, same jurisdictions, labour force and businesses	• Economy: Incremental positive effects on economy • Employment: Incremental positive effects on employment, perhaps accompanied by adverse labour shortages • Business: Incremental positive effects on business, perhaps accompanied by adverse labour shortages and wage inflation
DSO Iron Ore Project (Tata Steel Minerals Canada)	Y	Draws on, and benefits, same jurisdictions, labour force and businesses	• Economy: Incremental positive effects on economy • Employment: Incremental positive effects on employment, perhaps accompanied by adverse labour shortages • Business: Incremental positive effects on business, perhaps accompanied by adverse labour shortages and wage inflation
Lower Churchill Generation Project (Nalcor Energy)	Y	Draws on, and benefits, same jurisdictions, labour force and businesses	• Economy: Incremental positive effects on economy • Employment: Incremental positive effects on employment, perhaps accompanied by adverse labour shortages • Business: Incremental positive effects on business, perhaps accompanied by adverse labour shortages and wage inflation
Infrastructure or other projects at Port of Sept-Îles	N	Mostly uses, and benefits, Québec jurisdictions, labour force and businesses	• None
Urbanization	N	Changes in urbanization are a result of Economy, Employment and Business	• None
The Project and other projects and activities will result in the creation of new taxes, royalties, employment, and business. While it is recognized that the cumulative effects could be inflationary, as a result of aggregate demand exceeding the labour supply or business capacity, this is being addressed by the operators and proponents of all the projects, both individually and collaboratively, therefore, it is predicted that the Project and other ongoing and reasonably foreseeable projects will have significant positive cumulative effects on Economy, Employment and Business.			

26.8 Assessment of Accidents and Malfunctions

Accidents and malfunctions have limited potential to have effects on Economy, Employment and Business. Possible accidental events related to the Project include forest fires, train derailment, and dyke breaches.

A forest fire caused by the Project could lead to the short-term closure of highways, the railway, and the airport, thereby disrupting the Project and other economic activity in Economic Zone 2. A train derailment or a dyke breach is unlikely to cause disruption other than to the Project itself.

Project-related accidents and malfunctions are unlikely, as Alderon has mitigations in place to minimize their likelihood. Project personnel will also be trained to prevent and manage potential accidental events. However, should an accidental event occur, Alderon's response measures will address any negative effects of such events on Economy, Employment and Business.

The residual effects of Project-related accidents and malfunctions on Economy, Employment and Business are summarized in Table 26.42. Residual effects related to accidents and malfunctions are predicted to be not significant all three Project phases. This determination has been made with a high level of confidence because Alderon will have a number of emergency and safety plans and procedures in place to minimize the likelihood and effects of accidents and malfunctions on Economy, Employment and Business. In addition, Alderon will have communications strategies in place to keep economic stakeholders, the labour force and the business community informed of any accidents or malfunctions to reduce the likelihood of adverse effects to Economy, Employment and Business.

Table 26.42 Summary of Residual Effects for Economy, Employment and Business – Accidents and Malfunctions

Project Phase	Management Measures	Residual Effects Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-Economic Context	Significance	Prediction Confidence	
Change in Economy											
Accidents and Malfunctions	Keep economic stakeholders and public informed of developments	A	L	LW	ST	U	N/A	N/A	N	H	
Change in Employment											
Accidents and Malfunctions	Keep labour force and public informed of developments	A	L	LW	ST	U	N/A	N/A	N	H	
Change in Business											
Accidents and Malfunctions	Keep business community and public informed of developments	A	L	LW	ST	U	N/A	N/A	N	H	

KEY

Direction:
P Positive.
A Adverse.

Magnitude:
L Low: A change experienced by less than 5% of households.
M Moderate: A change experienced by 5% to 33% of households.
H High: A change experienced by more than 33% of households.

Geographic Extent:
WL Economic Zone 2.
L Labrador.
NL Province.

Duration:
ST Short term: 1 to 30 days.
MT Medium term: 31 days to 1 year.
LT Long term: longer than 1 year .
P Permanent: will not change back to original condition.

Frequency:
U Unlikely to occur.
O Occasionally, once per month or less.
S Occurs sporadically at irregular intervals.
R Occurs on a regular basis and at regular intervals.
C Continuous.

Reversibility:
R Reversible.
I Irreversible.
N/A Not Applicable.

Environmental or Socio-economic Context:
U Undisturbed: Area relatively or not adversely affected by human activity.
D Developed: Area has been substantially previously disturbed by human development or human development is still present.
N/A Not Applicable.

Significance:
S Significant.
N Not Significant.

Prediction Confidence:
Based on scientific information and statistical analysis, and effectiveness of effects management measure.
L Low level of confidence.
M Moderate level of confidence.
H High level of confidence.

26.9 Determination of Significance of Residual Adverse Effects

26.9.1 Project-related Residual Effects

As indicated above, no residual adverse effects on Economy, Employment and Business are predicted.

26.9.2 Cumulative Effects

The Project and other projects and activities in the RSA will result in the creation of new taxes, royalties, employment, and business and the effects will be largely positive. While it is recognized that the cumulative effects could be inflationary, as a result of aggregate demand exceeding the labour supply or business capacity, this is being addressed by the operators and proponents of all the projects, both individually and collaboratively. The latter includes cooperation with the provincial government's Skills Task Force and participation in the Labrador West Regional Task Force. The latter is a social development group comprised of local mining companies, municipalities and governments. The group works to identify ways in which collaboration between stakeholders may manage impacts upon the communities of Labrador City and Wabush arising from the rapid growth of the local mining industry. Given such effects management initiatives by the proponents and operators of the different projects, it is concluded that the Project and other ongoing and reasonably foreseeable projects will have significant positive cumulative effects on Economy, Employment and Business.

26.9.3 Accidents and Malfunctions

As indicated above, no significant adverse residual effects on Economy, Employment and Business as a result of accidents and malfunctions are predicted for all Project phases. This determination has been made with a high level of confidence.

26.9.4 Overall Residual Effects Conclusion

The overall residual effects of the Project on Economy, Employment and Business are predicted to be positive and significant, given the nature of the Project and the use of effects management approaches and measures described Alderon's Project Benefits Plan and Diversity Plan.

26.10 Follow-up and Monitoring

The follow-up and monitoring policies and practices for all Project phases will be as specified in the Benefits Plan and Diversity Plan. They provide a description of Alderon's process for monitoring and reporting benefits and diversity performance, including success in meeting quantitative and other targets, based on its own performance and that of its contractors and sub-contractors. This includes Alderon's commitments to provide quarterly reports throughout both the construction the operations phases, including information on the number of:

- Employed (by 4-digit NOC occupational classification);
- Full-time / part-time employees;

- The number of apprentices (by level) and journeypersons; and
- By gender and source of the workforce (Economic Zone 2, other Labrador, other Province, and outside of the Province).

There is also a description of the process by which this information will be used to further refine and develop Project benefits processes, policies, targets and initiatives.

26.11 Next Steps

Details with respect to details respecting benefits targets and commitments are ongoing between Alderon and the Government of Newfoundland and Labrador.

26.12 Summary

Economy, Employment and Business represent the primary means by which the Project will deliver benefits to adjacent communities and to the region within which it is located. This includes both the direct effects of Project employment and expenditures and their indirect and induced effects throughout the economy. Project-related effects also include benefits to such commonly economically disadvantaged groups as women, Aboriginal people and persons with disabilities. The effects on Economy, Employment and Business can also be adverse and can have linkage to other VECs.

Potential interactions between the Project and Economy, Employment and Business were identified for all Project activities and physical works. It was determined that none of the Project activities or physical works will directly cause effects on Economy, Employment and Business; instead, they are affected through expenditures on supplies and services and employment that are involved in all of the Project activities and works. The direct, indirect and induced effects of Project expenditures, together with proponent business taxes, royalties and grants in lieu, will also contribute to provincial and municipal revenues. It is not anticipated that Project expenditures will be directed towards the Fermont business community, nor is it expected that a substantial number of employees will be drawn from the Fermont workforce.

The assessment of Project-related effects was carried out for the Construction, Operations and Maintenance, and Decommissioning and Reclamation phases of the Project. Cumulative effects were also assessed with consideration of other projects that will draw on, and benefit, the same jurisdictions, labour force and businesses as will the Project. It was concluded that the Project and other ongoing and reasonably foreseeable projects will have significant positive cumulative effects on Economy, Employment and Business. This includes contributing to economic growth at the provincial, regional and local levels, by delivering taxes, royalties, employment, business opportunities and related capabilities.

27.0 COMMITMENTS MADE IN THE EIS

This section provides a list of all commitments made throughout the EIS, relating to environmental mitigation and effects management measures, and monitoring and follow-up. A summary of the commitments made in the EIS is provided in Table 27.1 and Table 27.2. Consistent with Alderon's Environmental Policy, the Project will be constructed and operated in compliance with provincial, federal, and municipal legislation, permits, standards, and guidelines.

Table 27.1 Environmental Mitigation/Effects Management Commitments in EIS

VEC	Commitment	Section of EIS
Atmospheric Environment	**Change in Air Quality:** • Fugitive dust suppression programs. • Equipment preventative maintenance programs. • Covered conveyors, as required. **Change in GHG Emissions:** • Equipment idling policy. • Equipment preventative maintenance programs. • Implementation of a GHG Management Plan. **Change in Acoustic Environment:** • Use of mufflers on construction equipment. • Conveyor motors enclosed, as required by regulation. • Adherence to equipment maintenance programs. • Maintain a vegetation buffer between the Project and nearby residents and cottages. **Change in Vibrations:** • Adherence to equipment maintenance programs. • Limit train speed to 50 km/h or less. • Use of continuous welled track and ballast system. **Change in Light Emissions:** • Direct light where needed. • Retain vegetation screen, where possible. • Locate portable lighting equipment where not visible in surrounding urban areas. • Use full horizontal cut off light fixtures, as appropriate.	Chapter 5 Section 14.6
Landforms, Soils, Snow and Ice	**Change in Landforms and Terrain Stability:** • Minimize use of esker material for aggregate use. • Maintain existing drainage to the extent possible. • Progressive rehabilitation.	Section 15.6

VEC	Commitment	Section of EIS
	Change in Soil Quality and Quantity: • Manage the collection and storage of soil stockpiles. • Promote vegetation of soil stockpiles to prevent erosion. • Design surface drainage to prevent flooding of stockpile areas. • Implement erosion-and sediment control. • Measure and track volumes of soil stored in stockpiles from salvage to replacement. **Change in Ice and Snow:** • Manage blasting so that the vibrations will not affect ice cover of nearby lakes. • Design facilities and activities to minimize dust emissions. • Use snow fences and snow removal.	
Water Resources	• Manage effluent treatment to meet *Metal Mining Effluent Regulations* (MMER) and NL *Environmental Control Water and Sewage Regulations* discharge limits. • Conduct progressive rehabilitation. • Optimize water harvesting and re-use. • Restore existing water balance conditions. • Implement erosion and sedimentation controls. • Use of appropriately sized sedimentation ditches and ponds. • Conduct ammonia contamination management. • Conduct effluent treatment, including red water control, as per options outlined in the Project Description. • Implement best management practices. • Monitor blasting. • Conduct perimeter and off-site water level monitoring (open pit mine, TMF, site). • Conduct open pit mine sump discharge monitoring. • Conduct water quality monitoring (TMF, open pit mine inflows). • Develop emergency response for spills. • Conduct open pit mine flooding. • Minimize drainage interactions and alterations. • Construct open pit mine and waste rock disposal area perimeter ditches. • Construct access roads and rail line cross drainage. • Restore natural drainage patterns.	Chapter 5 Section 16.6
Wetlands	• Minimize wetland by restricting construction activities to the PDA, and minimal Project footprint. • Maintain natural drainage, where possible. • Maintain hydrology at stream crossings. • Implement erosion and sediment control. • Conduct invasive species management. • Conduct progressive rehabilitation and wetland restoration. • Pursuing a Corporate Stewardship Agreement.	Chapter 5 Section 17.6

VEC	Commitment	Section of EIS
Fish, Fish Habitat and Fisheries	• Compensation for loss of fish habitat/production as determined and required by Fisheries and Oceans Canada under the *Fisheries Act*. • Control total suspended solids through surface water. • Provide for adequate surface water and baseline flows. • Correctly size and install culverts. minimize riparian disturbance. • Conduct progressive rehabilitation. • Manage effluent treatment so that it is within MMER and NL *Environmental Control Water and Sewage Regulations* discharge limits. • Conduct fish relocation. • Maintain existing hydrological inflow to receiving bodies. • Install screens on all water intakes in fish habitat. • Implement water management and use settling ponds. • Suppress dust.	Chapter 5 Section 18.6
Birds, Other Wildlife and Their Habitats, and Protected Areas	**Change in Habitat:** • Minimize construction footprint (i.e., PDA) to the extent feasible. • Avoid sensitive species and their habitats to the extent feasible. • Minimize disturbance and infilling within adjacent wetlands and maintain hydrological conditions to the extent feasible. • Rehabilitate access routes that are no longer needed. • Locate borrow pits more than 100 m away from the high water mark of water bodies, where feasible. • Maintain natural buffers around wetlands and riparian zones. • Dispose of slash from clearing, as specified in permits. • Restrict Construction activities to the PDA. • Comply with all provincial and federal legislation, permits, approvals and guidelines. • Implement erosion and sediment control. • Conduct invasive species management. • Conduct progressive rehabilitation. • Implement an Avifauna Management Plan. **Change in Distribution and Movement:** • Minimize construction footprint (i.e., PDA) to the extent feasible. • Avoid those locations of sensitive species to the extent feasible. • Restrict clearing activities to outside of the bird breeding season, whenever feasible. • Restrict clearing and other activities within 800 m of an active raptor nest, and within 200 m of an inactive nest. • Flag the boundaries of sensitive areas before commencing any work in the area. • Limit noise levels whenever feasible. • Allow wildlife to pass through construction sites without harassment. • Restrict construction activities to the PDA.	Chapter 5 Section 19.6

<table>
<tr><th>VEC</th><th>Commitment</th><th>Section of EIS</th></tr>
<tr><td></td><td>Comply with all provincial and federal legislation, permits, approvals and guidelines.
Maintain hydrology at stream crossings through approved methods to install culverts.
Implement erosion and sediment control.
Conduct invasive species management.
Conduct progressive rehabilitation.
Change in Mortality Risk:
Prohibit hunting or harassment of wildlife on Project site.
Implement Avifauna Management plan to address incidental take.
Limit situations leading to potential collisions.
Use welding mats from April 1 to November 15 to prevent forest fires.
Dispose of all waste appropriately.
Limit lighting to that required for safe operation.
Shield exterior lights from above.
Use motion sensors for security lighting.
Change in Health:
Consider clearing by mulching and mechanized forestry equipment.
Use best practices for fuels and other hazardous materials, e.g., herbicides.
Implement various dust-control measures.
Do not bury waste during progressive rehabilitation activities.
Allow fuel trucks to travel only on approved access roads.
Ensure equipment arrives on site free from fluid leaks.
Inspect and maintain equipment on a regular schedule.
Establish a site for equipment maintenance, repair and cleaning that is at least 100 m from any lake, river, stream, or wetland.
Dispose of all waste appropriately.
Limit lighting to that required for safe operation.
Change in Protected Areas:
Employ measures listed for other potential Project effects.
Establish a replacement protected area that performs the regional protection functions of the Pike Lake South Management area.
Pursuing a Corporate Stewardship Agreement.</td><td></td></tr>
<tr><td>Species at Risk and Species of Conservation Concern</td><td>Plant Species (alteration of habitat. distribution and abundance):
Delineate locations where plant species of conservation concern occur, and avoid those locations to the extent feasible.
Where avoidance is not possible, investigate transplantation of plant species of conservation concern to alternate sites.</td><td>Chapter 5
Section 20.6</td></tr>
</table>

VEC	Commitment	Section of EIS
	Wildlife Species – Change in Habitat: • Minimize construction footprint (i.e., PDA) to the extent feasible. • Avoid Species at Risk or Species of Conservation Concern and their habitats to the extent feasible. • Minimize disturbance and infilling within adjacent wetlands and maintain hydrological conditions to the extent feasible. • Rehabilitate access routes that are no longer needed. • Locate borrow pits more than 100 m away from the high water mark of water bodies, where feasible. • Maintain natural buffers around wetlands and riparian zones. • Dispose of slash from clearing as specified in permits. • Restrict construction activities to the PDA. • Comply with provincial and federal legislation, permits, approvals and guidelines. • Maintain hydrology at stream crossings through approved methods for culvert installation. • Implement erosion and sediment control. • Conduct progressive rehabilitation. **Wildlife Species – Change in Distribution and Movement:** • Minimize construction footprint (i.e., PDA) to the extent feasible. Delineate locations where plant species of conservation concern occur, and avoid those locations to the extent feasible. • Restrict clearing activities to outside of the bird breeding season, whenever feasible. • Flag the boundaries of sensitive areas before beginning work in the area. • Survey blasting areas for SAR or SOCC before blasting. • Limit noise levels, whenever feasible. • Allow wildlife to pass through construction sites without harassment. • Restrict construction activities to the PDA. • Comply with provincial and federal legislation, permits, approvals and guidelines. • Maintain hydrology at stream crossings through approved methods for culvert installation. • Implement erosion and sediment control. • Implement progressive rehabilitation. **Wildlife Species – Change in Mortality Risk:** • Prohibit hunting or harassment on Project site. • Implement Avifauna Management Plan to address incidental take. • Dispose of all waste appropriately. • Limit lighting to that required for safe operation. • Shield exterior lights from above. • Use motion sensors for security lighting.	

VEC	Commitment	Section of EIS
	Wildlife Species – Change in Health: • Use best practices for herbicides. • Implement dust control measures. • Do not bury waste during progressive rehabilitation activities. • Allow fuel trucks to travel only on approved access roads. • Check that equipment arrives on site free from fluid leaks. • Inspect and maintain equipment on a regular schedule. • Establish a site for equipment maintenance, repair and cleaning that is at least 100 m from any lake, river, stream or wetland.	
Historic and Cultural Resources	• Develop and implement an EPP in the event of an unexpected discovery.	Chapter 5 Section 21.6
Current Use of Lands and Resources by Aboriginal Persons for Traditional Purposes	• On-going engagement with Aboriginal communities and organizations. • No hunting and fishing policy on Project site. • Progressive rehabilitation. • Possible work rotations / cultural leave provisions. • Implement cultural activities in the workplace. • Compliance of Alderon and contractors with relevant benefits agreements provisions.	Chapter 5 Section 22.6
Other Current Use of Lands and Resources	**Change in Access:** • Install navigation signage for stream crossings and in-water Project features. • Work with local snowmobile and cross country ski organizations to replace trail equal to the amount lost. **Change in Level of Activity and Use:** • Manage dust and noise. • Install navigation signage for stream crossings and in-water Project features. • Implement a no harvesting and firearms prohibition policy on Project site. • Work with local snowmobile and cross country ski organizations to address Project effects. **Cabin Use:** • Manage dust and noise • Conduct an inventory of existing cabins and owners. • Continue engagement with cabin owners. • Install navigation signage for stream crossings and in-water Project features. • Work with local snowmobile organizations and cabin owners to address Project effects. • Develop Blasting Plan. • Work with cabin owners to address Project effects on access.	Chapter 5 Section 23.6

VEC	Commitment	Section of EIS
	Viewscape: • Rose South Waste Rock Disposal Area was moved to minimize viewshed effects on residents of Fermont. **Designated Land Use:** • Engage in ongoing discussions with Towns of Labrador City and Wabush.	
Community Services and Infrastructure	**Municipal Services and Infrastructure, Labrador City, Wabush and Fermont:** • Develop transportation arrangements (workers to be bussed to the Project site). • Construct an access road to the Project site to minimize Project-related traffic on public roads and through residential areas. • Develop human resource policies and practices. • Supply water during construction through groundwater wells. • Work with Nalcor energy to ensure Alderon's power demand will not place additional pressure on existing power supply. • A first aid office at the Project site, with a nurse, an emergency response team, and emergency vehicles. • Provide information to workers with respect to money management, alcohol and substance abuse, family adaptation and coping mechanisms, and other similar issues. • Provide worker induction training, safety absolutes, acknowledgement and respect of safety rules and emergency response team training. • Comply with provisions of any concluded benefits agreements respecting workplace policies and conditions. **Housing and Accommodations, Labrador City, Wabush and Fermont:** • Develop transportation arrangements. • Develop human resource policies and practices. • Engage with government agencies and communities to establish a workforce accommodations plan. Measures being considered include utilization of temporary accommodation and development of housing infrastructure. • Alderon will consult regularly with the relevant agencies and organizations, particularly the Labrador West Regional Task Force and the Labrador West Community Advisory Panel, to provide Project information and to identify and discuss potential Project-related implications for local services and infrastructure, including those of Project-related in-migration. • Engage with government agencies and municipalities to establish a Project accommodation strategy.	Chapter 5 Section 24.6

VEC	Commitment	Section of EIS
Health and Community Health	• Implement mitigation measures related to avoiding or reducing effects on the atmospheric environment, water resources, vegetation, soils, viewscapes and other relevant biophysical and socioeconomic VECs. • Comply with mining industry guidelines and government regulations for worker health and safety. • Use resident workforce wherever possible (with possible preference given to local residents when hiring). • Provide Project construction workers, as part of their initial and regular site and safety orientations, with community and cultural information and training related to respectful workplaces as well as being a respectful visitor to the communities in and near which they will be working. • Offer a comprehensive employee assistance program—to provide support to its workers with respect to any emotional or other issues that might contribute to substance abuse problems (e.g., income management or coping with temporary separation from family). • Work with local and regional communities and agencies and service providers to identify and plan for any associated issues, including through the provision of up-to-date project information and schedules. This will include its continued participation in the Labrador West Community Advisory Panel, and the Labrador West Regional Task Force. • Provide cross-cultural sensitivity training for all personnel and contractors. • Alderon will comply with the relevant provisions of any concluded benefits agreements respecting workplace policies and conditions. • Pre-employment and regular drug and alcohol testing, as legally allowed, for Project employees. • Alderon is participating in the ROLES project, which involves the clean-up and restoration of abandoned mineral exploration sites.	Chapter 5 Section 25.6
Economy, Employment and Business	**Economy:** • Deliver Project-associated benefits, including employment, education, training and business and economic development, to the Province and, in particular, to Labrador. • Timely provision of Project-related information to encourage the participation of provincial and, in particular, Labrador employees and businesses in the economic opportunities of the Project. • Encourage and assist residents of the province and, in particular, of Labrador, to receive the education and training necessary to enhance their opportunities for employment on and related to the Project. • Procure goods and services from within the Province and, in particular, from Labrador, with provincial suppliers having full and fair opportunity and first consideration on a competitive basis. • Where feasible and where there are long-term opportunities, transfer expertise from non-local specialist personnel and companies to local employees and businesses. Implement	Chapter 5 Section 26.6

VEC	Commitment	Section of EIS
	procurement policies and practices for Project goods and services that enhance economic and business opportunities in the Province and, in particular, of Labrador, including the identification and support of opportunities that will generate sustainable economic benefits. **Employment:** • Advertise Alderon positions externally through local print media, regional websites and a Project website. • Communicate projected human resource requirements to post-secondary institutions, education groups and other interested parties in a timely manner to encourage further dissemination of skills requirements information and to increase awareness of opportunities. • Participate in career fairs to promote careers in technical, engineering and trade and operational roles. • Work with the provincial Skills Task Force, the national Mining Industry Human Resources Council, other industry and professional groups, trades unions, training institutions and other mining companies to address current and future labour shortages. • Where a specific provincial shortage of skilled trades, engineering or other Project personnel is identified, work with educational institutions, other companies, industry groups, women's and Aboriginal groups and other stakeholders to facilitate the delivery of training to Labradorians and Newfoundlanders, including members of the designated groups. • Have, and require major operations and maintenance phase contractors to have, processes for recruitment and selection of candidates that provide first consideration for employment to residents of Labrador and Newfoundland and reflect the principles of equitable employment. • During operations and maintenance, define career development plans for key positions including skills training, health and safety and regulatory training, on-the-job training and mine-specific training. **Business:** • Maintain a Project office, including contracts and procurement personnel, in the Province, and disseminate contact information for all Project procurement personnel as soon as it becomes available. • Provide early and detailed notification of Project requirements, including through the use a Project website to disseminate requirements and provide contracting process and supplier development information. • Hold supplier information sessions and workshops, and participate in industry trade shows, conferences and workshops, including Expo Labrador. • Ensure companies are aware of any specific standards, practices, qualifications or certifications required by Alderon, and provide them with information on how to meet these requirements.	

VEC	Commitment	Section of EIS
	• Provide feedback to unsuccessful bidders, when so requested. • Encourage the establishment of joint ventures, licensing arrangements and education and training activities in support of identified business opportunities. • Ensure that contracts stipulate that contractors and suppliers must impose similar requirements on sub-contractors and suppliers. • Support diverse business development initiatives of the Newfoundland and Labrador Organization of Women Entrepreneurs and other relevant business networks and community organizations. • Communicate to diverse companies specific standards, practices, qualifications or certifications required by Alderon, and provide them with information on how to meet these requirements. • Provide diverse companies with detailed procurement-related information, including requests for proposals and to companies with local employees and businesses. • The implementation of procurement policies and practices for Project goods and services that enhance economic and business opportunities in the Province, and in particular of Labrador, including the identification and support of opportunities that will generate sustainable economic benefits.	

Table 27.2 Monitoring and Follow-up Commitments in EIS

VEC	Commitment	Section of EIS
Atmospheric Environment	• Ambient air monitoring at the facility boundary and within the nearest communities. • Annual monitoring of GHG emissions and reporting to Environment Canada. • Sound pressure level monitoring during both construction and operation.	Chapter 8 Section 14.10
Landforms, Soils, Snow and Ice	• Monitoring cut and fill locations have been placed, as well as any stream crossings for drainage conditions. • Personnel will supervise soil stripping, stockpiling, and replacement operations. • Volumes of stockpiled soil will be measured and tracked from salvage to replacement. • Soil stockpiles will be monitored to ensure erosion control and re-vegetation measures are effective and proper signage is in place. • Vegetation growth and erosion will be monitored on replaced soils against reclamation standards. • Regular checks of snow fences will be completed from November to April to ensure that fences are properly placed and functioning properly. • Monitor runoff from stockpiles, discharge from TMF, and mine water from the pit for pH, TDS, sulfate, and dissolved metals, as per MMER and the NL *Environmental Control Water and Sewage Regulations*.	Chapter 8 Section 15.10
Water Resources	• Surface water quantity monitoring during construction, operations and closure. • Surface water quality monitoring during construction, operations and closure. • Establishment of water quantity withdrawal / discharge thresholds. • Establishment of water balance restoration targets. • Erosion / sedimentation monitoring. • Restoration of drainage patterns at closure. • Monitoring of channel and water feature naturalization. • Monitoring of OPM filling. • Install permanent monitoring wells at OPM, TMF and select mine facilities. • Monitoring of groundwater chemistry and water levels. • Perimeter and off-site water level monitoring (OPM,TMF, site). • OPM sump discharge monitoring. • Water quality monitoring (TMF, OPM Inflows). • Emergency response for spills. • Post decommissioning monitoring of water levels near Rose Pit. • Post decommissioning monitoring of groundwater chemistry near TMF.	Chapter 8 Section 16.10

VEC	Commitment	Section of EIS
Wetlands	• Compliance monitoring will be conducted to confirm that wetland mitigation measures are appropriately implemented	Chapter 8 Section 17.10
Fish, Fish Habitat and Fisheries	• Monitoring compliance with Compensation Plan. • Water quality and biota sampling as per MMER requirements.	Chapter 8 Section 18.10
Birds, Other Wildlife and Their Habitats, and Protected Areas	• Compliance monitoring will be conducted to confirm that mitigation measures are appropriately implemented. • Monitor for compliance with mitigation measures. • Variety of monitoring and education initiatives.	Chapter 8 Section 19.10
Species at Risk and Species of Conservation Concern	• Compliance monitoring will be conducted to confirm that mitigation measures are appropriately implemented.	Chapter 8 Section 20.10
Historic and Cultural Resources	• Compliance monitoring against the EPP.	Chapter 8 Section 21.10
Current Use of Lands and Resources by Aboriginal Persons for Traditional Purposes	• On-going engagement with Aboriginal communities and organizations.	Chapter 8 Section 22.11
Other Current Use of Lands and Resources	• Continue engagement with local resource user groups such as the local snowmobile club and cross country ski club. • On-going engagement with cabin owners. • On-going liaison with municipalities.	Chapter 8 Section 23.10
Community Services and Infrastructure	• Engagement with local authorities and provide updates on Project activities and plans on a regular basis. • Alderon will, as appropriate, support and participate in the formation of a joint monitoring initiative which would include the towns of Wabush, Labrador City and Fermont. • Engage with the relevant agencies and organizations, particularly the Labrador West Regional Task Force and the Labrador West Community Advisory Panel, to provide Project information and to identify and discuss potential Project-related implications for local services and infrastructure, including those of Project-related in-migration.	Chapter 8 Section 24.10

VEC	Commitment	Section of EIS
Health and Community Health	• Continue to work with local and regional communities and agencies and service providers to identify and plan for any associated issues, including through the provision of up-to-date project information and schedules. This will include its continued participation in the Labrador West Community Advisory Panel, and the Labrador West Regional Task Force.	
Economy, Employment and Business	• Monitor and report on Project Benefits and Diversity Plan performance, such as success in meeting targets, as detailed in the Benefits Agreement, Benefits Plan and Diversity Plan. • Support and participate in the formation of a joint monitoring initiative which would include the towns of Wabush, Labrador City and Fermont, as appropriate.	Chapter 8 Section 26.10

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Porter, C. Personal communication. Conservation Officer, Department of Natural Resources.

Reccord, P. Personal communication. Town Councillor, Labrador West. Email, February 21, 2012.

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Sawyer, R. Personal communication. Campus Administrator, Labrador West Campus. Email, April 20, 2012.

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29.0 GLOSSARY AND ACRONYM LIST

100–year storm – A storm whose intensity level has a one percent chance of occurring in any given year.

Aboriginal traditional knowledge – Includes, but is not limited to, the knowledge Aboriginal Peoples have accumulated about wildlife species and their environment.

Acid Base Accounting (ABA) – An analytical technique applied to mine wastes and geologic materials that determines the potential acidity from sulfur analysis versus the neutralization potential. It is used to predict the potential of that material to be acid producing or acid neutralizing. http://www.gardguide.com/index.php/Glossary.

Acoustic environment – The complete set of all objects and their respective physical properties having an influence on the sound field that surrounds a listener. http://keithyates.com/glossary. htm.

Acid Rock Drainage (ARD) – A low pH, metal–laden, sulfate–rich drainage that occurs during land disturbance where sulfur or metal sulfides are exposed to atmospheric conditions. It forms under natural conditions from the oxidation of sulfide minerals and where the acidity exceeds the alkalinity. Non–mining exposures, such as along highway road cuts, may produce similar drainage.

Bag Limit – A law imposed on hunters and anglers restricting the number of animals within a specific species that may be retained.

Bedrock stratigraphy – The arrangement or sequencing of strata of the native consolidated rock underlying the surface and their interpretation in terms of mode of origin and geologic history.

CO_2eq – carbon dioxide equivalent – the result of the aggregation of greenhouse gases (GHG) which takes into account their respective global warming potentials.

Community knowledge – Information held by community members, such as farmers, hunters, fishers and naturalists, who are familiar with the environment in a specific geographic area.

Concentrator – Machinery designed to process mined ore into a more highly refined, concentrated product.

Concentrator plant – Area where grinding, screening, spiral concentration and magnetic concentration take place.

Coupler – a connector of mechanical components or systems.

Community health – The combination of sciences, skills, and beliefs directed towards the maintenance and improvement of the health of all the people in a community through collective or social actions.

Critical habitat – A habitat area essential to the conservation of a listed species.

Cumulative environmental effects – environmental effects likely to result from a project in combination with the environmental effects of other past, existing, and future projects or activities.

Cumulative impact assessment – The critical analysis and summary of potential / realized cumulative impacts on an environment.

Diversion ditches – A drainage depression or ditch built across the top of a slope to divert surface water from that slope.

Earthen dam – An artificial water barrier.

Ecological Land Classification (ELC) – The division of land based on its ecological role in the environment.

Esker – A long ridge of gravel and other sediment, typically having a winding course, deposited by meltwater from a retreating glacier or ice sheet.

Geographic extent – The geographic area within which an environmental effect of a defined magnitude occurs (e.g., site–specific, local, regional, provincial, national, international).

Hydraulic conductivity – A property of vascular plants, soil, or rock that describes the ease with which water can move through pore spaces or fractures.

Hydroseeding – A planting process where a slurry of seed and mulch is sprayed over prepared ground.

Ice–out – The annual thawing of winter ice on a body of water.

Littoral habitat area – Aquatic habitat that is close to shore.

Load–out facilities – Area designed to receive concentrate after transportation.

Magnetic separation – A process in which magnetically susceptible material is extracted from a mixture using a magnetic force.

Marshalling yard / area – Transition area used for receiving and holding mineral shipments before further transportation.

Processing – The process by which ore is worked into a concentrate and transported to a stockpile awaiting movement off–site.

Progressive rehabilitation – Rehabilitation done continually and sequentially within a reasonable time during the entire period that a project continues.

Polishing pond – The last in a series of settling ponds where mill effluent, final sedimentation, or contaminant remediation takes place.

Power easement – A license to use a power source owned by another person / entity.

Peak Particulate Velocity (PPV) – The velocity of vibrations through a solid surface.

Rail loop – A section of railway that leaves the main track but re–joins it further down the line.

Reasonable worst case scenario – The most negative outcome expected to occur within reason due to project activities.

Scarify – Creating cuts of scratches in a surface.

Settling ponds – A device used to treat turbidity in industrial wastewater.

Significance thresholds – A quantitative or qualitative standard, or set of criteria, pursuant to which the significance of a given environmental effect may be determined.

Sky glow – The illumination of night sky in urban areas.

Slope stability – Resistance of inclined surface to failure by sliding or collapsing.

Storage coefficients – Are used to represent the storage coefficient of an aquifer which is the volume of water released from an aquifer per 1 foot surface area per 1 foot change in head.

Tailings – The materials left over after the process of separating the valuable fraction from the worthless fraction (gangue) of an ore.

Tailings dewatering – Increasing percentage of solids by removing water by cycloning, thickening, or other solids settling methods.

Tailings thickener – Reducing percentage of solids by allowing tailings to settle.

Temporal boundary – A restriction that is time dependent.

Waste rock – Rock that remains after the desired minerals have been extracted.

Watershed – An area or region drained by a river, river system, or other body of water.

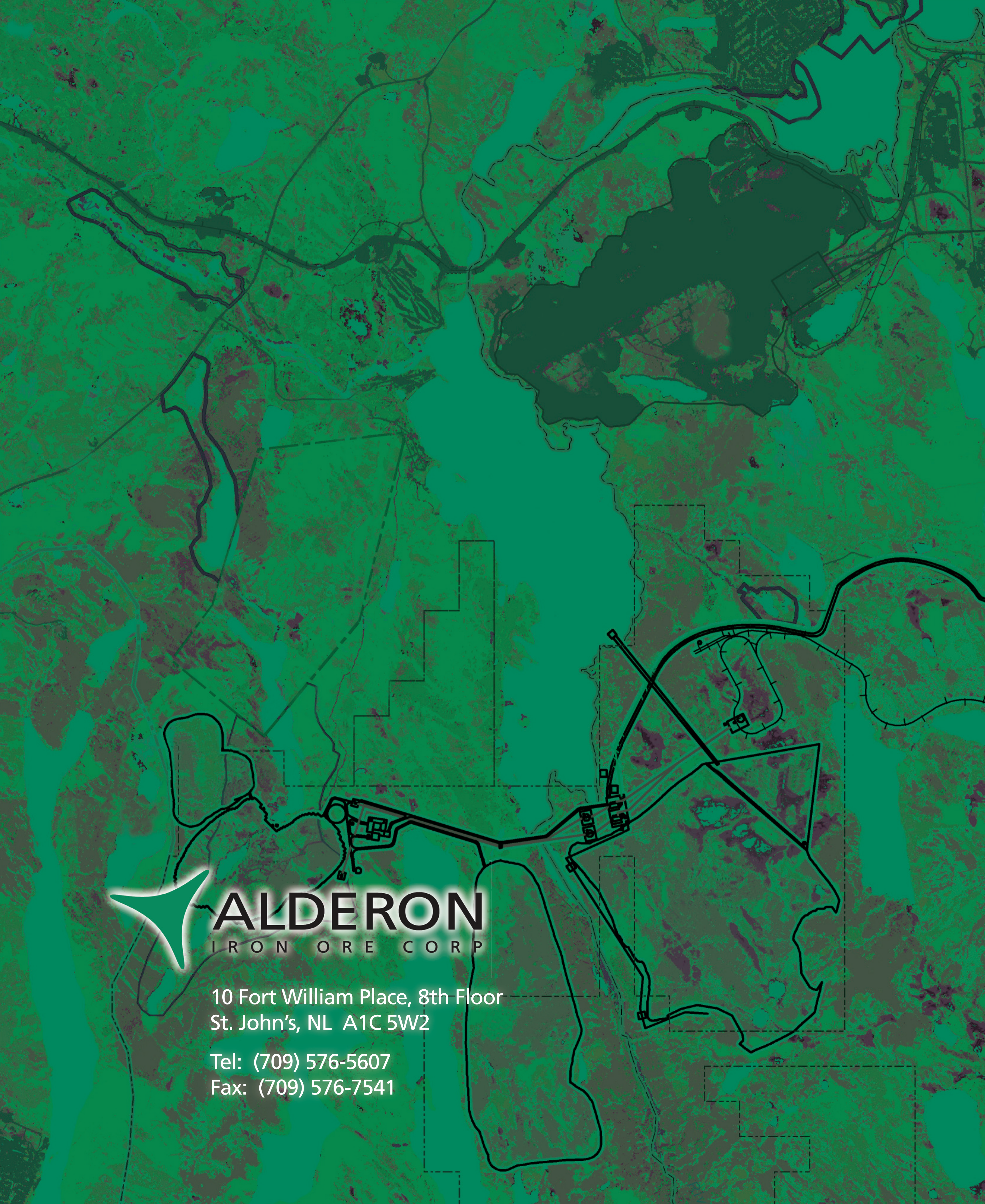
Waste Rock Disposal Area (WRDA) – an area designated for storing rock that remains after the desired minerals have been extracted.

%HA .... percent highly annoyed
ACCDC .... Atlantic Canada Conservation Data Centre
AIP .... Agreement–in–Principle
Alderon .... Alderon Iron Ore Corp.
ALT .... Acute Lethality Test
ARD .... acid rock drainage
AREMA .... American Railway Engineering and Maintenance–of–Way Association
BC .... British Columbia
BLR .... Bloom Lake Railway
CAC .... criteria air contaminants
CAM .... Conseil des Atikamekw et des Montagnais
CBC .... Canadian Broadcasting Corporation
CCTV .... closed circuit television
CDA .... Canadian Dam Association
CEA Agency .... Canadian Environmental Assessment Agency
CEAA .... *Canadian Environmental Assessment Act*
CIE .... Commission Internationale de L'Éclairage
CIHI .... Canadian Institute for Health Information
CNA .... College of the North Atlantic
CO .... carbon monoxide
COSEWIC .... Committee on the Status of Endangered Wildlife in Canada
CROR .... Canadian Rail Operating Rules
CSSSH .... Centre de santé et des services sociaux de l'Hématite
CT .... computed tomography
CWCS .... Canadian Wetland Classification System
CWJ .... Captain William Jackman [Memorial Hospital]
DFO .... Fisheries and Oceans Canada
DNR .... Department of Natural Resources
DOEC .... Department of Environment and Conservation
DSO .... Direct Shipping Ore [Project]
DTCR .... Department of Tourism, Culture and recreation
E&MJ .... Engineering and Mining Journal
EA .... environmental assessment
EHJV .... Eastern Habitat Joint Venture
EIS .... environmental impact statement
ELC .... ecological land classification
EPC .... Engineering, Procurement and Construction
EPP .... environmental protection plan

FIFO .... fly–in /fly–out
FNA .... Flora of North America
GCDWG........ Guidelines for Canadian Drinking Water Quality
GDP .... gross domestic product
GHG .... greenhouse gas
GIS .... geographic information systems
GLC .... ground–level concentrations
GOC .... Government of Canada
GPS .... global positioning system
GWh .... gigawatt hours
HADD .... Harmful Alteration, Disruption or Destruction
HBC .... Hudson Bay Company
HROA .... Historic Resources Overview Assessment
IELP .... Innu Environmental Limited Partnership
IOC .... Iron Ore Company of Canada
IPCC .... Intergovernmental Panel on Climate Change
ITUM .... Innu Takuaikan Uashat mak Mani–Utenam
JPS .... JPS–Out, as in outlet
JWEL .... Jacques Whitford Environment Limited
Kami .... Kamistiatusset
kW .... kilowatt
Ld .... day average sound level
Ldn........ day and night average sound level
LEED .... Leadership in Energy and Environmental Design
LIM........ Labrador Iron Mines
LIMS .... low intensity magnetic separation
LIS .... Labrador Interconnected System
Ln........ night average sound level
LNG .... liquid natural gas
LSA .... local study area
LSSI .... landforms, soils, snow and ice
MAC........ Mining Association of Canada
MAHF .... Maison d'aide et d'hébergement de Fermont
MBCA .... Migratory Birds Convention Act
MDDEPQ .... Ministère du Développement durable, Environnement et Parcs du Québec
MESS .... Ministère de l'Emploi et de la Solidarité Sociale
mg/L .... milligrams per litre
ML........ metal leaching
MMER........ Metal Mining Effluent Regulations

MMSD .... Mining, Minerals and Sustainable Development
MPMO .... Major Projects Management Office
MRC .... Municipalité Régionale de Comté
Mt .... megatonnes
MTQ .... Ministère du Transport du Québec
MW .... megawatts
NAO .... North Atlantic Oscillation
NCC .... NunatuKavut Community Council
NEQA .... Northeastern Québec Agreement
NGO .... non–governmental organization
NL .... Newfoundland and Labrador
NLDB .... Newfoundland and Labrador Department of Business
NLDCYFS .... Newfoundland and Labrador Department of Child, Youth and Family Services
NLDE .... Newfoundland and Labrador Department of Education
NLDOEC .... Newfoundland and Labrador department of environment and Conservation
NLDHCS .... Newfoundland and Labrador Department of Health and Community Services
NLDTW .... Newfoundland and Labrador Department of Transportation and Works
NLEPA .... Newfoundland and Labrador Environmental Protection Act
NLH .... Newfoundland and Labrador Hydro
NNK .... Naskapi Nation of Kawawachikamach
NOx .... nitrogen oxide
NPR .... neutralization potential ratio
NPRI .... National Pollutant Release Inventory
NYSIR .... NYSIR Consulting Services and University of Akureyri Research Institute
OCS .... Occupancy Control System
OMS .... Operation, Maintenance, and Surveillance
PACSW .... Provincial Advisory Council on the Status of Women
PAH .... polyaromatic hydrocarbon
PAO .... Provincial Archaeology Office
PDA .... project development area
PHC .... petroleum hydrocarbons
PM_{10} .... particulate matter less than 10 microns in diameter
$PM_{2.5}$ .... particulate matter less than 2.5 microns in diameter
PPV .... peak particle velocity
Project .... Kami Iron Ore Mine and Rail Infrastructure Project
PSD .... particle size distribution
QNSL .... Québec North Shore and Labrador Railway
RMS .... root mean square
RMWB .... Regional Municipality of Wood Buffalo

RNC .... Royal Newfoundland Constabulary
RSA .... regional study area
RTC .... Rail Traffic Controller
SARA .... *Species at Risk Act*
SDR .... Systematic Data Recovery
SO_2 .... sulphur dioxide
Stantec .... Stantec Consulting Ltd.
t/h .... tonnes per hour
TDS .... total dissolved solids
TIBS .... Train Information Braking System
TLH .... Trans Labrador Highway
TMF .... Tailings Management Facility
TPH .... Total Petroleum Hydrocarbons
TRT .... Tshiuetin Rail Transportation Inc.
TSP .... total suspended particulate matter
TSR .... Track Safety Rules
TSS .... total suspended solids
US EPA .... United States Environmental Protection Agency
VBNC .... Voisey's Bay Nickel Company
VEC .... valued ecosystem component
WHO .... World Health Organization
WLR .... Wabush Lake Railway



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